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A STUDY OF SPECTRAL LINE IDENTIFICATIONS IN PERSEID METEOR SPECTRA

Ian Halliday

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A Study of Spectral Line Identifications in Perseid Meteor Spectra

IAN HALLIDAY

ABSTRACT—A detailed list of spectral line identifications is derived from the study of five Perseid meteor spectra. A total of 229 features are identified in the region from 3680 A to 8710 A. It is shown that lines of N II, O II, and Sr II are present, and probably also lines of Sr I, Ba I, and Ba II, in addition to lines of other atoms and ions previously identified. The high excitation energies required for the lines of N II and O II are discussed. Additional wavelengths may be expected to appear on spectra of higher dispersion or by further extensions of the observations to the ultraviolet and infrared.

RÉSUMÉ—La liste détaillée d'identifications de raies spectrales provient de l'étude de cinq spectres météoriques des Perséides. On a identifié un total de 229 traits particuliers dans la région allant de 3680A à 8710A. On a relevé la présence de lignes N II, O II et Sr II, de même que la présence probable des lignes de Sr I, Ba I et Ba II, en plus des lignes d'autres atomes et ions identifiées antérieurement. Les grandes énergies d'excitation requises pour les lignes N II et O II y sont discutées. On peut prévoir la découverte de longueurs d'ondes additionnelles dans des spectres de plus grande dispersion ou encore par des observations plus poussées au sein de l'ultraviolet et de l'infrarouge.

Introduction

Among the meteor spectra photographed at the Meanook and Newbrook meteor observatories, Alberta, Canada, during 1958, 1959, and 1960 are several excellent spectra of Perseid meteors. The detailed analysis of the atomic emission lines observed in these spectra leads to a table of line identifications which is considerably more extensive than any such table previously published. This study is devoted exclusively to these spectral line identifications. Some of the spectra also exhibit interesting variations in intensity which will be discussed in a later paper.

Observational Material

The observatories themselves have been described by Millman (1959a) and the meteor spectrographs with which the spectrograms were secured have been described by Halliday (1958). The observing staff at the observatories consisted of A. A. Griffin, J. M. Grant, V. N. Beck, and T. E. Chmilar, together with T. L. Pearson and E. R. Seaquist as summer assistants.

The analysis of spectral lines is based on measurements in the spectra of five different Perseid meteors. For one meteor three different spectrograms contributed to the total number of lines measured. The basic observational material is summarized in Table 1. Successive columns list the date and universal time of the meteor's appearance, the observing station, the camera letter and exposure number of the spectrogram, and the emulsion used in the camera. The next columns list the number of

TABLE 1.—OBSERVATIONAL DATA

Date			Universal Time			Station	Exposure Number	Emulsion*	Grating, grooves per mm	Dispersion		Shutter, breaks per second
y	m	d	h	m	s					I order	II order	
1958	8	12	8	01	15	Newbrook	T 570	Tri-X	400	115	61	none
						Newbrook	U 570	IR	400	113		none
						Newbrook	WY	I-D	80	1950		11
1959	8	13	9	27	55	Newbrook	S 766	Tri-X	400	117	60	none
1960	8	12	5	28		Newbrook	H 1582	IR	400	119		24
1960	8	12	8	18	53	Meanook	B 668	I-D	300	105		12
1960	8	13	6	14	31	Meanook	A 678	I-D	300	106	50	12

*Tri-X — Kodak Tri-X Aerecon film.
IR — Kodak Infrared Aerographic film.
I-D — Kodak Spectroscopic I-D emulsion on film or plates.

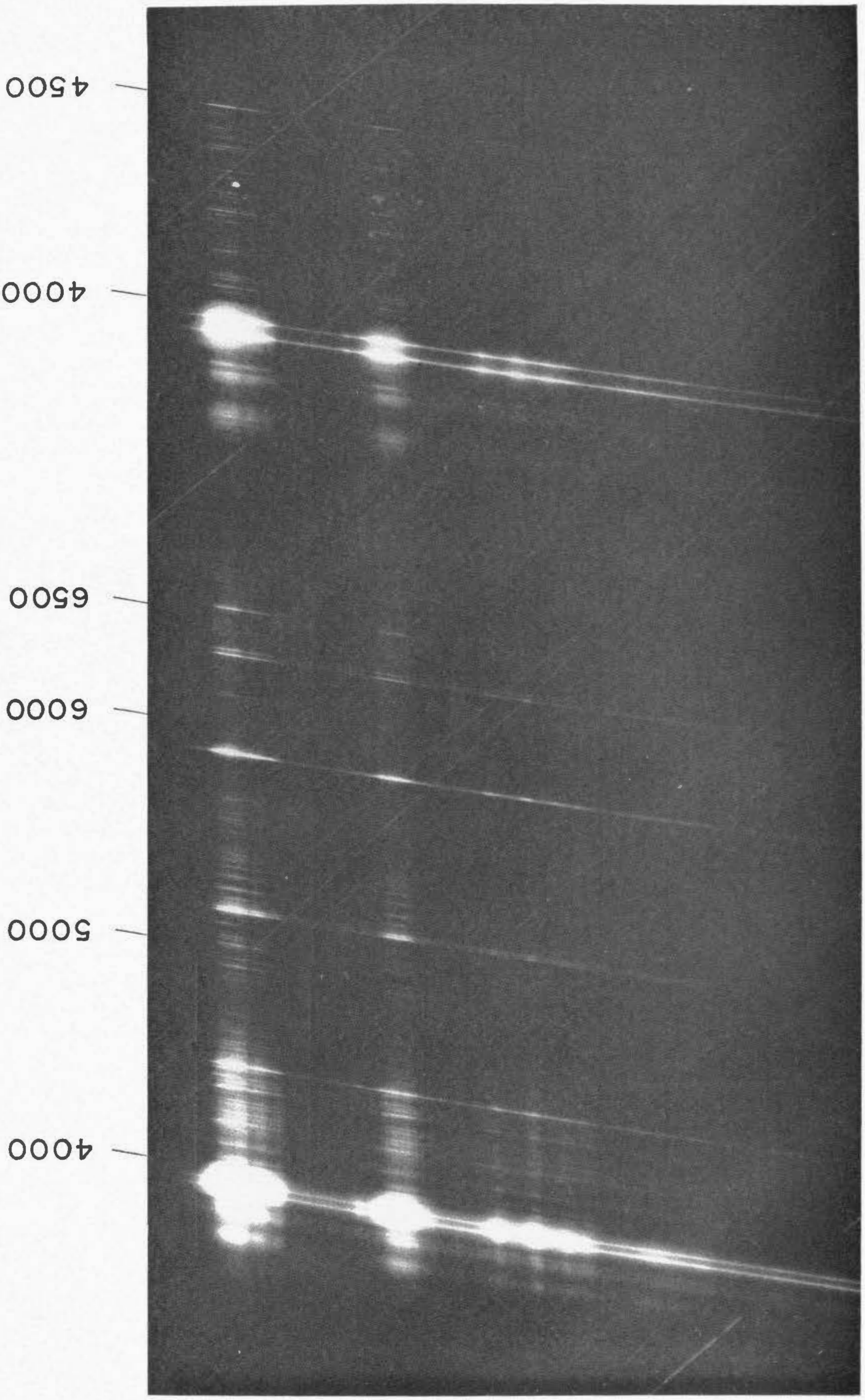

Figure 1. Exposure T570, August 12, 1958

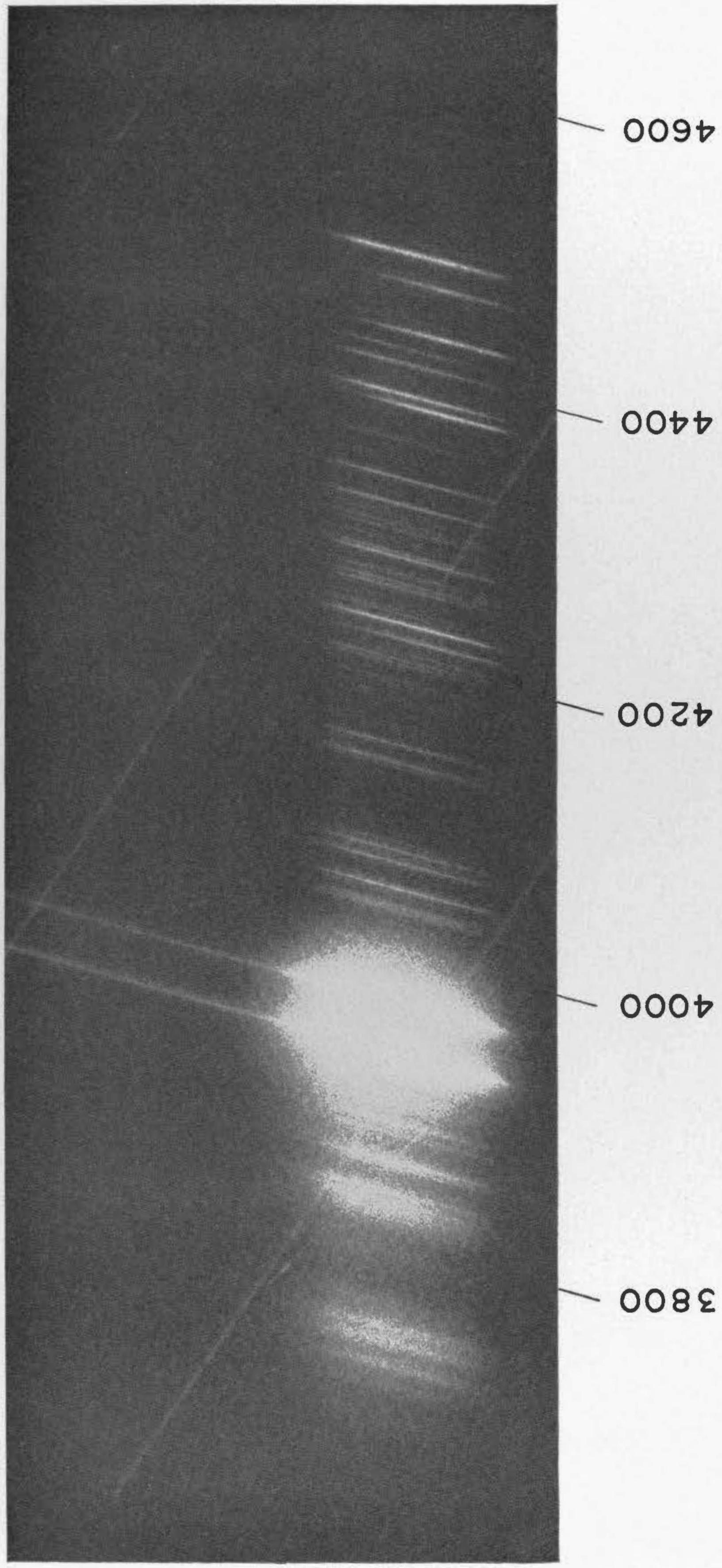

Figure 2. Exposure S766, August 13, 1959

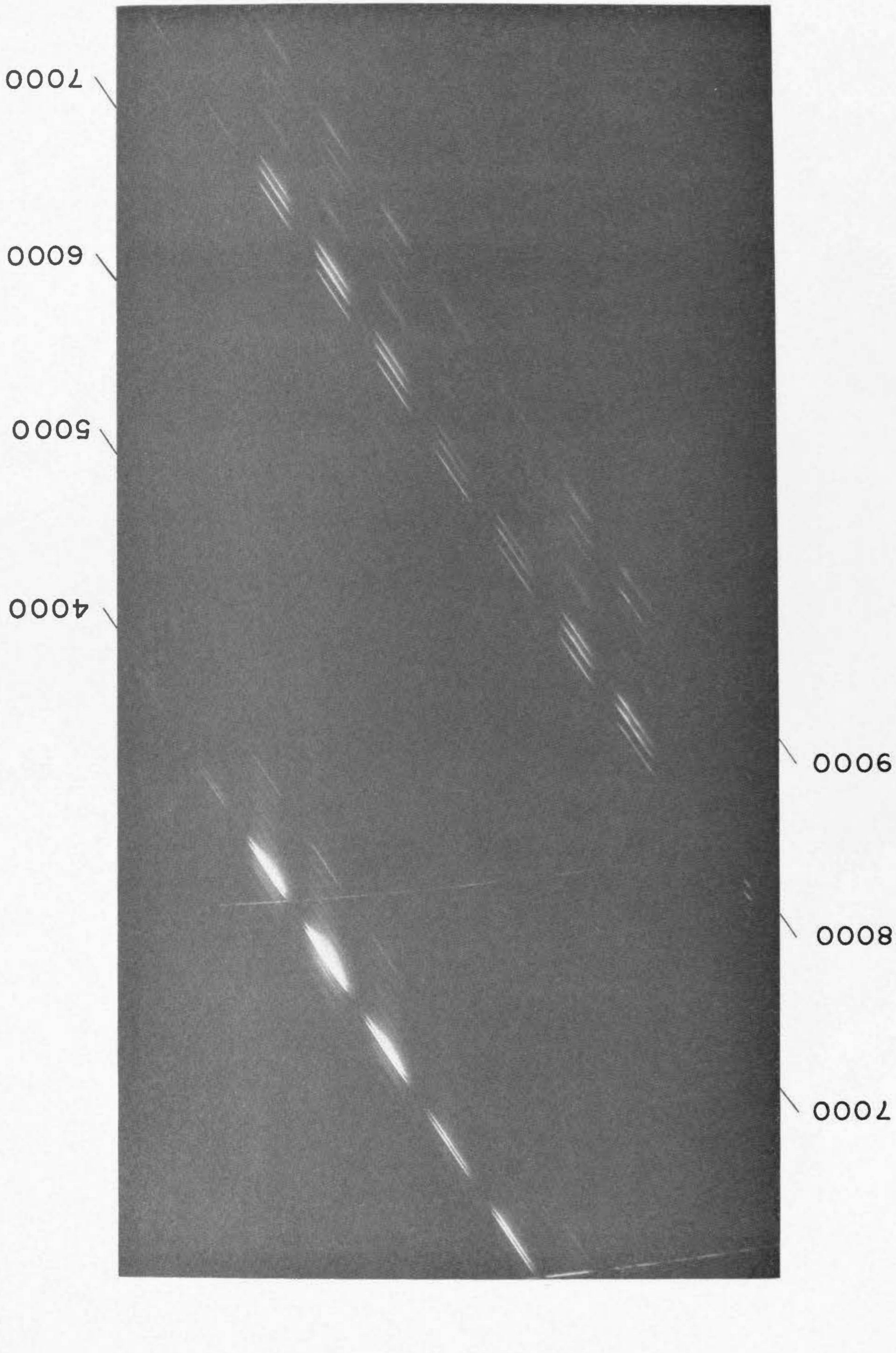

Figure 3. Exposure H1582, August 12, 1960.

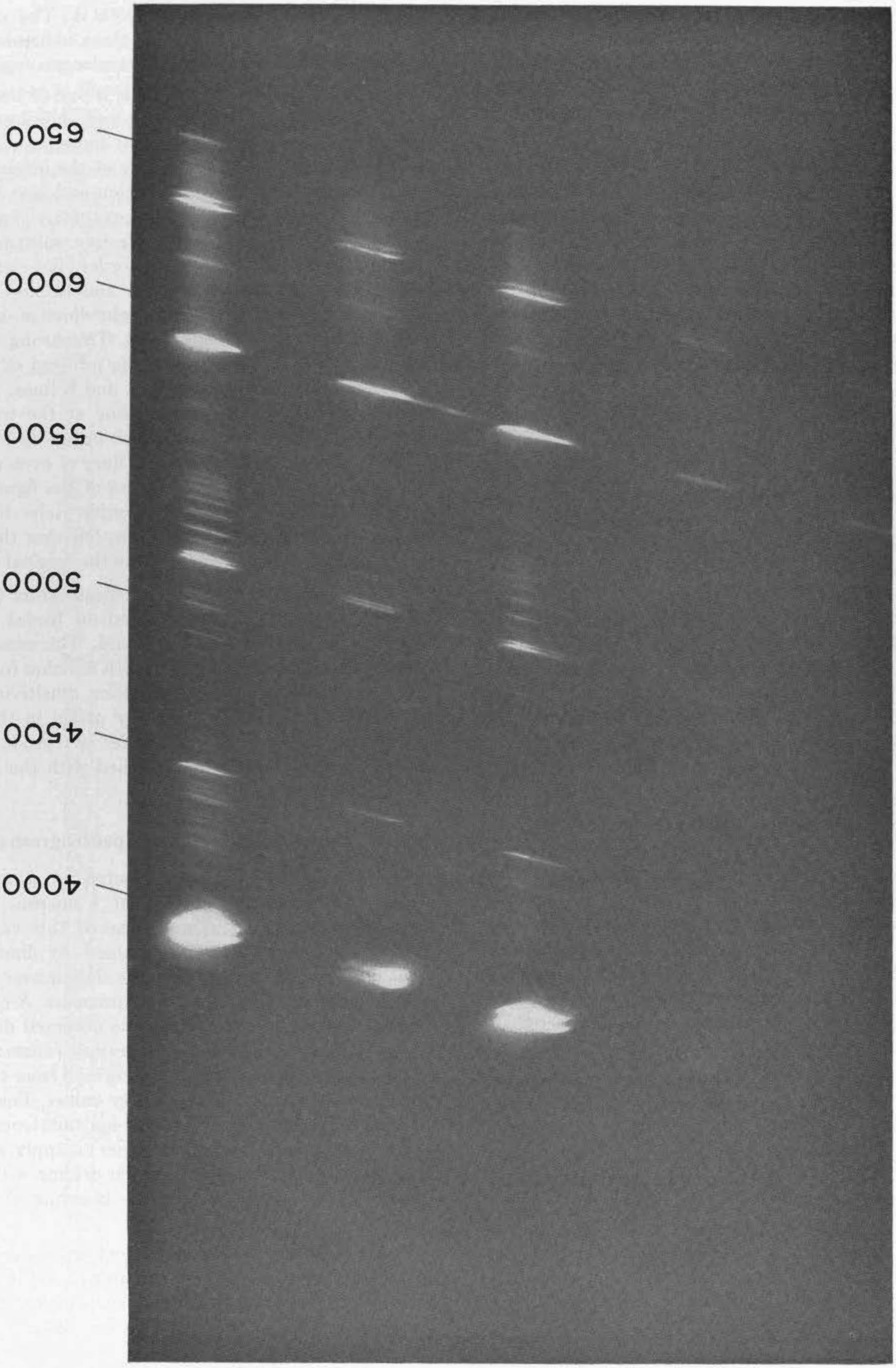

Figure 4. Exposure A678, August 13, 1960.

lines per mm on the objective grating for each camera and the dispersion of the original spectrogram in A/mm for the first order and also for the second order whenever this was used in the reductions. The final column indicates the presence or absence of a rotating shutter in front of the grating by indicating the approximate number of times per second that the trail was interrupted for those cameras which were equipped with a shutter.

Reproductions of four of the meteor spectra appear in Figures 1 to 4. The figures are all arranged with increasing wavelength to the right to facilitate comparisons. Wavelength markers appear at the edges of the figures. In Figures 1 and 4 the direction of motion of the meteor is toward the top of the figure while in Figures 2 and 3 the direction of the meteor's motion is toward the bottom of the figure.

Figure 1. Exposure T570. This shows the first-order spectrum and the blue end of the second-order spectrum of a spectacular Perseid meteor with numerous flares. Variations along the length of the trail represent variations in the luminosity of the meteor as the camera which took this photograph had no occulting shutter. Among the strongest lines in the spectrum are the following, from left to right: the K and H lines of Ca II in the first order at 3933 and 3968 A respectively; λ4481, due primarily to Mg II; a strong pair at 5170 and 5183 A due to Mg I, with some blending from Fe I; the sodium D lines near 5893 A; a pair of lines due to Si II at 6347 and 6371 A; and the Hα line of hydrogen at 6562 A. To the right, the lines of K and H dominate the second-order spectrum.

This is meteor spectrum number 275 in Millman's (1959b) world list of meteor spectra. It proved to be the most useful of the group of five meteors under consideration. A total of seven spectrographs photographed at least a portion of the spectrum. Exposure U570 showed some infrared features, although unfortunately most of the infrared region lay just outside the field of the camera. Camera WY, using a very fast, low-dispersion system, recorded the auroral green line at 5577 A. The other spectrograms did not record any lines not detected on exposure T570.

Figure 2. Exposure S766. The figure shows the second-order spectrum in the blue region only. The strong pair of lines are again the H and K lines of Ca II while the strong line at the right is λ4481 of Mg II. The blaze of the grating is such that the blue end of the second order has high intensity but the efficiency drops rapidly in the region just beyond 4500 A, where meteor spectra contain no strong lines. The terminal flare of this meteor was likely the brightest of the group, but the first-order portion of the spectrogram has generally inferior definition. The second order, reproduced in Figure 2, has excellent definition between 3850 A and 4500 A. The strong intensity and high dispersion made this a valuable spectrogram for detailed study of this wavelength region.

Figure 3. Exposure H1582. This is one of the best infrared spectrograms in existence and shows essentially all strong lines in this region that have been identified in meteor spectra. The sensitivity of the infrared emulsion is high in the blue-violet region and also in the infrared, but is quite low in the green, yellow, orange and red regions. This causes the effective splitting of the spectrum into two parts, the first-order blue-violet region at the left, dominated by the H and K lines, and the first-order infrared region at the right which is overlapped with the second-order blue-violet. The strong triplet of lines near the right consists of the infrared oxygen line at 7774 A and the second-order H and K lines. Note the greater strength of the oxygen line at the top of the figure before the strong flare which brings up the H and K lines. Except for H and K, all lines of even moderate intensity in the right-hand portion of the figure are infrared lines rather than second-order violet lines. The sensitivity in the visual region is so low that the intense Na D lines are barely detectable on the original negative.

Figure 4. Exposure A678. This spectrogram (and similarly exposure B668) was secured on Kodak Spectroscopic I-D emulsion on glass plates. The camera focal length was 12 inches compared with 8 inches for Figures 1 to 3. Because of different emulsion sensitivity curves this spectrum proved particularly useful in the yellow to red regions. Only the first order is reproduced. The strong lines can readily be matched with the strongest features in Figure 1.

Measurement of the Spectrograms

The spectrograms were measured in a measuring engine reading to an accuracy of 1 micron, although errors in setting will normally exceed this value. Preliminary wavelengths were obtained by linear interpolation between two wavelengths chosen near the ends of the spectral region under measurement. A correction curve was then drawn up from the observed differences between these values and the laboratory values for many of the stronger lines, and corrections read from this curve were then applied to all preliminary values. The spectrograms have sufficiently high dispersion and strong enough intensity to make this process easier to apply and more accurate than is usually the case in dealing with fainter spectra of low dispersion, where blending of spectral lines is more serious.

For lines below 4500 A the second-order spectra were generally more useful than the first-order and were given higher weight in forming average wavelengths when the same line was measured in both orders. When close lines were blended in the first order, but were resolved in the second order, the second-order measurements were adopted. Faint lines were sometimes measurable in the first order but not in the second.

After the measurements had been completed it was found that a number of very faint lines could be detected on enlarged positive prints which were too faint to see with the measuring engine. These lines often stand out most clearly by sighting along the print at a small angle to the plane of the paper. Approximate wavelengths were obtained for these lines by interpolation between nearby features using a millimeter scale and estimating distances on the enlargements to 0.1 mm. Additional evidence for the presence of these faint lines was often available from microphotometer tracings of exposure T570.

The measured wavelengths and the adopted identifications are shown in Table 2. The results are presented in detail in the hope that the table may serve as a convenient reference for identifications in the spectra of other fast meteors.

TABLE 2.—MEASURED WAVELENGTHS AND IDENTIFICATIONS

λ_{meas}	Atom or Ion	Mult.	λ_{lab}	Camera
3683	Fe I	5	3679.9	
			3683.1	
	Fe I	21	3687.5	
3706.1	Fe I	5	3705.6	
			3707.8	
	Fe I	21	3709.2	
3719.0	Fe I	5	3719.9	
3726	Fe I	21	3727.6	
3734.4	Fe I	5	3737.1	
	Fe I	21	3734.9	
3746.2	Fe I	5	3745.6	
			3748.3	
	Fe I	21	3749.5	
3762	Fe I	21	3758.2	
			3763.8	
			3767.2	
3798.8	Fe I	21	3795.0	
			3798.5	
			3799.5	
3815.0	Fe I	45	3815.8	S
3820	Fe I	20	3820.4	
3826.3	Fe I	20	3825.9	S
	Fe I	45	3827.8	
3829	Mg I	3	3829.4	
3832	Mg I	3	3832.3	
	Fe I	20	3834.2	
3837.6	Mg I	3	3838.3	
3856	Si II	1	3856.0	
	Fe I	4	3856.4	
3859.2	Fe I	4	3859.9	
3865	Si II	1	3862.6	
	Fe I	20	3865.5	
3872.7	Fe I	20	3872.5	
3877.9	Fe I	4	3878.6	
	Fe I	20	3878.0	
3886.4	Fe I	4	3886.3	
3896	Fe I	4	3895.7	
	Fe I	20	3898.0	
3899.2	Fe I	4	3899.7	S
3906	Si I	3	3905.5	
	Fe I	4	3906.5	
3919	Fe I	4	3920.3	
	Fe I	20	3917.2	
3923.6	Fe I	4	3922.9	S
3934.3	Ca II	1	3933.7	
3968.6	Ca II	1	3968.5	
	Fe I	43	3969.3	
4004.8	Fe I	43	4005.2	
4021.5	Fe I	278	4021.9	S
4031.1	Mn I	2	4030.8	S
4033.4	Mn I	2	4033.1	S
4034.8	Mn I	2	4034.8	S
4040.5	Mn I	5	4041.4	
4046.0	Fe I	43	4045.8	
4058.5	Fe I	558	4058.2	S
4063.8	Fe I	43	4063.6	
4067.7	Fe I	358	4067.0	S
	Fe I	559	4068.0	
4072.0	Fe I	43	4071.7	
	O II	10	4072.2	
4077.3	Sr II	1	4077.7	
	O II	10	4075.9	
	Fe I	558	4076.6	
4083.8	Mn I	5	4082.9	S
			4083.6	
	Fe I	559	4085.3	
	Fe I	698	4084.5	
4106.3	Fe I	354	4107.5	S
4109.5	N I	10	4110.0	S
	Fe I	357	4109.8	
4118.7	Fe I	801	4118.5	
4128.6	Si II	3	4128.1	
4131.3	Si II	3	4130.9	
	Fe I	43	4132.1	
4143.7	Fe I	43	4143.9	
	Fe I	523	4143.4	
4154.6	Fe I	354	4156.8	
	Fe I	355	4154.5	
	Fe I	694	4154.8	
	Fe I	695	4153.9	
4167.5	Mg I	15	4167.3	
4174.0	Fe I	19	4172.7	
			4174.9	
	Fe I	354	4175.6	
	Fe II	27	4173.4	
4178	Fe II	28	4178.9	
4181.8	Fe I	354	4181.8	S
4184.4	Fe I	355	4184.9	S
4187.7	Fe I	152	4187.0	
			4187.8	
4191.5	Fe I	152	4191.4	S
4195.5	Fe I	693	4195.3	S
			4196.2	
4198.7	Fe I	152	4198.3	
	Fe I	522	4199.1	
4202.0	Fe I	42	4202.0	
4206.4	Fe I	3	4206.7	
4211	Fe I	152	4210.4	
4216.2	Fe I	3	4216.2	
	Sr II	1	4215.5	
4222.7	Fe I	152	4222.2	
4226.9	Ca I	2	4226.7	
	Fe I	693	4227.4	
4233.1	Fe II	27	4233.2	
	Fe I	3	4232.7	
	Fe I	152	4233.6	
4235.8	Fe I	152	4235.9	
4246.5	Fe I	693	4247.4	
4250.7	Fe I	42	4250.8	
	Fe I	152	4250.1	
4254.5	Cr I	1	4254.3	
4258.2	Fe I	3	4258.3	S
4260.5	Fe I	152	4260.5	
4268.0	Fe I	482	4267.8	S
4271.6	Fe I	42	4271.8	
	Fe I	152	4271.2	

TABLE 2.—MEASURED WAVELENGTHS AND IDENTIFICATIONS—*Continued*

λ_{meas}	Atom or Ion	Mult.	λ_{lab}	Camera
4274.8	Cr I	1	4274.8	
4282.4	Fe I	71	4282.4	
	Ca I	5	4283.0	
4289.8	Cr I	1	4289.7	S
	Ca I	5	4289.4	
4291.7	Fe I	3, 41	4291.5	S
4294.1	Fe I	41	4294.1	
4299.4	Fe I	152	4299.2	
	Ca I	5	4299.0	
4303	Ca I	5	4302.5	
	Fe II	27	4303.2	
4308.0	Fe I	42	4307.9	
	Ca I	5	4307.7	
4315.1	Fe I	71	4315.1	
	Fe II	32	4314.3	
4318	O II	2	4317.1	
			4319.6	
	Ca I	5	4318.7	
4325.8	Fe I	42	4325.8	
4338.5 b	H I	1	4340.5	
	Fe I	41	4337.0	
	Cr I	22	4339.4	
4344.7	Cr I	22	4344.5	S
4351.1	Mg I	14	4351.9	
	Fe I	71	4352.7	
	Fe II	27	4351.8	
	O II	2	4349.4	
	Cr I	22	4351.8	
4368.6	O I	5	4368.3	
	Fe I	41	4367.9	
	Fe II	28	4369.4	
4376.1	Fe I	2	4375.9	
4383.6	Fe I	41	4383.5	
	Mg II	10	4384.6	
4389.6	Fe I	2	4389.2	
	Mg II	10	4390.6	
4404.7	Fe I	41	4404.8	
4409.7	Fe I	68	4407.7	S
			4408.4	
4415.3 w	Fe I	41	4415.1	
	Fe II	27	4416.8	
	O II	5	4414.9	
			4417.0	
4422	Fe I	350	4422.6	
4427.4	Fe I	2	4427.3	
	Mg II	9	4428.0	
4434	Ca I	4	4435.0	
			4435.7	
	Fe I	2	4435.2	
	Mg II	9	4434.0	
4442.7	Fe I	68	4442.3	
	Fe I	350	4443.2	
4447	Fe I	68	4447.7	
	N II	15	4447.0	
4455.1	Ca I	4	4454.8	
			4455.9	
			4456.6	
	Fe I	350	4454.4	
4461.5	Fe I	2	4461.7	
4468	Fe I	350	4466.6	
			4469.4	
4475.4	Fe I	350	4476.0	S
4481.3	Mg II	4	4481.1	
			4481.3	
	Fe I	2	4482.2	
4489.3	Fe I	2	4489.7	
	Fe II	37	4489.2	
4493.6	Fe I	68	4494.6	
	Fe II	37	4491.4	
4522	Fe II	37	4520.2	
	Fe II	38	4522.6	
4528	Fe I	68	4528.6	
4549.7	Fe II	38	4549.5	
4555.3	Fe II	37	4555.9	
	Ba II	1	4554.0	
4571.1	Mg I	1	4571.1	
4583.4	Fe II	37	4582.8	
	Fe II	38	4583.8	
	Ca I	23	4581.4	
			4585.9	
4601	Fe I	39	4602.9	
	N II	5	4601.5	
4606	N II	5	4607.2	
	Sr I	2	4607.3	
4619.5	Fe I	821	4619.3	
	Fe II	38	4620.5	
	N II	5	4621.4	
4630.0	Fe II	37	4629.3	
	N II	5	4630.5	
4636	Fe I	554	4637.5	
	Fe I	822	4638.0	
4642–4651	O II	1	4641.8	
			4649.1	
			4650.8	
	N II	5	4643.1	
	Fe I	409	4647.4	
4666.7	Fe I	554	4668.1	
	Fe I	822	4667.5	
	Fe II	37	4666.8	
4676	O II	1	4673.8	
			4676.2	
4691	Fe I	409	4691.4	
4702.9	Mg I	11	4703.0	
	Fe I	821	4705.0	
4733.7	Fe I	38	4733.6	
4823.7	Mn I	16	4823.5	
4861.2	H I	1	4861.3	
	Fe I	318	4859.7	
4870.5	Fe I	318	4871.3	
			4872.1	
4891.3	Fe I	318	4890.8	
			4891.5	
4923.5	Fe I	318	4919.0	
			4920.5	
	Fe II	42	4923.9	
4940	Fe I	16	4939.7	
	Fe I	318	4938.8	
4957.6	Fe I	318	4957.3	
			4957.6	
4967	Fe I	687	4966.1	
	O I	14	4967.4	
			4967.9	
			4968.8	
4984.1	Fe I	318	4985.6	
	Fe I	984	4985.3	
	Fe I	1066	4983.9	
	Fe I	1067	4982.5	
			4983.3	
5005.6 b	Fe I	318	5006.1	
	Fe I	965	5001.9	
	Fe I	984	5005.7	
	N II	19	5001.1	
			5001.5	
	N II	19, 64	5005.1	
5012	Fe I	16	5012.1	
	Fe I	965	5015.0	
	N II	4	5010.6	
5019.0	Fe II	42	5018.4	
	O I	13	5018.8	
			5019.3	
			5020.1	
5031	Fe I	585	5030.8	
	Fe I	1150	5031.9	
5042.2 w	Si II	5	5041.1	
	Fe I	16	5041.1	
	Fe I	36	5041.8	
	N II	4	5045.1	
5056.7	Si II	5	5056.0	
			5056.4	
5073	Fe I	1094	5074.8	

TABLE 2.—MEASURED WAVELENGTHS AND IDENTIFICATIONS—*Continued*

λ_{meas}	Atom or Ion	Mult.	λ_{lab}	Camera
5110.9	Fe I	1	5110.4	
5141.0	Fe I	16	5142.9	
	Fe I	383	5139.3	
			5139.5	
5152	Na I	8	5148.8	
			5153.4	
	Fe I	16	5150.8	
			5151.9	
5168.5	Mg I	2	5167.3	A
	Fe I	1	5166.3	
			5168.9	
	Fe I	37	5167.5	
	Fe II	42	5169.0	
5173.1	Mg I	2	5172.7	A
	Fe I	36	5171.6	
5183.7	Mg I	2	5183.6	
5194	Fe I	36	5194.9	
	Fe I	383	5191.5	
			5192.4	
	Fe I	1092	5195.5	
5205.3	Fe I	1	5204.6	
	Fe I	66	5202.3	
	Cr I	7	5204.5	
			5206.0	
			5208.4	
5214.3	Fe I	36	5216.3	
	Fe I	553	5215.2	
			5217.4	
5227.9– 5235 w	Fe I	37	5227.2	
	Fe I	383	5226.9	
			5232.9	
	Fe I	553, 1090	5229.9	
	Fe II	49	5234.6	
5270.2	Fe I	15	5269.5	
	Fe I	37	5270.4	
	Fe I	383	5266.6	
	Fe II	49	5276.0	
	Ca I	22	5270.3	
5302.6	Fe I	553	5302.3	
5317.4	Fe II	48	5316.8	
	Fe II	49	5316.6	
5328.0	Fe I	15	5328.0	
	Fe I	37	5328.5	
	Fe I	553	5324.2	
	O I	12	5329.0	
			5329.6	
			5330.7	
5340.0	Fe I	37	5341.0	
	Fe I	553	5339.9	
5371.3	Fe I	15	5371.5	
	Fe I	1146	5367.5	
			5370.0	
5383.0	Fe I	1146	5383.4	
5398.0	Fe I	15	5397.1	
5405.4	Fe I	15	5405.8	
	Fe I	1165	5404.1	
5414.6	Fe I	1165	5415.2	
	Fe II	48	5414.1	
5423.7	Fe I	1146	5424.1	
5430.0 b	Fe I	15	5429.7	
			5434.5	
	O I	11	5435.2	
			5435.8	
			5436.8	
5446.7	Fe I	15	5446.9	
	Fe I	1163	5445.0	
5455.0	Fe I	15	5455.6	
5463.1	Fe I	1163	5463.0	
			5463.3	
5476.5	Fe I	1062	5476.6	
5505.7	Fe I	15	5501.5	
			5506.8	
5528.6 b	Mg I	9	5528.4	
	Fe II	55	5534.9	
	Ba I	2	5535.5	
5571.6	Fe I	686	5569.6	
			5572.9	
5577	O I	3 F	5577.4	WY
5587.6	Fe I	686	5586.8	
	Ca I	21	5588.8	
5600.9 b	Ca I	21	5594.5	
			5598.5	
			5601.3	
			5602.8	
	Fe I	686	5603.0	
5615.4	Fe I	686	5615.7	
5624.0	Fe I	686	5624.5	
5657.2	Fe I	686	5658.8	
	Fe I	1107, 1314	5655.5	
5665.9	N II	3	5666.6	
	Si I	10	5665.6	
5679.2	N II	3	5676.0	
			5679.6	
5685.3	Na I	6	5682.6	
			5688.2	
	N II	3	5686.2	
	Si I	11	5684.5	
5709.1	Fe I	686	5709.4	
	N II	3	5710.8	
	Si I	10	5708.4	
5762.1	Fe I	1107	5763.0	
5890.0	Na I	1	5890.0	
5895.9	Na I	1	5895.9	
5942	N II	28	5941.7	
5957.9	Si II	4	5957.6	
	O I	23	5958.5	
			5958.6	
5978.9	Si II	4	5979.0	
6005	N I	16	5999.5	
			6008.5	
6027	Fe I	1018	6027.1	A
	Fe I	1178	6024.1	
6102.7	Ca I	3	6102.7	A
6120.9	Ca I	3	6122.2	
6138	Fe I	169	6136.6	A
	Fe I	207	6137.7	
6157.8	O I	10	6156.0	
			6156.8	
			6158.2	
	Na I	5	6154.2	
			6160.7	
6167.8 b	Ca I	3	6162.2	
	Ca I	20	6166.4	
			6169.1	
			6169.6	
6192	Fe I	169	6191.6	A
6203	Fe I	207	6200.3	A
6229	Fe I	207	6230.7	B
6247.5	Fe I	169	6252.6	
	Fe I	816	6246.3	
	Fe II	74	6247.6	
6301	Fe I	816	6301.5	B
6319	Fe I	168	6318.0	A
	Mg I	23	6318.5	
6337.9	Fe I	62	6335.3	
	Fe I	816	6336.8	
6347.6	Si II	2	6347.1	
6358.1	Fe I	13	6358.7	
6371.3	Si II	2	6371.4	
6398.5	Fe I	168	6393.6	
	Fe I	816	6400.0	
6422	Fe I	111	6421.4	S
6438.8	Ca I	18	6439.1	
6455.9	Fe II	74	6456.4	
	O I	9	6453.6	
			6454.5	
			6456.0	
6462.2	Fe I	168	6462.7	
	Ca I	18	6462.6	

TABLE 2.—MEASURED WAVELENGTHS AND IDENTIFICATIONS—*Concluded*

λ_{meas}	Atom or Ion	Mult.	λ_{lab}	Camera
6483.6	N I	21	6482.7 6483.8 6484.9	
	N II	8	6482.0	
6495.3 b	Fe I	13	6499.0	
	Fe I	168	6495.0	
	Ca I	18	6493.8 6499.6	
	Ba I	6	6498.8	
6525	Ba I	6	6527.3	A
6546	Fe I	268	6546.2	
6562.8	H I	1	6562.8	
6571.7	Ca I	1	6572.8	
6594.5	Fe I	268	6592.9	
	Ba I	6	6595.3	
6680	Fe I	268	6678.0	S
6717.1	Ca I	32	6717.7	
6752	Fe I	111	6750.2	S
7423.7	N I	3	7423.6	U
7442.1	N I	3	7442.3	U
7468.0	N I	3	7468.3	U
7773.9	O I	1	7772.0 7774.2 7775.4	H
8186.9	N I	2	8184.8 8188.0	H
8215.3	N I	2	8210.6 8216.3 8223.1	H
8244	N I	2	8242.3	H
8446.9	O I	4	8446.4 8446.8	H
8498	Ca II	2	8498.0	H
8542.2	Ca II	2	8542.1	H
8592	N I	8	8594.0	H
8630.2	N I	8	8629.2	H
8663	Ca II	2	8662.1	H
8683.4	N I	1	8680.2 8683.3 8686.1	H
8710.2	N I	1	8703.2 8711.7 8718.8	H

b — feature noticeably broad. w — wing observed on red side of feature.

The table is arranged in order of increasing wavelength. Column 1 shows the measured wavelength of each feature. It is quoted to 0.1 A when it is derived from accurate measurement, and to the nearest whole Angstrom unit when it is derived from measurement of the positive prints. Other columns list the identification for each feature, showing the atom or ion concerned, the multiplet number, and the laboratory wavelength, obtained from *A Multiplet Table of Astrophysical Interest* (Moore 1945). Frequently two or more lines are expected contributors to a single feature. The *M.I.T. Wavelength Tables* (Harrison 1939) were also found useful for judging relative intensities of many lines.

Most of the measured wavelengths are based on measurements of spectrogram T570. Certain faint lines were detected only in some of the other spectra, some lines were resolved on S766 which were blended on T570, and the infrared lines depend on U570 and H1582. An entry in the final column indicates that the measured wavelength is derived from a spectrogram other than T570. For example, the triplet due to manganese near 4030 A was blended on T570 but resolved into its three components in the second order of S766. This represents the highest resolution achieved; the separation of the two weaker components is only 1.3 A, which corresponds to a resolution of 35 lines per mm on the original film.

Discussion of Identifications

Since any detailed list of laboratory wavelengths will contain several lines more closely spaced than the best resolution achieved on these spectrograms, the method of selecting the identifications to list for each feature is by no means straightforward. The identifications reflect, to a considerable degree, the previous experience and the judgment of the particular investigator. Differences of opinion are likely to exist among different investigators, particularly in the case of very weak lines which have been recorded on one or only a very few spectrograms.

Table 2 contains many entries, both measured wavelengths and multiplet identifications, which have not been listed previously in meteor spectra. Some of these identifications are admittedly doubtful. On the other hand the dispersion and resolution of these spectrograms has seldom been equalled or surpassed in earlier investigations. A comparison of observed and laboratory wavelengths in Table 2 indicates that, for unblended features, the errors of measurement are only a few tenths of an Angstrom, which is of great help in choosing identifications compared with many earlier spectra in which the errors were often from 1 to 3 Angstroms. For the lines in Table 2 that are quoted to the nearest Angstrom, however, the errors may again be from 1 to 3 A.

Table 2 lists 229 separate features, and the identifications include 458 separate lines as expected contributors. Twelve chemical elements are included in the atomic state and eight of them are also listed in the first stage of ionization. In all, 160 different multiplets are involved and these have been collected in Table 3, where the elements are arranged in order of increasing atomic weight.

TABLE 3.—MULTIPLETS IDENTIFIED IN TABLE 2.

Atom or Ion	Multiplets
H I	1
N I	1, 2, 3, 8, 10, 16, 21
N II	3, 4, 5, 8, 15, 19, 28, 64
O I	1, 4, 5, 9, 10, 11, 12, 13, 14, 23, 3F
O II	1, 2, 5, 10
Na I	1, 5, 6, 8
Mg I	1, 2, 3, 9, 11, 14, 15, 23
Mg II	4, 9, 10
Si I	3, 10, 11
Si II	1, 2, 3, 4, 5
Ca I	1, 2, 3, 4, 5, 18, 20, 21, 22, 23, 32
Ca II	1, 2
Cr I	1, 7, 22
Mn I	2, 5, 16
Fe I	1, 2, 3, 4, 5, 13, 15, 16, 19, 20, 21, 36, 37, 38, 39, 41, 42, 43, 45, 62, 66, 68, 71, 111, 152, 168, 169, 207, 268, 278, 318, 350, 354, 355, 357, 358, 383, 409, 482, 522, 523, 553, 554, 558, 559, 585, 686, 687, 693, 694, 695, 698, 801, 816, 821, 822, 965, 984, 1018, 1062, 1066, 1067, 1090, 1092, 1094, 1107, 1146, 1150, 1163, 1165, 1178, 1314
Fe II	27, 28, 32, 37, 38, 42, 48, 49, 55, 74
Sr I	2
Sr II	1
Ba I	2, 6
Ba II	1

Some of the multiplets are represented only as partial contributors to a single blended feature. In such cases, or even when it is a suspected contributor to several features or the only contributor to an extremely weak line, the presence of the multiplet may be considered doubtful. Table 4 lists 41 multiplets which, on this basis, are considered to be the doubtful entries in Table 3.

Numerous lists of line and multiplet identifications in meteor spectra have been published. Among them, ones published by Millman (1953, 1956, 1961) and by Russell (1960) are perhaps the most useful for purposes of comparison.

TABLE 4.—DOUBTFUL MULTIPLET IDENTIFICATIONS

Atom or Ion	Multiplets
N I	10
N II	4, 19, 64
O I	13
O II	5, 10
Na I	8
Mg I	23
Mg II	9, 10
Si I	3, 10, 11
Ca I	20, 23
Fe I	62, 66, 111, 358, 482, 554, 585, 687, 694, 695, 698, 821, 822, 1018, 1066, 1090, 1092, 1314
Fe II	32, 48, 55
Sr I	2
Ba I	2, 6
Ba II	1

In the detailed discussion below, particular attention is directed to those identifications which involve an atom or ion not previously identified in meteor spectra. Many of the new multiplets in Table 2 are additional multiplets of atoms whose presence was already well established in other spectra and it was to be expected that more intense spectra with improved resolution would add significantly to the number of multiplets. This is particularly true of atomic iron, which has such a complex spectrum, and which has already accounted for the identification of a majority of lines in previous meteor spectra. No particular justification is required, therefore, for the addition of a multiplet such as Fe I, 1146, which contributes two unblended lines and one blended line in spectrum T570.

On the other hand, very careful consideration is required before adding a new atom to the list. This should include consideration not only of the measured lines to be attributed to the atom, but also a reasonable explanation for not observing other equally strong lines of the spectrum if such lines exist. Furthermore, the possible presence of the atom in observable quantities in meteors (or the upper atmosphere) should be considered. Somewhat less strict considerations apply before adding to the list of identifications lines that are due to the first ionized stage of an atom known to be present in the neutral state. With these criteria in mind, attention will now be given to each atom or ion identified, and later to some others which remain undetected.

H I. The Hα line was first identified by Millman (1953). Hβ and Hγ are also contributors to these Perseid spectra.

N I. The strong infrared multiplets identified by Millman (1953) and Millman and Halliday (1961) are found, as well as a few others in the visible region.

N II. One of the most interesting results of this analysis is the identification of lines due to ionized nitrogen. A line of moderate strength at 5679 A is observable on both T570 and A678 and is identified as λ5679.56 due to multiplet 3 of N II. A weaker member of the same multiplet at 5676.02 A probably also contributes to the same feature. No other reasonable identification is available for this feature. A microphotometer trace of T570, on a linear intensity scale, is shown in Figure 5, which shows that λ5679 is well separated from the feature near 5685 A (which is largely due to sodium but should also contain another line of N II, 3 and possibly a line of neutral silicon).

Ionized nitrogen is listed as a contributor to 15 features in Table 2. In only 2 cases, λλ5679 and 5942, is it the only identification listed for the feature, but in several cases the line appears too intense to be accounted for entirely by the other contributors. Furthermore, there are no serious omissions where a strong line of N II is known to exist but is lacking in the meteor spectra (except for λ3995 which is lost in the halation around the H and K lines).

The presence of molecular nitrogen in the atmosphere at meteor heights is well established, hence there is no problem in accounting for the presence of nitrogen. Strong lines due to neutral atomic nitrogen, as well as the first positive group of bands of molecular nitrogen, are observed in meteor spectra. The significant feature is the high excitation energies required for the lines of N II. They range from 20.6 ev to 23.1 ev for the upper states of the observed lines, with one other doubtful contributor at 27.8 ev. These values, together with the lines of O II discussed below, are much higher than any previous excitation energies, which went only as high as 12 to 13 ev for the Balmer hydrogen lines and some of the lines due to N I, O I, and Si II.

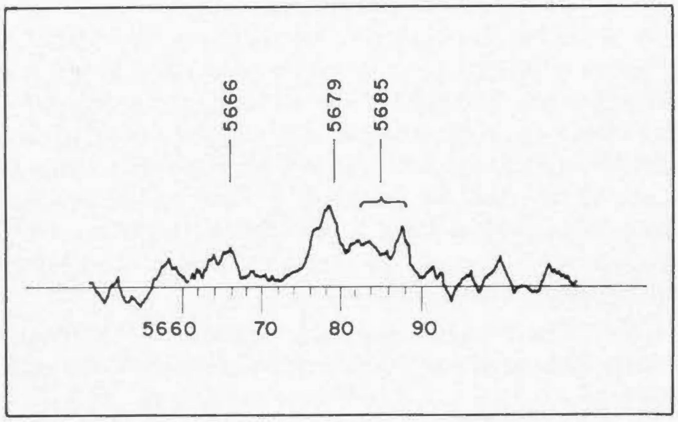

Figure 5. Intensity trace of N II line at 5679 A, exposure T570

The lines of N II are observed in the terminal flares near the bottom of the trails, at heights of about 80 km. At this height atmospheric nitrogen is in molecular form, so that the total energy required to dissociate the molecule, ionize the atom, and excite the observed lines amounts to 45 ev. This is very high compared with other lines observed in meteor spectra but still represents only about 10 per cent of the kinetic energy of an average atom from a fast meteor. In addition, it is possible that the dissociation, ionization, and excitation are accomplished by successive collisions of atmospheric particles with meteor atoms rather than all by the initial collision.

O I. Strong lines of O I are observed in the infrared region and several weaker multiplets are identified in the visual region. The auroral green line was observed on one spectrogram of spectrum 275. Its presence in meteor spectra has been discussed previously (Halliday 1960). The identification of O I, 10, at 6157 A, results from a comparison of the line with the Na D lines on plates taken with the I-D emulsion. The Tri-X and I-D emulsions both have some minor maxima and minima in their sensitivity curves in the red. Near 6160 A the I-D emulsion is superior to Tri-X because one of the maxima for the I-D emulsion is in this vicinity. The feature has sometimes been attributed to Na I, 5, one of the doublets with 6 A separation which is centred almost exactly on the more closely spaced triplet of O I, 10. Some of the spectrograms which resolve Na D show $\lambda 6157$ as a sharp line, indicating that the dominant contributor, in these cases at least, is O I, 10 rather than Na I, 5. It may also be noted that the line is comparatively weak in the spectra of slower meteors where O I, 10 would not be expected because of its high excitation potential.

O II. Seven features are listed with lines of O II as contributors. The only unblended member of this group is a very weak line at 4676 A, due to O II, 1. The presence of O II, 1 as well as N II, 5, is required to account for the width of a diffuse feature which extends from 4642 to 4651 A. The presence of lines due to O II is somewhat more difficult to establish, owing to the blending effects of other lines, than was the case for N II. The excitation energies for O II are slightly higher than for N II, ranging from 22.9 to 28.6 ev for the four multiplets listed in Table 3. The two cases are sufficiently similar, however, that with the presence of N II established, lines due to O II should definitely be expected. While oxygen is a less abundant atmospheric constituent than nitrogen, it must be expected that the meteor will contribute many oxygen atoms that were present in silicates and other compounds in the meteor.

Na I. The D lines are strong in all cases and well resolved in some of these spectra. Three other multiplets of Na I are contributors to blended features.

Mg I. All the usual multiplets of Mg I are identified in these spectra.

Mg II. In addition to the very strong line at 4481 A two other multiplets of Mg II are expected contributors.

Si I. The presence of Si I lines in these spectra remains doubtful, in spite of the prominence of Si II. Three multiplets are listed as possibly present but the absence of a line near 4102 A, the location of multiplet 2, casts doubt on the presence of the other Si I lines.

Si II. Five pairs of lines are identified with Si II including the strong pair near 6350 A.

Ca I. While 11 multiplets of Ca I are listed in Table 3 only 2 or 3 of these are at all prominent. Most of the other multiplets are blended with lines due to other elements.

Ca II. The H and K lines of Ca II are much the strongest lines in Perseid spectra and are often so overexposed as to make difficult the detection of any other lines within 30 or 40 A. Multiplet 2 is prominent in the infrared region.

Cr I. Chromium is a minor contributor to meteor pectra but a few lines of the strongest multiplets are efinitely present.

Mn I. As for Cr I, a few of the strongest multiplets of In I are observed. The triplet near 4030 is the most rominent feature due to Mn I.

Fe I. Lines of Fe I dominate the identifications in lmost all meteor spectra. These spectra add many multilets not previously identified, particularly among the igher multiplets with numbers above 500.

Fe II. Some moderately strong lines are due primarily o Fe II and 10 multiplets are listed in Table 3. Some of hem are doubtful, and it is noted that the lines of Fe II ppear to be involved in blends more frequently than ines of most other atoms or ions.

Sr I. The strongest line of Sr I is suggested as a contributor to a weak feature at 4606 A. The other possible contributor is a line of N II, 5, which, however, is listed with low enough intensity that it would not be expected to show unless it were reinforced by some other line. The more certain identification of Sr II lends some support to the presence of Sr I.

Sr II. The strong line at 4077 A is present in T570 and S766. While two other contributors are listed in Table 2, the precision of measurement, particularly in S766, indicates that the main contributor is Sr II, not Fe I or O II. The other strong line of Sr II, at 4215 A, is confused by the presence of a strong line at 4216 A due to Fe I, 3.

Ba I and Ba II. Among the doubtful identifications are two multiplets of Ba I and one of Ba II. The only line of barium which is not listed as a blend is 6525 A, a very weak feature observed on both A678 and S766. The wavelength agreement is only fair, as the suggested identification is the line of Ba I, 6, at 6527.3 A. The magnesium line at 5528 A is observed to have a wing on the red side which can be accounted for by a weak, and therefore doubtful, multiplet of Fe II, (number 55) or by the strong line of Ba I, 2, at 5535 A. The strongest line of Ba II, at 4554 A, is blended with one of the stronger lines of Fe II at 4555 A and hence positive identification of Ba II is lacking.

Among the elements of higher atomic weight, however, barium is perhaps the least surprising one to encounter. Its location in the periodic table is analagous to the positions of magnesium, calcium, and strontium, all of which are present in meteor spectra. The abundances of barium determined in the solar atmosphere (Goldberg, Müller and Aller 1960) and in the pure silicate portions of meteorites (Krinov 1960) are less than the abundances of strontium by a factor of only 3, in spite of the considerable difference in their atomic numbers. It is also recalled that in a few stellar spectra the line of Ba II at 4554 A is so strong that the stars have been called Ba II stars (Bidelman and Keenan, 1951).

It is suggested then, that barium may be present in meteor spectra although its presence is not considered to be established.

Elements Not Detected

A few comments are required regarding certain elements whose presence was not detected in these Perseid spectra. In this connection it is to be noted that the definition of these spectra in the ultraviolet region, particularly below 3800 A, is not very good. In addition the transmission of the optics limits the observable spectrum, so that very little can be detected below 3700 A. Some meteor spectra, photographed with other instruments, have had superior definition and transmission in the ultraviolet region. As a result some lines could be identified in this region which are unobservable on our spectrograms.

No lines of Al I were found in these spectra. The strong pair at 3944 and 3961 A are so close to the H and K lines of Ca II that it is impossible to search for them near strong bursts where H and K are heavily overexposed. From weaker portions of the trails, however, it is possible to conclude that the lines of Al I, if present, are not as strong as the strongest eight or ten lines of Fe I in the blue region.

No features were found which required the presence of Co I or Ni I in these Perseid spectra. To some extent this may be due to the performance of the instruments in the ultraviolet region. Lines of both Co I and Ni I would be expected from iron meteorites. Both have also been claimed at times in the spectra of shower meteors but such identifications receive no support from these intense and detailed Perseid spectra.

Among the elements still unidentified in meteor spectra, yet which might be expected to have reasonable abundances, are phosphorus, sulphur and potassium. The strong lines of neutral phosphorus are all in the infrared, beyond the limit of the emulsions used for meteors. Sulphur would not be detected easily, but multiplet 2, near 4695 A, should be kept in mind. The strong doublet of neutral potassium is near 7700 A, which is an accessible region of the spectrum, but one which may be confused by the second-order ultraviolet lines until filters are used to eliminate the second order. The other possible doublet is so close to the Fe I line at 4045 A that it would require somewhat higher dispersion than has yet been achieved to detect the presence of comparatively weak potassium lines.

The lines and bands of nitrogen which are observed in meteor spectra represent an atmospheric constituent excited by the passage of the meteor. Some fraction of the oxygen radiation will also be due to atmospheric oxygen. With emulsions extending well into the red the strong lithium line at 6707 A might be found if a careful search is made in this region.

Conclusions

The identifications listed in Tables 2 and 3 have been compiled from five Perseid meteor spectra. They should prove equally useful in the analysis of the spectra of other fast meteors. For slow meteors many of these features will not be observed, particularly lines from ionized atoms and those lines from neutral atoms which require excitation energies greater than about 7 ev. Essentially all the lines found in slow meteors, however, are also found in fast meteors, hence by dropping the high-excitation lines the present table should also prove useful for slow meteors.

Future additions to this list are likely to arise from the following sources. Many lines might be added in the ultraviolet region when a sufficiently bright meteor spectrum is obtained with one of the spectrographs with good transmission below 3700 A. Some other lines might be added in the near infrared, although the indications from existing spectra suggest that this will not become a region in which the lines are generally crowded.

In the visible region, from about 4000 A to 6600 A, further additions to the list are likely to be minor ones until such time as a very bright meteor is photographed with a first-order dispersion of about 40 A/mm. Meteor spectrographs capable of this dispersion are in operation on the Canadian programs conducted by the National Research Council and by the Dominion Observatory, but the expected yield of such detailed spectra is low.

Significant additions of spectral lines could also arise from the instances in which a meteor of asteroidal origin is photographed with a spectrograph. These are very rare events, and scarcely account for one per cent of the existing meteor spectra of the world.

The author wishes to express his thanks to the entire observing staff of the meteor observatories in Alberta for their persistence and enthusiasm, often under difficult observing conditions, and to Dr. P. M. Millman for valuable discussions concerning spectral identifications.

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THE IDENTIFICATION OF THE (0,0) AND (1,0) BANDS OF THE CN RED SYSTEM IN THE SOLAR SPECTRUM

Mario Rigutti

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The Identification of the (0,0) and (1,0) Bands of the CN Red System in the Solar Spectrum

Mario Rigutti*

Abstract—A comparison has been made of the wavelengths of the rotational lines in the (0,0) and (1,0) bands of the CN red system produced in the laboratory with the tabulated wavelengths of lines in the solar spectrum in the neighbourhood of 11,000 A and 9200 A respectively. Some 38 coincidences were established between CN lines and previously unidentified lines of solar or terrestrial origin.

Résumé—Nous avons établi une comparaison entre les longueurs d'onde des raies rotationnelles des bandes (0,0) et (1,0) du système rouge CN observé au laboratoire et les longueurs d'onde classées du spectre solaire dans le voisinage de 11,000 A et 9200 A respectivement. Quelque 38 coïncidences ont été établies entre les raies CN et des raies non encore identifiées d'origine solaire ou terrestre.

Introduction

The electronic transition $A^2\Pi - X^2\Sigma$ of the CN molecule produces a system of vibration-rotation bands covering the spectral range from 0.6 to 1.5μ. The most intense bands of this red system are located between 0.7 and 1.0μ but owing to technical difficulties they have scarcely been studied either in solar or stellar spectra. Improved infrared-sensitive emulsions now make it possible to photograph the red system at high spectral resolution. Since the presence of CN is well established in comets, planets, carbon stars, and the sun, a study of the rotational line structure of these bands covers a wide range of astrophysical interests.

Accordingly, spectra at high dispersion were obtained with a grating spectrograph and a laboratory source of CN of the (0,0) and (1,0) bands of the red system, covering the spectral range from 9140 to 11,550 A. A rotational analysis has been carried out on the two bands and these results, including wavelengths and provisional rotational constants, have been published elsewhere (Rigutti 1959). In the present paper the spectrum of the red bands produced in a laboratory source is compared with the tables of lines in the infrared solar spectrum by Babcock and Moore (1947) and previously unidentified lines of solar or terrestrial origin are assigned to the CN molecule.

Observations

The laboratory source of the CN red bands was a D.C. electric arc using carbon or graphite electrodes, either 6mm. or 12 mm. in diameter, operated in air with a current of 7 amperes. A comparison spectrum was obtained with an iron arc operated in air with a D.C. current of 3.5 amperes.

The spectrograph employs a plane reflection grating (ruled 14,400 lines per inch over an area 3 in. x 5 in.) in a modified Littrow mounting with camera and collimator mirrors of 20 foot focal length. The (0,0) band was photographed in the second order with a dispersion of 1.14 A/mm., while the (1,0) band was photographed in the third order with a dispersion of 0.61 A/mm. Nine spectrograms of the (0,0) band were taken on Kodak IZ plates hypersensitized in ammonia, with exposures ranging from 40 to 60 minutes. Four of the nine spectrograms were useful for wavelength measurements. For the (1,0) band ten spectrograms were taken on Kodak IM plates hypersensitized in ammonia, with exposure times ranging from 20 to 60 minutes. Five of the ten spectrograms were useful for wavelength measurements. Glass filters were used to isolate the appropriate orders of the grating: Corning 2540 for the (0,0) band; Corning 5031 and 2030 for the (1,0) band. A slit width of 70 μ was used for all the spectrograms.

No intensity calibration of the plates was attempted because it was found that the intensity of the CN lines depended strongly on the composition and condition of the electrodes in the arc source.

Wavelength measurements were made with a two stage Mann comparator at the Dominion Observatory. The wavelengths for the iron comparison spectrum were taken from the M.I.T. tables (Harrison 1939).

Results and Discussion

Examples of the spectrograms of the (0,0) and (1,0) bands are shown in Figure 1 and Figure 2 respectively. The results are presented in Tables 1 and 2 in which laboratory data are shown on the left and solar data from the tables of Babcock and Moore (1947) are on

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*Now at Arcetri Observatory, Florence, Italy.

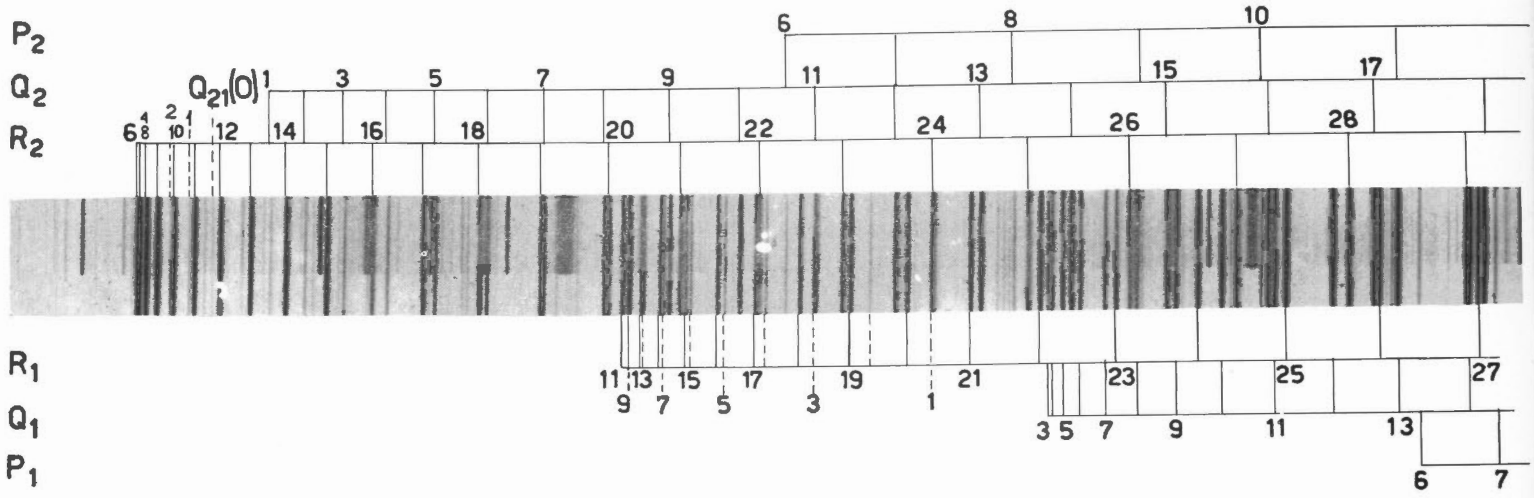

Figure 1. The first part of the (0,0) band of the CN red system in emission from a laboratory source. The R_2 head is at 10925.547 A. Enlargement 2x.

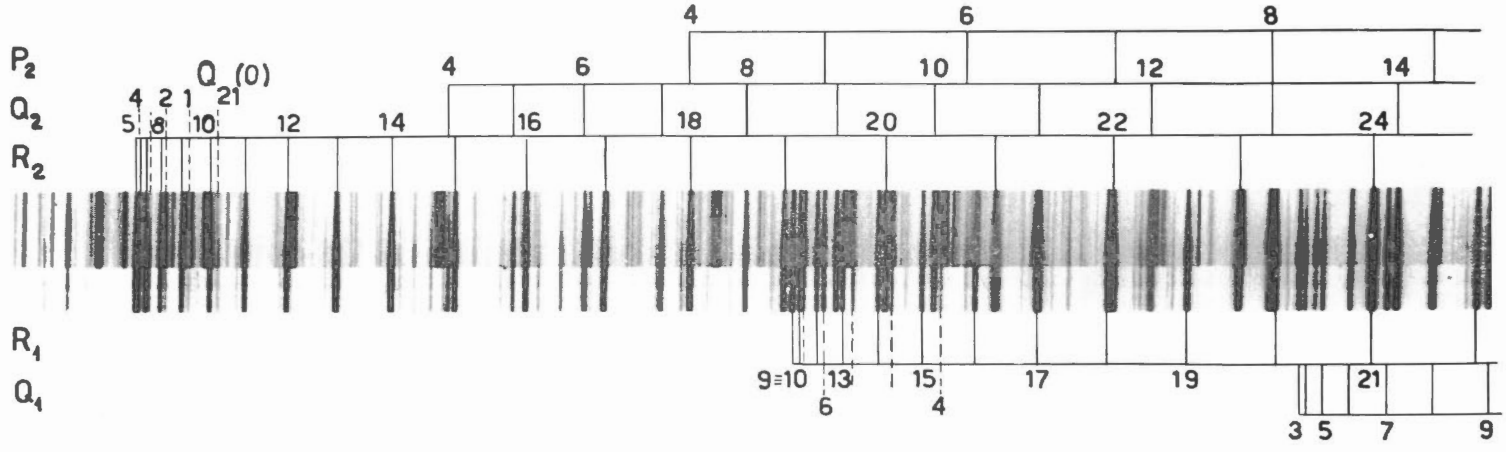

Figure 2. The first part of the (1,0) band of the CN red system in emission from a laboratory source. The R_2 head is at 9140.572 A. Enlargement 2x.

TABLE 1. $A^2\Pi$-$X^2\Sigma$ (0,0) BAND OF CN COMPARED TO THE SOLAR SPECTRUM

Rotational Quantum Numbers						Laboratory		Sun		Sun—Lab. A	Identification by Babcock and Moore (1947)
R_1	R_2	Q_1	Q_2	P_1	P_2	Wave number in vacuum, cm^{-1}	Wavelength in air A	Wave-length A	Disk Int.		
	10					9147.960	10928.405	10928.43	ON	+ 0.025	⊙
	11					9146.603	10930.026	10930.06	−3N	+ 0.034	Cr. Atm?
	12					9144.920	10932.038	10932.06	−2	+ 0.022	Atm
			2			9139.370	10938.677	10938.68	2NN	+ 0.003	Atm
	17					9131.679	10947.890	10947.88	1	− 0.010	Atm
			5			9130.893	10948.832	10948.85	−3	+ 0.018	⊙
	20					9119.693	10962.279	10962.30	3ns	+ 0.021	Mg?
10, 11						9118.719	10963.449	10963.48	−1	+ 0.031	⊙
8						9117.394	10965.043	10965.03	−1	− 0.013	⊙
			9			9115.709	10967.069	10967.08	−3	+ 0.011	—
16						9112.611	10970.798	10970.80	−3	+ 0.002	—
	22					9109.982	10973.965	10973.97	−1NN*	+ 0.005	⊙
18						9107.321	10977.170	10977.18	5nl	+ 0.010	Atm
21						9106.424	10990.321	10990.34	−2	+ 0.019	Atm
		6				9089.477	10998.720	10998.74	−2	+ 0.020	—
		7				9087.893	11000.637	11000.63	−2	− 0.007	—
			15			9083.949	11005.414	11005.42	−1	+ 0.006	—
		9				9083.408	11006.069	11006.08	−2	+ 0.011	Atm?
25						9076.431	11014.529	11014.56	−3	+ 0.031	—
		15				9059.736	11034.827	11034.80	ON	− 0.027	⊙
			19			9056.343	11038.961	11038.95	12	− 0.011	Atm
		17	20			9048.569	11048.445	11048.44	1N	− 0.005	⊙
			22			9032.104	11068.586	11068.57	−2	− 0.016	⊙
		20				9028.808	11072.626	11072.64	−2	+ 0.014	Atm
		21				9021.440	11081.669	11081.65	−2N	− 0.016	⊙
					19	8992.074	11117.859	11117.86	4	+ 0.001	Atm
			28			8974.322	11139.853	11139.84	3	− 0.013	Atm
			29			8963.460	11153.351	11153.33	−3	− 0.021	⊙
					22	8957.590	11160.661	11160.65	(75)	− 0.011	Atm
				22		8938.321	11184.720	11184.69	−3	− 0.030	—
				25		8902.620	11229.573	11229.60	−2	+ 0.027	⊙
			35			8890.918	11244.353	11244.36	0	+ 0.007	Ti

*Sunspot line; absent from disk.

TABLE 2. $A^2\Pi$-$X^2\Sigma$ (1,0) BAND OF CN COMPARED TO THE SOLAR SPECTRUM

Rotational Quantum Numbers		Laboratory		Sun		Sun—lab. A	Identification by Babcock and Moore (1947)
Q_1	Q_2	Wave number in vacuum, cm^{-1}	Wavelength in air A	Wave-length A	Disk Int.		
	8	10906.437	9166.381	9166.39	−3	+0.009	Fe?
	9	10901.895	9170.200	9170.17	−3	−0.030	⊙?
	13	10880.399	9188.317	9188.346	−3	+0.029	⊙
10		10866.280	9200.256	9200.23	−3	−0.026	⊙
	22	10811.122	9247.195	9247.19	−3	−0.005	⊙

the right. The rotational quantum numbers of the lines as assigned in the laboratory analysis are entered under the headings for the various branches. It should be noted that the tables of Babcock and Moore are now under revision at the National Bureau of Standards but wavelengths longer than 6600 A will not be changed (Moore-Sitterly 1961).

The wavelengths of 569 lines were measured in the two CN bands: 322 in the (0,0) and 247 in the (1,0) band. Two criteria were used in identifying these lines with lines in the solar tables. First, lines were retained only if the differences in wavelength "sun-lab" were $|\Delta\lambda| \leq 0.03$ A, disregarding their previous identification by Babcock and Moore (1947). Second, lines were rejected if the relative intensities did not correspond to the rotational intensity distribution computed for a $A^2\Pi - X^2\Sigma$ band at the temperature of the photosphere, with due allowance made for the spectrographic resolution in the solar spectrum.

As shown in Tables 1 and 2, only 38 CN lines are attributed to the solar spectrum. This small number can be easily explained. First of all, weak solar lines (such as those due to CN) might escape detection altogether. Then, the combined errors in the laboratory and solar wavelengths might in some cases exceed the adopted limit of 0.03 A. The criterion of rejecting lines according to their relative intensities was strictly applied and eliminated many lines which fulfilled the condition $|\Delta\lambda| \leq 0.03$ A. However, some error might arise because the expected intensity distribution of the CN lines might be altered in the solar spectrum. For example, blends with other solar lines may cause intensity distortions. Finally, the region of the solar spectrum under examination is crowded with many atmospheric lines which are often intense; the CN lines, on the other hand, are very weak.

The identifications given in this paper can be regarded with confidence for the majority of them satisfy simultaneously both criteria described above. Some doubts can however be advanced for the CN lines coinciding with strong lines assigned by Babcock and Moore to atmospheric absorption. In these cases the lines satisfy the condition $|\Delta\lambda| \leq 0.03$ A only and it is assumed that those atmospheric lines mask the solar lines. This is quite possible and for this reason they are retained in the list.

Acknowledgments

The author is greatly indebted to the National Research Council of Canada for the grant of a Fellowship which made possible the work described in this paper. He would also like to express his thanks to the following: Dr. C. S. Beals for making available the facilities of the Dominion Observatory; Dr. J. L. Locke for his personal interest and general supervision of this research; Dr. V. Gaizauskas for assistance in the laboratory and with this publication; Dr. L. Herzberg for many valuable suggestions regarding the analysis of molecular bands and the identification of solar lines; and Dr. C. M. Sitterly for her suggestions and encouragement in preparing this paper.

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PHOTOGRAPHIC REGISTRATION OF TRANSITS AND REDUCTION OF OBSERVATIONS ON THE OTTAWA MIRROR TRANSIT TELESCOPE

G. A. Brealey and R. W. Tanner

Price $1.25

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QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1963

Photographic Registration of Transits and Reduction of Observations on the Ottawa Mirror Transit Telescope

G. A. BREALEY AND R. W. TANNER

ABSTRACT:—A new mirror transit has been under development in the Division of Positional Astronomy of the Dominion Observatory in Ottawa during the past several years. While the instrument is now physically complete and operative, it will clearly require a year or more to make all the observational, mechanical and electrical tests required before its performance can be usefully assessed and compared with that of conventional instruments. It has therefore been decided to publish an account of its design, construction and method of operation; to be followed at a later time by a report on results obtained by it on an extended program of observation. It has been designed so that either visual or photographic observations can be made. For both types of observations a velocity-generating analogue computer has been built to drive a carriage, with associated eyepiece and photographic camera, at velocity $V = V_e \cos\delta$, where V_e is the velocity of an equatorial star image and δ is the declination of the star being observed. For visual observations the eyepiece is used with a differential device to initiate and control the coincidence of image and reference wires in the manner of an impersonal micrometer. For photographic observations a time-mark generator has also been built, which causes a flashtube to ignite for a few microseconds at known times. An etched reticle is illuminated by the flash and is recorded on the photographic plate together with the stellar image.

Enregistrement photographique des passages et réduction des observations au télescope de passages à réflection à Ottawa

G. A. BREALEY ET R. W. TANNER

RÉSUMÉ:—La Division de l'astronomie de position de l'Observatoire du Canada à Ottawa a mis au point, au cours des dernières années, un nouveau télescope de passages à réflection. Quoique l'instrument soit maintenant au point et en état de fonctionner, il s'écoulera encore au moins une année d'observations et d'essais mécaniques et électriques avant qu'on puisse évaluer la qualité de son rendement et le comparer aux instruments classiques. C'est pourquoi l'on a décidé de publier un exposé du plan, de la construction et de l'utilisation de l'instrument. Un rapport ultérieur rendra compte des résultats obtenus au cours d'un long stage d'observations. L'instrument a été conçu de façon à permettre des observations visuelles et photographiques. On a construit pour ces deux genres d'observations, un calculateur analogique générateur de vitesse qui entraîne un chariot portant un oculaire et une caméra à une vitesse $V = V_e \cos\delta$, dans laquelle équation V_e représente la vitesse de déplacement d'une étoile à l'équateur céleste et δ, la déclinaison de l'étoile observée. Lorsque l'on fait des observations visuelles, l'oculaire est couplé à un mécanisme différentiel qui permet d'obtenir et de régler la coïncidence entre l'image et les fils du réticule à la façon d'un micromètre impersonnel. On l'a muni aussi, pour les observations photographiques, d'un chronomètre enregistreur qui allume une ampoule pendant quelques microsecondes à intervalles déterminés. L'éclair illumine un réticule gradué que la plaque photographique enregistre avec l'image de l'étoile.

REGISTRATION OF OBSERVATIONS

The term "mirror transit", for an instrument such as the one described herein, probably originated with Dr. R. d'E Atkinson. In place of the conventional refracting telescope, pivoted on an east-west axis so as to sweep out the meridian, the mirror transit makes use of a mirror of suitable size, likewise pivoted on an east-west axis so as to reflect the light from the selected star into a fixed horizontal telescope. Thus differential flexure of the telescope is avoided; and furthermore the space orientation of measuring micrometers is constant. There are two such telescopes facing one another on a north-south baseline, the stellar image being reflected into the one on the same half of the meridian as the star. Within 20° of the zenith some freedom of choice exists. The image of the star is formed at the prime focus of the telescope; and in the focal plane are placed any reference wires required. In theory at least all observations can be performed by a direct examination of this domain. In practice, however, this becomes impractical. If one desires to use high-power, short focal length eyepieces, with provision for optional photographic transits, and optical and photographic registration of collimation and autocollimation, then the design problems become formidable. In the Ottawa mirror transit all the information is carried to a second-

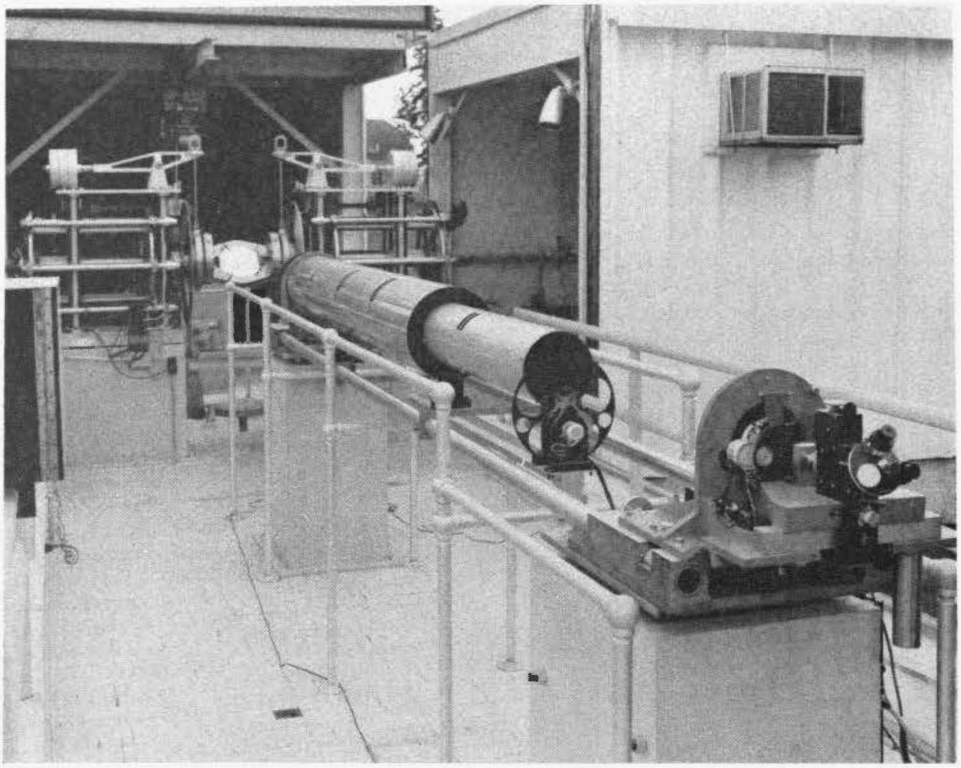


Figure 1.
The north collimator at an early stage of construction. The velocity computer has not yet been mounted on the pier, nor have the screens been added to the 5-station screen selector.

ary focal plane through a system of unit magnification, where it can be more conveniently used.

Figure 1 is a view of the north telescope and Figure 2 is a schematic drawing of the optical system, which does not require any additional description. In order to ensure that the star will be somewhere in the field of view at transit the mirror angle must be set to an accuracy of the order of one minute. This is done from the observing station by a servomechanism; and since this device also serves to set one of the parameters on the velocity-generating computer it is described here.

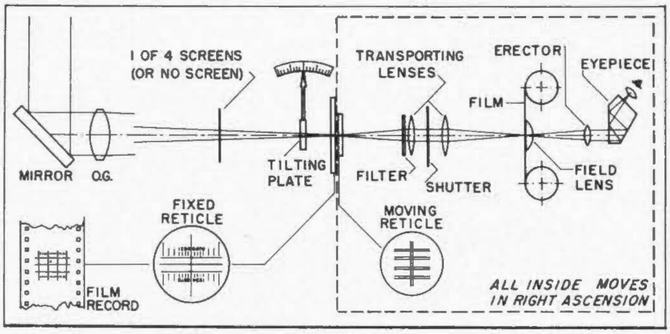


Figure 2. Optical system of main collimators, Ottawa mirror transit.

A typical error-signal link is shown in Figure 3. The input rotor is set to a desired angle by means of a pointer or some other reference dial and the output rotor will have induced in it voltages of a phase and magnitude proportional to its angular relation with the input rotor. This voltage is amplified and drives a servo motor, which in turn rotates the device to be positioned. The servo motor at the same time rotates the output rotor in such a way as to tend to reduce the out-of-phase signal; and rotation will continue until the signal is essentially zero.

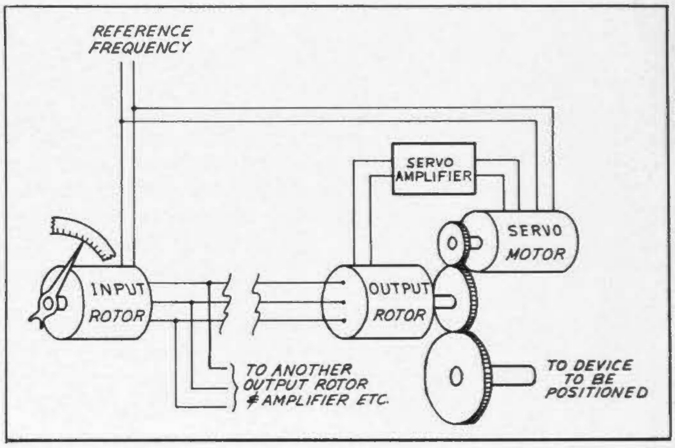


Figure 3. Error-signal servo link.

In practice the order of accuracy of such a simple link is of the order of 8-15 minutes of arc, set by the imperfect electrical balance inherent in the construction of the components; and additionally by the so-called zero errors, which occur chiefly because at some point the error signal becomes so small that it no longer drives the amplifier to full output. At this point the motor develops insufficient torque to overcome residual friction.

To overcome this limitation and achieve much higher angular accuracy (such as the 1 minute required for mirror positioning) two complete servo links in a so-called coarse-fine system are used. On the mirror transit the two input servo transmitters are geared 1:36 as are the two receiving servo transformers. The 'coarse' high-speed link tells the system where it is in the 360° of possible angular position and drives it to the desired vicinity, where the 'fine' slow-speed link assumes control and accurately positions the system. The fine link has the same order of accuracy as any similar servo, hence it resolves 10° of mirror angle just as the coarse link resolves 360°. It follows then, that it increases the accuracy of following by a factor of 36, or in other words, reduces the zero errors of the coarse system to one thirty-sixth, corresponding to 13-32 seconds of arc.

The transition from coarse to fine is made automatically. Assume the system is lined up from a previous setting. If the observer now selects a new desired position on the transmitters both error signals immediately rise; however the coarse signal, on increasing, trips a sensitive relay in the servo amplifier and thus becomes the driving signal. This condition remains until, within about 2° of coarse-system coincidence, the signal no longer suffices to hold the relay, whereupon the fine signal becomes the input. By means of an electromagnetic clutch energized by the same relay, the controlled device is moved quite quickly by the high-speed gear train of the motor, but near coincidence is moved more slowly by the low-speed gear train; which of course makes the torque of the motor much more effective in overcoming mechanical friction and hence reducing zero errors.

Two views of the transmitter are shown in Figure 4. The modified counter reads the angle to the nearest .01 degree and is set by the pushbuttons nearby which drive

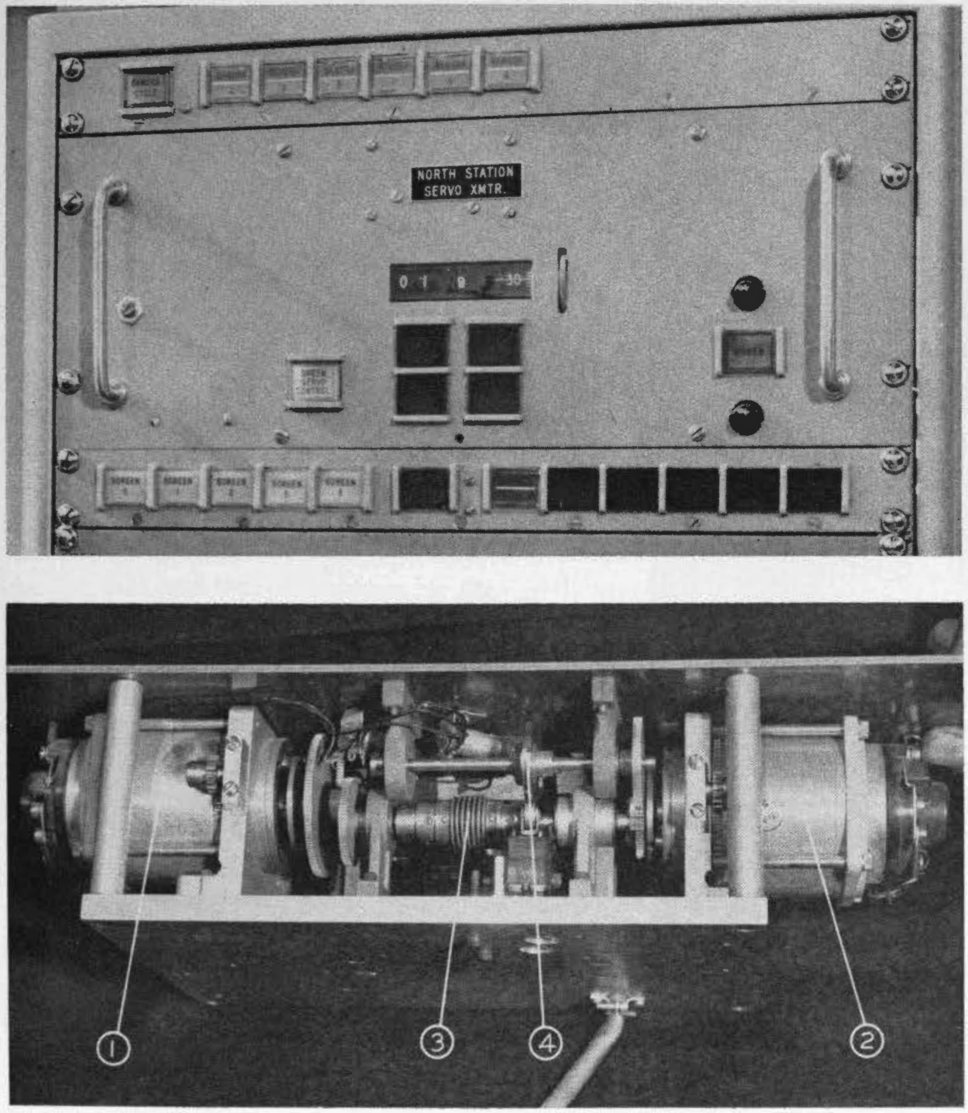


Figure 4.

Two views of north servo transmitter. At top the camera cycle indicators are shown above the transmitter, and the screen selector control and other test switches below. Details of lower view are described in the text.

a small motor not visible in the picture. Fine adjustments are made by the thumbwheel to the right of the counter. The fine transmitter is cross-coupled by coupling (3) to the coarse transmitter at (2). Coupling (3) is used to set the initial phase between the coarse and fine transmitters. There is an additional shaft and cam at (4), the purpose of which is described later. There are two such transmitters, one for each telescope eye end; and by a system of latching relays either one can be placed in control. It is intended eventually to place a third digital servo transmitter in the control room (east wing of mirror transit building) where the observer in winter will be able to perform his tasks in comparative comfort.

The mirror positioning servo receiver is shown in Figure 5, looking down at an angle (to the horizontal) of about 60°. The large gear, part of which can be seen on the right, is one of the two large circles clamped to the main mirror axis, (the other, on the opposite end of the axis and out of the picture, is not geared; but instead is engraved with division marks which are photographed to measure the precise angle of the mirror normal). This large gear is driven by the pinion which can be seen below it, through a ratio of 1:36, and the fine servo transformer at (1) is coaxial with this pinion shaft. Internal worm gearing which can be seen couples the coarse transformer at (2) likewise through a 1:36 ratio. Hence every time the axis rotates once, so does the coarse transformer. The clutch for automatic switching to high-speed drive is visible at (3). The visible end of the clutch carries a large gear engaged by a pinion, and is the low speed end of the clutch. The high-speed gears are hidden by the frame as is the servo motor. In practice the mirror axis is reversed, east for west, about once a month; and the servo receiver reverses with it. A concurrent change of polarity of servo signals makes the axis rotate always "top-to-north" with increasing readings; thus only one entry is required in the observing book for the position of each star.

Reference to Figure 3 illustrates that the servo transmitter outputs can be fed into other servo transformers. In the mirror transit these outputs are used to set one of the parameters in the velocity generator described below.

The idea of using a variable speed device as the prime mover for an impersonal micrometer is not new. The speed range required for a meridian circle right ascension screw is considerable and in an extreme case could range

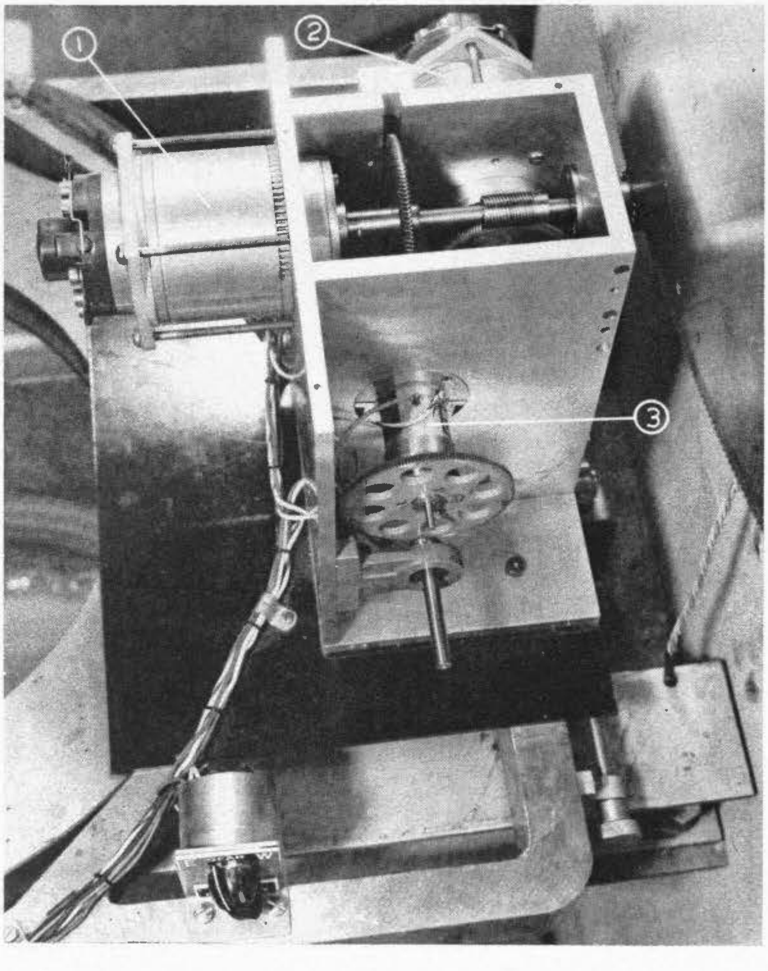


Figure 5.

The axis servo receiver. The switch in the lower part of the picture was used to change servo polarity with change of clamp so as to preserve the condition that readings increased as the normal swung north. This change is now done automatically with a relay.

from maximum (for an equatorial star) to zero (for a 'true' pole star). In practice it happens that travelling-wire transits are not feasible very close to the pole. The wavering of the star due to atmospheric conditions will approach in scalar magnitude the velocity motion of the image; and in general the observing of such stars in right ascension is difficult. However, for the present generation of astronomers at least, it is desirable to be able to follow *Polaris* and λ *Ursae Minoris;* which implies that the speed range should be variable from maximum to about 1/64 of maximum.

The velocity for any star is of course given by the expression:

$V = V_e \cos\delta \qquad \delta = \text{declination}$

$\qquad\qquad\qquad V_e = \text{velocity equatorial star}$

One of the earliest attempts to drive a right ascension lead screw was made at the Cape Observatory. A description of the apparatus used is contained in *History and Description of the Cape Observatory, 1913*, pages 49 to 58, Sir David Gill being at that time in charge. Briefly the system consisted of a right circular cone driven at constant velocity about its main axis, with a longitudinal adjustment of the position of a driven wheel frictionally bearing on the cone periphery. Hence the effective "gear ratio" could be varied from maximum at the base of the cone to minimum at the apex.

A more recent device, presumably still in operation, drives the lead screw of the 6-inch transit circle at the U.S. Naval Observatory in Washington D.C. The system is described in considerable detail in *Publications of the U.S. Naval Observatory.* It relies on a tuneable audio oscillator and amplifier, a synchronous motor, and selectable gear ratios sufficient to produce the desired speed range. There is every indication that the drive works well for visual observations, which are the only type at present performed on this instrument. However, it provokes the inherent difficulty of variable frequency sources and synchronous motors, in that such motors will only stay synchronous over a relatively small frequency range and require external gear changes to extend the speed range. It is greatly to the credit of C. B. Watts and his associates that the system was made so well; and at the same time did not physically overload the eye end of the transit circle, which is of conventional design.

The foregoing system is not suitable for photographic registration of transits as it lacks sufficient accuracy for good following, at least with the present calibration accuracy of variable frequency oscillators. Unless many cumbersome gear changes, sophisticated temperature-controlled oscillator ovens and other accessories are used, the tracking velocity cannot be guaranteed to be within even 1 per cent of its assigned value.

The Ottawa mirror transit originally utilized a present-day, highly refined version of the Cape Observatory cone drive, and used experimentally as the variable velocity source a so-called ball-and-disc integrator, of which there are many on the market. They all use the same principle and the best of the models have a reproducibility of 0.1 per cent. Figure 6 shows the principle of operation. An input spindle, terminated by a disc, is rotated at a constant velocity; the disc imparting to a chain of two balls angular velocity linearly proportional to the ball displacement from centre. The balls are contained in a 'cage' by which they can be moved along a radius of the disc.

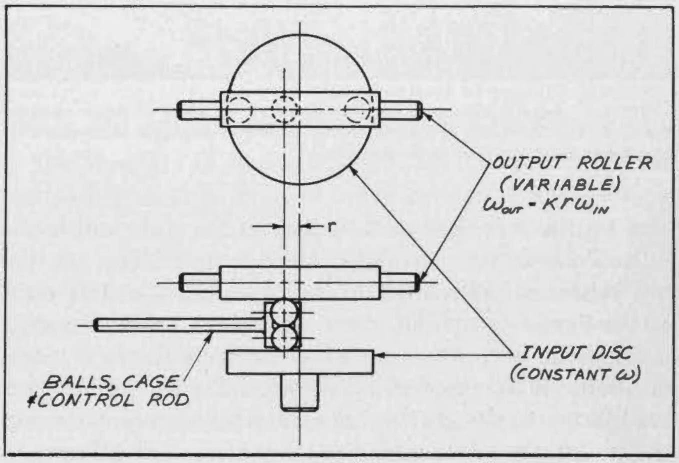


Figure 6. Principle of ball-and-disc integrator.

The second of the balls drives the output roller. In practice the components are made of very hard steels and run with considerable contact pressure in order to minimize slip. They require careful setting-up to ensure that the balls truly follow a diameter of the disc. It is interesting to note that as the balls pass through the centre the output velocity reverses direction—a property which has been put to good use in accommodating the right ascension drive to lower culmination stars. Most ball-and-disc integrators will deliver up to 3 inch-ounces torque at about 1000 rpm maximum speed.

To appreciate fully the problems inherent in using an integrator for lead screw drive, the reader is referred to Figure 2 for some of the details of the eyepiece assembly.

That part of the eyepiece in the dotted outline of Figure 2 moves in right ascension with the star; and for the 168-inch focal length of the main collimators its velocity for an equatorial star must be about 18.5 mm/min. The entire slide is supported essentially by three points, viz., opposing V grooves at opposite ends of the back and a flat plate and ball-bearing at the front. In Figure 7, with the carriage removed, these various features can be seen in part, as well as the lead screw, (single pitch) which has a lead of .635 mm. The long

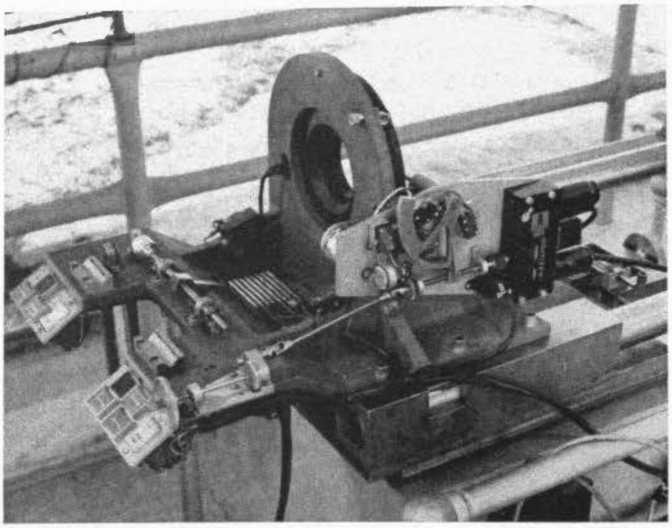


Figure 7. Base casting of the north collimator. The series of bars between the Vees and flat block are contacted by wipers on the right ascension slide to provide electrical service for the latter.

arm on the nut rides on a socket on the slide and hence is prevented from turning; while a projection on the nut bears against a hook on the slide, thus exerting none but a linear constraint on it. A weight pulls the slide against the nut. The angular velocity of the lead screw is about 29.3 rpm for an equatorial star. It is then reasonable to design the velocity computer so as to run the integrator at its maximum recommended velocity in order to get the greatest possible dividend from its rated output torque.

It has been mentioned that the output velocity of the integrator is a linear vector function of the ball displacement. The velocity desired at the output of the computer is, however, required to vary as the cosine of the declination. It has already been pointed out that the transmitting servos are set according to the declination of the star being observed; so it is clearly apparent that some shaft at the receiving transformer end will take up an angular position also proportional directly to declination. In the case of the receiving servos at the main mirror, this 'shaft' is obviously the mirror axis itself. However, at the eyepiece ends, one must somehow translate the shaft position reproduced there into a cosine-functional displacement of the ball-and-disc integrator push rod.

In the design concept of the Ottawa mirror transit this has been done, in effect, by having a *limaçon* cam attached to the receiving servo shaft, with the cam follower bearing against this cam and connected to the integrator push rod. The *limaçon* is a general curve of which the cardioid is a special case, and its locus is given by

$$R = a + k \cos\theta$$

where R is the radius vector at angle θ from the x-axis, say, and a and k are constants.

Figure 8 illustrates the fundamental principle. The cam shaft carries a graduated disc which serves as a lining-up jig and servo-checking index, and is suitably coupled to the coarse and fine receiving servos. (It is pointed out that as the mirror is turned through an angle α, 2α is swept out in the sky; so that the shaft in the above figure must turn through double the transmitter angle. This condition is met through suitable gearing, described below). Reference to the enlarged view of the cam follower shows that it is necessary that its centre follow a simple harmonic motion; so that the cam itself cannot be a true *limaçon*. If it were, the cam follower would not perform the required cosine motion because of the inclination angle θ_i between follower line-of-action and tangent point of roller. Furthermore a and k in the formula must be chosen so that the curvature of the cam is everywhere less than that of the cam follower.

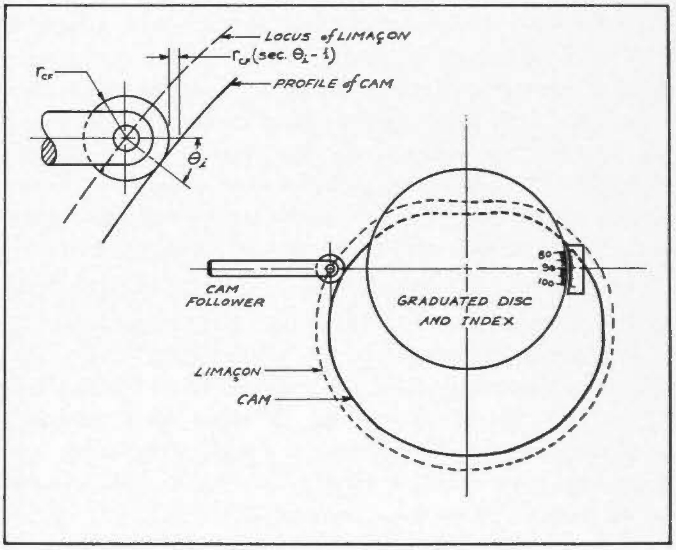


Figure 8. Principle of cam and follower.

The requirements of the velocity generating computer are summarized before describing it in detail:

(1) The cam must be located angularly by being suitably connected to a receiving servo system.

(2) The integrator should be running at nearly maximum rate for an equatorial star. In order to allow for uncertainties of determination of the speed of an equatorial image the cam should not work directly on the integrator push rod, but through a linkage which will permit an adjustment of push rod throw in proportion to the excursion of the cam follower.

(3) As the output shaft speed drops, the limits which define the travel of the lead screw nut should be drawn in, so that polar stars will not take excessively long to observe.

(4) The travel of the eyepiece assembly should be symmetrical, for all stars, about the line of collimation,

(5) The integrator, in reversing direction as it passes through zero output, caters thus automatically to the lower culmination stars; hence automatic reversing of the functions of limit switches must be incorporated.

(6) A high-speed drive should be added to run the lead screw quickly to the 'start exposure' position, and to return it to centre position at the end, again with regard to the function interchange mentioned in (5).

(7) A device should be added to permit the observer, in the case of visual observations, to add or subtract additional velocities to the lead screw to initiate or maintain coincidence of wires and image. This incremental velocity should be always of the same magnitude rather than proportional to the lead screw velocity.

Figure 9 shows one of the velocity generators mounted in position on the north pier, with the shaft passing up through the base casting to couple it, via bevel gears (Figure 7), to the lead screw.

The cam is concentric with the graduated worm gear at (1) and is obscured by it. The cam follower is the rod at (2), and the $\frac{3}{8}$-inch outside diameter ball-bearing at its extremity (likewise obscured) follows the cam. In order to get an extremely accurate cam satisfying the condition that the cam follower perform a simple harmonic motion, it was made by rough-cutting a blank and then centring it in the dividing head of a milling machine, for which the transverse table feed screw was disconnected. See Figure 10.

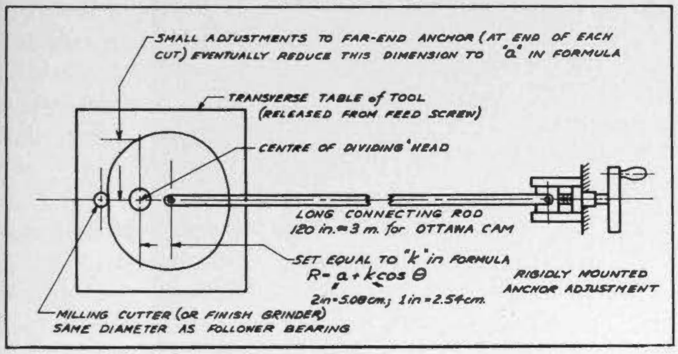


Figure 10. Shaping of modified *limaçon* cam.

A long rigid bar was attached, via an adjustment, to a solid masonry wall and, being so long, approximated to a sufficient degree of accuracy an infinite connecting rod. As the dividing head was turned, the bar pulled the head, and hence the transverse table, back and forth while the cutter, *of the same diameter as the follower bearing*, finished the shape. The penetration and feed of the cutter was governed by the length adjustments of the long bar. The entire procedure was repeated on a universal grinder to get a smooth cam periphery.

By suitable spring loading, the cam follower (Figure 9) imparts a swing to the lever (3) which in turn controls the throw of the integrator push rod at (4). The fulcrum of lever (3) is adjustable two ways. In the direction more or less parallel to the lever, it alters the lever ratio so that the full throw of the cam can be made to give the proper throw to the integrator push rod. The other adjustment, more or less perpendicular to the lever, ensures that the integrator push rod is centred (zero output velocity) when the cam follower is in the middle of its travel.

The integrator, driven through gearing from the synchronous motor at (5), drives through a clutch (6) and eventually into the differential (7). An additional motor (8) and clutch (9) provide for high-speed positioning or centring of the lead screw as required. The incremental velocity for visual observations is applied through motor (10) acting on the other end of the differential.

The device for shortening the lead screw travel as one approaches the pole, in order to avoid excessive time requirements, is contained in the system of drums at (11) and (12), and the connecting rods and racks at (13) and (14). There is a chain of gears, not clearly visible in the figure, which causes the drum (11) to rotate once in about 30 revolutions of the lead screw. Since the equatorial exposure is anticipated at about 40 seconds (20 revolutions of the lead screw) the drum (11) rotates about 2/3 revolution, or less as one approaches the pole. The drum is, in diametral section, like an I-beam; and at one point on the rim, two shallow lobes are cut on the opposite undersides of the top bar of the 'I'. They are located so as to be at the top of the drum when the lead screw is centrally located. The disc at (12) has a counterpart on the far side and both discs run freely on the shaft which carries drum (11). These discs carry small microswitches on their inner (hidden) faces which are triggered by the aforementioned lobes on (11). Racks (14) are toothed in such a way that the back half of each rack drives the disc (11) on that side; while the front halves provide for contrary motion of the racks through the gear (15). Hence if one of the racks is moved in any direction, it causes a rotary motion of its microswitch disc and a contrary motion of the rack and microswitch disc on the other side. If the two microswitches are suitably wired as limit switches, the lead screw and drum (11) will rotate until the lobes have covered the angular interval between switches. The angular separation of the limit switches would ideally be zero for a true pole star and increase with decreasing declination. However, such extremes are not practical. Lost motion, uncertainties of operating points of the limit switches, inertia of the lead screw drive, necessity for reasonable separation of the reticle flashes on film, all contribute to the necessity for a compromise with the ideal case. The degree of compromise is a matter of choice. On the system as

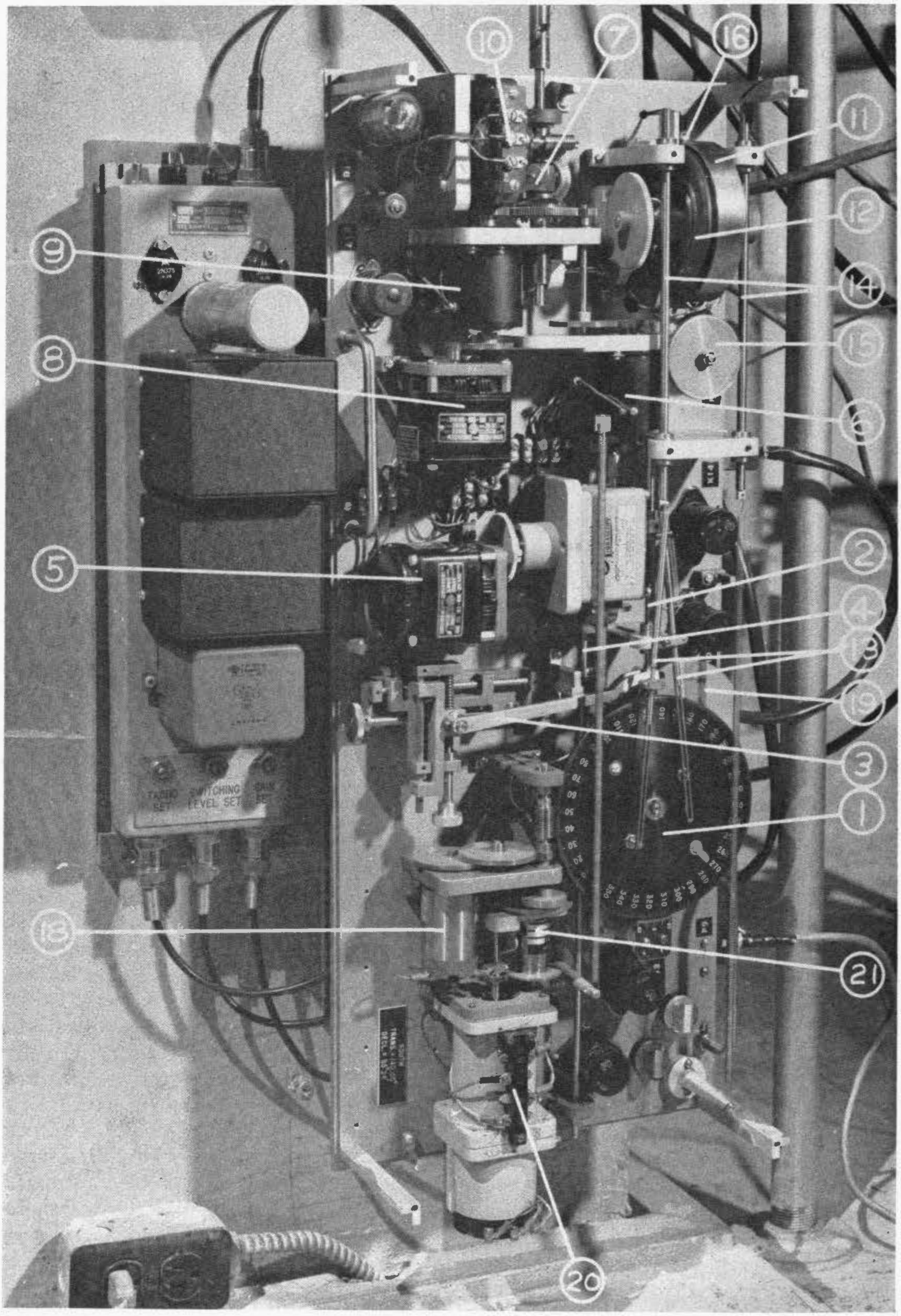


Figure 9. The north station velocity computer with servo amplifier. The computer is mounted on three integral legs which are clamped to posts on the pier and hence can be quickly removed. The drive from computer to collimator is made by a spline connection and universal joints; so the computer exerts no undesirable constraint.

developed here, the limiting declination for which following is attempted is 89° 06′ (secant 64.00) and the exposure time tentatively set at 120 seconds. This requires a limit-switch separation of 9° for the 89° 06′ polar, which must be increased to about 240° for an equatorial star.

The increase in separation of the limit switches is performed by connecting rods (13). They are slotted as shown, so that either one will pull on the rack as the cam shaft is rotated either way from the declination 90° position. The radii (on the cam gear) at which the rods terminate is adjustable and determines the increase in limit switch angular separation. In order to permit rotation past the position of 0° declination, one of the connecting rods is in the form of a spring-loaded spline. It is the one on the right in Figure 9 and is closed up in this view. The small retracting spring can be seen opposite the integrator. It closes up a centimeter or so when not in tension (i.e., when it is not pulling on the rack) and is thus enabled to clear the pin of the other rod by passing behind it. There is also, on drum (11), an external lobe located so as to define, with microswitch (16), the central position of the drum and hence of the lead screw.

The fine servo transformer is at (18), the coarse transformer is obscured by gear (19). (20) and (21) are the motor and clutch respectively, which function in the same way as the motor and clutch on the axis positioning gear. All components are geared in such ratios that the cam will be rotated through twice the mirror angle, as it is required to do.

It will be observed that this system can not and must not attempt to follow all readings of the input servos. The doubling of the angle would result in damage and mis-phasing if, for example, the receivers attempted to follow to the mirror positions for mercury autocollimation. The purpose of cam (5) in Figure 4 is to prevent this. For the north collimator computer, this cam disconnects the servo motor outside the range of input angles 110° - 265° (40° above S horizon to 10° above N). For the south computer, the cam excludes all but 95°-250° (10° above S horizon to 40° above N).

Beneath the cam, and on the same shaft as the cam and graduated gear, are two additional cams for activation of microswitches. One of these energizes a series of relays as the cam assembly passes declination 90° going towards lower culmination transits. These relays reverse the function of the limit switches, the direction of the high-speed motor, and the polarity of the control switch for the differential motor.

The second of the additional cams serves to change the flashing interval automatically, making the flashes less frequent nearer the pole; so that the film will not be over-crowded by imprints of the reticle.

A component has been added to the velocity generator since Figure 9 was taken. It is a photoelectric tachometer geared to the integrator output shaft. The output pulses from this tachometer are counted electronically, with the counter time base being selected so that 10,000 counts are admitted for an equatorial star. Hence this part of the equipment acts as a cosine computer, the values determined being quickly comparable with cosine δ for checking purposes during observations, and for initial setting-up of the components.

The velocity computers prove to be accurate to better than 0.1 per cent from $\cos\delta = 1.0$ to about $\cos\delta = 0.1$. As $\cos\delta$ decreases further the values become less reliable. Since the rate of change of $\cos\delta$ is proportional to $\sin\delta$, any alignment or zero errors of the servo system (insofar as they cause errors in the *limaçon* cam angle) become more serious as the pole is approached. Further complications result, in particular with the north collimator computer, and observations of circumpolar and lower culmination stars. These complications, described below, have an effect peculiar to the photographic registration of transits, and do not detract from the simplicity of operation of the ball-and-disc integrator for visual observing.

The first complication arises as follows: Consider for example a star at lower culmination, declination 60°N. Its image will have velocity $V_e/2$. However the refraction at zenith distance 75° is about 3′; and for observation purposes the axis (and hence servo system) must be set for the refracted star. In this case the refracted star appears farther above the horizon, and the input angles will be those for an *unrefracted* star at declination 60° 03′. The velocity error is then $V_e/2 \div V_e/.4992$, or about 0.2 per cent. One remedy for this situation would be a *limaçon* cam corrected for refraction—a nearly impossible undertaking. An alternative would be separate position controls for the velocity generators. Such a policy would unfortunately undo all the efforts made to simplify the operating procedure.

The second complication arises from the technique of observing. The photographs of the graduated circle (of the axis) must satisfy certain conditions, one of which is that the reference wire shall not be too close to the division marks. These conditions are attained by 'rounding-off' the observing positions (as listed in the observing book) to the nearest 3′ (.05°) and using these incremental values for input position. This approximation results in a further error in the generated velocity, which is less than 0.1 per cent for equatorial zone stars and remains so until $\tan\delta \; d\delta = 0.05$ for which $\delta = 49°$.

It was at first decided to apply corrections for these velocity errors rather than to attempt avoiding them. They do not become serious until declination 49°N, at which point approximately 60 per cent of the observable stars have been accounted for. For the remaining 40 per cent the time interval between shutter opening and first flash and between the last flash and shutter closing is determined by additional elementary pulse circuits. This information, together with the actual generated velocity, suffices to give a correction to be applied to the measured position of the star image on the film. All the foregoing information may be binary-coded on to tape as well as being visually displayed on the counter.

However, since the mirror transit is almost exclusively a photographic instrument, it seemed advisable to solve the tracking problem in a more positive manner. This involves replacing the servo-controlled ball-and-disc integrator by a separately programmed speed selector. It should be emphasized that the ball-and-disc integrator incorporates a valid principal for photographic registration so long as all the parameters of observation are read. It is however possible that one of these could be missed, thus rendering the transit invalid; or in a more serious case be misinterpreted, thus giving an erroneous value of right ascension.

While at present the ball-and-disc integrator is giving acceptable results, a new type of velocity generator is being developed. The general philosophy is to have the velocity entered as a four-figure decimal number directly equal to $\cos\delta$. The velocity increments, 0 to 9, for each decade are obtained by a system of clutches, mechanical differentials, and a decimal-to-binary code conversion. The input shaft drives simultaneously four electromagnetic clutches. Two of these are coupled to the inputs of a mechanical differential through ratios of 1:1 and 1:2 (reduction) respectively. The other two are coupled to another differential through reduction ratios of 1:2 and 1:4 respectively. These two differential outputs are in turn combined by a third differential to give the final output. As the clutches are selectively engaged by the coding network, velocities expressible as an arithmetic series result as follows: ("X" indicates clutch on).

1:1	1:2	1:2	1:4	Decimal
0	0	0	0	0
0	0	0	X	1
0	0	X	0	2
0	0	X	X	3
0	X	X	0	4
X	0	0	X	5
X	X	0	0	6
X	X	0	X	7
X	X	X	0	8
X	X	X	X	9

One such experimental decade has been built and operates with a high degree of accuracy. It is now necessary to construct four of these, each one basically running at 10 times the speed of its successor, and combining these through further differentials to achieve a velocity equivalent to $\cos\delta$. An over-all gear ratio to give the correct lead screw velocities will be the final component. This ratio will depend on the speed of the driving motor on the one hand and the equatorial velocity V_c on the other.

The controls are rendered as simple as possible by suitable circuitry. Having selected all the necessary parameters, whether by ball-and-disc integrator or digital computer, the observation proceeds as follows: the observer finds the lead screw always in its central position; closes one circuit to send the lead screw to its starting point, and then another to start the exposure. The equipment returns automatically to centre after the exposure. The flash timing generator consists essentially of a synchronous motor rotating at 1 rps (sidereal). It is fitted with a cam pulse switch and it has been established that the interval between pulses is sidereal $1^{s}.0000 \pm 0^{s}.0001$ noncumulative. Three shafts of successive speed reduction follow the motor shaft and carry in turn cams and microswitches, which serve merely as gates. By selection performed at the velocity generator auxiliary cam, and thence dependent on declination, the interval between flashes can be made $5^{s}.000$, $10^{s}.000$, or $30^{s}.000$.

The manner in which the photographically recorded transits will be reduced is now discussed and the effect of various departures from ideal conditions is considered. In particular, to what degree can the following be tolerated—(a) inaccuracies in the speed of the lead screw and (b) errors in timing which place the middle of the exposure not on the meridian. Also it is necessary to know if any determination of the phase angle of the lead screw is required either for the reading of instrumental constants or at the instant of occurrence of a flash, or if and why the absolute sidereal time of the flashes will be required, or if the scale factor of the film will need to be determined independently of star observations.

REDUCTION OF OBSERVATIONS

Definitions and Conventions:

In a rectangular horizontal coordinate system, OXYZ, (*see* Figure 11) with O the mirror centre, X west, Y south, Z up, the mean axis of rotation of the mirror is supposed to be directed along OA, where (on the unit sphere) A is a south of the XOZ plane and b above the XOY plane; a and b are the usual azimuth and level constants. The outward normal to the main mirror, ON, makes the angle $90° + \beta$ with OA. A divided circle provides readings, θ, which increase as ON goes from Y towards Z. The XOY plane is taken as the initial position for ON; here the circle is supposed to read θ_o; then θ_r (as read) $- \theta_o = \theta$ gives the rotation of ON from its initial position.

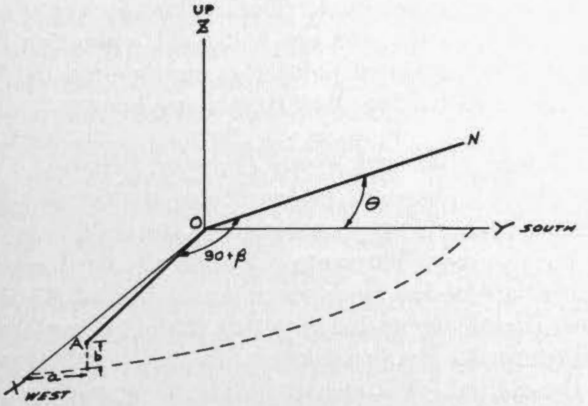


Figure 11. Mirror transit coordinate system.

a,b,β are adjusted to be less than 45″, so that their squares and products are less than 0″.01. With this restriction, the direction cosines of OA are (1,a,b), and the direction cosines of the normal in the general position are ($-$a cos$\theta-$b sin$\theta-\beta$, cosθ, sinθ).

In the focal planes of the north and south telescopes are *fixed* graticules with horizontal and vertical markings. A particular intersection of these markings is chosen as origin for measurement; it is supposed to be at (X_n,$-$1,Z_n), (X_s,1,Z_s) respectively in the above co-ordinate system.

Determination of b, β, X_s, etc.

Three types of observation can be made for this purpose:—

1: with the mirror out of the way, the north graticule is photographed alongside the south graticule.
2: with θ approximately zero the south graticule is photographed alongside itself after one mirror reflection.
3: with θ approximately 315°, the south graticule is photographed alongside itself after two reflections at the mirror, one at the mercury surface.

These may be called collimation, autocollimation and nadir. Similar observations are made in the north collimator.

The photographs so obtained are measured on a comparator in both X and Z directions. The conversion of comparator readings to arc follows in principle from two photographs of type 2 with suitably differing θ's together with the readings of the divided circle. In general the circle settings will be, say, ϵ different from the ideal ones. When X_s, Z_s, etc., are all kept less than 60″, and the various ϵ's less than 0°.05, products of these with a,b,β are almost negligible.

The sense of all measurements on the film is *from* the indirect (or remote) image *to* the direct (or local image). Now tracing rays through the system shows the connection between the observed quantities and the unknowns to be as follows:

Type	θ Measure	X Measure	Z Measure
IS	—	$C_s + C_n$	$Z_s + Z_n$
IN	—	$C_n + C_s$	$Z_n + Z_s$
2S	$\theta_0 + \epsilon_{2s}$	$2(C_s + \beta + b\epsilon_{2s})$	$2(Z_s - \epsilon_{2s})$
2N	$\theta_0 + \epsilon_{2n}$	$2(C_n + \beta - b\epsilon_{2n})$	$2(Z_n + \epsilon_{2n})$
3S	$\theta_0 + \epsilon_{3s}$	$2(C_s - b + \sqrt{2}\beta + \epsilon_{3s}(2b - \sqrt{2}\beta))$	$2(Z_s - 2\epsilon_{3s})$
3N	$\theta_0 + \epsilon_{3n}$	$2(C_n - b + \sqrt{2}\beta - \epsilon_{3n}(2b - \sqrt{2}\beta))$	$2(Z_n + 2\epsilon_{3n})$

Here θ measure is understood to mean the excess of θ as read on the circle over the corresponding ideal value (0°, 180°, 315° etc.). Since X_s, X_n cannot at this stage be separated from a,

$X_s \mp$ a is replaced by C_s, (being somewhat similar to the ordinary collimation constant)

$X_n -$ a is replaced by C_n.

The unknowns as they stand, are over-determined, as Atkinson pointed out in *Monthly Notices* 107, 296. Consideration of the best method of solution is postponed until the errors of the various measurements may be estimated. A combination of the measurements is readily found that gives values for all the unknowns; an approximative method is necessary where the cross products are sensible.

Star Observations:

In the general case of star observations with the mirror at θ, the stellar image at some instant is supposed to fall at $-X_*$, $-Z_*$, in either collimator, where X_* is the measured distance *from* the star image *to* the graticule image *less* X_n or X_s etc.

Tracing in the reverse direction, the ray is found to intersect the unit sphere in:

$$X_a = +X_* - q + pZ_*$$
$$Y_a = \pm\cos(2\theta \pm Z_*) + qX_*$$
$$Z_a = \pm\sin(2\theta \pm Z_*) + pZ_*$$

with the upper sign applying to south *collimator*, lower to north.

The subscript a is to indicate apparent position.

$$p = a\sin 2\theta + b(1-\cos 2\theta) + 2\beta\sin\theta$$
$$q = a(1+\cos 2\theta) + b\sin 2\theta + 2\beta\cos\theta$$

It is convenient to introduce ζ, the approximate *south* zenith distance of the star by putting:

$\zeta = 90° - (2\theta_s + Z_*)$ or

$\zeta = 270° - (2\theta_n - Z_*)$ for south or north collimator observations.

Refraction Corrections:

The apparent zenith distance ($\cos^{-1}Z_a$) differs from $|\zeta|$ by an amount which is negligible for the purpose of entering refraction tables to get the refraction correction, R.

The true place of the star becomes:

$$X_t = fX_* \pm q + pZ_* + k\cos\varphi \quad \begin{matrix}(-\text{ S coll.})\\(+\text{ N coll.})\end{matrix}$$
$$Y_t = \sin(\zeta \pm R) + qX_* \quad (+\text{ star north of zenith})$$
$$Z_t = \cos(\zeta \pm R) + pX_*, \quad (-\text{ star south of zenith})$$

with k the diurnal aberration constant (0″.32), φ the latitude, and $f = (1 + R\,\mathrm{ctg}|\zeta|) \approx 1.00029$. f varies a few percent with ζ and about $\pm$ 10% with pressure and temperature. Insofar as it is constant it may be incorporated into the scale conversion factor in X.

Hour Angle and Declination:

Using the customary notation (δ declination, h hour angle *west*, φ latitude, ZD zenith distance, az azimuth from south via west):

$$X_t = \sin ZD \sin az = \cos\delta \sinh$$
$$Y_t = \sin ZD \cos az = \sin(\varphi - \delta) - 2 \sin\varphi \cos\delta \sin^2 h/2$$
$$Z_t = \cos ZD = \cos(\varphi - \delta) - 2 \cos\varphi \cos\delta \sin^2 h/2$$

Hence $h = \sin^{-1} (X_t \sec\delta)$; and

$$(\varphi - \delta)_{\mathrm{U.C.}} = \zeta \pm R + \sin 2\delta \sin^2 h/2 \pm pX_* = (\varphi + \delta - 180^\circ)_{\mathrm{L.C.}}$$

for upper or lower culmination; where first ± refers to a south(north) star, the second ± to south (north) collimator, respectively.

The further reduction is similar to the ordinary transit circle reduction, and need not be given. It should be noted however that the reduction can be cast into the standard form

$$\alpha - (T + \Delta T) = m + n\mathrm{tg}\delta + C \sec\delta$$

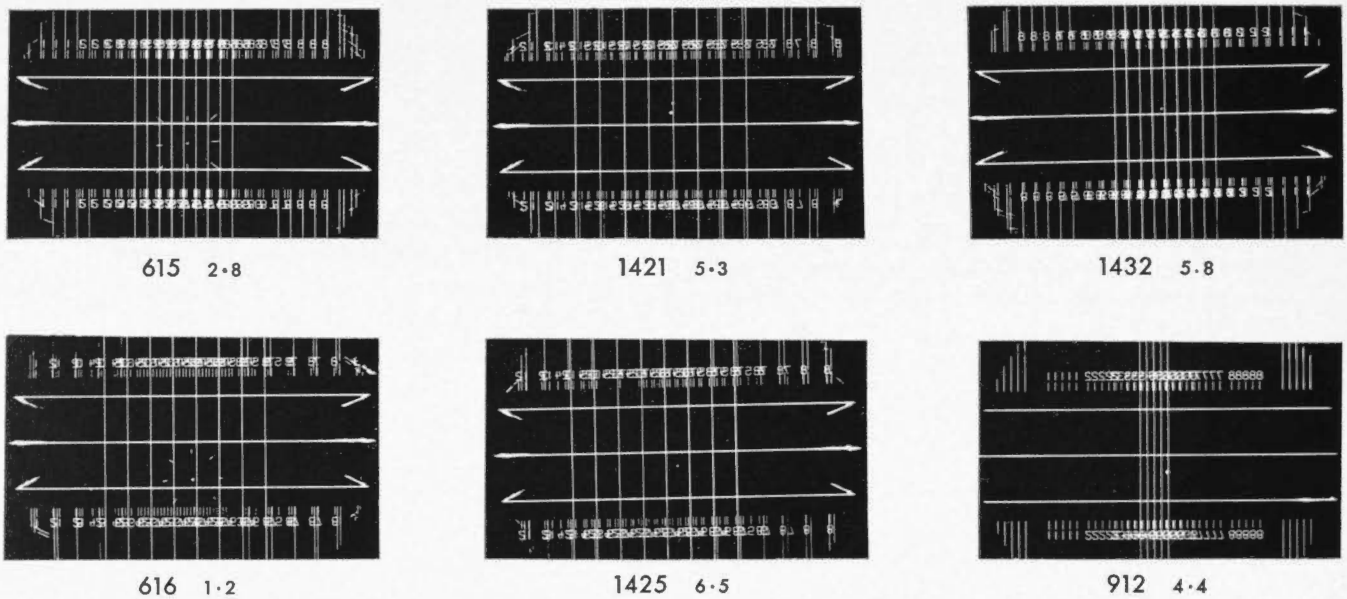
with C *variable,* because of the terms involving β. This is not an obstacle, since C has to be taken as variable, in effect, when allowance is made for pivot irregularities or small motions of the mirror in its cell.

In any event a suitable combination of stars at small and larger zenith distances will yield a solution for a (or n). The details of doing this are deferred until the errors in determining X_*,b,β, etc., are known.

Star Observations with Finite Exposure Times:

So far the observations have been treated as instantaneous. In practice, transporting system, camera and film are to move horizontally behind the fixed graticule at the rate of the star's meridian motion in X. Under these circumstances the resultant motion of a star with respect to the film is a *rotation* (about the transit point) at the diurnal rate times $\sin\delta$. The linear motion of the image with respect to the film (in seconds of arc per second of time) is $5.45 \times 10^{-4}h \sin 2\delta$, with h in seconds. For all but the high declination 'azimuth mark' stars, mid-exposure will lie within $5^s\sec\delta$ of transit, so that the residual trailing will always be less than 1″, and, as borne out by photographic zenith tube observations, totally masked by diffraction, seeing and irradiation effects. For most stars, then, the centre of the dot represents the star position at *mid-exposure.*

The non-driven stars will show trailing, and the best treatment is to be decided by experience. The present policy, which gives results adequate for the intended purpose, is to take three or four exposures in succession and then measure the gaps. For example BD89-2, which has declination of 89°30′, is given three exposures of 30 seconds duration with 30-second gaps. A quick calcula-



615 2·8

1421 5·3

1432 5·8

616 1·2

1425 6·5

912 4·4

Figure 12. Typical photos.

The numbers given are from the FK3, together with the magnitudes. The stars have been deliberately overexposed, and a bright flash has been used so that the stars and reticle images will show up well in reproduction. Note the screen diffraction pattern for 615 and 616, and the faint companion for 1421. The "half-arrow-heads" on the outside horizontal lines are due to reflections from the wall of the transporting-lens tube.

tion shows that the image moves about 80 microns in 30 seconds; and unless the seeing conditions are exceptional this motion can be concealed by atmospheric effects. Indeed one cannot, on cursory examination, distinguish these trail images from those obtained from tracking the faint stars in other parts of the sky.

The times of beginning and end of exposures are noted to the nearest second, and the flash is initiated by the observer at some convenient time. Further, since these stars may be observed far from the graticule origin, it will be necessary to calibrate outer marks of the graticule with respect to the origin—probably by visual observation of the transit of equatorial stars across them.

Effect of Inaccurate Drive Rate:

Since provision is not made for precise determination of the instant of mid-exposure, the error introduced by confusing this instant with the instant of a particular flash is examined.

If the distance from the star image to the i^{th} graticule image is measured and taken to be related to h_i by the equations previously given, an error is committed—

$$\epsilon = (t_i - t_e)(k-1)r_\delta \text{ (to be added to } h_i \cos\delta\text{)},$$

where t_i is the instant of the i^{th} flash, t_e that of mid-exposure, r_δ the ideal drive rate and k the ratio of the actual rate to the ideal. The error is seen to be independent of the length of exposure, and to vanish for $k = 1$ and/or $t_i = t_e$. It is seen that if the i^{th} image is chosen to be that nearest to t_e, then for k between .999 and 1.001,

$\epsilon \sec\delta$ will be less than 0″.04, 0″.08, 0″.22,

respectively for the three flash intervals used. This is almost acceptable in view of the fact that $(t_i - t_e)$ will vary randomly from star to star and from night to night. For part of the sky the rate error mentioned may possibly be halved.

Conclusion:

If the drive rate is closely controlled, restrictions on the timing of the exposures are readily met. The phase of the screw is not required in photographic operation, except for keeping the optical system tolerably centred on the star. As the mirror transit clock correction is required only for the reduction of its own observations, it suffices to assure the invariability of the flash intervals, and to determine the approximate whole second of any one of each of the three types. In view of the differential nature of the measurements the simple methods suggested for determining scale factors should be adequate.

A recent short series of trial photographic observations of a list of about 20 fundamental stars well distributed in declination and magnitude indicates, on preliminary differential reduction, mean errors of about 25 milliseconds in $\Delta\alpha\cos\delta$ and about 0″.75 in $\Delta\delta$. The principal corrections still to be applied are those for the apparent variation of β with θ and for the accidental errors of the individual divisions of the circle. Both are at present ill-determined; the first is apparently less than 20 milliseconds, but the second may amount to several tenths of a second of arc.

A portion of the north collimator film strip from observations of October 1961 is shown in Figure 12. It shows that the horizontal 'wires' are heavier than the vertical because of the many flashes during a tracking observation. The increased thickness has no adverse effect on the ability to measure distances. The many scratches on the film are due to break-in on film guides, and now no longer appear.

No insuperable difficulties have been found with the photographic method. Shortly after the Figure 12 series of trial exposures, the winter season afforded the first opportunity to assess cold-weather operation. It was found that the synchronous motor for tracking drive had insufficient torque (at near-equatorial speeds) to overcome the increased friction concomitant to cold-weather operation. It was encouraging to find that the ball-and-disc integrator functioned normally within the limitations of the observational method. However, for photographic purposes it has been decided to separate the functions of plate drive and mirror setting; and to replace the ball-and-disc integrator with a digital velocity computor as already described.

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A JUMPING-FILM CAMERA FOR METEOR PHOTOGRAPHY

I. Halliday and A. A. Griffin

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A jumping-film camera for meteor photography

I. HALLIDAY and A. A. GRIFFIN
Dominion Observatory, Ottawa, Ontario, Canada
MS. received 22nd November 1962

A camera system is described in which the film advances by short, sudden jumps. Three similar cameras are described, in which the film is advanced 10, 100, and 150 times per minute respectively. The cameras were designed for use in meteor spectroscopy, but the technique should prove useful in other applications.

1. Introduction

The instruments described in this paper were designed in order to investigate particular problems in meteor spectroscopy. The general features of the instruments, however, appear to have applications to other problems of night-sky photography, particularly in the observation of satellites or rockets from ground stations.

When the auroral green line (λ5577) was first detected in meteor spectra (Halliday 1958) it was suspected that the duration of the emission of this forbidden line was quite short, probably only a small fraction of a second. Later however (Halliday 1960), when observations of the line were made through rotating shutters, the absence of a perceptible decay in the occulted portions of the trail showed that the duration of the luminosity was long compared to the length of an individual exposure (about 0·1 sec) and quite possibly was as long as the expected lifetime of the metastable state, i.e. 1·0 sec.

Two meteor spectrographs have been constructed with which it is hoped to record multiple images of λ5577 during the decay after the passage of the meteor itself. A third, similar instrument has been adapted to the problem of photographing the spectrum of a persistent meteor train. Basically the instruments consist of a transmission diffraction grating mounted in front of the objective of an extremely fast camera system. Instead of advancing the film a whole frame at intervals of one to several minutes the film is advanced a short distance at quite frequent intervals. For the two 'green-line' spectrographs the film advance rates are 100 and 150 per minute, while for the train spectrograph a much slower rate of 10 advances per minute is employed. The cameras may conveniently be designated by these film advance rates, i.e. cameras 10, 100 and 150.

2. The optical components

The camera lens in each case is a Super-Farron lens with a focal length of 76 mm and a focal ratio of *f*/0·86. The angular diameter of the circular field is 30° and the lens maintains good definition over this field. As in other lenses of extreme speed the focal plane is situated close to the last element of the optical system, in this case 3 mm from the rear face of the lens.

The table lists details of the three instruments. The gratings are Bausch and Lomb replica transmission gratings with the number of rulings and blaze wavelengths shown in the table. The blaze for the grating on camera 100 is particularly efficient for several hundred ångströms on both sides of the blaze wavelength. The dispersions of the first-order spectra are also shown in the table.

Description of the instruments

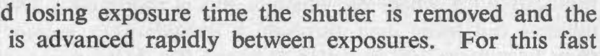
	Camera 10	Camera 100	Camera 150
Focal length (mm)	76	76	76
Grating (lines per mm)	400	85·7	400
Blaze λ (Å)	5000	4800	5000
Dispersion (Å mm^{-1})	328	1530	328
Film advance time (sec)	0·02	0·023	0·012
Effective exposure (sec)	5·98	0·577	0·388
Length of advance (mm)	6·25	0·646	0·646
Duration of 100 ft roll (h)	8·13	7·86	5·24

3. The camera body

The camera body is a modified 'Vinten 70 mm Reconnaissance Camera' chosen for its film size and adaptability to the desired spectrographs. The shutter has been removed and the film advance system modified almost completely. The internal heating, controlled by a thermostat, is retained so that the cameras may be operated at winter temperatures in northern Alberta. The heaters are run from a 24 v a.c. supply and deliver 100 w to each camera.

4. Film advance system

The problems of film exposure are basically the same as encountered in other forms of meteor photography. To avoid losing exposure time the shutter is removed and the film is advanced rapidly between exposures. For this fast lens a particularly high speed film advance is required to



Details of film advance mechanism.

avoid trailing of images between exposures. Also, for full frame exposures of less than one second the film consumption would be enormous. Because of the relatively few strong lines in the meteor spectrum and the fact that the auroral green line is normally confined to the upper portion of the trail where other lines are weak or absent, it was found that by advancing the film small calculated intervals in the direction of the dispersion serious overlap of spectral images should be avoidable. The mechanical problems of rapid film advance and the excessive consumption of film are then reduced greatly. The slower film advance rate for camera 10 permits a much longer length of film to be advanced each time.

The film advance system of camera 100 is shown in the figure. The system is identical for cameras 100 and 150 except for the variation in speed. The spiral cam A is driven by a 100 rev min^{-1} synchronous motor. As it rotates, the lever B, on which is mounted a spring-loaded dog C, is drawn back against the tension of a spring D. As the lever B is forced fully back by the cam, the dog C drops behind a tooth of the escapement wheel E, which has 96 teeth and is mounted on the end of the film advance sprocket. During this motion a flat spring F engages in the escapement wheel, preventing the wheel from rotating backwards. When the cam A is rotated further, the lever B, under tension of the spring D, drops off the lip of the cam, and the dog C advances the escapement wheel E and hence the film. In the position of the figure the lever is just ready to drop off the lip of the cam. As the motor continues this cycle is repeated. The tension in spring D is adjusted so that the film is advanced fast enough to assure negligible trailing during the advance and yet not cause excessive vibration. The spring G acts as a belt to drive the take-up spool in the film magazine, acting through the assembly H which includes a slipping clutch to allow for the changing diameter of the spool as the film is wound from the supply to the take-up spools.

The slower advance rate and longer film advance for camera 10 required modifications to the film advance mechanism. The toothed wheel now has only 10 teeth and is of small diameter. The cam on the motor shaft has been replaced by a wheel on which a pin is mounted. The pin deflects the lever arm through a considerably greater arc than in camera 100 in order to move the dog far enough to clear one of the larger teeth on the toothed wheel. The spring drive to the take-up spool has been replaced by a rubber belt drive.

Tests of the film advance mechanisms indicate that the advance is accomplished in a small fraction of the total exposure time. The times required for film advance and the effective duration of the exposures between advances are shown in the table. Also shown in the table are the lengths of each film advance and the time in which a 100 ft roll of film would be exposed, neglecting the slight loss due to loading the film.

5. Altitude–azimuth mount

The mount used for this camera is in part the conventional altitude–azimuth mount, with a rotating turntable for azimuth adjustment and a fork in which the camera rotates in altitude. It has been mentioned that the film must be advanced in the direction of dispersion of the grating. In meteor spectroscopy the meteor itself acts as the line source and the grating is oriented so its lines are parallel to the most probable direction of a meteor during meteor showers. The mounting is designed to be able to fulfil both of these conditions. Once the camera has been focused the grating is aligned so that the dispersion is in the direction of film motion. The camera, including lens and grating, is fastened to a circular collar which can be rotated in a cross member to fulfil the second condition. The cross member is mounted on pivots which rotate in 'V' grooves cut in the brass plates on top of the fork.

6. Discussion

Cameras 100 and 150 were designed specifically for measuring the decay of the emission from $\lambda 5577$. The ratio of 3 to 2 in exposure durations is an attempt to reach a balance between the good time resolution one would desire and the exposure time required to secure an image of a faint source. Any fast, green-sensitive emulsion would be suitable for these cameras. With the gratings aligned as described the spectra of those stars which are bright enough to record are smeared out into a continuous streak by the overlap of successive exposures.

It is hoped that these cameras will record meteors as faint as magnitude 0 or +1. From the existing evidence it appears that $\lambda 5577$ may be a relatively stronger contributor for these meteors than for the group of very bright meteors. With an expected duration of about 0·3 sec for meteors in this range there is an appreciable chance that the film will be advanced while the meteor is still in flight. In many cases the break produced in the normal meteor spectrum can be used to infer the duration of the first (incomplete) exposure on $\lambda 5577$.

Camera 10 has been designed to attack the difficult problem of recording photographically the spectrum of an enduring meteor train. Since the train may well be a diffuse line in this case, spectral resolution may be achieved by increasing the number of rulings per millimetre on the grating but not by increasing the focal length of the camera. From attempts to record trains on blue-sensitive emulsions it is known that they are deficient in blue light and from early visual spectral observers (Herschel 1881) it is expected that trains will show lines in the green, orange and probably red regions. A fast, panchromatic film is required. For enduring trains there is a chance that a visual observer spotting a train outside the field of the camera will have sufficient time to swing the instrument in its altitude-azimuth mounting to record the decay of the train luminosity.

Acknowledgments

The authors are grateful to Mr. V. E. Hollinsworth of the Observatory staff for valuable suggestions in designing the film advance mechanism.

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DIFFUSION EFFECTS OBSERVED IN THE WAKE SPECTRUM OF A GEMINID METEOR

Ian Halliday

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Diffusion Effects Observed in the Wake Spectrum of a Geminid Meteor

By Ian Halliday[1]

The spectrum of a spectacular Geminid meteor was photographed on the night of December 12/13, 1960, at the Meanook Meteor Observatory ($\varphi = 54°37'$N, $\lambda = 113°21'$W). This is one of two meteor observatories operated by the Dominion Observatory in northern Alberta. The spectrum exhibits interesting peculiarities.

The meteor was photographed with a converted K19 aerial camera, focal length 12 inches, focal ratio f/2.5, using Kodak Spectroscopic I–D emulsion on glass plates 8 by 10 inches. A Bausch & Lomb replica transmission grating with 300 lines per mm was mounted immediately in front of the camera objective. The camera was occulted 12.5 times per second by a rotating shutter with a closed-to-open ratio of 2:1.

The meteor was not observed visually but was recorded on an exposure that began at 3^h32^m U.T. and ended at 4^h05^m U.T., December 13, 1960. The meteor was initially outside the field of view of the camera, but the zero-order image entered the field before peak luminosity was attained, while the first- and second-order spectra entered the field at progressively lower heights.

The spectrum is reproduced in plate 1. The meteor moved from upper right to lower left. The right-hand edge of the photograph is the edge of the original plate. The first segment of the zero order at the top of the photograph is the sixth segment that appeared on the plate, while the lower end of the zero order (beyond segment 13) has been omitted at the left. The segment numbers are shown opposite each segment of the spectrum along the right-hand edge. Segments 20 and 21 are detectable only in the first-order image of the Na D lines. A small portion of the first- and second-order spectra of Vega appears in the lower left corner of the photograph.

Height and velocity measures

Since the meteor was photographed from only one station, no direct measures of height or velocity are possible. Reasonably accurate heights may be obtained, however, by assuming a radiant position and velocity for the Geminid shower and then determining ranges and hence heights from the observed angular velocity.

A standard Geminid radiant at $\alpha = 113°$, $\delta = +32°$, was assumed (Millman, 1954) since the meteor appeared within an hour of the peak of the shower (solar longitude 261°.1). This assumed radiant was displaced to allow for the effect of zenith attraction. It was then found that the observed trail passed through the apparent radiant shortly before the end of the exposure, which gave a computed time for the appearance of the meteor of 4^h01^m U.T.

A plot of the observed angular velocities along the trail indicated a marked deceleration in the latter half of the observed trail. The angular velocity at the bottom of segment 4 was assumed to correspond to a meteoric velocity of 36.0 km/sec, and other heights and velocities were based on this assumption. The meteor was 90° from the radiant near the end of segment 10, at a minimum range of 106.0 km from the camera. Table 1 lists the computed heights (corrected to sea level) and corresponding velocities at the lower ends of selected segments. Errors in the assumed meteoric velocity, radiant position, and speed of shutter rotation could result in the heights and velocities of table 1

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[1] Dominion Observatory, Ottawa, Canada.

being in error by as much as 3 to 5 percent. There is no doubt, however, that the meteor penetrated to unusually low heights in the atmosphere.

TABLE 1.—*Heights and velocities*

Segment	*Height of bottom of segment (km)*	*Velocity (km/sec)*
1	72.9	36.1
5	67.2	36.0
9	61.5	35.4
13	55.9	33.7
15	53.3	32.3
17	50.7	30.3
19	48.5	26.7
21	46.6	----

The meteor spectrum

The dispersions of the first and second orders of the meteor spectrum were found to be 95 and 46 A/mm, respectively. Atomic emission lines indentified in this spectrum are shown in table 2. A total of 95 features are identified. The spectrum appears normal for a meteor of this velocity except that the lines of ionized magnesium, calcium, and silicon are relatively strong compared to those in the spectra of fainter meteors with the same velocity. Almost all the lines in table 2 were also identified in a recent study of Perseid spectra (Halliday, 1961). The only significant addition is the pair of lines of Al I at 3944 and 3961 A. These are barely detectable by sighting along the lines in a 30× enlargement of the strongest segment of the second order. The much greater relative strength of the H and K lines for fast meteors makes the detection of faint lines in this spectral region very difficult for Perseid spectra.

TABLE 2.—*Measured emission lines in the Geminid spectrum*

λ_{meas}	*Atom or ion*	*Mult.*	λ_{lab}
3683.1	Fe I	5	3679.9
			3683.1
	Fe I	21	3687.5
3705.4	Fe I	5	3705.6
			3707.8
	Fe I	21	3709.2
3719.9	Fe I	5	3719.9
3735.6	Fe I	5	3737.1
	Fe I	21	3734.9
3747.8	Fe I	5	3745.6
			3748.3
	Fe I	21	3749.5
3797.1	Fe I	21	3795.0
			3798.5
			3799.5
3815.9	Fe I	45	3815.8
3821.0	Fe I	20	3820.4
3825.1	Fe I	20	3825.9
	Fe I	45	3827.8
3832.8	Mg I	3	3829.4
			3832.3
	Fe I	20	3834.2
3839.1	Mg I	3	3838.3
3856.4	Fe I	4	3856.4
	Si II	1	3856.0
3859.7	Fe I	4	3859.9
3878.2	Fe I	4	3878.6
	Fe I	20	3878.0
3886.5	Fe I	4	3886.3
3900.3	Fe I	4	3899.7
3905.5	Fe I	4	3906.5
3921.4	Fe I	4	3920.3
			3922.9
3933.6	Ca II	1	3933.7
3943.6	Al I	1	3944.0
3960.6	Al I	1	3961.5
3968.8	Ca II	1	3968.5
	Fe I	43	3969.3
3997.2	Fe I	276	3998.1
	Fe I	278	3997.4
4005.0	Fe I	43	4005.2
4030.8	Mn I	2	4030.8
4033.5	Mn I	2	4033.1
			4034.8
4046.1	Fe I	43	4045.8
4063.4	Fe I	43	4063.6
4071.7	Fe I	43	4071.7
4132.4	Si II	3	4130.9
	Fe I	43	4132.1
4144.4	Fe I	43	4143.9
	Fe I	523	4143.4
4155.5	Fe I	354	4156.8
	Fe I	355	4154.5
4200.9	Fe I	42	4202.0
	Fe I	152	4198.3
	Fe I	522	4199.1
4217.3	Fe I	3	4216.2
4226.6	Ca I	2	4226.7
	Fe I	693	4227.4
4250.9	Fe I	42	4250.8
	Fe I	152	4250.1
4253.6	Cr I	1	4254.3
4260.6	Fe I	152	4260.5
4272.1	Fe I	42	4271.8
	Fe I	152	4271.2
4274.2	Cr I	1	4274.8
4282.2	Fe I	71	4282.4
	Ca I	5	4283.0

TABLE 2.—*Measured emission lines in the Geminid spectrum*—Continued

λ_{meas}	*Atom or ion*	*Mult.*	λ_{lab}
4290.2	Cr I	1	4289.7
	Ca I	5	4289.4
	Fe I	3, 41	4291.5
4307.6	Fe I	42	4307.9
	Ca I	5	4307.7
4314.2	Fe I	71	4315.1
4325.8	Fe I	42	4325.8
4353.1	Mg I	14	4351.9
	Fe I	71	4352.7
4376.1	Fe I	2	4375.9
4383.6	Fe I	41	4383.5
4404.8	Fe I	41	4404.8
4415.9	Fe I	41	4415.1
4427.1	Fe I	2	4427.3
4461.6	Fe I	2	4461.7
4481.4	Mg II	4	4481.1
			4481.3
	Fe I	2	4482.2
4530	Fe I	68	4528.6
4920.4	Fe I	318	4919.0
			4920.5
4955.1	Fe I	318	4957.3
			4957.6
5008.9 [b]	Fe I	16	5012.1
	Fe I	318	5006.1
5041.3	Fe I	16	5041.1
	Fe I	36	5041.8
5108.5	Fe I	1	5110.4
	Fe I	16	5107.5
	Fe I	36	5107.6
5146.1 [b]	Fe I	16	5142.9
			5150.8
	Fe I	383	5139.5
	Na I	8	5148.8
			5153.4
5169.4	Mg I	2	5167.3
			5172.7
	Fe I	1	5166.3
			5168.9
	Fe I	36	5171.6
	Fe I	37	5167.5
5183.6	Mg I	2	5183.6
5207.2	Cr I	7	5204.5
			5206.0
			5208.4
5227.2	Fe I	37	5227.2
	Fe I	383	5226.9
			5232.9
5269.5	Fe I	15	5269.5
	Fe I	37	5270.4
	Fe I	383	5266.6
5328.5	Fe I	15	5328.0
	Fe I	37	5328.5
5341.8	Fe I	37	5341.0
5370.5	Fe I	15	5371.5
5402.8	Fe I	15	5397.1
			5405.8
5429.8	Fe I	15	5429.7
5448.8	Fe I	15	5446.9
5456.9	Fe I	15	5455.6
5499.0	Fe I	15	5497.5
			5501.5
			5506.8
5528.3	Mg I	9	5528.4
5573.2	Fe I	686	5572.9
5587.2	Fe I	686	5586.8
5615.5	Fe I	686	5615.5
5685.8	Na I	6	5682.6
			5688.2
5712	Fe I	686	5709.4
	Mg I	8	5711.1
5892.9	Na I	1	5890.0
			5895.9
5980.2	Si II	4	5979.0
6063	Fe I	207	6065.5
6105	Ca I	3	6102.7
6121.9	Ca I	3	6122.2
6139	Fe I	169	6136.6
	Fe I	207	6137.7
6157.0	Na I	5	6154.2
			6160.7
6162.7	Ca I	3	6162.2
6229	Fe I	207	6230.7
6251	Fe I	169	6252.6
6347.1	Si II	2	6347.1
6369	Si II	2	6371.4
6397.8	Fe I	168	6393.6
	Fe I	816	6400.0
6438	Ca I	18	6439.1
6461	Fe I	168	6462.7
	Ca I	18	6462.6
6494.4	Fe I	168	6495.0

[b] Feature noticeably broad.

Variation in luminosity

The photograph in plate 1 indicates that this meteor maintained approximately peak luminosity from segments 6 to 16, inclusive, an atmospheric path length of 27 km. Before segment 6, the zero order is considerably weaker, while the spectral lines are fading noticeably by segment 17 and drop abruptly in intensity at segment 19. Peak luminosity appears to occur at about segment 11, near a height of 59 km. The lines in the blue region of the first-order spectrum appear stronger here than in subsequent segments, although the variation between segments 11 and 14 is quite small.

To estimate the peak luminosity the zero-order image of the meteor was compared with zero-order star trails. The meteor trail is definitely weaker than the trail of Vega and appears to match the zero order of α Cygni. The meteor image trails across the plate at a rate 5,820 times greater than does the image of α Cygni, corresponding to a difference of 9.4 magnitudes. The apparent magnitude of α Cygni is $+1.3$, from which the meteor magnitude is estimated at -8. This is a "panchromatic" magnitude, which may be influenced by such factors as emulsion sensitivity and the blaze of the grating. In other cases (Cook and Millman, 1956; Millman and Cook, 1959), it proved to be only slightly different from photographic magnitudes.

The meteor exhibits a rapid flickering superimposed on the gradual rise and fall in overall intensity. The frequency of the flickering was estimated in each segment by measuring the fraction of a complete segment occupied by the largest number of complete cycles observed within the segment. The results were converted to cycles per second and are shown plotted in figure 1.

Over most of the observed trail the flicker is within the range of 100 to 300 cycles per second. In a sense, it follows the general light curve with a gentle rise to maximum and a steeper decline. The peak of the frequency curve occurs about two segments after the peak of the light curve. From segments 9 to 12 the frequency is fairly constant near 150 cps, but jumps suddenly at segment 13 to about 320 cps and then declines, only slowly, for another two segments. The amplitude of an individual fluctuation reaches a maximum near segments 10 to 12, resulting in a more pronounced fluting of the spectrum here than at other places.

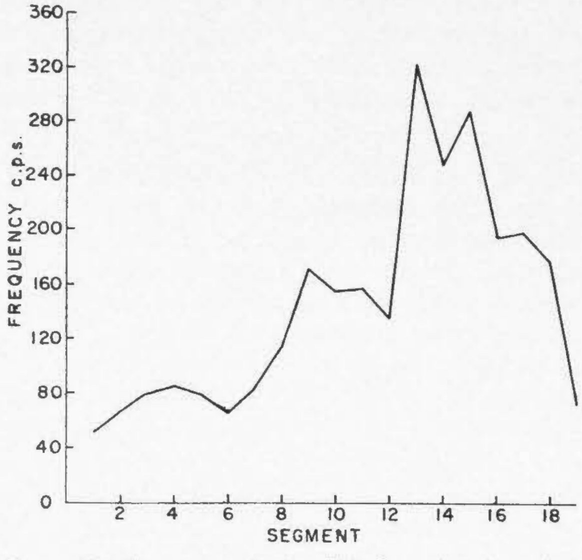

Figure 1.—Frequency of the flickering plotted against position along the trail as indicated by segment numbers.

The periodic flaring might be interpreted as indicating the repeated crumbling or fragmentation of minor amounts of material from the main meteoroid in the form of solid fragments. The increased surface area exposed to ablation would then account for the increased luminosity at each minor flare.

Alternatively, the phenomenon might be closely associated with rotation of the meteoroid. If the meteoroid is quite irregular in shape and rotates in such a manner that it alternately presents a large side and a smaller end to the oncoming atmosphere, then the amount of material ablated, in gaseous form, would vary in a periodic manner. The light, of course, is produced by the hot ablated gas and not by the solid surface.

A third possibility, suggested by Dr. L. G. Jacchia, is based on laboratory studies of ultraspeed pellets by Rinehart (Rinehart, Allen, and White, 1952). A flashing phenomenon was observed for the pellets and explained by an oscillation of the pellet during its flight. The luminosity will be low if there is a leading edge of the object, and high when a whole face of the object is exposed to ablation. For a meteor at relatively low heights where continuum flow occurs, as is expected for this Geminid, an oscillation may be set up that would lead to a flickering phenomenon. Sudden jumps in the frequency of the flicker, such as are observed near segment 8 and again just before segment 13, could indicate a tumbling of the meteoroid to oscillate about a new axis. On the rotation hypothesis these changes might be interpreted as a fracturing of the object into two or more pieces with an accompanying increase in rotational velocity for each piece. It is noted, however, that no general increase in luminosity accompanies these changes in the period of the flicker,

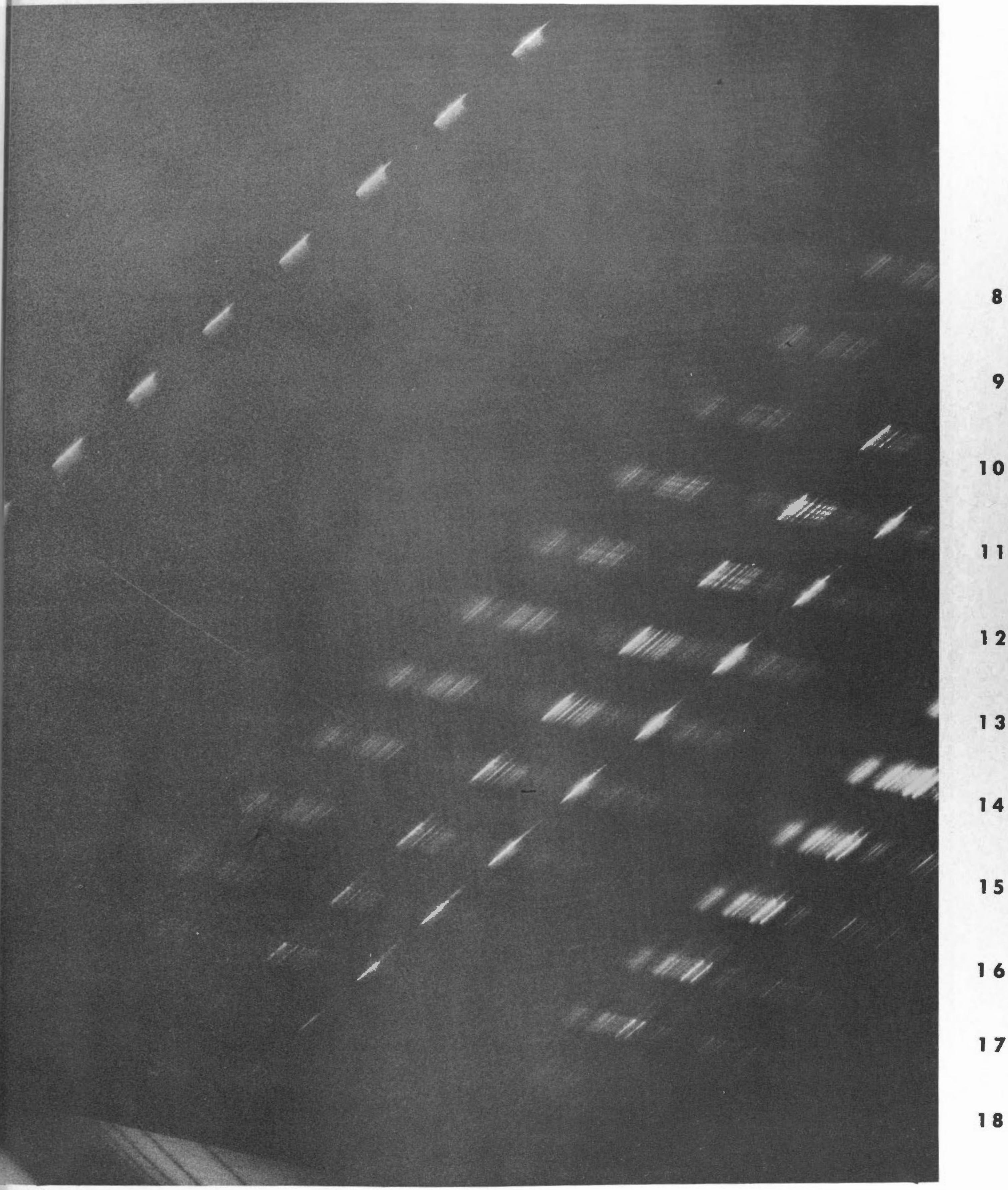

PLATE 1

A Geminid meteor spectrum showing parts of the zero order (at left), and first- and second-order spectra. Segment numbers are indicated at right.

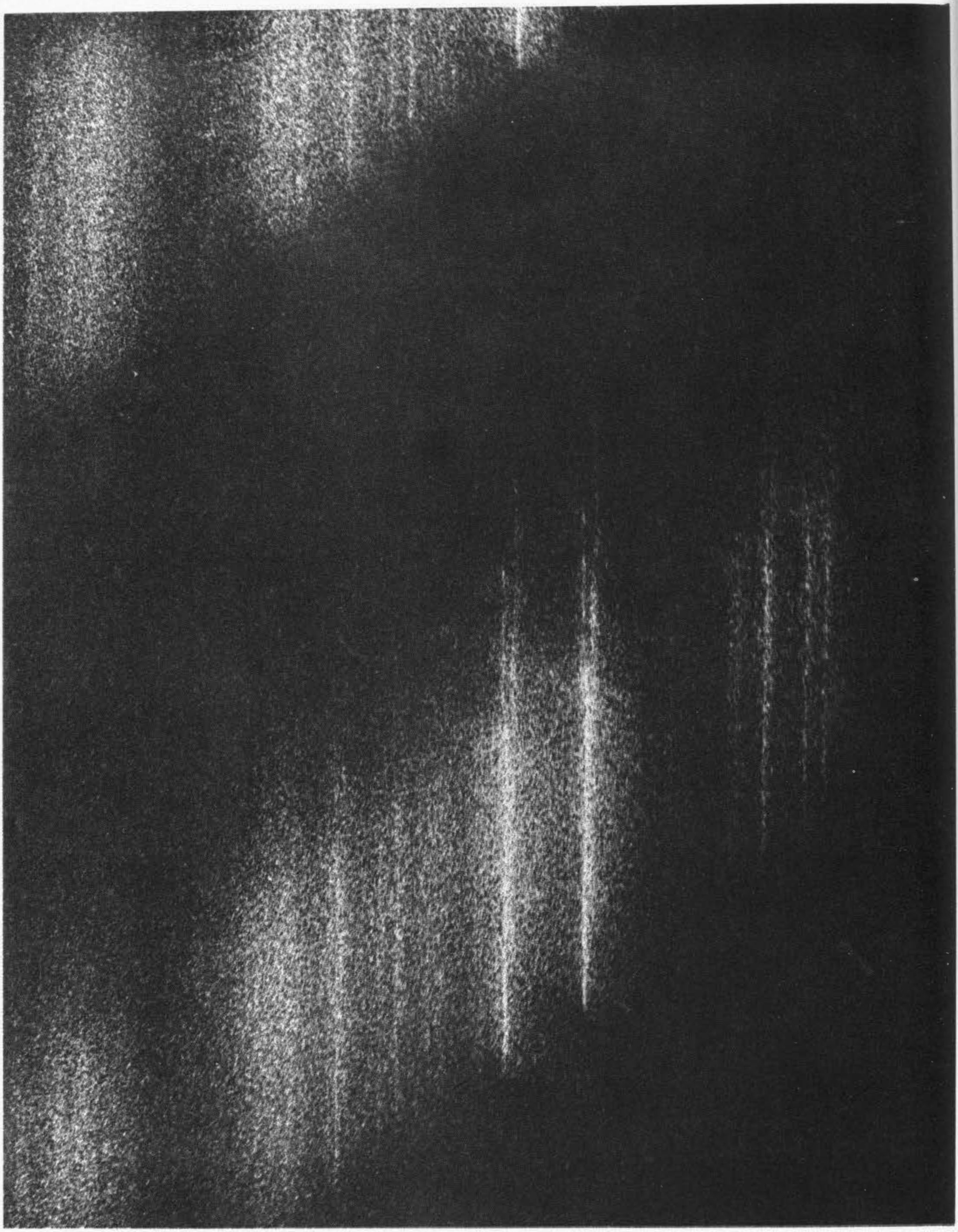

PLATE 2

Greatly enlarged portion of the meteor spectrum showing the split wake-lines of H and K in segment 15 of the second-order spectrum.

which suggests that the effective exposed area is not greatly changed. This would appear to favor the oscillation hypothesis.

The wake spectrum

The zero-order image shows a slight wake in the gap between the segments, beginning at segment 6. The D lines of Na I show a strong wake where they enter the field of the camera at segment 11, and the wake is observable as far as segment 19. Peak intensity of the wake occurs at segment 15, where the following multiplets can be detected in the wake: Na I, 1; Mg I, 2, 3; Ca I, 2; Ca II, 1; Mn I, 2; Fe I, 1, 2, 4, 5, 15, 20, 21, 41, 42, 43.

Most of these multiplets have been listed in earlier studies of wake spectra (Halliday,1958), although the manganese lines near 4030 A have not been listed previously. The wake spectrum shows the usual preference for lines of low excitation potential, but it is less pronounced than in most other cases. The line of Mg I, 2 at 5183.6 A is moderately intense in the wake, whereas its presence was quite doubtful in most earlier wake spectra. The H and K lines of Ca II are strong in the wake and persist essentially as far back into the gap as the other wake lines, in contrast to some spectra in which the H and K lines decay much faster in the wake than the low-excitation Na I and Fe I lines.

The most significant feature of this spectrum appears to be a clear splitting of the stronger wake lines into two components. It is observable in the second-order spectrum from segments 14 to 18. The H and K lines show the splitting most distinctly because of their strength, but other lines in which it is also observable are: λ 4045 of Fe I, 43; λ 4226 of Ca I, 2; and λ 4383 of Fe I, 41. For the Na D lines, in the first-order spectrum, the situation is complicated by the fact that the splitting is in general comparable to the separation of the two D lines. In segments 18 and 19, however, the separation due to the splitting effect is large enough to show in spite of the duplicity of the spectral feature. For the remainder of the wake lines the intensity in the wake is either too low or the resolution of individual lines is too poor to identify both components of the wake lines.

The two components of one wake line may be considered as "red" and "violet" components; i.e., displaced to longer or shorter wavelengths compared to the position of the main spectral line in the adjacent segment of the normal meteor spectrum. The flickering effect can be detected in the wake, although in some cases only one component appears to strengthen. The individual components show distinct curvature in places with little correlation between the two components. In some instances the wake components can be traced down the trail well into the following segment of the meteor spectrum.

Individual descriptions of the components of the H and K lines, in the second order, are given below for segments 14 to 18.

Segment 14.—The red component is the stronger, shows some curvature, and appears to fluctuate more due to flickering than does the violet component. The images are within 1 mm of the extreme edge of the plate, which limits the value of this segment.

Segment 15.—A large-scale reproduction of this region is shown in plate 2. The red component is strong near the main segment and can be traced back farther than the violet one. The effects of flickering are more evident in the violet component. Both components show some minor kinks, particularly near the main segment.

Segment 16.—The red component is very strong in the lower portion of the wake, while the violet component is weak. The violet line strengthens considerably at an earlier flare in this segment of the wake. The red component may be detected higher than the violet one, and also continues about two-thirds of the way through the main part of segment 16. With decreasing height within the segment, the red component approaches the main line but fades out before actually joining the main spectral line.

Segment 17.—The violet component is much the stronger in this segment. Just above the main segment the splitting is quite large, while the violet line bends over toward the red component a little farther up in the wake.

Segment 18.—The wake is now quite weak, with the violet component stronger than the red component. The splitting of the two components is larger than in earlier segments.

In the first-order Na D lines the two components are not clearly resolved until segment 18. Faint double wake-lines are also detectable in segment 19 for Na D, with an even wider separation than in segment 18.

Interpretation of the double lines

One obvious explanation to consider for the doubling of the spectral lines in the wake is a physical splitting of the meteoroid into two pieces. This has been observed for some meteors; for example, in spectrum 132 (Millman and Cook, 1959). A splitting of the meteoroid was suggested as one possibility to account for the sudden jump in the frequency of the flicker at segment 13. While this may have occurred it is not the explanation for the double wake-lines, since the wake-lines are generally converging near their lower ends in each segment, while a splitting of the meteoroid would lead to diverging fragments. In segment 16 the red component can be traced for a total distance equivalent to half a complete segment, whereas the exposure time is only one-third of a segment; i.e., the red component is not an exposure on a trailing fragment.

The two components are not due to Doppler effects of an expanding column. The observed splitting would correspond to a relative expansion, transverse to the direction of meteor motion, of about 600 km/sec. This is a most unreasonable value when the initial velocity of the meteor was only 36 km/sec.

The best interpretation is that the wake represents a time exposure of the expanding column of meteoric gas, taken while the luminosity is decaying. Meteor spectrographs are slitless spectrographs, which produce a broad image of a broad source even in monochromatic light. The two wake components apparently represent a side view of a hollow luminous column that shows two well-defined edges because the effective thickness of the luminous portion is small compared to the thickness of the entire column. Note that in comparing the two components at a particular point on the trail, one should compare two points on a line perpendicular to the direction of meteor motion, rather than two points on a line parallel to the spectral dispersion.

Figure 2 shows three computed curves for the intensity profile plotted along a radius of the column from $x=0$ at the center to $x=1.0$ at the outer edge. The three curves correspond to an effective thickness t of the luminous portion of the column of 0.05, 0.15, and 0.40, in units of the column radius. The resolution of the plate is insufficient to rule out very small values of t, but the components are sharp enough to indicate that the effective value of t is not much greater than 0.15.

One complete segment corresponds to $0^{s}080$, made up of an exposure of $0^{s}027$ and an occulted interval of $0^{s}053$. The wake is observable approximately halfway across an occulted portion, from which it follows that the effective duration of the luminosity is considerably less than one shutter break. For all points within the gap, the total exposure is the same, $0^{s}027$, but the "age" of the column when the exposure starts is different for each point. A point at the lower end of a normal wake, where the main meteor spectrum segment is starting, receives an exposure from age $t=0^{s}0$ to $t=0^{s}027$. For a point in the middle of the gap, the exposure runs from $t=0^{s}027$ to $t=0^{s}054$. This is about the last observable point in most segments; i.e., there is insufficient luminosity emitted after $t=0^{s}03$ to record on the plate.

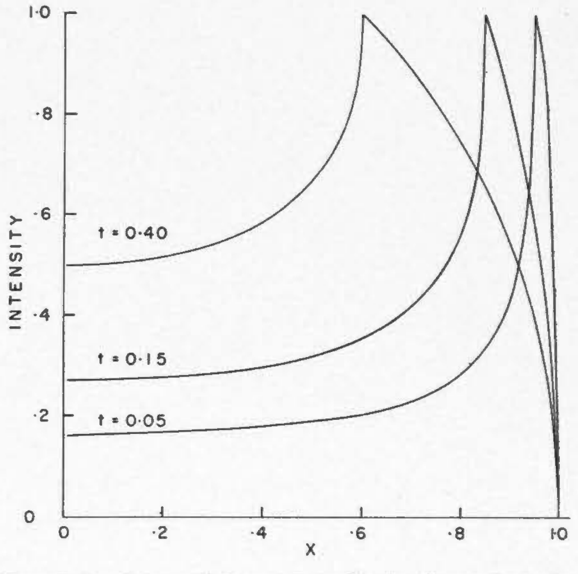

FIGURE 2.—Computed intensity profiles for three values of t, the effective thickness of the luminous column.

As noted earlier, some of the wake lines, particularly the red components, can be traced down into the following segment. For different points within the segment itself, all exposures start at $t=0$ but have different durations. The durations decrease linearly with distance down the segment from a maximum exposure of $0^{s}027$ at the top to $0^{s}000$ at the bottom (where the shutter occults the camera for the next $0^{s}05$). In segment 16, it was noted that the red component was observable two-thirds of the way through the segment; i.e., for any exposure duration longer than $0^{s}009$.

Magnitude of the splitting

Once it is known that the split lines correspond to a physical separation of material in the meteor column, it becomes of interest to determine the magnitude of the splitting. The separation of the two components was measured at frequent intervals in each segment of the wake, and the results were plotted. The scales were converted to diameters of the column, in meters, by allowing for the plate scale and the range of the meteor corresponding to each segment.

The results are presented in table 3, where the curves have been read at equal intervals corresponding to $0^{s}004$ of meteor travel. For example, a time of $t=0^{s}012$ indicates a point in the occulted portion from which it took the meteor $0^{s}012$ to reach the point at which the shutter reopened to begin the next segment of the main spectrum. (The entire gap corresponds to $0^{s}053$, and although the wake can sometimes be detected at least halfway through the gap, both components are seldom observable for more than one-third of the gap.) The mean splitting within each segment is shown at the bottom of the table.

TABLE 3.—*Diameters of the column (meters)*

t (*sec*)	*Segment* 14	15	16	17	18
0.000	----	31	49	69	78
0.004	37	34	49	73	82
0.008	42	39	44	61	85
0.012	----	45	49	54	83
0.016	----	----	53	----	77
0.020	----	----	----	----	77
Mean	40	37	49	64	80

In segments 15 and 16, the red components can be traced into the main segment. They begin with separations from the main spectral line (corresponding to a *radius* of the column) of about 24 meters. One-third of the way down through the segment the separation is about 16 meters, and this is maintained for another third of the dash, until the line fades out as noted previously. At the lowest observable points these red components are displaced about 16 meters from the main column, recorded in an exposure which lasted for only $0^{s}009$.

In all cases where separations for lines of Ca I or Fe I could be measured, the observed points fell quite well on the corresponding curve derived for the H and K lines of Ca II.

The splittings within one segment of the wake are fairly constant; i.e., the red and violet components are nearly parallel. The mean values for the five segments show a curious dependence on height: the splitting increases with decreasing height and may be represented quite well by the linear relation

$$d=550-9.41\ h,$$

where d is the diameter in meters at a height of h km. The relation is derived from observations between heights of 50 and 55 km.

From the observed rates of expansion, one may compute an equivalent diffusion coefficient. Öpik (1958) has shown that an effective radius R at time t may be defined by $R^2=3Dt$. For the lowest observed points on the red components, $t=0^{s}009$, $R=16$ meters, from which $D=9.5\times10^7$ cm²/sec. The effective value of t should really be smaller, or D should be somewhat larger. For a typical point in the wake, $R=30$ meters, and an effective value of t is about $0^{s}03$, from which $D=1.0\times10^8$ cm²/sec. Öpik tabulates normal diffusion coefficients for these heights of about 2×10^2 cm²/sec; i.e., the observed expansions exceed those predicted from normal diffusion by a factor of 5×10^5.

Discussion

At the low heights of this meteor one should expect a shock front to form around the moving meteoroid. The observed wake luminosity, however, is produced by meteor atoms of calcium, sodium, and iron, not by atmospheric particles. An effective front of expanding meteoric material appears to exist inside the heated volume produced by the shock front. Violent collisions at the surface of this meteoric front continue to excite the meteoric atoms for intervals up to about $0^{\mathrm{s}}03$. As shown earlier, the sharpness of the two components of the strong wake lines indicates that the effective thickness of the luminous portion of the meteor column is not more than about 15 percent of its radius, or else the lines would appear more diffuse.

The wake components indicate a diffusion of meteoric material into the atmosphere, but the effective diffusion coefficients are so large as to suggest the phenomenon is essentially explosive. During the initial stages the diameter of the column is observed to expand at a rate in excess of 3 km/sec. It is not surprising that the expansion should be very rapid compared to normal diffusion since the amount of material deposited by such a bright meteor is so great as to constitute a major change in local density along the meteor trajectory. The rate of diffusion of meteoric material in this case is so great that it seems reasonable to infer that much fainter meteors, perhaps any meteor brighter than 0 magnitude, will also give rise to appreciably more rapid diffusion than is observed by radar for faint meteors. Great care should be taken, then, that normal diffusion coefficients are not considered as a known quantity in calculations involving the gas columns left by bright meteors.

It is of considerable interest to note that the ion column of Ca II ions expands at the same rate as the atom column of Ca I or Fe I. This is not normally considered to be the case, at least for radar observations, which, of course, are for meteors about 10 magnitudes fainter than this Geminid. Manning (1958), for example, quotes Loeb (1934) to support a statement that the ion column will diffuse only one-fifth as fast as the atom column. Loeb's results are based on experiments in which ions were allowed to diffuse through an electric field. He states (p. 548): "the velocity gained from the field between impacts is further supposed small compared with the thermal velocities of agitation." It is not clear that these results are applicable to the meteor case, where the presence of an electric field is unlikely and the systematic velocity of the meteor particles is very large compared with thermal velocities. Manning mentions that the ion column for a bright meteor may be larger than for a faint one if ionization can still be accomplished during the expansion of the atom column. For calcium, 6.09 ev are required for ionization, which is higher than the excitation of any wake line. This makes it more likely that an ion of Ca II, which emits H or K radiation $0^{\mathrm{s}}03$ after the passage of the meteor, survived nearly all of that interval as an ion, and was then excited with an additional 3.1 ev to radiate, rather than that the ion was formed from a Ca I atom and excited to radiate by any collision occurring later than perhaps $0^{\mathrm{s}}002$ after the atom left the meteoroid.

Rapid rotation or oscillation for this meteoroid is suggested by the regularity of the flickering phenomenon and is supported to some extent by the split wake-lines. The variation in relative intensity between the red and violet components could arise from either mechanism, since varying amounts of material would be ejected from the meteoroid in a manner which is not radially symmetrical. This could also account for some of the curvature observed in the wake lines.

One Perseid spectrum is known which shows a similar but much less pronounced splitting of the wake-lines. It is spectrum 223 in Millman's (1958) list of meteor spectra. The splitting is evident in one segment of the H and K lines, but it is confined to a very short path length near a bright flare. The fact that the phenomenon is so pronounced for the Geminid meteor may be associated with its low height in the atmosphere. The much smaller mean free path may tend to localize the zone where appropriate collisions may occur and effectively shield the inner portion of the wake column, giving rise to the hollow-tube effect.

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Abstract

A study is made of an unusual Geminid meteor spectrum, photographed between heights of 73 and 47 km. Peak luminosity, estimated at magnitude −8, occurred near 59 km. The meteor exhibited a pronounced flicker, with a frequency varying from 50 to 300 cycles per second. The flicker may be associated with rotation or oscillation of the meteoroid.

A prominent wake spectrum was photographed between 50 and 55 km, consisting of lines of Na I, Mg I, Ca I, Ca II, Mn I, and Fe I. The stronger lines are split into two distinct components attributed to a hollow luminous column rather than splitting of the meteoroid or Doppler effects. The diameter of the column varies from 40 to 80 meters, but shows no variation from one atom or ion to another. Diffusion coefficients computed from the observed rate of expansion exceed the normal values at these heights by a factor of more than 10^5. The expansion in this case might be considered as explosive.

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THE DIGITAL VELOCITY-GENERATING COMPUTER FOR THE DOMINION OBSERVATORY MIRROR TRANSIT

G. A. Brealey

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OTTAWA, 1964

ERRATA

PAGE 61, right coln., line 9, *for* milliseconds, *read* microseconds.

PAGE 63, left coln., line 30, ("Whence $C' C'' = \ldots$") *for* $(\alpha \mathrm{a} + \alpha \mathrm{s})$ *read* $(\alpha \mathrm{a} - \alpha \mathrm{s})$.

The Digital Velocity-generating Computer for the Dominion Observatory Mirror Transit

G. A. Brealey

Abstract: The original velocity-generating computer of the Ottawa mirror transit has been found to lack sufficient accuracy for the tracking of stars during meridian passage. This shortcoming is shown to be caused by a combination of observing techniques, atmospheric refraction, thermal expansion effects, and mechanical alignment errors. The first two of these effects are referred to briefly (with references to a previous paper) and the last two are examined in detail and shown to exceed tolerable amounts.

The new computer uses electro-magnetic clutches and mechanical differentials to supply a mechanical analogue of binary arithmetic. The differentials are used to add angular velocities which in turn are selected by the energizing of appropriate clutches. The selection of velocity is done through a four-column decimal keyboard in which the observer enters the digits of cosine declination directly. A diode matrix converts each decimal number into its binary equivalent; and this in turn energizes the required clutches.

The new velocity generator is shown to be an extremely accurate device. The output velocity error does not exceed plus or minus 2 parts in 10,000 whereas the original generator had errors of about ten times this value.

Résumé:—On s'est rendu compte à l'observatoire d'Ottawa que la première calculatrice génératrice de vitesse reliée à l'instrument de passage à réflexion n'était pas suffisamment précise pour suivre les étoiles à leur passage au méridien. Un ensemble d'éléments comprenant les techniques d'observation, la réfraction atmosphérique, des effets d'expansion thermique et des erreurs d'alignement mécanique sont responsables de cette faiblesse. L'auteur analyse succinctement les deux premiers éléments et renvoie le lecteur à une étude précédente, mais il examine les deux derniers en détail et démontre qu'ils causent des erreurs excédant la tolérance permise.

La nouvelle calculatrice emploie des embrayages électro-magnétiques et des différentiels mécaniques qui alimentent une calculatrice analogique mécanique binaire. Les différentiels servent à augmenter les vitesses angulaires qui à leur tour sont sélectionnées par la mise en mouvement des embrayages appropriés. Le choix de la vitesse se fait à l'aide d'un clavier à décimales en quatre colonnes où l'observateur inscrit directement les chiffres du cosinus de la déclinaison. Une matrice à diode convertit chaque chiffre décimal en son équivalent binaire qui, à son tour, fait mouvoir les embrayages répondants.

Cette nouvelle génératrice de vitesse est un instrument très précis. Les erreurs de vitesse ne dépassent pas ± 2 parties en 10,000 tandis que le premier instrument pouvait accuser des erreurs dix fois supérieures.

Introduction

In a previous paper (*Pub. Dom. Obs.* XXV, No. 3, 1963), the writer described in detail the mechanical and optical equipment used for the photographic registration of transits on the Ottawa mirror transit. In the summation, it was mentioned that the device used to drive the right ascension slide (at a velocity proportional to cos δ) failed to give a sufficiently accurate velocity for observations of stars within 30° or so of the pole; which in turn required the observer to record other observing parameters involving the time-relationship between the shutter operation and the incidence of flashes.

It was further mentioned that these difficulties led to the design of a more accurate device for deriving plate carriage velocities, in which the accuracy would be independent of δ, and would thus reduce the number of necessary parameters and simplify the reduction of observations.

1. Observing Techniques

A brief description of the original velocity generator will obviate reference to the previous paper. The mirror transit uses a flat mirror held in a cell, which is pivoted on an east-west axis, to reflect the selected star (at meridian passage) into one of two rigid horizontal telescopes that face one another on a north-south baseline. In general, the telescope on the same side of the zenith as the star is the one used, although near the zenith either telescope can be used. The mirror angle is set by means of a servo-mechanical transmitter with an accuracy of $\pm \frac{1}{2}'$ of arc, which ensures that the star's image will transit in the field of view of the telescope eyepiece.

As the star crosses the meridian its image moves horizontally at the focus of the telescope, where a fixed glass reticle is placed, having etched on it a pattern of horizontal and vertical lines. The reticle is flashed at precisely known times, by a high-intensity discharge tube giving a flash of some 10 milliseconds duration.

The right ascension slide is ideally made to move at exactly the speed of the star image, so that the latter will appear as a small circular dot on the film, which is carried on the slide. The successive flashes of the reticle (which is of course in motion relative to the film) appear on the film, the vertical lines being equi-spaced horizontally and the horizontal lines merely extending themselves with each flash.

The reduction of observations, which consists essentially of measurements of distances, on the film, from star image to horizontal and vertical wire images, is greatly complicated if the tracking velocity is incorrect and thus causes the star images to be elongated. One does not know whether the centre of gravity of the image corresponds to the middle of the exposure (since various atmospheric conditions, e.g., scattered clouds, could conceivably cause the last half of the exposure, for example, to contribute most of the light from the star). Furthermore the time-phase between the opening and closing of the shutter and the sequence of flashes is not predictable; and calculations show that this must be measured if the tracking velocity is in error by more than .001. These are "nuisance" measurements. If they are omitted or erroneously recorded the observation cannot be used; or if the erroneous data is unwittingly used, the observation, accepted in good faith, will be not indicative of the true position of the star.

2. The Original Computer and Associated Errors

The original velocity generator was designed to use the transmitted servo-mechanism signals that serve primarily to position the mirror axis. These signals are sent on transmission lines to the eyepieces of both telescopes, where servo-receivers cause a shaft to adopt a position corresponding to the declination of the star. Since the velocity of a star image is proportional to cos δ rather than δ, it is necessary to have the linear (with δ) rotational motion of this shaft generate a cos δ-functional velocity.

The method used will become apparent with reference to Figure 1A. A very accurately ground limaçon cam is fixed to the shaft, so that its associated cam follower performs a simple harmonic motion with cam rotation, hence a cos δ-functional displacement has been obtained. The variable velocity is obtained from a ball-and-disc integrator, for which it can be readily seen that the output-shaft velocity is linearly proportional to the ball-cage displacement from centre, provided that the input velocity is constant. In the mirror transit application, the integrator input and output are geared in such a way that about .95 of the maximum possible velocity corresponds to the equatorial stars. This value was selected at a time when the exact focal length, and hence maximum plate velocity, was unknown; so that it was necessary to keep slightly below the maximum setting of the integrator in calculating subsequent gear ratios in the mechanism. To ensure the required displacement of the ball cage, and to allow for future adjustments, (e.g., due to focal length changes with temperature) the cage push rod and the cam follower are linked with a lever with adjustable fulcrum as indicated. The reproducibility of velocity in a good ball-and-disc integrator is better than .1 of 1%. The first limitation to the accuracy of the system became serious with the realization that the star positions in declination could not be entered exactly on the servo-mechanical transmitters, but had to be rounded off to the nearest 3′ of arc so that certain other unavoidable conditions could be satisfied. So long as cos δ changes slowly with δ the velocity error is negligible and can be ignored, but close to the pole cos δ is changing quite rapidly and the errors become appreciable. The second limitation is the more serious of the two and, in a perverse way, did not come to mind at any time during the design stage. The atmospheric refraction for low stars makes them appear higher than they really are, so the servo-mechanically transmitted positions for the mirror axis have to be adjusted correspondingly. This also changes the limaçon cam angle and hence output velocity—which introduces an error as the refraction does not affect the horizontal velocity. Hence for sub-polar stars the errors of velocity due to cos δ and refraction combine sometimes in very serious ways. A detailed analysis of the contribution of these errors is given in the previous paper.

In addition to the above difficulties the computer gives rise to other errors in velocity which were at first incomprehensible, until with the passage of time it was observed that these errors increased with decreasing ambient temperature. This phenomenon seemed to indicate that thermal contraction of the various linkages could not be neglected, and led to the following analysis of potential sources of error.

Figure 1B condenses the components used in the analogue computer (Figure 1A) into a schematic system

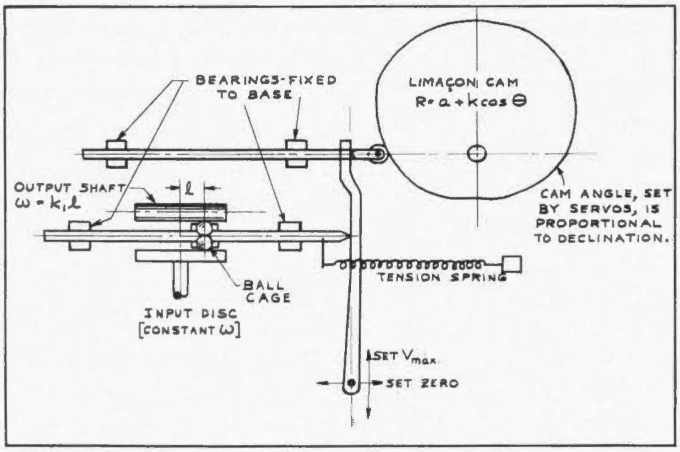

FIGURE 1A. Semi-Pictorial Outline of the Original Velocity-Generating Computer. The bearings that support the input disc shaft and output shaft are, of course, fixed to the same base as the other bearings, so the parallelism between the cam follower and the push rod is preserved at all displacements.

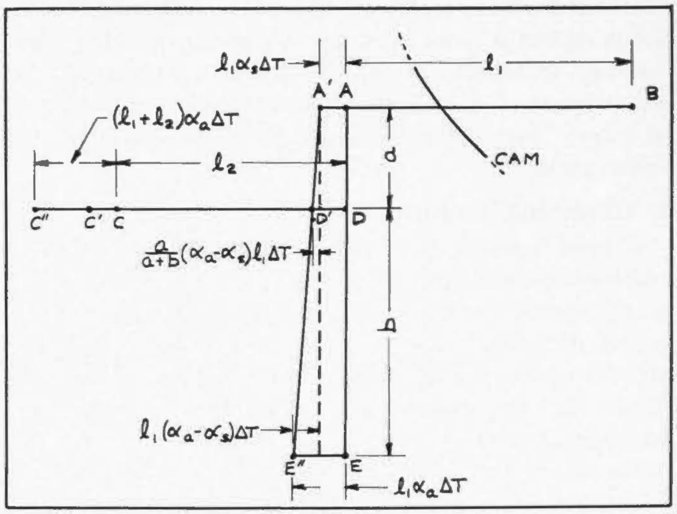

FIGURE 1B. The Components of Figure 1A in Schematic Portrayal for Analysis of Thermal Expansion Effects.

more adaptable to analysis. Examine first the thermal expansion effects. Suppose that at some temperature T the cam is set to correspond to $\delta = 90°$, so that the integrator ball cage is in the centre of the disc and hence gives the required zero output velocity. B represents the cam axis, ADE the lever, CD the integrator push rod, and C the axis of the input disc. AB, the cam radius vector plus a portion of the follower, can be treated as a unit since cam and follower are made of identical materials. It will also be in accordance with the facts if we assume that C, E, and B are on a common aluminum base having coefficient of expansion α_a, and that AB, ADE, and CD are made of identical steels having coefficient α_s; $\alpha_s < \alpha_a$.

Now suppose temperature increases to a new value T°. We take B as the origin. It can be shown (*see* Appendix 1) that the horizontal component of expansions only need be considered, therefore E moves to E″ and C moves to C″ as the base expands. A moves to A′ (hence D to D′) and C (as it indicates the ball cage) to C′ as the steels expand. The lever ratio, $\frac{b}{a+b}$ remains constant. We wish to find the order of magnitude of C′C″, which will effectively move the integrator push rod off its zero velocity position.

The displacement CC″ is given by

$$CC'' = (l_1 + l_2)\alpha_a \Delta T$$

and displacement CC′ by

$$CC' = (l_1 + l_2)\alpha_s \Delta T + \frac{al_1(\alpha_a - \alpha_s)\Delta T}{a + b}$$

$$\text{Whence } C'C'' = \left[(l_1 + l_2)(\alpha_a + \alpha_s) - \frac{al_1}{(a+b)}(\alpha_a - \alpha_s)\right]\Delta T$$

$$= (l_1 + l_2 - \frac{al_1}{a+b})(\alpha_a - \alpha_s)\Delta T$$

$$= (\frac{l_1 b}{a + b} + l_2)(\alpha_a - \alpha_s)\Delta T$$

assigning values $\alpha_a = 12.8 \times 10^{-6°F}$

$$\alpha_s = 9.2 \times 10^{-6°F}$$
$$\Delta T = 50°F$$
$$l_2 = l_1 = 3''$$
$$\frac{a}{a+b} = 1/6$$

$$C'C'' = (6 - .5)(3.6 \text{ x } 10^{-6})\, 50 = .99 \times 10^{-3}$$

or approximately .001″.

Since the total throw of the integrator push rod is .75″, the above shift introduces an error of about .13%. This is barely tolerable and then only if no other contributing errors act in the same direction. For the latitude of Ottawa, ΔT can easily be 70° with a proportionately greater error as the result. The effect of a temperature increase is, then, to move the ball cage farther out along the disc radius and increase speed. If the ball cage is on the "opposite" radius (as it is for lower culmination stars requiring reverse drive) then the effect is to decrease the speed.

We now investigate the nature of the errors resulting if the line of action of the cam follower does not pass through the origin of the cam, and refer to Figure 2. In this figure the ideal line of action is CO where O is the cam origin. Actually the line of action is C′DE, not directed at the origin.

We write the equation of the cam as

$$R = a + k \cos \delta \text{ so that}$$
$$\delta \text{ in the equation } = \delta \text{ the declination angle.}$$

The slope of the cam at any point is then $-\sin\delta$. Referring to Figure 2, and noting that the angles and displacements are small, we have

$$\Delta = (R-S)\varphi$$

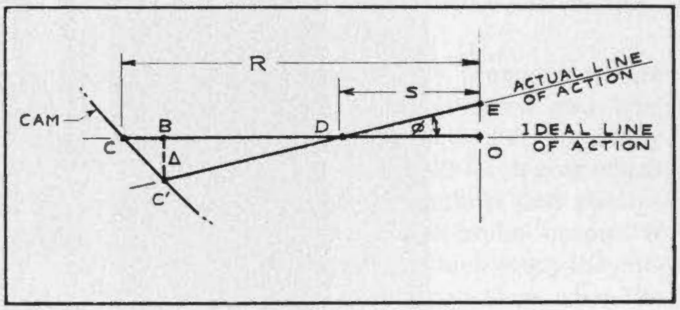

FIGURE 2. Geometry of Ideal and Actual Relationships of Cam Follower to Cam.

To a first order approximation C′O falls short of CO by CB, which is then the error in displacement of the cam follower.

We have

$$CB = \Delta\sin\delta = (R-S)\varphi \sin\delta$$

The error will not be identically zero unless $\varphi = 0$. In the general case it will be zero when $\sin\delta = 0$, i.e., when the cam is set for equatorial stars; and at the point where R = S. If S = 0 this corresponds to the case where the index is improperly set.

$$\text{When } \sin\delta = 1 \qquad CB = (R-S)\varphi$$

and if $R-S = 1.5$ inches

then φ must be less than 3′ for the displacement error to be less than .001

The errors introduced by differential thermal expansion could be eliminated by using a steel base instead of the present aluminum one, which would necessitate complete rebuilding of the velocity generator; or by temperature control of the whole velocity generator. Since refrigeration would not be feasible, it would be necessary to select some temperature, higher than the ambient due to normal power consumption, and use thermostatted heaters to maintain this value. This proposal leads in turn to a further problem, viz, the enclosure must be extremely well insulated so that heat dissipation into the atmosphere does not affect the astronomical seeing.

Errors due to misalignment of the cam follower are more elusive and hence more difficult to eliminate. It has been shown that the angle φ between actual and ideal lines of action of the cam follower must be less than 3′, and under the existing mechanical arrangements one cannot guarantee this order of accuracy in setting-up. Indeed the very act of removing the velocity generator from the test bench to the face of the mounting plate (on the instrument pier) may introduce errors of this order of magnitude. *See* Figure 3.

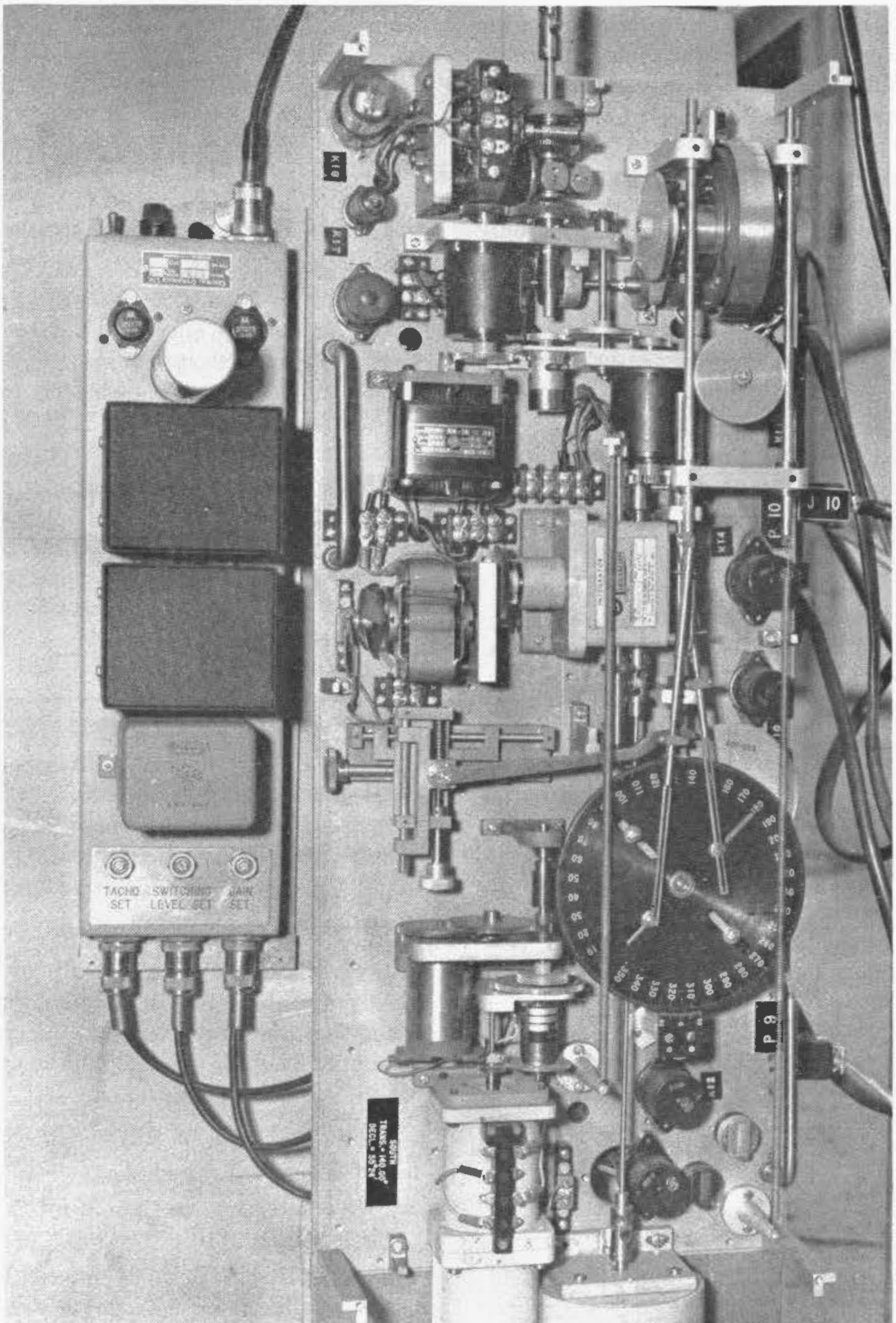

FIGURE 3. Original Velocity Computer on North Collimator Pier. It will be noticed that accuracy of alignment between cam follower and cam axis cannot be continually monitored because of the system of connecting rods on top of the graduated gear.

3. Principle of the New Computer

Consideration of the foregoing factors culminated in the decision to approach the whole problem of precise velocity generation from another viewpoint. First of all, it was clearly apparent that the velocity would have to be set independently of other parameters of observation. Furthermore, digital input of velocity would be a desideratum if the digits could be related one-to-one with cos δ—a factor always available from the various ephemerides. While there are probably several sophisticated ways of deriving a variable velocity accurate to .1% or better, (particularly if one has unlimited funds and time at their disposal) it is logical to give careful consideration to ease of maintenance and trouble-shooting in whatever method is selected. It would be of little profit to have such a complex system that specialized help would be required in the event of breakdown.

The possibility of using a synchronous motor and an electronic variable frequency oscillator-amplifier was considered and rejected. There are a few oscillators on the market with digital frequency selection but the advertised accuracy is never as good as .1%. To make such a system feasible the output frequency must be measured by a second precise unit. The difference between actual and desired frequency must then be used as an error signal to correct the oscillator.

The straightforward simplicity of a completely mechanical system always held great appeal. At first the problem of making a 1,000-speed gear box seemed insoluble within reasonable space limitations, until the mechanical analogues of binary arithmetic were considered. It is well known that the decimal digits from zero to nine can be made up from various combinations of four binary digits in the so-called 4-2-2-1 code. In computer techniques, this means that a "yes" in the least significant binary stage means a decimal "1", in the next stage a decimal "2", in the next again a "2", and in the most significant a "4". So that a decimal 8, for example, is made up of "yes" signals from 4, 2, and 2 of the binary stages.

If four velocities in the 4-2-2-1 ratio each-to-each could be extracted, as desired, from a single input velocity, and furthermore be added in various combinations, then a ten-speed (zero being considered as a speed) gear box would result. This would take care of one decimal digit in cos δ. If then there are three such gear boxes made, and number 2 is run at an input speed 1/10 of number one and number 3 at input speed 1/100 of number one, and if furthermore their outputs are added together mechanically, then a 1,000-speed gear box would result, in which the speeds will form an arithmetic series from 000 to 999.

Two rotating shafts can be combined into a single rotation by a mechanical differential, in which the output velocity is one-half the arithmetic sum of the two input velocities. This resultant can be further combined with other velocities (or indeed the resultant from another differential) through a second differential; and so on in a cascade of differentials. The only drawback is that net velocity is lost on each addition because one gets only the average, not the sum, of the two input velocities; and in some applications this might preclude extended use of differentials. It is however, an advantage in the possible mirror transit application, since the lead screw of the right ascension drive moves at only about 30 r.p.m. whereas the synchronous motors run at 1,800. Thus the differentials can occupy the low torque, high-speed stages of the drive system, and can be of small physical size. Furthermore the various gears will rotate many times during one excursion of the right ascension slide. No gear is completely perfect, and has small errors of concentricity and ellipticity, hence any two gears will have their errors combined in some way so that, depending on the phase of the mesh, the driving ratio and backlash will differ slightly. The differences are minute for precision class gears; and for many rotations will average into negligibility insofar as the final velocity of the right ascension lead screw is concerned.

The first experimental test of the proposed system called for the construction of one 10-speed gear box, shown in Figure 4. The input shaft, on the left, nominally rotates at 1,800 r.p.m. and carries a 40-tooth gear which drives four 80-tooth gears on the inputs of four electromagnetic clutch-brakes. The clutch-brake output is braked unless current is applied, in which event the output is clutched to the input. The outputs then, when the respective clutch-brakes are energized, rotate at 900 r.p.m. In Figure 4A, pinion (1) drives gear (2) through a 1:4 reduction and pinion (3) drives gear (4) through a 1:2 reduction. Gears (2) and (4) are the end gears of a differential (partly concealed by the post) for which the output appears at gear (5). If pinions (1) and (3) are driven, the velocity at (5) will be $\left(\frac{900}{4} + \frac{900}{2}\right)/2 = 337.5$ r.p.m. Gear (5) is further coupled 1:1 (by an idler pinion which is concealed by the bracket B) into the gear 6 which is one of the end gears of the final output differential.

In Figure 4B, which is a view of the gear box from the opposite side to 4A, pinion (7) drives gear (8) 1:2, and pinion (9) drives gear (10) 1:1. Gears (8) and (10) are the end gears of a differential for which the output appears at gear (11). If (7) and (9) are driven, the output at 11 will be $\left(\frac{900}{1} + \frac{900}{2}\right)/2 = 675$ r.p.m. Gear (11) is further coupled 1:1 by the idler pinion (14) into gear (12) which is the other end gear of the final output differential. This differential averages the two previous summation velocities, giving 506.25 r.p.m.

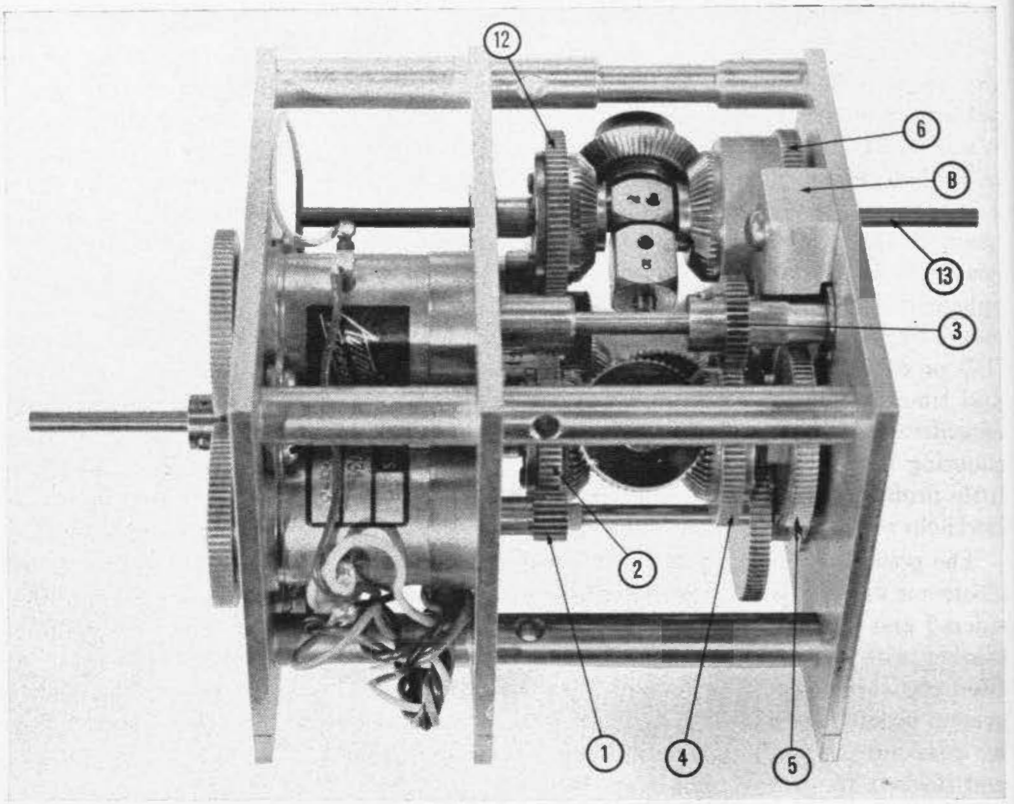

FIGURE 4

Two Views of the Experimental 10-speed Gear Box. The pinion at (7) is rather difficult to see, being mostly obscured by gear (8). The final mixing differential end gear (6) had to be of special extended design so that it would meet its idler pinion from gear (5).

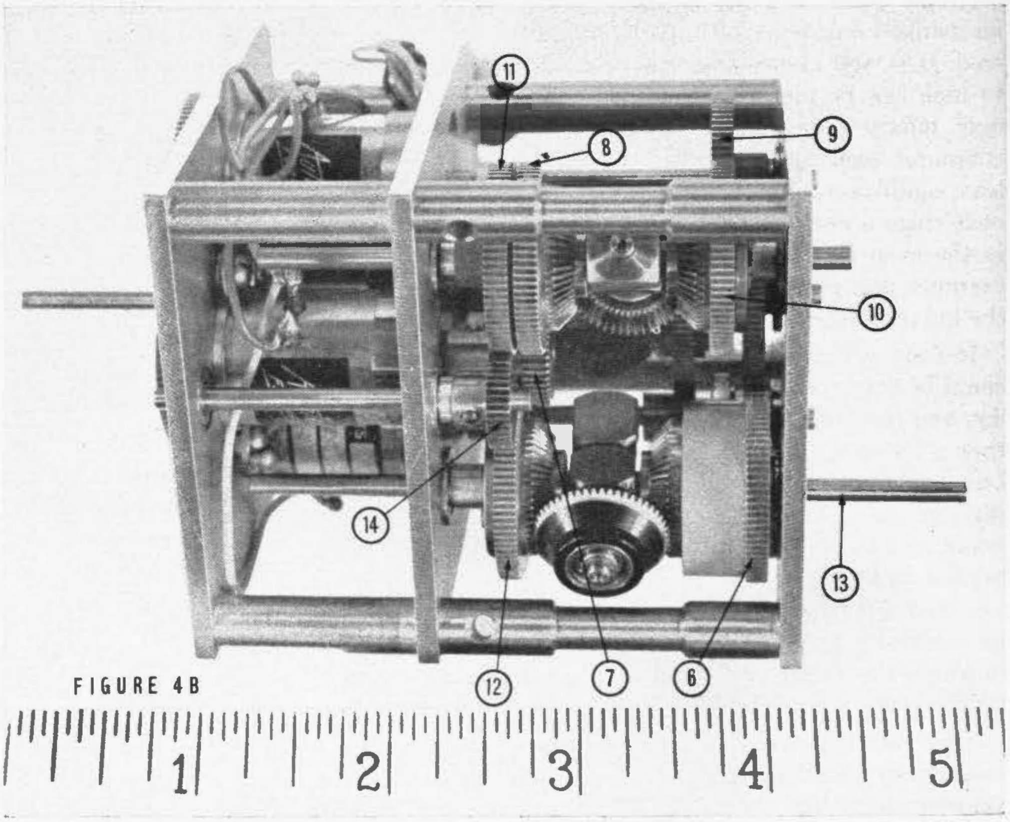

FIGURE 4B

(when all clutches are energized) at shaft (13). If the various clutches are energized in accordance with the following table, 10 decimally-related speeds are available. "O" indicates off, "X" indicates on.

TABLE 1. Decimal-to-binary conversion code.

Decimal Speed	Stage Reduction			
	1:1	1:2	1:2	1:4
0	O	O	O	O
1	O	O	O	X
2	O	O	X	O
3	O	O	X	X
4	O	X	X	O
5	X	O	O	X
6	X	X	O	O
7	X	X	O	X
8	X	X	X	O
9	X	X	X	X

For testing purposes the gear-box output was directly coupled to a photoelectric tachometer and the input driven at 1,800 r.p.m. from a synchronous motor. The pulses from the tachometer were electronically counted, the counter "gate open" time being set so that theoretically the counter would read 9,000 if all clutches were energized. On the first test the average counter reading was 8997 ± 0005. This was a rather alarming scatter and did not auger very well for the project, it being supposed that gear errors would prove too large to be tolerated after all. The test was repeated somewhat later, giving readings averaging 9002 ± 0004. The suggestion was then made that the synchronous motor be driven from a precise 60-cycle crystal-controlled source at the observatory time room. When this was done the readings became 9000 ± 0001, thus showing that the variations in domestic power-line frequency were the main cause of the previous scatter. The .0002 scatter is quite tolerable—actually the counter readings themselves contribute half of this because the phase between start and stop gates and incoming pulses changes for each sampling. For every decimal speed selected the nominal counter readings agreed with prediction and with the same scatter magnitude.*

4. Extension of Experimental Model into Complete Computer

The next problem was the combining of three such 10-speed gear boxes into a 1,000-speed gear box. Since the mechanical differential is able to combine only two velocities at once it would be necessary to do the combination of the three outputs in two stages. This implied that, for very little extra effort, a 10,000 speed box could be made by using four 10-speed boxes, using them in pairs through differentials to make two 100-speed gear boxes. The two resultants could then be combined into the final output. It is of course, still true that the output velocities of any gear box, digit for digit, must be one-tenth that of the gear box for the next-higher order of decimal digit, this being a net ratio, i.e., it does not matter when the ratio is achieved in the gear train so long as the final adding differential receives velocities having the "times 10" correspondence.

The array of the 10-speed gear boxes will depend on many engineering factors, not the least of which is the shape and size of the space available. On the mirror transit velocity-generating computer, the space available was nearly 12 inches square and about 4 inches high, and the way this space was utilized is shown in Figure 5.

The two 100-speed gear boxes are identical. Each is made by making two 10-speed gear boxes side by side, but with one being a mirror-image of the other so that the two output shafts will be relatively close together. In Figure 5 the unit below provides the two highest-order digits of cos δ. The other unit, which is inverted for over-all design reasons, provides the two lowest-order digits. In the lower unit, shafts (1) and (2) are the outputs of the two 10-speed assemblies. The right-hand assembly is driven directly from the 1,800-r.p.m. motor, the other at 2/11 of this speed through an idler and gear (3). The mixing differential is at (4). Its outer end is driven 1:1 by the fast assembly; and its inner end through a gear reduction of 11:40 from the slow assembly. The product of 2/11 and 11/40 reduction gives the required over-all 1:10 ratio between the inputs to differential (4), digit-for-digit, and hence gives 100 decimally-related possible output speeds. The output of differential (4) is geared, 1:1, onto one end of differential (5).

In exactly the same way the right-hand 100-speed gear box is driven by an 1,800-r.p.m. motor so that the output appears at shaft (6). Since this 100-speed gear box provides only the two lowest order digits of cos δ, its output, relative to the output of the other 100-speed gear box, must have a 100:1 reduction where it goes into the final mixing differential at (5). This is done by using a worm-and-worm gear input which gives the desired ratio directly, so that the shaft at (7) represents the output of a gear box having 10,000 speeds. For a star very close to the celestial equator, for which $\cos \delta = 1.0000$, it is necessary to compromise by programming 9999. This is sufficiently accurate for all purposes and removes the necessity for the highest order 10-speed gear box to be modified to provide 11 possible output speeds 0 to 10 inclusive.

It is a straightforward mathematical exercise to show that, for 1,800-r.p.m. inputs, the output velocity at shaft (7) is 140.611 r.p.m. when the 9999 selection is made. The lead screw of the mirror transit has to be rotated at 29.476 r.p.m. for a star having $\cos \delta = .9999$. There is another shaft rotating at twice this velocity into

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*The 4-2-2-1 code selected is not the only possible one. For a discussion of other possible codes, see appendix II.

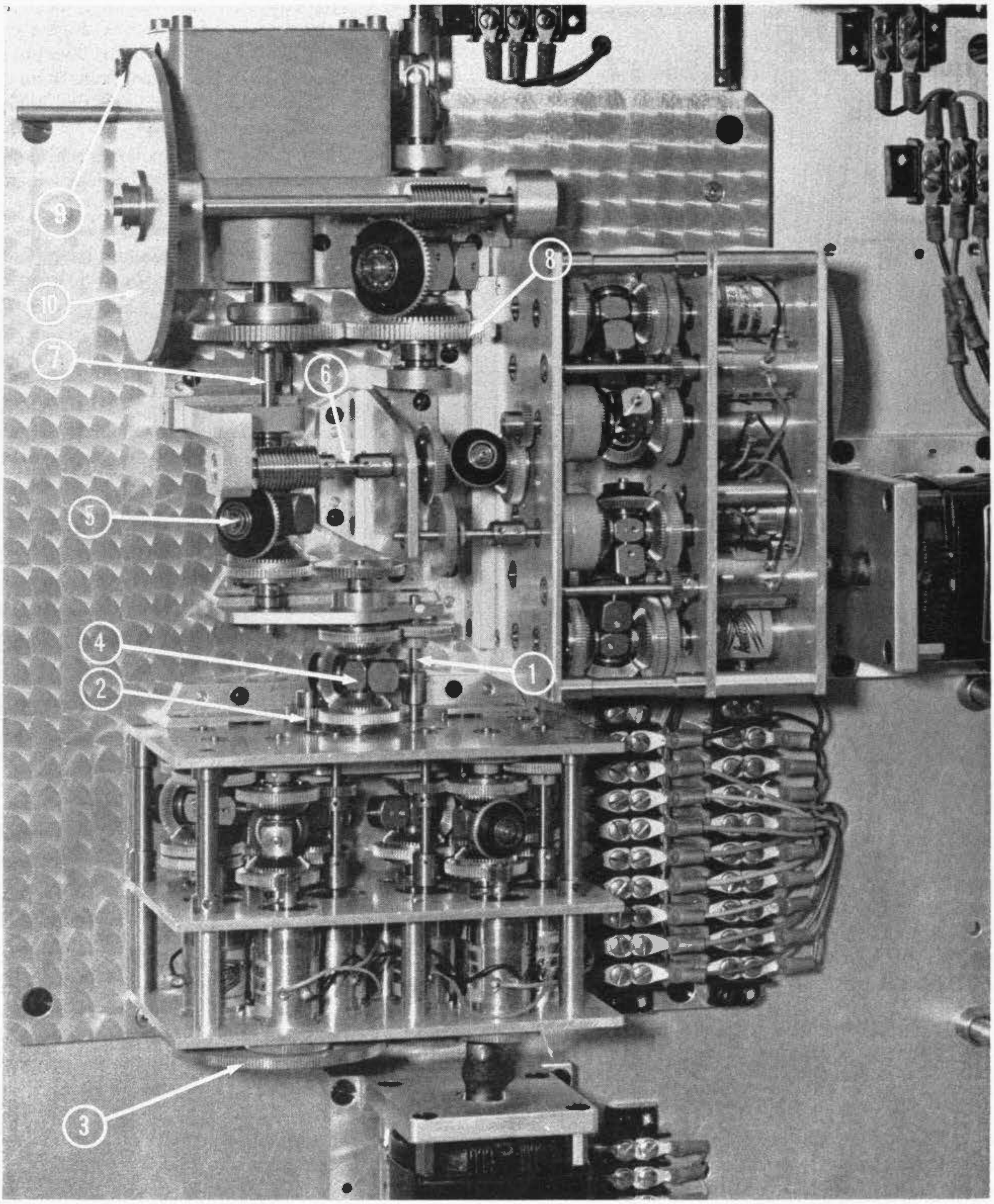

FIGURE 5. The Complete 10,000-speed Gear Box. The lower unit provides the two highest-order digits of cos δ, the right-hand unit the two lowest-order digits. Following the two 100-speed gear boxes, the differentials and gear-tooth sizes are increased in steps in order to handle the increasing torques as speed drops.

which the 10,000-speed gear box must be coupled; and in order to find the required gear ratio, one must divide 140.611 by 58.952, and hope the quotient will be expressible in terms of a proper fraction of reasonable size, where the numerator and denominator will then represent the numbers of teeth of the driver and driven gears. Actually the foregoing is a simplification. The value of 29.476 r.p.m. for lead screw velocity is an average figure for the two mirror transit collimators, whose mean focal lenghts, and hence lead screw velocities, differ by about a factor of .001. Furthermore, if the focal length of either collimator changes with the gross temperature changes from summer to winter, then the lead screw velocity will also change and this must be incorporated into the digital velocity-generator.

This is done by extracting from shaft (7) a small portion of its angular motion and adding it to, or subtracting it from, the original motion. In order to make this a continuously variable increment, use is made of the ball-and-disc integrator. Varying the position of the push rod will change the magnitude and sign of the small incremental motion, which can be fed into the original motion via a differential and associated gears. At first thought it might be supposed that the nominal position of the push rod would correspond to the zero output of the integrator; but this is not the case as the integrator should not be run with the ball cage at dead centre for any length of time. A little reflection will show that the disc centre and the contacting ball abrade one another in this position. Hence a better way is to start with the push rod half way out from the zero position in either direction and calculate subsequent gear ratios using this as the nominal zero. The resulting increment can be either additive or subtractive as one wishes. Suppose for purposes of argument it is additive (as in the present application) then if the push rod is moved towards zero, the added amount will be decreased, and conversely if the push rod is moved out, the added amount will be increased. The ratio between the direct input to one end of the mixing differential and the ball-and disc-input to the other end will determine to what degree the added increment can be increased or decreased.

The large gear on shaft (7) is geared, 1:1, with the differential end gear (8), and in the absence of any input at the other end of the differential the latters's output velocity will be one-half of input. Shaft (7) also feeds directly into a ball-and-disc integrator, whose output at pinion (9) drives gear (10), which in turn drives the worm gear at the other end of the differential. The gear ratios are so arranged that, with the integrator push rod halfway out from the zero position, the corrective input is .0015 of the main input at the differential, and additive, so that the final output velocity becomes

$$140.611 \frac{(1 + .0015)}{2} = 70.411 \text{ r.p.m.}$$

The quotient of 70.411 and 58.952 is 1.19447 and fortuitously it happens that gears of 86 and 72 teeth have a ratio of 1.19444 which could not be more ideal. The ball-and-disc integrator adjustment makes possible velocities from 70.305 to 70.516 r.p.m. at the output, i.e., ± .15% of nominal. The entire velocity computer can be seen in Figure 6.

The switching array for the drive system is shown in Figure 7, where the four columns of pushbuttons on the right, each numbered 0-9, represent cos δ. The rest of the panel is devoted to other controls used in the mirror transit operation. The pushbuttons and associated switch modules are interlocked within decades so that pressing one releases the previous number. The conversion of the decimally selected signals to binary signals for clutch activation is done through a diode matrix, shown schematically in Figure 8.

The system has been in use for several observing periods and has given no difficulty. At the present time the synchronous motors are driven from the domestic 60-cycle power line, as present experience is that the frequency is fairly exact and stable during the observing periods, when domestic and industrial loads are light and constant. If evidence accumulates that controlled 60-cycle power must be used, it will be necessary only on the motor that provides the two highest-order digits.

The operating cycle is arranged so that the programmed gear train begins to run when the observer initiates the rapid moving of the lead screw to its start position; hence the backlash of all gears, up to and including the ball-and-disc integrator, is taken up prior to the initiation of the exposure.

After this point in the gear train, the only two meshes left are from the tracking clutch output to the "visual observation differential" referred to in Figure 8; and from the vertical drive shaft to the horizontal collimator lead screw. The shutter operation which opens the optical path is started simultaneously with the tracking drive. Since the shutter takes some 800 milliseconds to open, these two final backlashes have been taken up and the plate carriage is in uniform motion by the time the light of the star begins to fall on the film.

The writer wishes to acknowledge the cooperation of E. Sanders and his staff at the Observatory machine shop, where the velocity-generating computer was made. The execution of the work was almost solely the responsibility of J. C. Reynolds: and the fact that no jig-boring machine was available to him makes the fine workmanship and close-tolerance achievements doubly commendable.

Reference

BREALEY, G. A. and TANNER, R. W. Photographic registration of transits and reduction of observation on the Ottawa mirror transit telescope. *Dom. Obs. Pub.* v. XXV, no. 3, 1963.

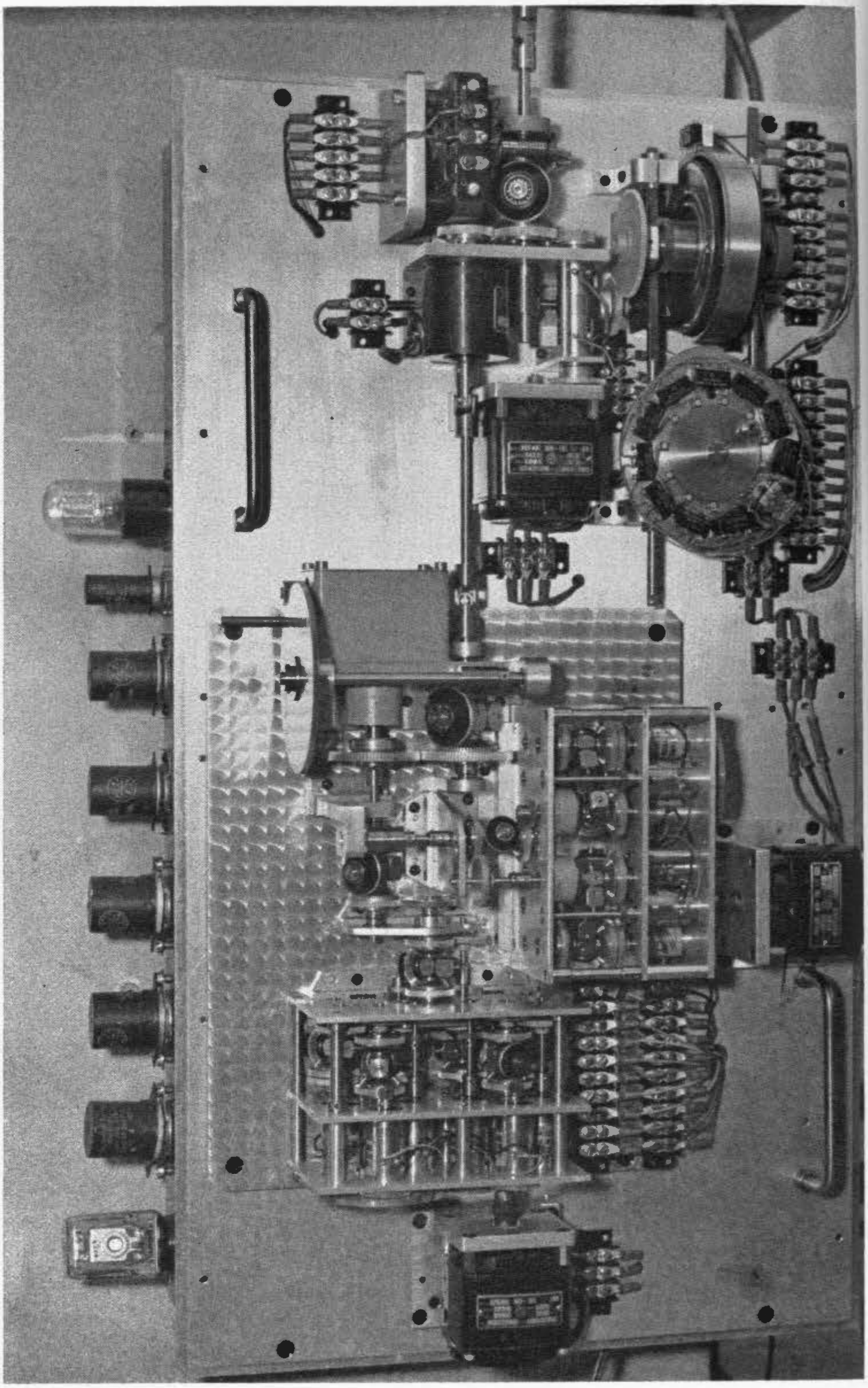

FIGURE 6

The Complete Velocity Computer on the North Collimator Pier. The circular array of microswitches uses the first decimal digit of cos δ to drive the two parallel racks below, which in turn rotate limit switches that shorten the travel of the right ascension slide proportionately as stars closer to the pole are observed, thus keeping the exposure time constant. The motor and clutch near the microswitches are used for high-speed motion of the lead screw. The motor and differential at the very top are used for adding to or subtracting from the lead screw a velocity increment for visual observations.

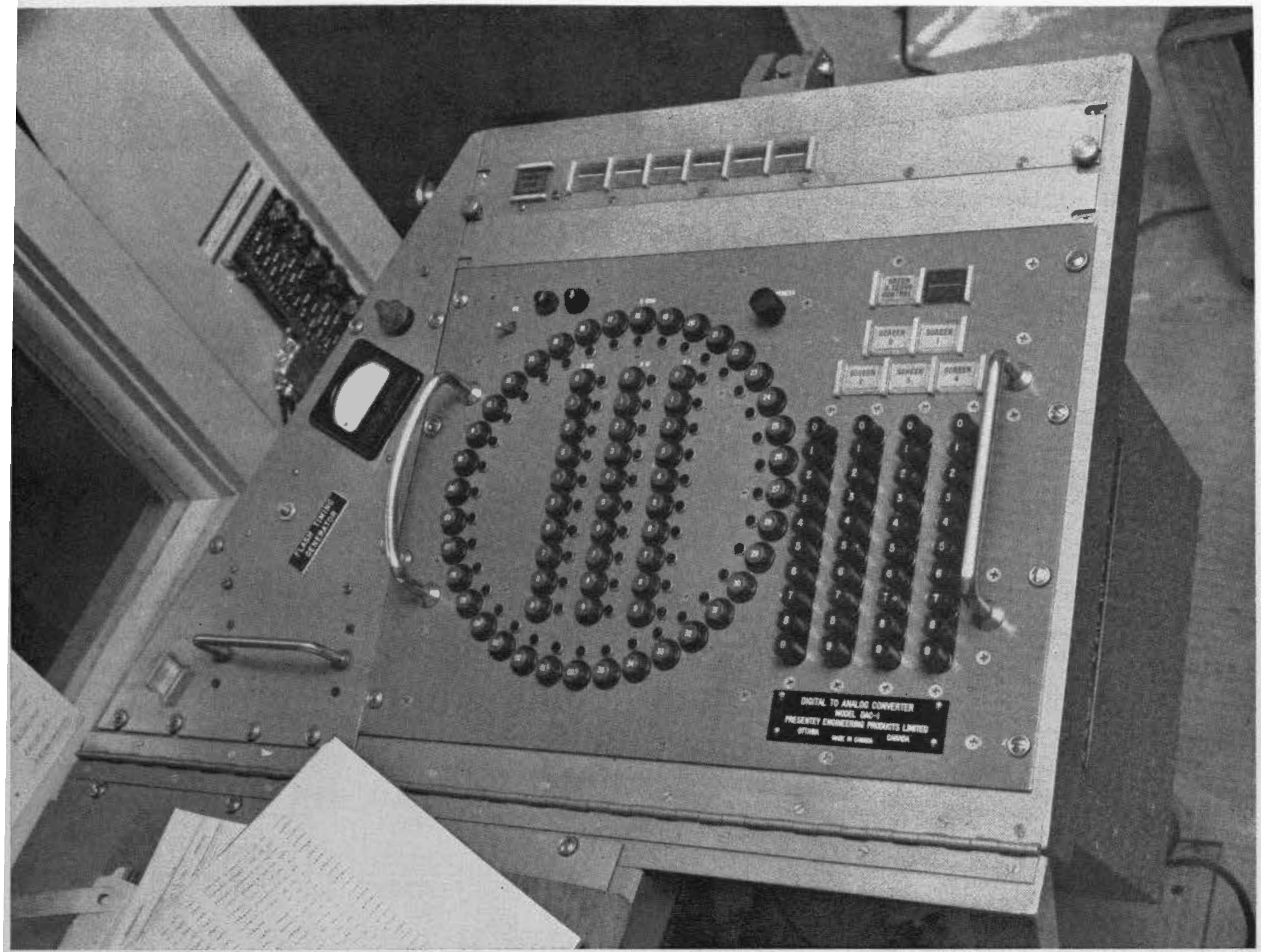

FIGURE 7. The Control Panel for Observing Parameters. The left side is devoted to the digital servo-transmitter, the lower right to velocity selection, and the upper right to the screen selector (the various screens dim the bright stars so they will not overexpose). These are the only data that have to be entered. The initiation of exposures is controlled by a programmable digital clock, not seen in the figure.

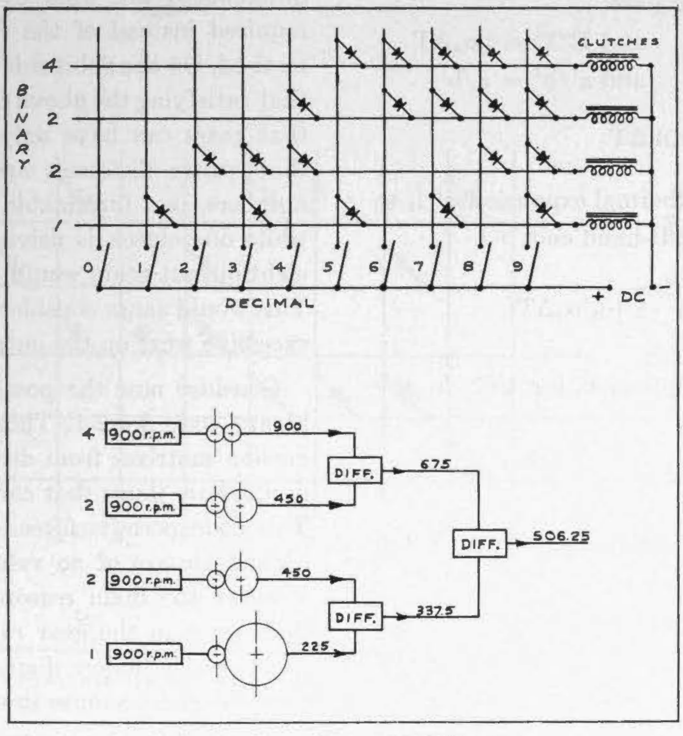

FIGURE 8. The Decimal-to-Binary Conversion Matrix (above) and a Block Diagram of a 10-speed Gear Box. The switches numbered from 0 to 9 are actually relay contacts associated with the decimal keyboard. The velocities shown for the gear box are those for the highest-order digit of cos δ.

APPENDIX I

The differential thermal expansion in both vertical and horizontal coordinates of Figure 1B will be considered, and the result will be shown to be equivalent to that obtained by considering the horizontal component only. Once again the origin is taken at B, (Figure 9), and with an increase in temperature E moves to E″ and C to C″ as the base expands; while A moves to A′ (and hence D to D′) and C to C′ as the steels expand.

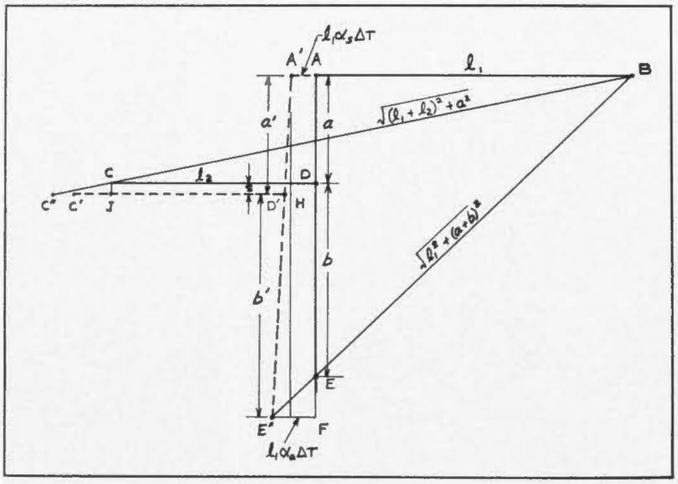

FIGURE 9. Schematic of original velocity-generating computer, showing relative motions with temperature change when both vertical and horizontal components are considered.

$$EE'' = (\sqrt{l_1 + (a+b)^2})\alpha_a\Delta T$$

whence $EF = (a+b)\alpha_a\Delta T$ and $E''F = l_1\alpha_a\Delta T$

furthermore $S = a\alpha_a\Delta T$ and $a'/b' = a/b$

so that $D'H = \frac{a}{a+b}(\alpha_a-\alpha_s)l_1\Delta T$

To find C′J, we must add the thermal expansion of l_2 to the *total* displacement of its right-hand end.

$$\therefore\ C'J = \frac{a}{a+b}(\alpha_a-\alpha_s)l_1\Delta T + (l_1+l_2)\alpha_s\Delta T$$

This is identical to the expression for CC′ in the approximation. Now for C″

$$C''B = (\sqrt{(l_1+l_2)^2 + a^2})\alpha_a\Delta T$$

whence $C''J = (l_1+l_2)\alpha_a\Delta T$

which likewise is identical to the expression for CC″ in the approximation.

So that C″C′, the relative displacement of ball cage from push rod, is correct as given by the formula in the approximation.

APPENDIX II

The 4-2-2-1 binary code was selected as being the most suitable for the computer mechanism. However, there are other codes that are discussed briefly with the reasons for their rejection in favour of the 4-2-2-1 code.

One might first of all ask why not avoid binary equivalents altogether and use strictly decimal concepts throughout each decade. Suppose an input shaft carries a pinion that drives nine gears, each of which is the input of a clutch, which in turn has the property that when de-energized its output is free and when energized its output is connected to its input. At the output ends of the clutches place other gears that all engage with a single gear on an output shaft. Call the input gear ratios for each clutch I_1, I_2 . . . I_9 and the output ratios O_1, O_2 . . . O_9, then to obtain nine decimally related output speeds by energizing one of nine clutches the gear ratios must satisfy the following conditions, where K is any constant.

$$\begin{aligned} I_1O_1 &= K \\ I_2O_2 &= 2K \\ I_3O_3 &= 3K \\ &\cdot \\ &\cdot \\ &\cdot \\ I_9O_9 &= 9K \end{aligned}$$

Obviously the advantage of this proposal is that no differentials are used even though nine clutches are required instead of the four in the 4-2-2-1 conversion method. On the debit side it is submitted, without proof, that satisfying the above equations, within the limitation that gears can have only whole numbers of teeth and that centre distances are rigorously subject to tooth numbers, is a formidable design problem. Furthermore while one clutch is driving the output shaft the other eight output gears would be driven by the output shaft. This would cause considerable loading of the output and excessive wear on the output shaft gear.

Consider now the possibility of using the "straight" binary code 8-4-2-1. This has the advantage that conversion matrixes from decimal to binary and binary to decimal are items that can be purchased "off the shelf". This code permits fifteen possible speeds of which the highest six are of no value in the present application; however the main reason for its rejection is the wide divergence in the gear ratios between the highest and lowest order binary digits. A spur gear ratio of 1:8 is a rather cumbersome thing. If for example a pinion is

3/8 inch diameter, then the driven gear has a diameter of 3 inches and takes up nearly as much space as all the other gears put together.

A third possible code was seriously considered. To the writer's knowledge, it does not have any formal name and is a hybrid of products and sums. The decimal digits from zero to nine are obtained as follows:

$0 = 0$

$1 = 1$

$2 = 3-1$

$3 = 3$

$4 = 3+1$

$5 = 3\times 2-1$

$6 = 3\times 2$

$7 = 3\times 2+1$

$8 = 3\times 3-1$

$9 = 3\times 3$

The mechanical anologue of these expressions is difficult to describe in words but is clearly apparent in Figure 10.

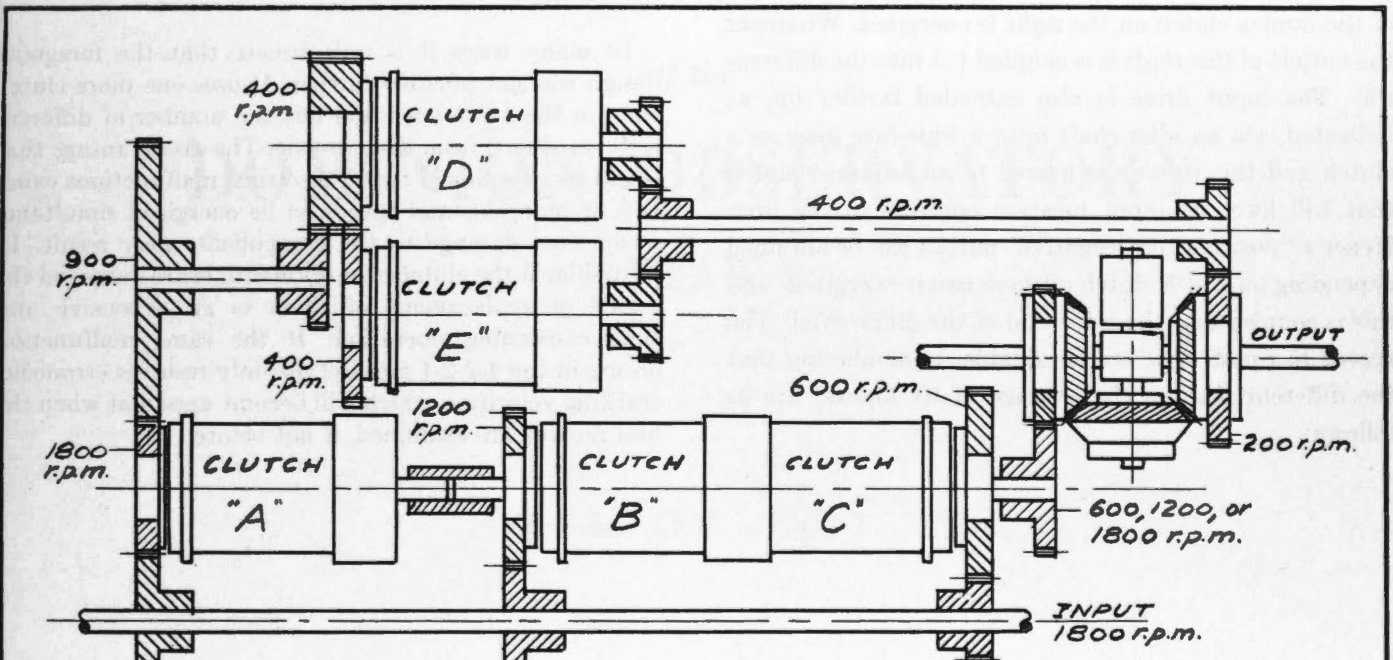

FIGURE 10. Assembly drawing for 10-speed gear box described in Appendix II, and diode matrix for conversion of decimal to 1-2-3 code. It is understood that clutch input gears are bolted to clutch input discs and output gears are set-screwed to output shafts. No support bearings for components or shafts are shown.

It is emphasized that for simplicity of examination the mechanism has been arranged all in one plane whereas in a final design a certain amount of "folding" would be desirable and could result in a very compact package. In the array shown, the clutches and the differential are drawn to scale and the gears are supposed to be of 80 diametral pitch. The lower shaft is the input, driven at 1,800 r.p.m. (so that the equivalence to the above table will later be seen). The next shaft up can have speeds of 1,800, 1,200, or 600 r.p.m. depending on whether the clutch on the left is energized or alternatively which half of the duplex clutch on the right is energized. Whatever the output of this shaft it is coupled 1:1 into the differential. The input drive is also extended farther up, as indicated, via an idler shaft onto a wide-face gear on a clutch and this in turn is geared to an adjacent clutch that will have its input rotation opposite to the first. Hence a "positive" or "negative" output can be obtained depending on which clutch of these two is energized; and this is coupled into the other end of the differential. The speeds in r.p.m. that are obtainable (remembering that the differential gives the average of its inputs) are as follows:

r.p.m. out	obtained by	*clutch(s) engaged (see Figure 10)*
0	0	none
100	200/2	D
200	(600−200)/2	C and E
300	600/2	C
400	(600+200)/2	C and D
500	(1200−200)/2	B and E
600	1200/2	B
700	(1200+200)/2	B and D
800	(1800−200)/2	A and E
900	1800/2	A
1,000*	(1800+200)/2	A and D

*if required for any purpose

In many ways it is unfortunate that the foregoing design was not pursued further. It uses one more clutch than in the 4-2-2-1 method but the number of differentials is reduced from three to one. The disadvantage that led to its rejection is that if electrical malfunctions cause two or more decimal speeds to be energized simultaneously then damage to the components may result. In particular if the clutches or differentials are damaged the repair or replacement of them is an expensive and time consuming operation. If the same malfunction occurs in the 4-2-2-1 method the only result is erroneous tracking velocities, which will become apparent when the film records are examined, if not before.

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THE 1420 MC/S RADIO TELESCOPE OF THE DOMINION RADIO ASTROPHYSICAL OBSERVATORY

J. L. Locke, J. A. Galt and C. H. Costain

Price: 25 cents

ROGER DUHAMEL, F.R.S.C.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1965

96597—1

FIGURE 1. The 25.6-m radio telescope of the Dominion Radio Astrophysical Observatory.

The 1420 MC/S Radio Telescope of the Dominion Radio Astrophysical Observatory

J. L. LOCKE, J. A. GALT AND C. H. COSTAIN

ABSTRACT:—The radio telescope of the Dominion Radio Astrophysical Observatory, used both for studies of the hydrogen line and the continuum, is described. The antenna, a 25.6-metre-diameter paraboloid of focal ratio 0.34, is mounted equatorially. The radiometer is a Dicke type instrument with a comparison resistor at liquid oxygen temperature. An over-all noise temperature of 160°K is attained using an electron beam parametric amplifier.

RÉSUMÉ:—Les auteurs décrivent le radio-télescope de l'Observatoire de radio-astrophysique du Canada que l'on emploie à la fois à l'étude des raies de l'hydrogène et du spectre continu. L'antenne parabolique de 25.6 mètres de diamètre et de 0.34 d'ouverture est montée en équatorial. Le radiomètre est un instrument du type Dicke muni d'une résistance de comparaison à la température de l'oxygène liquide. On obtient une température de bruit totale de 160° K en utilisant un amplificateur paramétrique à faisceau d'électrons.

Introduction

The Dominion Radio Astrophysical Observatory was established in 1960 to pursue studies of interstellar matter, a subject that has for many years been investigated by the observatories at Ottawa and Victoria. Radio waves from neutral hydrogen at a wavelength of 21 cm provide accurate radial-velocity information and can penetrate the dust clouds in the galactic plane that are opaque to light waves. Studies of the radiation from hydrogen can be used to investigate the size, shape, mass and rotational properties of our galaxy. Radio methods are also of great value in studies of extragalactic nebulae, the sun, the moon and some of the planets.

The observatory is located about 20 km south of Penticton, B.C., in a large uninhabited valley surrounded by mountains. The site was chosen after an extensive survey and is remarkably free of electrical interference. At 119°37′W, 49°19′N, it is far enough south that observations down to declination −30° are possible. The area surrounding the observatory, being flat and devoid of trees, is well suited to the installation of interferometers or large aerial arrays.

Antenna

The antenna, shown in Figure 1, is an equatorially mounted parabolic reflector 25.6 metres in diameter with a focal length of 7.6 metres. The aluminum mesh surface conforms to a true paraboloid to within ± 1 cm. Any part of the sky may be observed directly, and the telescope position is indicated by synchronous repeaters reading declination, right ascension and hour angle. The telescope can track in hour angle at the sidereal rate, scan at speeds from 0° to 1° per minute or, for setting, can be rotated at 15° per minute. For movement in declination, similar scan and rapid motions are available; in addition there is a synchronous drive in declination of 1/4° per sidereal minute. The reflector is supported by a steel tower which is bolted to a massive reinforced concrete foundation. The polar axis was aligned by tilting the tower through an angle determined from sky photographs taken with a camera temporarily mounted on the declination axis. Errors in pointing are less than 1/10 of a beamwidth at the operating frequency.

A 25.4-cm cassegranian optical telescope is permanently mounted parallel to the axis of the antenna. This has been used to check the accuracy of the tracking motion and the perpendicularity of the polar and declination axes; it can also aid in locating a comet or other transient object whose coordinates are not well known. The optical telescope is mounted in the wall of the large cylindrical tube which forms the declination axis and supports the antenna. A system of prisms and lenses brings the light out along the axis of declination. An observer's chair rolls around the inside of the tube and remains upright as the telescope moves in declination.

Three fibreglass spars support the electronic apparatus at the focus. This is housed in a weatherproof, thermally insulated box whose temperature is maintained at 22° ± .5°C by circulating water in coils around the outside of the box. A refrigerator in the top of the tower and a heater adjust the temperature of the water in response to changes of the temperature inside the box.

Radiation from a celestial source is collected at the focus with a stepped-waveguide horn, which can be adjusted for a VSWR of less than 1.02 from 1370 Mc/s to 1450 Mc/s (Millar, 1960). The horn is flared in the E-plane to obtain nearly equal response in the E and H planes. It provides a smoothly tapered aperture illumination which falls by 14 db at the edge of the reflector. This produces a nearly circular beam with a half width of 36′ and a very low side-lobe level at 1420 Mc/s. The E-plane of the horn is parallel to the axis of declination. The horn is matched to a 50-ohm coaxial line by means of a waveguide plunger and a reactance stub. This stub, which is only needed for small impedance corrections, is an open-circuited coaxial line about $\lambda/2$ long whose electrical length can be adjusted slightly by moving a polystyrene tube in the line. This type of tuning stub avoids the problem of intermittent contact fingers which are troublesome with the more conventional $\lambda/4$ shorting stub.

Radiometer

A block diagram of the radiometer is shown in Figure 2 and a list of the principal components and their manufacturers is given in Table 1. Power from the horn is fed to a ferrite circulator switch that alternately connects the aerial or a matched resistive termination to the following amplifier. After amplification and detection the signal is applied to a demodulator operating in synchronism with the input switch. The demodulator output is proportional to the difference in power received from the aerial and the comparison resistor.

It has been shown by Orhaug and Waltman (1962) that a Dicke radiometer of this type has maximum stability when the aerial temperature is equal to the temperature of the comparison resistor. Under usual operating conditions at high frequencies the aerial temperature is lower than the temperature of the comparison termination. To make the two temperatures equal, noise power from a discharge tube is introduced into the aerial side of the switch through a directional coupler and a motor-driven variable attenuator. To keep to a minimum the noise power that must be injected to balance the system, the comparison resistor is immersed in liquid oxygen at 90°K. A calibration signal can be inserted through a second directional coupler. The ferrite circulator switch operates at 97.7 cps and is similar to the one described by Lax and Button (1962). Besides acting as a SPDT coaxial switch it also functions as an isolator preventing small changes in antenna or comparison resistor impedance from degrading the performance of the following amplifier. Switching is accomplished by

TABLE I. EQUIPMENT SUPPLIERS

Block No.	Manufacturer	Block No.	Manufacturer
(1)	D.S. Kennedy Co.	(25)	Microlab, CA4IN
(2)	National Research Council, Ottawa.	(26)	Arra π Line, Model 3414-30
(3)	Hewlett-Packard Co.	(27)	Airborne Instruments Laboratory, Type 7010
(4)	Melabs, Model X-124A	(28)	Narda Microwave Corp., 3003-10
(5)	Zenith Radio Corp., Model LB (Power Supplies, D.R.A.O.)	(29)	Alfred Electronics, Model 703
(6)	Applied Research Inc., Model HFF-T-ZX	(30)	Gombos Microwave Inc., Model 2S12
(7)	Microlab, Series CJ-N	(31)	Alfred Electronics Inc., Model 502A—(Higgins HA-2E)
(8)	Ewen-Dae Corp.	(32)	Gombos Microwave Inc., Model 3S12
(9)	D.R.A.O.	(33)	Fideltone Mcrowave Inc., (JVM), Modified by D.R.A.O.
(10)	Ewen-Dae Corp.	(34)	D.R.A.O.
(11)	Ewen-Dae Corp.	(35)	D.R.A.O.
(12)	Ewen-Dae Corp.	(36)	D.R.A.O.
(13)	Bulova Watch Co. and Daven Co.	(37)	Fieldtone Microwave Inc., (JVM)
(14)	Ewen-Dae Corp.	(38)	D.R.A.O.
(15)	R.C.A. 2N384 Transistor	(39)	Ewen-Dae Corp., Modified by D.R.A.O (see Figure 2)
(16)	Ewen-Dae Corp.	(40)	Melabs Model RL-3
(17)	Stevens Arnold Corp. Model A32-94	(41)	Ewen-Dae Corp.
(18)	Texas Instrument Inc., Servo Riter Model PSD	(42)	D.R.A.O.
(19)	D.R.A.O.	(43)	D.R.A.O.
(20)	Hewlett-Packard Co., Model 405 CR	(44)	D.R.A.O.
(21)	D.R.A.O.	(45)	D.R.A.O.
(22)	I.B.M. Type 024	(46)	D.R.A.O.
(23)	Stoddart Aircraft Radio Co., Inc., 92234-58	(47)	Phelps Dodge Electronics Products Corp., Styroflex.
(24)	Sulfrian Cryogenics, Inc.		

D.R.A.O.—Dominion Radio Astrophysical Observatory.

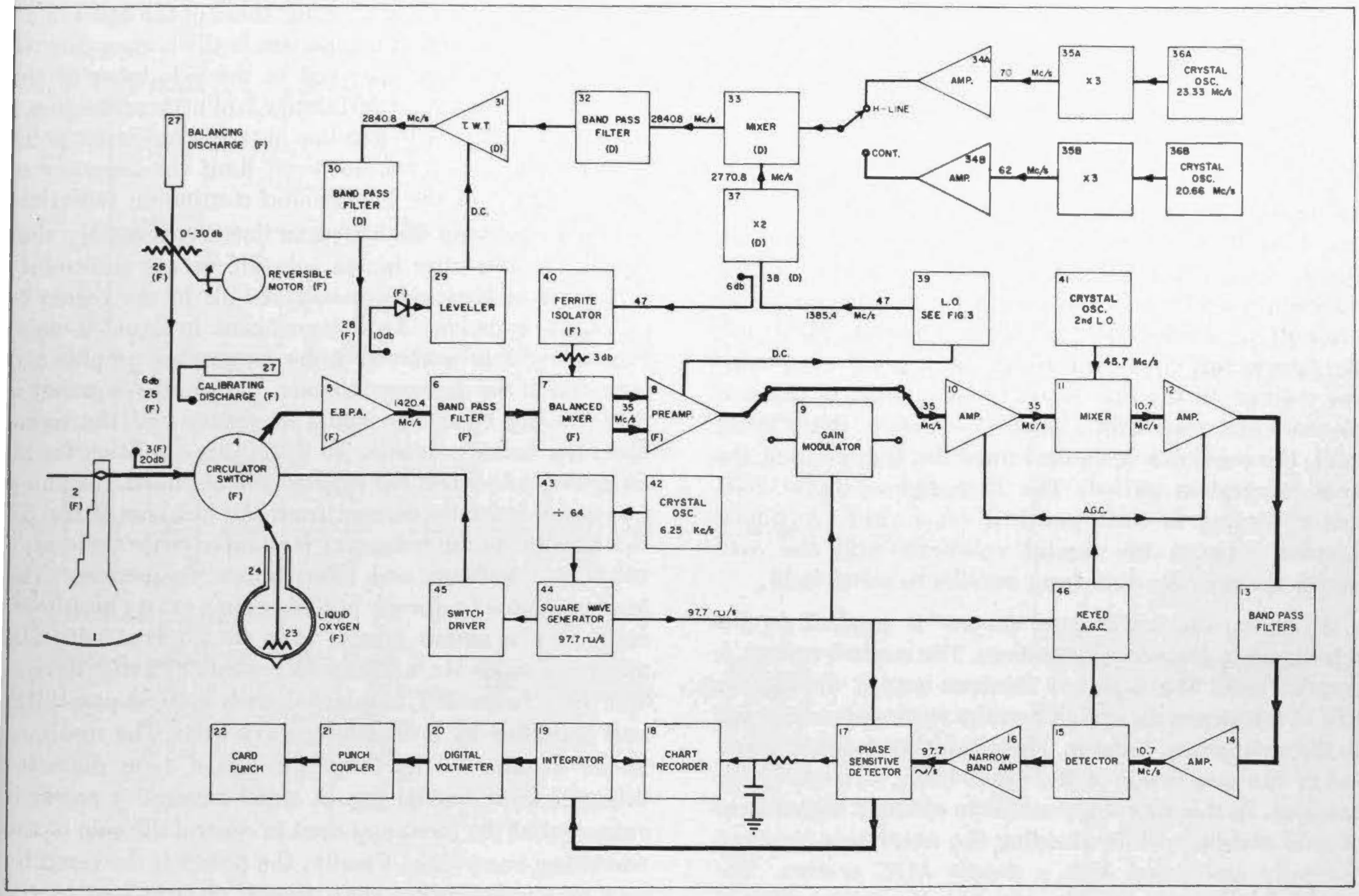

FIGURE 2. Block diagram of the radiometer. Numbers refer to Table 1. Items marked (F) are located at the focus of the radio telescope. Items marked (D) are located in the declination axis. All other apparatus is in laboratory building.

reversing the magnetic field applied to the ferrite. The loss in the switch is about 0.1 db and hence contributes only approximately 7°K to the receiver noise temperature.

When maximum sensitivity rather than maximum stability is required, the balancing discharge tube is turned off and a gain modulator inserted in the intermediate frequency amplifier. This device uses attenuators and a crystal diode switch operating in synchronism with the input switch to reduce the power from the comparison resistor until it is equal to that from the antenna. Although this mode of operation has a property of a balanced Dicke system of being insensitive to gain fluctuations, it is sensitive to noise factor fluctuations. In the present case, a change in receiver noise temperature, T_N °K, will appear as an output deflection of approximately $\frac{1}{2}$ T_N °K.

The radio frequency preamplifier is an electron beam parametric amplifier (Adler tube) similar to the one described by Adler, Hrbek and Wade (1959). Its gain, when operating at minimum noise temperature of 90°K, is about 23 db. To obtain optimum performance, the electrode potentials, magnetic field and pump power are stabilized to a high degree and the input impedances must be accurately matched. The Adler tube is operated in a degenerate mode for hydrogen-line reception and the pump power required at twice the signal frequency is about 200 mw. A double-cavity band-pass filter following the Adler tube keeps stray pump power out of the crystal mixer and prevents local oscillator power from entering the parametric amplifier. The balanced crystal mixer combines the signal, whose nominal frequency is 1420.4 Mc/s, and the local oscillator power at 1385.4 Mc/s to produce an intermediate frequency of 35 Mc/s. A cascode preamplifier and three pentode stages amplify the signal before it is transmitted by cable to the laboratory building. The signal is then further amplified and converted to 10.7 Mc/s where the pass-band is limited by filters of 2, 5, 10, 50, 200 or 6000 kc/s bandwidth. The first four are crystal filters. After further amplification the signal is detected in the base-to-emitter junction of a transistor. A tuned audio amplifier follows the detector and the signal is then applied to a chopper-type demodulator driven in synchronism with the ferrite switch at the focus.

The DC output of the demodulator is applied to a simple RC low-pass filter and then to a potentiometer pen recorder. The output also feeds an integrator in which a capacitor is charged for an accurately timed interval, usually half a sidereal minute, with a current proportional to the output of the receiver. At the end of the interval an identical capacitor begins charging while the voltage on the first capacitor is applied to the pen recorder and read with a digital voltmeter. After being read, the capacitor is shorted until the beginning of the next integration period. The three-figure digital voltmeter reading is then punched on a card. A punch coupler between the digital voltmeter and the card punch changes the data from parallel to serial form.

A keyed automatic gain control is applied to the intermediate frequency amplifiers. The control voltage is derived from the detected receiver output during the half of the switching cycle when the receiver is connected to the comparison resistor. The gain is therefore independent of the magnitude of the signal being received by the antenna. In this way it is possible to obtain a high degree of gain stability while avoiding the non-linear response normally associated with a simple AGC system. The sensitivity is, however, dependant on the temperature of the comparison resistor and the receiver noise temperature. The comparison resistor is maintained at constant temperature. The effect of changes in receiver noise on the output of the system is proportional to the percentage change in the total input noise and to the size of the unbalanced switched signal. Since the receiver is normally operated in a nearly balanced condition, small changes in receiver noise are unimportant.

Because changes in temperature of the comparison resistor will normally be indistinguishable from changes in aerial temperature, the temperature of the comparison resistor must be held constant to within the desired accuracy of the measurements; for some observations this is of the order of 0.05°K. This requirement is met by immersing the resistor in liquid oxygen. Liquid oxygen is used instead of the cooler liquid nitrogen because the temperature of a liquid nitrogen bath will rise as oxygen from the atmosphere dissolves in it. The resistor is at the bottom of a 5-litre dewar flask fixed to a spar near the focus. A rigid evacuated coaxial line connects the resistance termination to a short length of thermally insulated RG9B cable.

The stability of the system for times of the order of an hour or more is limited by changes in the temperature of the ground which is observed in the side lobes of the antenna. This apparent instability is of little consequence for most galactic hydrogen-line observations or for point source studies. It does, however, limit the accuracy of measurements of the background continuum radiation.

When observing the hydrogen line it is necessary that the signal and idler bands coincide or are sufficiently separated so that only one band falls in the region of hydrogen emission. An improvement in signal-to-noise ratio of $\sqrt{2}$ is achieved if the parametric amplifier is operated in the degenerate mode. The pump frequency is then exactly twice the signal frequency and the signal and idler bands coincide. To fulfill this condition for all frequencies to which the receiver can be tuned, the pump frequency must be derived from the local oscillator. In this case the pump frequency is equal to twice the sum of the local oscillator and intermediate frequencies. The local oscillator frequency is doubled in a cavity multiplier employing a planar triode. It is then mixed with the output of a 70-Mc/s source in a similar cavity device. The sum frequency is selected with a band-pass filter and amplified by a travelling wave tube. The resultant power is sent to the focus through a 4-cm diameter nitrogen filled coaxial line. A small amount of power is extracted at the focus and used to control the gain of the travelling wave tube. Finally, the power is delivered by way of a balun and a short length of twin lead to the quadrupole structure inside the Adler tube. When observations of the continuum rather than the hydrogen-line are to be made, the receiver is tuned to 1424 Mc/s and the pump frequency returned to 2840 Mc/s; the signal and idler bands are then spaced on either side of the hydrogen frequency. This doubles the effective bandwidth of the receiver.

Local Oscillator

A block diagram of the local oscillator is shown in Figure 3. For observing galactic hydrogen, its frequency is approximately 1385.4 Mc/s. The local oscillator must be frequency stable to a small fraction of the receiver bandwidth and must be continuously tunable over a range of several megacycles.

To satisfy both requirements, the local oscillator frequency is synthesized by adding a high frequency (1235 Mc/s) derived from a very stable crystal oscillator to a lower variable frequency (≈ 150.4 Mc/s). To obtain the 1235 Mc/s power an oscillator is phase-locked to the 247th harmonic ($4 \times 62 - 1 = 247$) of a stable 1 Mc/s

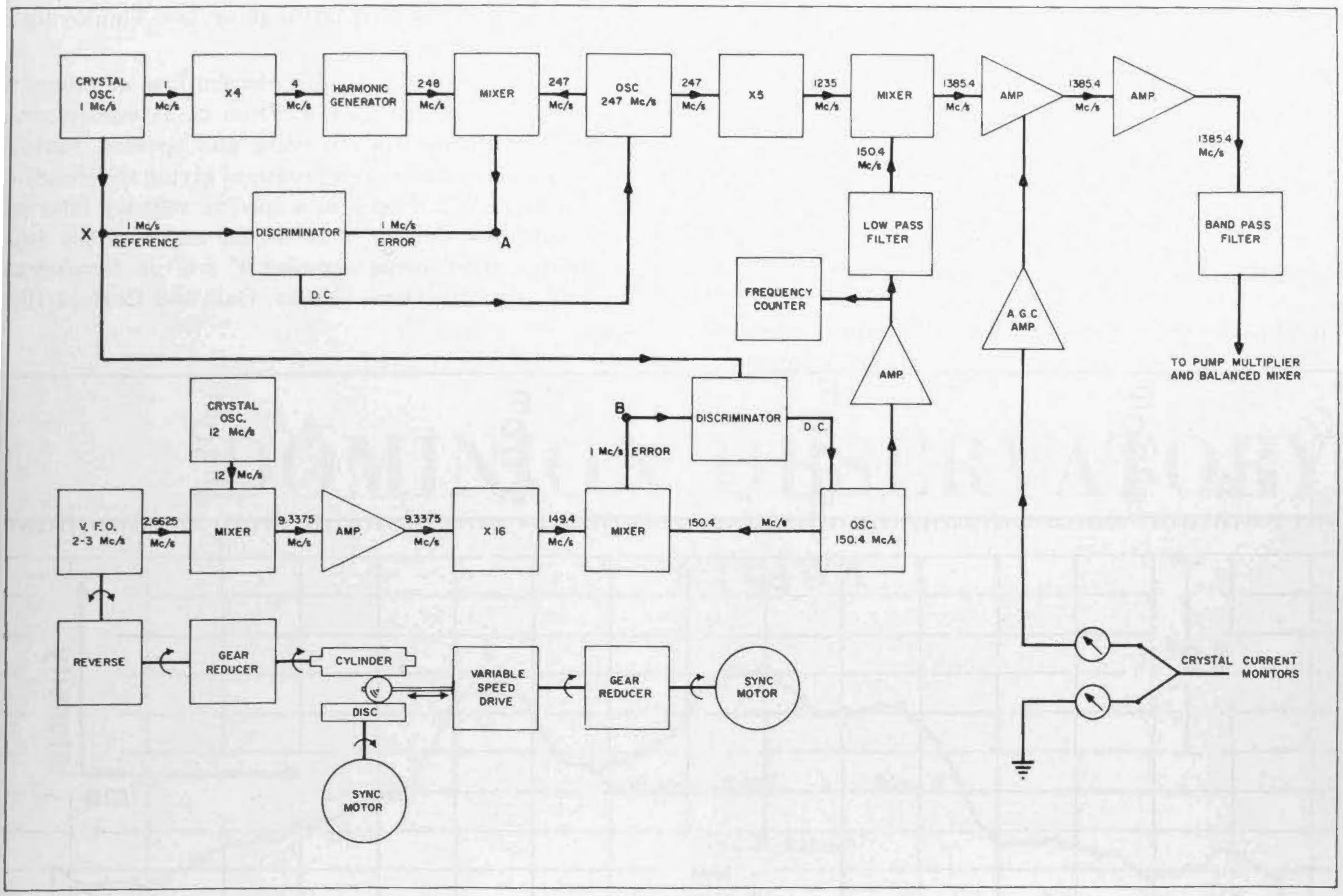

FIGURE 3. Block diagram of first local oscillator. (Shown as number 39 in Figure 2.)

crystal oscillator. This frequency is then multiplied by 5 to give 1235 Mc/s. The variable frequency is derived from an inductively tuned oscillator operating at a nominal frequency of 2.6625 Mc/s. This frequency is subtracted from a crystal-controlled frequency of 12 Mc/s and the difference multiplied by 16 to obtain a frequency of 149.4 Mc/s. A free-running oscillator is then phase-locked 1 Mc/s higher to produce 150.4 Mc/s. This frequency is added to 1235 Mc/s to obtain the 1385.4 Mc/s local oscillator frequency. The power is then amplified by two triode stages and delivered to a 4-cm-diameter coaxial cable which conducts it to the mixer at the focus and the pump-frequency multiplier in the declination axis. An automatic gain control voltage derived from the mixer crystal current is applied to the penultimate amplifier. The operation of the two phase-locked systems is continuously monitored by observing lissajous figures between point X and the points A and B in Figure 3.

Since the local oscillator determines the frequency of reception, it is important for hydrogen-line observations that its frequency be accurately known. The 1 Mc/s crystal is checked periodically against the standard frequency transmissions of WWV. The variable frequency oscillator is monitored continuously by means of a frequency counter and markers at selected frequency intervals are placed on the pen recorder.

When drift scans are used to observe hydrogen moving at a *particular velocity* with respect to the local standard of rest, the receiving frequency must be altered continuously to compensate for doppler shifts caused by the changing components of the sun's and earth's motion in the direction of observation. The frequencies, f, corresponding to the desired velocity, are therefore calculated using the tables of MacRae and Westerhout (1956) for each half hour of right ascension. Values of $\frac{df}{d\alpha}$ and $\frac{d^2f}{d\alpha^2}$ are calculated or obtained from a plot of frequency *vs* right ascension. At the start of an observation the local oscillator is set to the appropriate frequency. The scan rate, $\frac{df}{d\alpha}$, is set to the calculated value by positioning the ball of a ball-disc variable drive which connects a synchronous motor to the oscillator turning adjustment. A second motor and speed reducer changes the scan rate by moving the ball along the radius of the disc at a speed proportional to $\frac{d^2f}{d\alpha^2}$. The quadratic approximation to the variation of frequency with time is usually adequate for observations lasting an hour or two employing a 10-kc/s bandwidth.

A sample drift record of hydrogen-line emission in *Auriga* is shown in Figure 4. From many such records combined with declination scans and spectra, contour maps of the sky have been produced giving the distribution of neutral hydrogen in a specific velocity interval. Five maps covering 30° x 20° in the region of the anticentre and three maps covering 6° x 8° in *Geminorum* are presented elsewhere (Locke, Galt and Costain 1964 a,b).

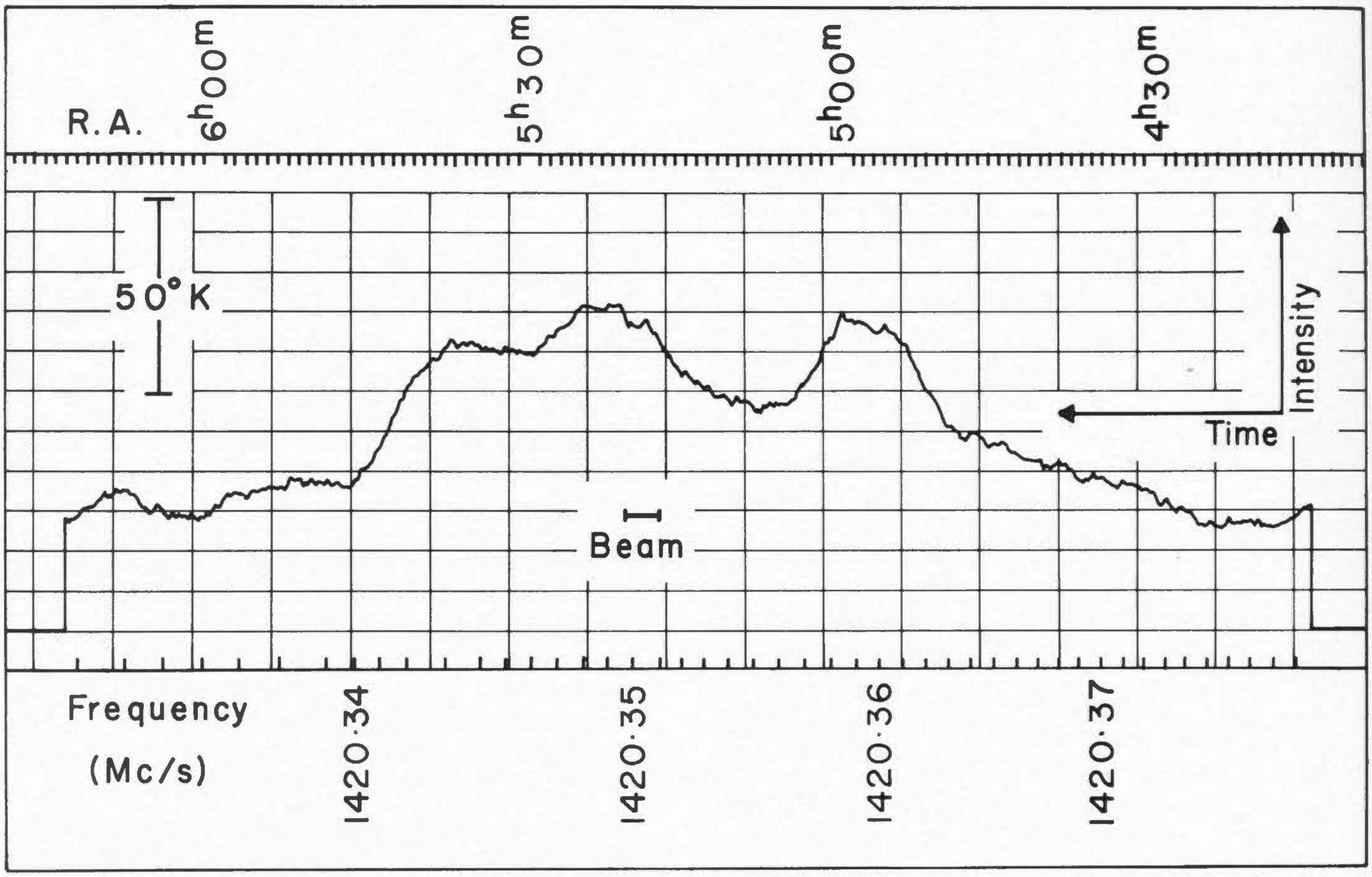

FIGURE 4. Sample drift record at declination 39°30′ and radial velocity V = −15.7 km/s. Observed April 26, 1962, beginning at 1519 P.S.T.

Acknowledgements

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(Revised Edition)

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CATALOGUE OF 3753 AGK3 REFERENCE STARS

CORRECTIONS TO 930 FK3 STARS

E. G. Woolsey

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OTTAWA, 1966

Results of Observations Made with the Reversible Meridian Circle 1956-1961

E. G. Woolsey

Abstract: This publication contains the results of observations of 3753 AGK reference stars, which form the Ottawa contribution to the cooperative re-observation of the AG stars. The published positions were determined differentially using the 930 FK3 stars whose declinations are greater than —12°30′; the positions used for these stars were the FK3R positions.

The catalogue also gives the relative corrections for the fundamental stars in the form observed minus FK3R position.

The program stars were each observed twice: the probable error of a single observation is ″.21 in right ascension and ″.27 in declination.

Résumé: Cette publication renferme les résultats de l'observation de 3,753 étoiles de références AGK qui constituent la contribution d'Ottawa à la ré-observation en coopération des étoiles AG. Les positions publiées ont été déterminées de façon différentielle à l'aide de 930 étoiles FK3 dont les déclinaisons sont supérieures à —12°30′; les positions utilisées pour ces étoiles ont été celles des étoiles FK3R.

Le catalogue donne aussi les corrections relatives pour les étoiles fondamentales sous la forme observée moins la position des étoiles FK3R.

Les étoiles au programme ont été observées chacune deux fois. L'erreur probable d'une seule observation est de ″.21 en ascension droite et de ″.27 en déclinaison.

INTRODUCTION

The Ninth General Assembly of the International Astronomical Union, held in Dublin, Ireland, in 1955 approved a plan for new photographic observations of the AGK stars in the northern sky, and for meridian circle observations of the reference stars to assure their agreement with the fundamental catalogue.

The fundamental catalogue used in the reduction was the FK3 revised. The adopted positions of the fundamental stars were obtained from "Apparent Places of Fundamental Stars," with the corrections from *Veroffentlichungen des Astronomischen Rechen-Instituts*, Heidelberg, Nr 6, 1957, and Nr 8, 1960, applied to the individual star observations.

The observations for this catalogue were commenced on February 13, 1956, and were completed September 29, 1961. All observations were made by E. G. Woolsey and R. W. Tanner; they were assisted in the reductions by G. A. Brealey, M. O. Wheeler, E. G. Garland, Miss O. Boshko, Mrs. B. Crawford and a number of summer assistants.

The catalogue is divided into three parts. Part I contains the positions of the AGK3 reference stars. The star numbers used are those provided by F. P. Scott of the U.S. Naval Observatory who coordinated this program. Part II contains the AGK3 reference stars and presents the differences between the observed values and the AGK2 catalogue in the form observed minus AGK2, and is given for the convenience of anyone wishing to compare catalogues or make proper motion studies. Part III contains the observed corrections to the fundamental catalogue in the form observed minus FK3 Revised. The stars in Part III are numbered using the FK4 numbering system. This is the same as the FK3 except for the high polars which have been assigned numbers in place of Greek and Roman letters.

The probable error of a single observation was calculated for each star. The average of these probable errors for all stars is ″.21 in right ascension and ″.27 in declination. The same value of probable error of a single observation was obtained for both the reference and program stars.

Although these results are published here, the individual observations have been forwarded to F. P. Scott at the U.S. Naval Observatory, where they will be combined with the observations from other observatories to produce a catalogue which will be known as the "AGK3R."

OBSERVING PLAN

As two observations were to be secured on each of the program stars, it was planned that each star would be observed once in each clamp and once by each observer. Observations were to be taken at all declinations and an effort was made to observe about thirty well-distributed FK3 stars each night. All the stars published in "Apparent Places of Fundamental Stars" that lie north of −12°30′ were used as reference stars. These were divided as follows:

−12°30′ to + 12°30′	Time stars
over 80°	High azimuth stars
75° to 80°	75° azimuth stars
60° to 75°	Refraction stars
12°30′ to 60°	Comparison stars

An average night's work covered about 6 hours of right ascension and included: (a) four azimuth stars, one at upper and one at lower culmination, from each of the two groups; (b) four refraction stars, two at upper, two at lower; (c) ten time stars (though a minimum of seven for a night was acceptable); (d) the comparison stars distributed at least one in each 10-degree zone of declination. The program stars were observed at upper culmination only.

Collimation, azimuth marks, level and nadir points were read before and after the night's observing, and in addition, level and nadir readings were repeated at two hourly intervals. Barometer, barograph, external thermometer and thermograph and the observing room thermograph were read before and after observing. Thermometer readings at the telescope were taken several times per hour.

The telescope was reversed in its pivots on the first day of each month except November. At the same time the mean of contacts and strip width were determined. The brighter stars were screened down to sixth magnitude and a reversing prism was used in all observations.

For this program, the standard deviation, σ, of the residuals, observed minus FK3 Revised, were calculated in both right ascension and declination for each night's work. Nights on which either of these values of σ exceeded $0^{s}.050 \sec\delta$ in right ascension or $0''.75$ in declination, were rejected. These values were selected as approximately twice the expected mean error of a single observation. When the difference between the two observations on a program star exceeded $0^{s}.100 \sec\delta$ in right ascension or $1''.50$ in declination, the star was re-observed. As was anticipated this was required for about 8 per cent of the stars.

RIGHT ASCENSION

The right ascensions were calculated using Bessel's formula:

$$\alpha = T + M' + c\sec\delta + n\tan\delta$$

in the manner described in Vol. XV, No. 3. The data from each night were examined by forming the residuals, observed minus FK3 Revised. It had been noted during observation that on several nights these residuals followed a curve as though there were an error in collimation and that the individual values of n as determined for the polars over 80 degrees differed from those between 75° and 80°. However the average of the higher polars taken above and below pole and of the 75° to 80° polars, above and below pole, gave the same value. It was decided to leave any adjustment until the program was completed.

On a number of nights the residuals (O-FK3R) appeared to be very high for the stars observed near the zenith. These nights were examined and in all cases a correction to the collimation improved the residuals for all stars. In our past publications the mean residuals followed a similar curve. In order to determine whether the residuals should be reduced by a clamp correction or a night correction, the residuals for each night were correlated with the curve

$$(\text{O-C})\cos\delta = k(1-\sin\delta - \cos\delta)$$

where k is the correction for collimation.

On 43 of the 283 nights the correlation factor exceeded .50. The value k did not appear to have any relation to clamp or observer, but appeared to make major changes at times of interruption such as change of clamp or servicing of the instrument. It was decided that the best way to apply a correction was as a night correction of $k(1-\sin\delta - \cos\delta)$, where k was determined by a least-squares solution of the residuals of all the FK3 stars observed.

The corrected values (O-FK3R)cosδ were then examined for difference of clamp and observer for each three hours of right ascension and ten degrees of declination. The weights are derived by the usual probability formula $mn/(m + n)$, where m and n are the number of observations in each clamp. Table I shows the difference by clamp, and Table II by observer. These tables indicate that there is no justifiable correction for clamp or observer.

Table V gives the values (O-FK3R)cosδ, for all observations for each three hours of right ascension and ten degrees of declination. The weights in this table are the number of observations.

Satisfactory agreement between observation and reference catalogue was reached except for the right ascension coordinate for stars with declinations between 80° and the pole. Examination of mean errors led us to believe that this discrepancy was due to the small number of observations rather than an instrumental error. No adjustment was made in the results.

Tables VII and VIII show the differences in right ascension with culmination, and weights dependent on m and n as before. These differences are considered to be negligible.

Tables XVII and XVIII show the attachment to the FK3 Revised values. The weights are the number of stars compared.

A least-squares solution of the residuals (O-FK3R) for the 311 time stars gave:

$$(\text{O-FK3R})_\alpha = .0020 \cos \alpha - .0007 \sin \alpha - .0004 \cos 2\alpha - .0020 \sin 2\alpha.$$

All values have the mean error ± .0009.

Since all program stars have been observed at upper culmination, no effort has been made to combine observations of reference stars at upper and lower culmination. The values are given separately to assist anyone in applying additional corrections.

DECLINATIONS

All observations were corrected for refraction, division error, and reduction to the meridian. No correction for inclination of the wires was necessary since any observation not made symmetrically was discarded. The refraction table of Vol. XV, No. 2 (essentially Bessel's) was used, the auxiliary tables having been adapted from their logarithmic form.

A constant value of 45°23′39.″00 was first assumed for the latitude. The resulting apparent places of all the FK3 stars were compared with the FK3 revised positions. A $\Delta\phi$ was calculated to make the O-FK3R in declination vanish in the average for the night, thus allowing for a variation in latitude. Where the standard deviation exceeded 0.″75 (for all FK3 stars) the night was excluded. An examination of the residuals (O-FK3R) revealed that on many nights the residuals varied with the zenith distance. This could be explained either as a flexure correction, or a refraction correction.

Each night's work was examined using the curve $(\text{O-FK3R}) = \Delta\phi + kR$, where R is the refraction value taken from the tables, and varies with zenith distances. The values of k do not appear to have any relation to clamp or observer. Owing to the uncertainty of observations made at large zenith distances the adopted $\Delta\phi$ was based on stars whose declinations lie between the equator and the pole. The values of $\Delta\phi$ and k, determined by a least-squares solution of the residuals for the FK3 stars on each night's work, have been applied as a night correction.

These corrected values (O-FK3R) were examined for differences of clamp and observer for each three hours of right ascension and ten degrees of declination. The weights were derived by the usual probability formula $mn/(m + n)$. Table III shows the differences by clamp and Table IV by observer.

Table VI gives the values (O-FK3R) for all observations for each three hours of right ascension and ten degrees of declination. The weights in this table are number of observations. These show satisfactory agreement between the observations and the reference catalogue.

Tables VII and IX show differences in declination with culmination. Table IX shows a strong variation with declination. However Table XVIII, which shows $\Delta\delta_\delta$, agrees with the fundamental catalogue except for the stars at lower culmination.

The past observational programs have always shown a change in the star residuals when the zenith distance exceeds about 60°, which is approximately where the roof meets the walls of the observing room. For this reason the program stars were observed at upper culmination only, and no correction based on Table IX has been applied.

Table XII shows the attachment to the FK3 Revised values. The weights are the number of stars compared. Again no effort has been made to combine observations made at upper and lower culmination.

PROGRAM STARS

All program stars were treated in exactly the same manner as the FK3R stars. To demonstrate the agreement of the program stars with the fundamental catalogue a number of additional tables are provided.

Tables XII, XIII and XIV tabulate the average differences observed minus AGK2. No proper motions have been applied. Tables XV and XVI give the mean error of a single observation for the AGK3R stars. In order that a comparison of the mean errors for a single observation may be compared, Tables X and XI give these same values for the FK3R stars.

TABLE I. - Clamp differences in Right Ascension (C1W–C1E)cos δ .
Unit $\overset{s}{.}001$, weight mn/(m+n)

R.A.	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
Declination	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
70°L to 60°L	-10	10	-2	8	-7	13	2	13	-2	9	-12	9	-11	6	-7	11	-6	79
80°L to 70°L	7	10	-9	9	-8	13	-2	8	-2	13	11	11	-1	17	-10	17	-2	98
90°L to 80°L	9	10	6	11	9	5	18	10	7	6	7	4	-3	10	-4	11	6	68
80° to 90°	6	6	4	8	12	6	3	14	10	9	10	6	6	13	13	12	8	74
70° to 80°	5	12	-8	10	13	15	0	6	3	16	4	19	0	15	-3	16	2	111
60° to 70°	-10	11	15	8	2	16	7	21	0	13	0	15	4	6	-3	13	2	103
50° to 60°	-1	15	13	10	-9	8	-16	12	-10	14	-6	19	-6	13	-6	10	-5	103
40° to 50°	-8	15	-17	21	-8	22	0	21	-1	22	1	29	-1	12	-7	16	-5	159
30° to 40°	-1	15	-4	15	-8	14	-8	25	4	22	-10	18	0	20	-2	20	-4	148
20° to 30°	5	21	-3	20	5	30	2	14	7	18	-3	24	6	24	-12	19	1	170
10° to 20°	9	20	-8	17	1	30	5	25	3	21	1	21	2	30	-1	19	2	185
0° to 10°	2	38	5	30	4	39	2	49	5	30	8	45	3	43	-4	38	3	311
-10° to 0°	4	20	-12	37	-1	42	5	48	4	37	-7	36	6	53	2	44	0	317
-20° to -10°	-7	7	0	0	-10	9	-11	8	1	8	-4	11	5	4	-7	5	-5	51
Mean	1	210	-4	205	0	261	1	273	2	238	0	267	2	268	-3	252	0	1974

TABLE II. - Differences by observer in Right Ascension (Woolsey-Tanner)cos δ .
Unit $\overset{s}{.}001$, weight (m+n)/mn.

R.A.	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
Declination	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
70°L to 60°L	11	9	27	7	11	11	1	12	5	8	9	7	3	6	-3	11	7	72
80°L to 70°L	6	10	-12	10	-9	12	-14	7	-2	12	-16	12	5	14	-9	16	-6	92
90°L to 80°L	2	9	-7	11	4	5	-8	10	2	6	-28	4	1	11	-2	11	-4	66
80° to 90°	-8	5	-20	7	-3	6	10	12	-15	9	-3	6	2	12	2	11	-3	69
70° to 80°	-1	12	-8	9	-2	15	6	6	-1	16	8	19	-5	15	10	16	2	109
60° to 70°	-11	9	9	8	2	16	12	19	4	11	9	14	-16	6	-8	11	2	95
50° to 60°	5	13	-15	9	-2	7	-9	11	7	13	-11	17	-5	11	9	9	-3	90
40° to 50°	1	13	-7	19	-5	20	-4	21	-3	21	-9	25	10	10	2	13	-3	141
30° to 40°	8	14	12	14	10	13	6	23	-9	21	4	17	-1	18	-1	18	3	138
20° to 30°	9	20	-2	19	-2	29	-3	14	2	15	0	22	11	23	-15	17	0	159
10° to 20°	13	18	-7	15	3	28	-9	22	11	18	4	21	2	29	15	20	4	171
0° to 10°	10	35	5	29	0	36	-1	47	-1	30	1	43	-1	39	3	35	2	294
-10° to 0°	2	19	7	36	-1	39	1	45	-2	33	-10	35	-5	53	1	41	-1	302
-20° to -10°	-31	5	0	0	5	8	10	8	9	8	3	10	25	4	7	4	4	48
Mean	4	191	0	194	0	245	0	258	0	223	-2	253	0	249	1	233	0	1847

TABLE III. Clamp Differences in Declination (ClW–ClE)

Unit ″01, Weight mn/(m+n)

R.A. / Declination	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
70°L to 60°L	-3	9	1	7	20	13	-5	13	-24	8	-18	8	-1	6	22	9	1	74
80°L to 70°L	3	8	12	8	-38	11	-6	7	-1	13	0	11	21	15	-11	16	-3	91
90°L to 80°L	15	9	-27	11	-6	5	5	10	21	6	27	4	-12	10	-20	11	-4	68
80° to 90°	4	6	-23	8	-19	6	8	14	4	9	-33	6	-3	12	-2	12	-5	72
70° to 80°	34	12	16	10	-7	15	-10	7	3	15	8	18	18	14	-11	15	7	106
60° to 70°	0	11	-1	8	-1	16	-15	20	-14	13	-14	14	-8	6	-7	13	-9	101
50° to 60°	-2	15	-3	11	42	8	4	12	10	14	-12	19	-11	13	-1	10	1	101
40° to 50°	5	16	-14	21	13	22	13	21	-4	22	-15	28	-23	12	-4	15	-3	158
30° to 40°	12	15	-18	15	2	13	-13	24	5	22	-19	18	-3	20	-3	19	-5	146
20° to 30°	-1	20	-11	19	6	29	12	14	-2	17	10	23	-7	24	-5	19	0	167
10° to 20°	25	19	10	17	19	29	12	25	-12	21	11	22	6	30	8	19	10	183
0° to 10°	11	36	-13	31	4	38	-22	48	0	29	-2	44	1	41	3	37	-3	304
-10° to 0°	0	19	-15	38	12	41	5	47	5	36	-2	36	-1	53	9	43	2	312
-20° to -10°	-25	6	0	0	14	9	-10	8	-25	8	8	11	12	4	8	4	-3	50
Mean	8	201	-9	204	7	255	-2	271	-1	235	-3	262	0	263	0	243	0	1934

TABLE IV. Differences by Observer in Declination (Woolsey–Tanner)

Unit ″01, Weight mn/(m+n)

R.A. / Declination	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
70°L to 60°L	1	8	-10	7	-23	11	-5	12	-49	7	-13	6	9	6	-37	9	-16	67
80°L to 70°L	19	9	-2	9	-11	11	-15	7	-11	11	-3	11	18	12	7	15	0	85
90°L to 80°L	2	9	21	12	26	5	28	10	33	5	-7	4	22	10	24	11	20	65
80° to 90°	-23	5	-26	8	-3	6	23	12	11	9	38	6	5	10	-23	11	1	67
70° to 80°	11	12	-16	9	-23	14	-26	6	20	16	-29	19	10	15	-28	15	-10	105
60° to 70°	6	9	1	8	-11	15	-12	18	-21	11	-1	14	-32	5	5	11	-8	92
50° to 60°	-4	13	-24	9	10	6	12	11	8	14	-1	17	-22	11	-12	9	-4	89
40° to 50°	4	13	-10	18	-11	20	3	21	16	21	3	25	12	10	-15	13	0	141
30° to 40°	14	13	20	14	23	13	0	23	13	21	10	17	11	18	-9	17	9	137
20° to 30°	34	19	13	19	2	27	5	14	10	15	-4	22	8	23	-11	18	7	157
10° to 20°	12	18	2	15	5	28	19	22	-8	18	20	22	-12	29	5	19	5	170
0° to 10°	12	33	3	30	5	36	0	46	-8	29	18	43	-12	37	-8	34	2	288
-10° to 0°	6	18	13	36	2	38	-7	42	-1	33	-1	35	-1	53	-6	40	0	297
-20° to -10°	-11	5	0	0	-15	8	-42	8	-27	8	20	10	-25	4	-10	4	-14	48
Mean	9	184	3	194	-1	238	0	254	1	219	4	251	-1	244	-7	226	1	1810

TABLE V. Observed Differences in Right Ascension (O-FK3R) cos δ

Unit ^{s}001, Weight - Number of Observations

R.A.	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
Declination	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
70°L to 60°L	-09	40	5	34	-5	52	-6	53	-6	38	-7	37	1	27	-2	47	-4	328
80°L to 70°L	-3	41	2	42	-7	55	-4	32	1	55	3	51	0	69	-6	76	-2	421
90°L to 80°L	10	40	24	47	19	22	6	45	13	27	10	18	9	45	11	46	13	290
80° to 90°	-7	27	-24	34	-14	23	-4	57	-14	41	-5	26	-5	52	-9	47	-10	307
70° to 80°	7	52	4	42	7	63	9	26	-1	70	-2	80	-7	69	-2	70	1	472
60° to 70°	19	46	5	37	11	69	8	86	4	55	4	60	-4	25	0	53	7	431
50° to 60°	0	62	-2	43	-2	34	4	52	3	56	-2	80	-2	55	-1	43	0	425
40° to 50°	-8	62	-10	88	-2	91	1	90	-8	90	-10	117	-5	51	-4	65	-6	654
30° to 40°	-10	60	-4	62	0	58	0	110	1	90	-3	75	2	80	-3	82	-2	617
20° to 30°	2	86	-3	81	-1	124	0	59	3	73	-3	100	6	101	0	81	0	705
10° to 20°	6	81	1	70	-3	122	3	102	1	88	1	89	6	125	-3	82	2	759
0° to 10°	2	162	0	125	-1	158	0	200	-2	126	1	186	9	176	3	156	2	1289
-10° to 0°	-6	83	1	158	-1	172	3	197	-1	152	-5	148	3	223	2	184	0	1317
-20° to -10°	5	28	0	0	-5	36	-9	35	-5	34	-5	44	-7	16	-4	22	-4	215
Mean	1	870	0	863	-1	1079	1	1144	-1	995	-2	1111	2	1114	0	1054	0	8230

TABLE VI. Observed Differences in Declination (O-FK3R)

Unit ″01, Weight - Number of Observations

R.A.	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
Declination	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
70°L to 60°L	24	38	43	31	16	53	28	54	30	34	18	34	4	25	24	40	24	309
80°L to 70°L	8	38	-5	39	-25	50	-19	31	-16	53	-14	47	-9	63	-4	71	-10	392
90°L to 80°L	-16	38	-9	49	-21	22	-3	46	-11	26	-21	18	-13	45	-31	45	-15	289
80° to 90°	28	25	14	35	-6	23	1	55	18	41	-2	25	0	49	1	47	6	300
70° to 80°	1	50	11	42	-5	60	11	27	14	67	4	78	1	66	1	66	4	456
60° to 70°	5	45	-19	36	-5	67	-12	84	5	55	6	59	3	27	2	54	-2	427
50° to 60°	21	60	17	43	0	31	2	51	4	58	4	81	16	55	15	42	10	421
40° to 50°	3	63	17	86	8	91	5	90	1	89	2	116	9	51	7	63	6	649
30° to 40°	-5	59	06	61	11	55	1	108	-1	90	-10	75	-1	81	-4	80	-1	609
20° to 30°	-5	83	-10	80	10	120	6	59	3	70	-6	97	-16	101	-1	80	-3	690
10° to 20°	-5	78	-1	69	-3	120	-6	101	-5	88	-10	92	-2	124	-17	80	-6	752
0° to 10°	5	155	0	128	-2	157	0	197	-6	124	-8	183	0	169	-10	154	-3	1267
-10° to 0°	-6	79	-8	160	-3	170	-2	192	-12	151	6	147	1	222	0	180	-2	1301
-20° to -10°	-10	28	0	0	10	38	5	35	12	34	4	43	13	17	10	19	6	214
Mean	2	839	2	859	0	1057	0	1130	0	980	-2	1095	-1	1095	-2	1021	0	8076

TABLE VII. Differences Above and Below Pole, R.A.-(U.-L.) cos δ and DECL.-(U.-L.)

Unit ^{s}001 in R.A., ″01 in Decl. Weight mn/(m+n)

B.D. No.		FK4 No.	Decl.		R. A.				Decl.			
					(U-L) cos δ	No. U	L	Wt.	(U-L)	No. U	L	Wt.
88	112	914	89	3	-.001	9	5	3	.71	7	3	2
88	8	907	89	1	.008	8	12	5	.50	7	11	4
87	51	909	87	7	.004	9	11	5	.04	9	11	5
86	269	913	86	36	.012	11	7	4	.05	11	7	4
85	19	906	85	59	.000	10	16	6	.39	9	16	6
86	161	1641	85	54	-.010	17	8	5	.09	17	10	6
85	74	1637	85	53	-.009	6	12	4	.25	7	13	5
85	383	1648	85	51	.008	18	17	9	.26	18	17	9
86	176	1642	85	51	.006	8	9	4	.46	8	10	4
85	63	908	85	25	.011	10	16	6	.21	10	17	6
85	80	1638	85	10	.007	6	11	4	.22	6	11	4
84	59	1636	84	44	-.002	12	8	5	.25	12	8	5
84	451	1647	84	31	.010	14	15	7	-.09	13	16	7
84	196	1640	84	23	.010	8	14	5	-.19	7	14	5
84	169	1639	84	12	.004	14	11	6	.19	14	11	6
83	640	1649	84	4	-.007	19	11	7	.49	19	10	7
82	51	1635	83	19	.004	9	12	5	.41	9	11	5
83	536	1646	83	8	-.003	12	13	6	.19	12	13	6
83	453	1645	83	6	-.008	7	5	3	.21	7	5	3
83	397	1643	83	0	.003	23	11	7	.09	23	10	7
82	743	1650	82	54	-.004	10	18	6	.24	10	18	6
83	297	911	82	48	.003	18	11	7	.34	18	10	6
83	431	1644	82	43	-.013	10	7	4	.09	10	6	4
81	718	915	82	20	.004	17	12	7	.12	17	13	7
82	498	912	82	7	.008	8	6	3	.39	7	6	3
81	302	910	81	33	.007	14	12	6	-.03	13	12	6
79	212	248	79	37	-.007	14	18	8	-.04	14	17	8
79	628	734	79	30	.003	7	12	4	.05	7	11	4
78	34	41	79	24	-.005	11	10	5	-.09	11	10	5
78	103	105	79	13	-.010	12	8	5	-.20	11	6	4
79	169	191	79	10	.007	8	14	5	.07	8	14	5
78	801	1593	78	34	.009	4	7	3	-.30	4	7	3
78	367	413	78	2	-.010	9	9	5	.24	9	9	5
78	527	590	77	56	.004	8	7	4	.30	7	7	4
77	800	795	77	55	-.011	8	7	4	.15	8	5	3
78	412	454	77	53	.004	14	15	7	.10	13	14	7
78	478	524	77	46	.018	11	5	3	.59	10	6	4
77	764	759	77	33	-.002	8	10	4	-.01	7	11	4
77	115	115	77	33	-.010	13	6	4	-.34	13	6	4
77	627	623	77	32	-.015	8	9	4	.10	9	9	5
77	699	700	77	30	-.022	6	8	3	-.10	6	7	3
76	928	893	77	21	-.007	7	19	5	.28	6	19	5
77	461	451	77	11	-.007	8	5	3	.26	7	5	3
77	266	260	77	2	.000	13	10	6	.62	12	8	5
76	667	675	76	58	-.003	13	7	5	.16	11	7	4
76	594	606	76	0	.005	25	10	7	.38	25	8	6
76	393	395	75	58	.010	4	12	3	.71	4	11	3
75	836	1594	75	58	-.016	9	7	4	.45	9	7	4
76	527	1379	75	55	-.018	12	12	6	.63	12	11	6
76	310	310	75	54	.013	19	13	8	.23	18	12	7
76	596	612	75	52	.004	13	9	5	.41	13	8	5
75	189	173	75	51	.000	9	11	5	.48	9	10	5
75	682	1494	75	22	.000	9	8	4	.39	9	7	4
74	252	205	75	0	.020	8	7	4	.20	8	5	3
74	595	550	74	21	.044	6	4	2	.64	6	4	2
74	872	770	74	47	-.009	8	8	4	-.11	7	6	3
74	27	24	74	42	-.004	8	4	3	.00	8	4	3
73	1063	1627	74	7	-.018	7	5	3	.28	5	5	3
74	338	300	74	3	-.004	9	9	5	.22	8	8	4
74	370	322	73	48	-.015	8	5	3	-.04	8	5	3
72	1003	1578	73	27	.001	7	6	3	-.13	7	6	3
72	1049	851	73	23	.016	6	6	3	.01	6	5	3
73	857	729	73	15	-.027	7	6	3	-.10	7	6	3
73	478	372	73	7	.024	9	6	4	.32	10	6	4
72	86	51	72	47	.018	4	6	2	-.27	4	5	2
72	839	695	72	42	-.020	12	4	3	.09	11	4	3
73	592	499	72	39	.015	5	5	3	-.16	5	4	2
72	140	87	72	36	.032	4	5	2	-.11	3	5	2
72	957	1538	72	21	.002	6	8	3	.06	6	8	3
71	117	70	72	10	.001	5	4	2	-.10	5	4	2
72	804	670	72	10	.001	7	5	3	-.54	7	4	3
71	1111	837	72	5	-.012	9	7	4	.41	8	6	3
72	679	569	72	0	.002	6	4	2	.00	6	4	2
71	659	505	71	29	-.002	7	4	3	-.12	7	5	3
71	915	714	71	13	-.003	6	5	3	.74	6	3	2
70	259	138	71	10	.007	4	4	2	-.20	4	4	2
70	1193	817	71	4	-.031	8	6	3	-.23	8	6	3
69	1173	809	70	20	.007	5	6	3	-.34	5	5	3
70	703	472	70	3	-.005	7	5	3	.18	7	4	3
70	565	357	70	3	.010	4	5	2	-.27	4	5	2
69	102	1042	70	0	.014	8	4	3	.45	8	4	3
65	828	429	64	36	.012	12	6	4	-.79	11	8	5
69	531	363	69	27	-.013	7	6	3	.26	7	6	3
69	371	234	69	20	.028	4	6	2	.24	4	6	2
69	586	403	69	20	.000	8	8	4	-.50	8	7	4
69	258	1122	69	16	.023	5	6	3	-.71	5	6	3
69	394	259	68	56	.020	6	6	3	.04	6	6	3
69	850	619	68	52	.003	13	7	5	-.17	12	6	4
68	949	664	68	46	-.005	16	7	5	-.08	16	7	5
68	524	1215	68	37	.024	6	4	2	-.63	5	4	2
68	480	284	68	34	-.003	4	6	2	.25	4	5	2
68	938	659	68	10	.015	5	4	2	-.01	5	4	2
67	123	46	67	52	-.028	4	4	2	.17	4	4	2
68	551	338	67	49	.008	6	5	3	-.08	6	6	3
67	149	55	67	47	.022	4	4	2	-.18	4	4	2
67	224	92	67	36	.040	5	4	2	.18	5	4	2
67	1129	723	67	34	-.006	6	6	3	-.07	6	5	3
67	876	565	67	32	.037	5	4	2	.22	5	4	2
67	1562	895	67	31	.039	7	4	3	-.19	7	4	3
67	714	440	67	1	.000	11	5	3	-.17	10	5	3
65	239	76	66	17	.034	4	5	2	-.27	4	4	2
66	358	178	66	15	.008	8	5	3	-.67	7	5	3
66	878	554	66	7	-.021	10	5	3	-.42	9	4	3
65	1814	863	65	56	.004	10	6	4	.10	10	5	3
66	664	387	65	49	.005	9	4	3	-.74	9	4	3
65	1170	639	65	46	-.018	8	6	3	-.15	8	6	3
65	517	233	65	43	-.003	15	10	6	-.35	15	10	6
66	778	486	65	42	.000	8	4	3	.02	8	4	3
65	1283	701	65	26	-.038	5	4	2	-.74	6	4	2
65	767	1262	65	21	.012	5	5	3	.27	5	5	3
65	963	511	64	58	-.020	6	6	3	-.08	7	7	4
65	978	521	64	36	.018	7	6	3	-.11	7	4	3
70	665	433	69	36	.002	12	4	3	-.11	12	4	3
64	391	1096	64	24	.008	4	4	2	-.64	4	3	2
64	1252	685	64	22	.018	5	4	2	.20	5	4	2
63	99	29	63	58	-.007	6	5	3	-.39	5	5	3
62	320	63	63	25	.021	6	4	2	-.38	6	4	2
62	2102	853	63	19	-.005	9	5	3	-.31	10	5	3
63	845	355	63	16	.009	9	4	3	-.62	9	4	3
62	597	129	63	3	.016	7	7	4	-.46	7	6	3
62	759	203	63	1	.021	7	6	3	-.54	7	6	3
63	1026	478	62	59	-.005	8	5	3	-.33	8	5	3
62	1821	767	62	49	-.002	4	8	3	.21	5	7	3
63	1225	587	62	45	-.030	4	4	2	-.13	4	3	2
62	102	16	62	39	.015	13	6	4	-.29	13	5	4
62	2029	830	62	32	.018	5	10	3	-.29	5	9	3
61	2111	803	62	22	-.018	9	8	4	-.23	9	6	4
62	1161	417	62	1	.004	6	6	3	-.92	6	6	3
61	2444	882	62	0	-.012	8	8	4	-.39	8	6	3
62	1198	1303	61	40	-.014	7	5	3	-.27	7	5	3
61	2050	783	61	38	.010	5	5	3	.32	5	5	3
61	893	247	61	31	.009	8	5	3	.08	8	5	3
61	1598	1432	60	55	-.010	9	5	3	-.52	9	4	3
60	2288	1572	60	53	-.024	5	6	3	-.23	5	5	3
61	1054	317	60	53	-.004	13	5	4	-.50	12	6	4
60	1105	302	60	27	-.012	7	5	3	-.92	7	5	3
59	144	32	60	26	-.018	4	4	2	-.77	4	4	2
60	1547	536	60	26	-.003	5	7	3	-.37	5	5	3
60	856	182	60	22	-.007	6	6	3	-.80	6	5	3
60	1461	500	60	12	.009	11	5	3	-.37	11	5	3
59	248	48	59	58	.010	5	4	2	.34	5	4	2

TABLE VIII. Differences Above and Below Pole in Right Ascension (U - L) cos δ

Unit $^{s}.001$, Weight mn/(m+n)

R.A. / Declination	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
80° to 90°	4	16	3	19	4	11	3	24	0	16	5	11	3	24	0	22	2	142
75° to 80°	-7	10	4	18	2	21	-2	8	-2	20	0	25	-4	17	-8	15	-2	133
70° to 75°	12	12	7	2	-8	8	19	6	12	10	1	5	-11	16	-7	19	0	79
65° to 70°	18	8	15	6	10	19	0	19	-12	6	2	17	-20	5	18	6	5	87
60° to 65°	6	13	10	12	-2	10	3	13	0	16	-18	5	8	7	-8	18	1	93
Mean	6	60	6	56	3	68	3	69	0	68	0	63	-3	69	-4	81	1	534

TABLE IX. Differences Above and Below Pole in Declination

Unit $''.01$, Weight mn/(m+n)

R.A. / Declination	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
80° to 90°	43	15	23	20	12	11	7	24	20	15	20	10	13	23	32	22	21	139
75° to 80°	-14	9	11	17	22	20	43	7	38	19	28	23	9	16	19	14	21	126
70° to 75°	1	12	-20	2	11	7	10	6	13	10	-28	5	9	15	0	18	3	74
65° to 70°	-2	8	-69	6	-13	19	-18	19	-20	5	-7	17	-38	5	-3	6	-17	64
60° to 65°	-29	13	-60	11	-44	10	-67	13	-25	15	-37	4	24	8	-29	16	-35	90
Mean	3	57	-8	55	-1	67	-10	69	10	65	7	60	8	66	7	76	2	514

TABLE X. Mean Error of a Single Observation in Right Ascension, FK3 Stars

Unit $^{s}.001$, Weight - Number of Stars

R.A. / Declination	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
60° to 70°	24	9	31	6	22	9	22	10	26	7	24	7	29	5	19	7	24	60
70° to 80°	19	7	25	5	25	5	20	4	22	8	17	7	18	9	23	10	21	55
80° to 90°	24	3	19	4	16	2	21	4	17	3	23	3	18	4	21	3	20	26
80° to 90°	15	3	15	4	24	2	21	4	21	3	16	3	19	4	19	3	18	26
70° to 80°	18	7	18	5	19	5	19	4	17	8	21	7	20	9	20	10	19	55
60° to 70°	20	9	19	6	24	9	19	10	17	7	19	7	18	5	21	7	20	60
50° to 60°	19	10	24	9	15	5	20	8	17	8	21	11	22	9	18	8	20	68
40° to 50°	17	11	23	17	17	14	15	12	16	12	22	15	18	9	17	12	18	102
30° to 40°	20	12	23	12	20	11	18	15	17	14	19	13	15	13	16	14	18	104
20° to 30°	24	16	19	16	18	19	15	10	19	12	21	15	20	14	17	14	19	116
10° to 20°	22	14	21	15	19	14	19	14	18	13	18	14	23	16	21	12	20	112
0° to 10°	21	20	26	17	21	14	19	16	19	13	27	16	25	14	20	17	22	127
-10° to 0°	24	12	24	22	23	14	22	16	21	16	31	13	24	20	22	18	24	131
-20° to -10°	28	5	0	0	23	4	18	4	31	6	31	4	34	2	19	4	26	29
Mean	21	138	23	138	20	127	19	131	19	130	22	135	21	133	20	139	21	1071

TABLE XI. Mean Error of a Single Observation in Declination, FK3 Stars

Unit ″01, Weight - Number of Stars

R.A. / Declination	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
60° to 70°	36	9	37	6	36	9	48	10	39	7	38	7	42	5	43	7	40	60
70° to 80°	38	7	42	5	47	5	45	4	47	8	44	7	45	9	37	10	43	55
80° to 90°	51	3	46	4	42	2	41	4	41	3	45	3	33	4	49	3	43	26
80° to 90°	45	3	48	4	50	2	40	4	35	3	46	3	36	4	42	3	42	26
70° to 80°	33	7	35	5	35	5	27	4	44	8	33	7	38	9	42	10	37	55
60° to 70°	36	9	41	6	38	9	41	10	37	7	36	7	42	5	48	7	40	60
50° to 60°	34	10	34	9	41	5	44	8	40	8	39	11	31	9	42	8	38	68
40° to 50°	38	11	32	17	32	14	36	12	34	12	41	15	38	9	37	12	36	102
30° to 40°	31	12	34	12	35	11	41	15	39	14	39	13	31	13	39	14	36	104
20° to 30°	39	16	31	16	33	19	41	10	39	12	37	15	37	14	41	14	37	116
10° to 20°	33	14	31	15	39	14	39	14	36	13	40	14	36	16	37	12	36	112
0° to 10°	40	20	40	17	37	14	40	16	39	13	40	16	33	14	38	17	38	127
-10° to 0°	41	12	41	22	44	14	45	16	41	16	44	13	45	20	43	18	43	131
-20° to -10°	45	5	0	0	45	4	42	4	36	6	39	4	42	2	34	4	40	29
Mean	38	138	37	138	37	127	41	131	39	130	40	135	38	133	40	139	39	1071

TABLE XII. Differences in Right Ascension (O-AGK2)

Unit ^{s}001, Weight - Number of Stars

R.A. / Declination	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
80° to 90°	-221	7	-95	14	-150	9	118	3	-64	12	107	7	-254	10	-287	6	-120	68
70° to 80°	-71	18	-6	18	-12	24	-135	21	-59	26	-93	22	-45	30	-26	22	-55	181
60° to 70°	-12	23	12	34	-20	34	-16	45	-19	42	-28	37	-30	36	-9	30	-16	281
50° to 60°	-12	43	-9	46	-30	39	-21	57	-33	58	-27	47	-7	38	-9	35	-19	363
40° to 50°	1	56	-5	47	-34	55	-26	65	-44	64	-40	59	-25	49	-10	46	-24	441
30° to 40°	4	67	-8	46	-37	52	-38	59	-27	74	-33	57	-8	50	-21	54	-21	459
20° to 30°	0	59	-18	46	-28	52	-24	77	-39	70	-30	63	-3	54	-3	62	-19	483
10° to 20°	14	93	6	74	-19	68	-16	87	-5	80	-6	72	7	51	14	66	-1	591
0° to 10°	18	83	19	86	6	49	-12	73	-8	79	6	74	21	56	26	76	10	576
-10° to 0°	11	41	-2	36	-11	39	-4	40	-9	42	-17	47	6	27	9	38	-3	310
Mean	0	490	-2	447	-24	421	-24	527	-26	547	-22	485	-13	401	-3	435	-15	3753

TABLE XIII. Differences in Right Ascension (O-AGK2) cos δ

Unit ˢ001, Weight - Number of Stars

R.A. / Declination	0h to 3h		3h to 6h		6h to 9h		9h to 12h		12h to 15h		15h to 18h		18h to 21h		21h to 24h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
80° to 90°	-11	7	-6	14	-9	9	16	3	-3	12	-5	7	-19	10	-30	6	-9	68
70° to 80°	-18	18	-3	18	-4	24	-38	21	-15	26	-24	22	-10	30	-7	22	-15	181
60° to 70°	-5	23	5	34	-8	34	-6	45	-8	42	-12	37	-12	36	-3	30	-6	281
50° to 60°	-8	43	-6	46	-17	39	-12	57	-20	58	-16	47	-4	38	-6	35	-12	363
40° to 50°	0	56	-3	47	-24	55	-19	65	-31	64	-29	59	-17	49	-8	46	-17	441
30° to 40°	3	67	-6	46	-30	52	-32	59	-22	74	-27	57	-7	50	-17	54	-17	459
20° to 30°	0	59	-17	46	-25	52	-22	77	-36	70	-28	63	-2	54	-3	62	-17	483
10° to 20°	14	93	5	74	-18	68	-15	87	-5	80	-6	72	6	51	14	66	-1	591
0° to 10°	17	83	19	86	6	49	-12	73	-8	79	5	74	20	56	26	76	9	576
-10° to 0°	10	41	-2	36	-12	39	-4	40	-9	42	-18	47	6	27	8	38	-3	310
Mean	5	490	1	447	-16	421	-17	527	-17	547	-16	485	-2	401	3	435	-8	3753

TABLE XIV. Differences in Declination (O-AGK2)

Unit ″01, Weight - Number of Stars

R.A. / Declination	0h to 3h		3h to 6h		6h to 9h		9h to 12h		12h to 15h		15h to 18h		18h to 21h		21h to 24h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
80° to 90°	39	7	14	14	-14	9	-80	3	21	12	17	7	11	10	11	6	10	68
70° to 80°	6	18	-3	18	-5	24	15	21	-7	26	31	22	23	30	26	22	11	181
60° to 70°	6	23	-1	34	-6	34	-9	45	1	42	7	37	17	36	17	30	3	281
50° to 60°	2	43	-3	46	-33	39	-15	57	-4	58	1	47	7	38	11	35	-5	363
40° to 50°	5	56	-20	47	-28	55	-12	65	5	64	7	59	7	49	13	46	-3	441
30° to 40°	15	67	-20	46	-21	52	-28	59	-15	74	7	57	-4	50	7	54	-7	459
20° to 30°	-18	59	-23	46	-34	52	-15	77	-23	70	-15	63	-33	54	-8	62	-20	483
10° to 20°	10	93	-3	74	9	68	5	87	12	80	26	72	32	51	17	66	12	591
0° to 10°	-1	83	3	86	-2	49	-7	73	-2	79	-4	74	23	56	14	76	3	576
-10° to 0°	12	41	4	36	5	39	-2	40	16	42	15	47	-2	27	13	38	8	310
Mean	5	490	-6	447	-13	421	-9	527	-2	547	7	485	7	401	11	435	0	3753

TABLE XV. Mean Error of a Single Observation in Right Ascension, Program Stars

Unit ˢ001, Weight - Number of Stars

R.A. / Declination	0h to 3h		3h to 6h		6h to 9h		9h to 12h		12h to 15h		15h to 18h		18h to 21h		21h to 24h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
80° to 90°	24	7	18	14	22	9	7	3	24	12	10	7	17	10	25	6	19	68
70° to 80°	24	18	17	18	18	24	15	21	17	26	16	22	19	30	17	22	18	181
60° to 70°	17	23	17	34	16	34	17	45	21	42	19	37	17	36	25	30	19	281
50° to 60°	19	43	20	46	18	39	16	57	16	58	18	47	23	38	20	35	18	363
40° to 50°	19	56	21	47	16	55	16	65	15	64	19	59	21	49	24	46	18	441
30° to 40°	19	67	17	46	18	52	16	59	17	74	15	57	19	50	22	54	18	459
20° to 30°	22	59	22	46	17	52	17	77	19	70	17	63	23	54	21	62	19	483
10° to 20°	21	93	19	74	20	68	20	87	18	80	19	72	23	51	26	66	21	591
0° to 10°	23	83	24	86	19	49	20	73	23	79	19	74	22	56	22	76	22	576
-10° to 0°	28	41	24	36	25	39	22	40	29	42	27	47	29	27	26	38	26	310
Mean	21	490	21	447	19	421	18	527	19	547	19	485	22	401	23	435	20	3753

TABLE XVI. Mean error of a Single Observation in Declination, Program Stars

Unit ″.01, Weight - Number of Stars

R.A. / Declination	0h to 3h Val.	Wt.	3h to 6h Val.	Wt.	6h to 9h Val.	Wt.	9h to 12h Val.	Wt.	12h to 15h Val.	Wt.	15h to 18h Val.	Wt.	18h to 21h Val.	Wt.	21h to 24h Val.	Wt.	Mean Val.	Wt.
80° to 90°	36	7	31	14	33	9	53	3	43	12	52	7	28	10	38	6	37	68
70° to 80°	30	18	40	18	39	24	36	21	31	26	38	22	30	30	37	22	35	181
60° to 70°	49	23	33	34	35	34	36	45	41	42	42	37	39	36	37	30	39	281
50° to 60°	43	43	39	46	39	39	36	57	31	58	38	47	25	38	42	35	36	363
40° to 50°	40	56	35	47	35	55	35	65	37	64	31	59	38	49	36	46	36	441
30° to 40°	32	67	34	46	37	52	32	59	33	74	38	57	37	50	31	54	34	459
20° to 30°	41	59	30	46	36	52	37	77	37	70	37	63	37	54	42	62	37	483
10° to 20°	42	93	38	74	35	68	36	87	38	80	42	72	35	51	39	66	38	591
0° to 10°	44	83	41	86	39	49	39	73	41	79	37	74	43	56	47	76	41	576
-10° to 0°	39	41	33	36	41	39	43	40	41	42	45	47	41	27	49	38	42	310
Mean	40	490	36	447	37	421	36	527	37	547	38	485	36	401	40	435	38	3753

TABLE XVII. Catalogue Comparison in Right Ascension (O-FK3R)

Unit ˢ.001, Weight - Number of Stars

δ	$\Delta\alpha_\delta$ Val.	Wt.	$\Delta\alpha_\alpha$ 0^h to 3^h Val.	Wt.	3^h to 6^h Val.	Wt.	6^h to 9^h Val.	Wt.	9^h to 12^h Val.	Wt.	12^h to 15^h Val.	Wt.	15^h to 18^h Val.	Wt.	18^h to 21^h Val.	Wt.	21^h to 24^h Val.	Wt.
70°L to 60°L	10	60	10	9	-24	6	-1	9	5	10	8	7	6	7	-9	5	-10	7
80°L to 70°L	5	55	9	7	-8	5	33	5	8	4	-30	8	-16	7	-1	9	17	10
90°L to 80°L	37	26	31	3	-149	4	-189	2	98	4	10	3	8	3	82	4	34	3
80° to 90°	1	26	155	3	-167	4	-163	2	72	4	-27	3	37	3	52	4	0	3
70° to 80°	4	55	26	7	11	5	23	5	36	4	-6	8	-17	7	-33	9	-4	10
60° to 70°	19	60	26	9	-4	6	12	9	0	10	-9	7	-3	7	-28	5	-15	7
50° to 60°	-1	68	-2	10	-3	9	-4	5	10	8	9	8	-4	11	-1	9	-2	8
40° to 50°	-8	102	-4	11	-6	17	4	14	11	12	-4	12	-6	15	-1	9	3	12
30° to 40°	-3	104	-8	12	-2	12	2	11	3	15	3	14	0	13	4	13	-2	14
20° to 30°	1	116	1	16	-4	16	-2	19	-3	10	6	12	-4	15	6	14	-1	14
10° to 20°	2	112	4	14	0	15	-4	14	1	14	1	13	-1	14	5	16	-5	12
0° to 10°		127	0	20	1	17	-8	14	-2	16	-4	13	-1	16	9	14	1	17
-10° to 0°	1	131	-5	12	1	22	-2	14	4	16	-4	16	-7	13	4	20	1	18
-20° to -10°	-4	29	9	5	4	0	-1	4	-5	4	0	6	0	4	-7	2	-1	4

TABLE XVIII. Catalogue Comparison in Right Ascension (O-FK3R) cos δ

Unit ^{s}001, Weight - Number of Stars

δ	$\Delta\alpha_\delta \cos\delta$		$\Delta\alpha_\alpha \cos\delta$															
			0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
60° to 65°	6	31	12	5	1	4	8	3	0	4	−5	5	−2	2	−7	3	−10	5
65° to 70°	10	29	11	4	−6	2	2	6	−1	6	3	2	−3	5	−18	2	3	2
70° to 75°	0	27	9	5	−15	1	11	2	14	2	−1	4	−3	2	−9	5	−2	6
75° to 80°	1	28	5	2	6	4	4	3	8	2	−2	4	−4	5	−7	4	0	4
80° to 90°	10	26	4	3	−12	4	−6	2	7	4	−3	3	4	3	5	4	−1	3
90°L to 80°L	12	26	−2	3	12	4	7	2	−6	4	−1	3	−2	3	−5	4	−3	3
80°L to 75°L	−3	28	−11	2	0	4	0	3	−6	2	2	4	5	5	4	4	−4	4
75°L to 70°L	1	27	3	5	21	1	−22	2	3	2	13	4	4	2	−3	5	−5	6
70°L to 65°L	−3	29	−1	4	15	2	4	6	−5	6	−20	2	2	5	−11	2	12	2
65°L to 60°L	−8	31	−14	5	−1	4	−20	3	−7	4	−4	5	−27	2	7	3	−7	5

TABLE XIX. Catalogue Comparison in Declination (O-FK3R)

Unit ″01, Weight - Number of Stars

δ	$\Delta\delta_\delta$		$\Delta\delta_\alpha$															
			0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
70°L to 60°L	24	60	−1	9	18	6	−7	9	2	10	7	7	−4	7	−19	5	0	7
80°L to 70°L	−8	55	13	7	10	5	−17	5	−6	4	−5	8	−2	7	−4	9	3	10
90°L to 80°L	16	26	1	3	8	4	−5	2	11	4	6	3	−6	3	−2	4	−17	3
80° to 90°	7	26	21	3	8	4	−17	2	−7	4	4	3	−7	3	−2	4	−7	3
70° to 80°	3	55	−2	7	3	5	−8	5	8	4	10	8	−1	7	−3	9	−2	10
60° to 70°	−1	60	6	9	−21	6	−3	9	−9	10	8	7	9	7	5	5	3	7
50° to 60°	11	68	11	10	5	9	−15	5	−11	8	−5	8	−5	11	5	9	4	8
40° to 50°	7	102	−2	11	9	17	2	14	−3	12	−10	12	−3	15	3	9	1	12
30° to 40°	−1	104	−7	12	9	12	12	11	−1	15	0	14	−8	13	2	13	−4	14
20° to 30°	−2	116	−2	16	−6	16	11	19	13	10	5	12	−6	15	−13	14	−2	14
10° to 20°	5	112	−1	14	5	15	3	14	0	14	2	13	−5	14	2	16	−9	12
0° to 10°	−3	127	6	20	4	17	−1	14	3	16	−3	13	−4	16	1	14	−6	17
−10° to 0°	−3	131	−2	12	−4	22	−3	14	0	16	−8	16	8	13	3	20	6	18
−20° to −10°	3	29	−18	5	−3	0	8	4	2	4	7	6	−1	4	7	2	2	4

Part I

CATALOGUE OF 3753 AGK3 REFERENCE STARS

OBSERVED IN THE YEARS 1956 to 1961

REDUCED WITHOUT PROPER MOTION

TO THE EQUINOX 1950.0

EXPLANATION OF THE SEPARATE COLUMNS

1. The number of the star as provided by F.P. Scott of the U.S. Naval Observatory, Washington, D.C.

2. The B.D. number of the star. This is the same as in the AGK2.

3. The magnitude and spectral class as provided by F.P. Scott.

4 and 7. The right ascension and declination of the star as determined at Ottawa; reduced to the epoch 1950.0 without proper motion.

5 and 6,
8 and 9. The first and second terms of the precession (the same as those published in the AGK2).

10. The number of observations.

11. Mean epoch of observation.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
9	39 5213	7.9 F8	0 0 27.908	307.55	1.33	39 43 1.41	2004.3	-.5	2	57.67
10	31 5024	8.6 F8	0 0 31.697	307.52	1.01	31 35 30.26	2004.3	-.5	2	57.69
14	58 2691	8.0 K5	0 0 47.296	308.09	2.57	58 48 1.33	2004.2	-.5	2	57.27
21	12 5059	7.9 K0	0 1 8.486	307.48	.44	13 5 13.03	2004.2	-.5	2	57.25
24	21 5019	8.0 A2	0 1 18.738	307.64	.70	22 1 3.92	2004.2	-.6	2	58.22
26	64 1893	7.0 M0	0 1 40.226	309.40	3.32	64 52 28.85	2004.2	-.6	2	58.23
32	0 5084	8.4 A5	0 2 12.556	307.36	.13	1 15 31.68	2004.2	-.6	2	58.85
35	50 4233	7.9 K2	0 2 22.299	309.03	1.96	50 54 8.36	2004.2	-.7	2	57.21
39	67 1599	7.6 K0	0 2 32.202	310.91	3.80	67 33 42.49	2004.1	-.7	2	58.76
45	- 4 6019	7.7 K0	0 2 51.753	307.21	-.01	- 4 7 46.71	2004.1	-.7	2	58.86
47	52 3598	7.3 K0	0 2 59.425	309.63	2.10	52 53 36.35	2004.1	-.7	2	57.77
48	87 220	8.9 K0	0 3 3.513	350.30	45.90	87 36 39.91	2004.1	-.8	2	58.24
51	23 4853	6.6 K5	0 3 22.224	308.21	.78	24 17 27.88	2004.1	-.8	2	57.69
52	15 4937	7.5 G5	0 3 26.900	307.91	.54	16 10 25.67	2004.0	-.8	2	57.28
54	8 5172	7.8 F5	0 3 34.004	307.67	.35	9 26 12.64	2004.0	-.8	2	58.36
55	- 0 4619	8.2 G5	0 3 34.272	307.32	.10	- 0 9 24.55	2004.0	-.8	3	58.38
57	- 2 6099	8.0 K2	0 3 44.995	307.27	.06	- 1 30 57.66	2004.0	-.8	2	59.32
58	42 4834	8.9 F8	0 3 58.742	309.53	1.54	43 30 15.29	2004.0	-.8	4	59.99
59	69 1383	8.5 K0	0 4 2.016	313.75	4.35	69 53 28.54	2003.9	-.8	2	58.75
60	32 4771	8.5 K0	0 4 3.574	308.89	1.10	33 22 33.99	2003.9	-.8	2	57.75
64	22 4955	8.0 F0	0 4 27.487	308.41	.73	22 33 59.09	2003.9	-.9	2	59.34
69	45 4418	7.7 K0	0 4 35.444	310.14	1.70	46 28 44.07	2003.9	-.9	4	59.75
71	19 5210	8.2 K0	0 4 40.038	308.33	.66	20 16 38.24	2003.8	-.9	2	58.78
74	16 1	8.6 K0	0 4 54.916	308.20	.57	17 1 28.31	2003.8	-.9	3	58.43
80	41 2	8.4 G5	0 5 38.999	310.29	1.47	41 56 43.48	2003.6	-1.0	3	59.75
86	13 3	7.5 K0	0 6 11.531	308.22	.48	13 51 50.82	2003.5	-1.0	2	57.23
90	- 0 6	7.6 K2	0 6 18.444	307.36	.12	0 24 50.98	2003.5	-1.1	2	58.30
105	59 4	7.9 K0	0 7 35.797	314.92	2.80	59 44 52.29	2003.2	-1.2	2	57.74
111	11 10	8.0 G5	0 8 4.647	308.38	.45	12 32 32.43	2003.0	-1.2	2	57.79
117	31 8	7.5 M5	0 8 11.677	310.31	1.06	31 57 52.20	2003.0	-1.2	2	57.29
122	9 12	8.4 K0	0 8 40.427	308.25	.39	10 21 28.18	2002.8	-1.3	2	57.69
130	- 1 9	8.4 F0	0 9 25.519	307.28	.11	- 0 30 27.60	2002.6	-1.3	2	58.75
136	21 10	7.6 M0	0 9 40.751	309.64	.74	22 16 42.39	2002.5	-1.4	2	58.34
142	56 19	7.5 K2	0 10 6.284	316.38	2.55	56 56 58.80	2002.3	-1.4	2	58.30
146	28 19	8.6 K0	0 10 23.981	310.70	.97	29 6 52.84	2002.2	-1.5	2	57.75
149	36 13	7.8 K0	0 10 28.234	311.95	1.28	37 8 27.18	2002.2	-1.5	2	57.83
153	20 12	8.3 G5	0 10 37.003	309.72	.71	21 7 38.27	2002.1	-1.5	2	58.15
157	42 30	7.2 K0	0 11 1.490	313.25	1.55	42 40 17.48	2001.9	-1.5	2	57.79
166	- 4 12	7.5 K0	0 11 27.630	306.84	.02	- 4 11 11.46	2001.8	-1.5	2	58.22
170	75 5	8.0 G5	0 11 33.728	333.85	7.00	75 44 40.26	2001.7	-1.7	2	58.21
175	- 3 18	7.3 K0	0 11 50.879	307.03	.06	- 2 28 32.46	2001.6	-1.6	2	58.34
182	32 26	7.3 K0	0 12 30.443	312.02	1.12	32 45 10.51	2001.3	-1.7	2	57.22
195	37 32	8.0 G5	0 13 21.256	313.51	1.36	38 28 52.97	2000.9	-1.8	2	58.22
199	80 3	8.7 K0	0 13 48.959	360.47	13.36	81 23 10.51	2000.6	-2.0	2	58.74
200	15 30	8.2 A5	0 13 59.582	309.60	.55	15 33 33.53	2000.5	-1.8	2	57.69
204	45 48	7.3 G5	0 14 13.243	316.01	1.78	46 20 13.33	2000.4	-1.9	2	57.24
207	47 49	9.0 K0	0 14 28.390	316.79	1.91	48 17 14.30	2000.3	-1.9	2	58.25
208	30 31	7.5 K5	0 14 29.212	312.36	1.05	30 47 48.05	2000.3	-1.9	2	57.75
209	9 23	8.4 K2	0 14 30.441	308.85	.40	10 13 28.24	2000.2	-1.8	3	59.76
217	43 45	7.3 K0	0 15 14.178	315.99	1.67	44 18 1.18	1999.8	-2.0	3	57.83

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
220	33	24	8.5 F2	0 15 19.799	313.42	1.19	34 17 53.83	1999.8	-2.0	2	58.22
224	18	27	8.5 G0	0 15 43.001	310.50	.67	19 7 37.19	1999.6	-2.0	2	58.28
227	20	22	8.6 F2	0 15 51.442	310.91	.73	21 12 1.16	1999.5	-2.0	2	59.35
229	35	46	7.5 K2	0 15 58.919	314.02	1.25	35 42 45.16	1999.4	-2.0	2	58.31
232	51	40	7.5 K0	0 16 15.992	319.41	2.18	51 53 43.69	1999.2	-2.1	2	57.69
239	- 0	42	7.9 G0	0 16 42.799	307.37	.15	0 14 35.19	1998.9	-2.1	2	58.22
241	8	31	8.4 A5	0 16 47.766	308.84	.37	8 45 59.51	1998.9	-2.1	2	57.75
246	49	49	8.5 K0	0 17 8.970	319.43	2.09	50 28 21.43	1998.6	-2.2	2	59.35
248	54	37	7.6 K2	0 17 11.429	321.86	2.50	55 26 13.08	1998.6	-2.2	4	59.77
250	38	31	8.1 K0	0 17 17.159	315.56	1.42	39 15 56.89	1998.6	-2.2	3	57.82
259	2	37	7.7 M0	0 17 35.479	307.82	.22	2 45 22.06	1998.4	-2.2	2	58.43
261	3	34	7.9 G5	0 17 47.476	308.14	.26	4 30 6.00	1998.2	-2.2	4	59.53
266	10	31	6.8 K0	0 17 55.465	309.29	.43	10 38 26.35	1998.1	-2.2	2	58.86
271	- 1	31	8.7 A5	0 18 16.148	307.11	.11	- 1 8 54.22	1997.9	-2.2	2	59.91
276	77	6	8.8 F2	0 18 40.077	359.38	9.67	78 12 9.28	1997.6	-2.6	2	58.15
288	6	30	8.6 K2	0 19 25.260	308.66	.32	6 44 3.40	1997.1	-2.3	3	57.43
291	32	53	8.8 M0	0 19 41.991	314.72	1.15	32 47 28.41	1996.9	-2.4	2	57.68
303	11	51	7.4 K0	0 20 52.295	309.81	.46	11 33 33.03	1996.0	-2.5	2	57.27
307	36	47	8.6 F0	0 21 7.094	316.47	1.32	36 37 27.18	1995.8	-2.5	2	57.70
312	2	44	8.0 K0	0 21 22.881	308.08	.24	3 29 2.54	1995.5	-2.5	2	57.28
319	15	56	7.6 F5	0 22 2.560	311.04	.59	16 7 51.54	1995.0	-2.6	3	57.07
321	19	57	7.7 K0	0 22 8.569	311.97	.71	19 47 38.91	1994.9	-2.6	4	58.30
327	34	51	7.3 K5	0 22 39.142	316.48	1.25	34 45 37.92	1994.5	-2.7	2	57.76
328	8	45	8.7 K0	0 22 44.302	309.37	.39	8 47 28.86	1994.4	-2.7	2	57.75
337	54	59	7.2 K0	0 23 22.149	326.91	2.57	55 12 51.43	1993.8	-2.9	2	57.75
343	50	72	8.0 G0	0 23 36.669	324.30	2.19	51 0 14.12	1993.6	-2.9	2	58.21
344	0	54	8.4 K0	0 23 38.217	307.54	.18	0 53 15.42	1993.6	-2.7	2	58.27
345	31	52	8.2 K2	0 23 38.717	315.92	1.14	31 58 11.10	1993.6	-2.8	2	58.88
350	46	78	8.0 K2	0 23 58.670	322.19	1.89	46 48 26.45	1993.3	-2.9	3	58.11
352	9	44	8.4 K5	0 24 18.258	309.79	.42	9 52 20.01	1993.0	-2.8	2	58.24
357	37	68	8.0 K0	0 24 28.120	318.65	1.43	38 30 6.61	1992.8	-2.9	2	57.75
359	30	60	8.2 G5	0 24 45.162	315.85	1.09	30 37 1.52	1992.6	-2.9	2	57.29
360	2	54	7.2 G5	0 24 46.168	307.96	.23	2 32 15.29	1992.5	-2.9	2	57.79
363	13	52	8.3 K2	0 24 55.748	310.98	.55	14 8 56.85	1992.4	-2.9	2	57.67
364	21	46	7.7 K0	0 25 5.722	313.17	.78	21 49 8.89	1992.3	-2.9	2	58.89
367	3	48	8.3 K2	0 25 9.060	308.44	.28	4 19 51.69	1992.2	-2.9	2	58.43
370	41	67	8.1 G5	0 25 33.603	320.67	1.62	41 54 3.13	1991.8	-3.0	2	58.24
373	6	54	8.6 K0	0 25 56.177	309.13	.34	6 48 50.13	1991.4	-3.0	2	57.74
374	32	69	8.0 K0	0 25 57.844	317.27	1.20	33 21 27.66	1991.4	-3.0	2	58.23
376	47	113	6.9 M0	0 26 14.236	324.36	2.00	48 8 14.68	1991.1	-3.1	2	58.88
379	10	54	7.7 F0	0 26 33.253	310.34	.46	11 2 38.19	1990.8	-3.0	2	58.27
392	44	101	8.5 G5	0 27 12.169	323.00	1.79	44 43 50.87	1990.2	-3.2	2	58.29
403	17	61	8.1 K0	0 28 0.314	312.47	.65	17 32 13.17	1989.3	-3.2	2	57.20
408	49	108	7.3 K0	0 28 18.381	326.93	2.16	49 58 40.95	1989.0	-3.4	4	58.00
418	18	67	6.9 K5	0 29 17.956	313.31	.72	19 22 0.88	1987.9	-3.4	3	57.40
436	36	82	8.1 K0	0 30 37.403	320.70	1.39	36 54 25.81	1986.4	-3.5	2	57.67
437	- 4	59	7.4 K0	0 30 38.213	306.04	.08	- 4 7 24.71	1986.4	-3.4	2	57.79
447	- 3	64	8.5 F0	0 31 4.870	306.38	.10	- 3 0 38.29	1985.9	-3.4	2	57.67
453	2	67	7.6 G5	0 31 19.980	308.30	.26	3 2 39.76	1985.6	-3.5	2	57.28
458	68	34	8.6 K0	0 31 37.986	355.62	5.28	69 9 33.71	1985.2	-4.0	2	58.15

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900.0, T' in centuries from epoch.

No.	B.D. No.		M + Sp.		R.A. 1950			Precession		Decl. 1950			Precession		No. Obs.	Epoch 1900+
								1st Term	2nd Term				1st Term	2nd Term		
460	0	77	8.4	K0	0	31	49.976	307.56	.20	0	43	37.72	1985.0	-3.5	2	57.75
464	22	86	8.5	F2	0	32	17.343	315.15	.83	22	37	39.24	1984.4	-3.6	2	58.24
469	61	125	8.0	G5	0	32	29.890	342.24	3.53	61	35	22.07	1984.1	-3.9	2	57.30
471	67	56	7.1	K2	0	32	39.091	353.47	4.85	67	39	2.84	1984.0	-4.1	3	57.47
475	71	25	8.4	K5	0	32	54.587	366.97	6.57	72	13	26.00	1983.6	-4.3	2	58.74
478	28	96	8.1	G5	0	33	13.085	317.95	1.05	28	49	29.60	1983.2	-3.8	2	57.67
482	6	75	8.4	A2	0	33	22.111	309.82	.38	7	20	2.59	1983.1	-3.7	4	58.78
483	37	98	7.0	K5	0	33	24.897	322.48	1.46	37	58	37.32	1983.0	-3.8	2	58.28
484	56	91	7.1	K2	0	33	25.345	337.26	2.90	57	1	58.00	1983.0	-4.0	2	58.30
503	- 4	64	8.2	K0	0	34	23.625	306.05	.10	- 3	40	31.20	1981.7	-3.8	2	57.24
509	44	128	8.0	M0	0	34	53.262	327.83	1.87	45	19	45.98	1981.1	-4.1	2	57.22
516	21	77	8.6	G5	0	35	22.623	315.72	.83	22	13	16.88	1980.4	-4.0	2	57.74
517	1	108	7.7	K0	0	35	26.243	308.22	.26	2	29	20.00	1980.3	-3.9	2	57.76
518	5	81	8.8	K2	0	35	26.456	309.34	.34	5	34	21.66	1980.3	-3.9	2	57.68
519	- 1	75	6.9	K0	0	35	31.022	307.05	.17	- 0	46	40.97	1980.2	-3.9	2	57.69
528	33	89	7.9	K5	0	36	18.268	321.57	1.28	34	2	39.10	1979.2	-4.1	2	57.24
531	7	86	8.5	K0	0	36	22.247	310.16	.40	7	38	26.87	1979.1	-4.0	2	57.76
537	31	89	8.2	K5	0	36	48.757	320.87	1.21	32	21	18.95	1978.5	-4.2	2	57.69
543	15	100	7.6	G5	0	37	39.716	313.41	.62	15	33	1.33	1977.3	-4.2	2	58.15
549	3	86	8.0	G5	0	38	15.331	308.97	.31	4	12	15.49	1976.4	-4.2	2	57.69
550	20	90	7.0	K0	0	38	21.024	315.76	.79	20	44	47.10	1976.3	-4.3	3	58.07
556	18	93	8.5	A5	0	38	38.604	315.10	.74	19	7	35.89	1975.8	-4.3	2	58.20
567	11	86	8.2	K0	0	39	32.350	312.07	.52	11	40	16.92	1974.5	-4.3	2	57.76
568	57	130	8.1	G0	0	39	33.680	344.48	3.15	58	17	46.81	1974.5	-4.7	2	57.24
570	43	135	7.2	K0	0	39	36.695	329.26	1.81	43	39	50.11	1974.4	-4.5	2	58.30
575	22	106	8.2	K0	0	39	43.811	316.90	.85	22	33	31.54	1974.2	-4.4	2	57.69
589	34	108	7.9	K0	0	40	27.794	323.81	1.33	35	4	44.91	1973.1	-4.6	2	57.68
597	24	104	8.2	G5	0	41	1.378	318.23	.93	24	36	60.22	1972.2	-4.5	2	57.28
601	48	219	7.2	K0	0	41	11.409	334.61	2.17	48	47	48.72	1972.0	-4.8	2	58.27
605	17	93	8.3	K2	0	41	30.177	314.99	.70	17	39	21.69	1971.5	-4.6	4	59.06
612	41	123	8.4	G5	0	42	2.664	329.45	1.73	42	13	25.28	1970.6	-4.8	2	57.31
619	14	105	8.1	F0	0	42	41.038	313.91	.62	14	53	33.94	1969.6	-4.7	2	57.24
623	7	104	8.0	G5	0	43	4.863	310.65	.41	7	34	18.32	1969.0	-4.7	2	57.22
632	30	114	7.5	G5	0	43	45.601	322.37	1.17	30	40	44.03	1967.8	-4.9	3	58.37
635	38	108	8.3	K5	0	43	53.276	328.18	1.57	39	20	56.16	1967.6	-5.0	2	57.76
637	45	199	7.3	G5	0	44	4.331	333.86	1.99	46	5	28.92	1967.3	-5.1	2	57.29
644	50	141	7.5	K2	0	44	34.533	339.02	2.38	50	49	24.37	1966.5	-5.2	2	58.27
646	10	89	7.6	G5	0	44	52.976	312.56	.52	11	22	10.58	1965.9	-4.9	2	57.79
649	- 3	99	7.2	K5	0	45	3.684	306.14	.15	- 2	35	40.73	1965.6	-4.8	2	58.39
654	20	106	7.9	K0	0	45	16.691	317.26	.81	20	45	5.79	1965.3	-5.0	2	58.87
656	60	107	7.9	G5	0	45	23.948	355.38	3.72	61	18	43.38	1965.1	-5.5	2	58.24
659	18	106	8.6	K2	0	45	29.613	316.51	.76	19	12	39.81	1964.9	-5.0	2	59.36
660	- 4	95	8.2	K0	0	45	30.971	305.49	.12	- 3	59	4.34	1964.9	-4.8	2	59.37
669	57	151	7.9	K7	0	46	2.171	349.56	3.17	57	44	6.11	1964.0	-5.5	2	58.24
676	12	95	8.2	K5	0	46	20.041	313.33	.56	12	36	26.52	1963.4	-5.0	2	59.27
685	5	109	7.6	K2	0	47	4.663	310.26	.38	6	8	6.17	1962.1	-5.0	3	57.79
691	14	121	8.3	A0	0	47	49.816	314.85	.64	15	12	44.45	1960.8	-5.2	2	57.74
694	9	97	8.6	A2	0	47	56.975	312.29	.49	10	8	22.68	1960.6	-5.1	4	58.85
711	48	257	7.4	K2	0	48	59.633	339.61	2.24	48	42	44.00	1958.6	-5.7	2	57.22
713	70	57	8.1	G5	0	49	1.197	391.44	6.91	71	22	0.44	1958.6	-6.5	2	57.23

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
718	15	126	7.9 G5	0 49 13.042	315.73	.68	16 26 41.46	1958.2	-5.3	3	57.10
721	84	14	8.1 G8	0 49 26.731	665.41	60.95	85 25 55.20	1957.8	-10.8	3	58.40
729	29	145	8.1 K2	0 49 59.410	324.25	1.17	30 20 1.68	1956.8	-5.5	2	57.30
733	36	145	8.5 M0	0 50 9.382	328.93	1.46	36 40 24.47	1956.5	-5.6	2	58.81
747	1	158	8.6 G0	0 51 4.547	308.17	.27	1 38 18.93	1954.7	-5.4	4	57.52
751	10	105	8.4 K0	0 51 13.639	313.00	.52	10 51 5.80	1954.4	-5.5	2	57.79
761	41	163	8.0 A3	0 52 22.324	334.56	1.77	41 58 47.70	1952.2	-5.9	2	57.23
763	12	108	8.0 K0	0 52 23.464	314.08	.57	12 34 36.64	1952.1	-5.6	2	57.40
765	0	142	8.4 G5	0 52 27.475	307.60	.25	0 31 10.08	1952.0	-5.5	2	58.24
767	35	167	8.6 K5	0 52 32.053	329.21	1.43	35 46 52.48	1951.8	-5.9	2	58.28
775	3	127	8.6 K2	0 53 13.277	309.61	.35	4 14 27.66	1950.5	-5.6	3	57.48
776	69	54	8.6 A2	0 53 19.139	392.82	6.50	70 10 59.49	1950.3	-7.0	2	58.82
778	58	136	8.1 K0	0 53 22.945	358.21	3.42	58 46 48.03	1950.1	-6.4	2	57.79
784	59	145	8.6 G5	0 53 41.683	360.68	3.59	59 49 40.38	1949.5	-6.5	2	57.28
790	13	130	8.4 K5	0 54 4.573	315.41	.63	14 30 20.59	1948.7	-5.8	2	58.24
791	16	90	8.2 A5	0 54 6.137	317.15	.72	17 27 21.61	1948.7	-5.8	4	58.84
792	9	109	8.7 K5	0 54 7.202	312.78	.50	9 53 44.26	1948.6	-5.7	2	57.75
802	11	120	8.2 K2	0 54 44.332	314.14	.57	12 9 35.96	1947.4	-5.8	2	57.68
803	52	213	7.8 K2	0 54 48.245	349.80	2.72	53 18 32.44	1947.2	-6.5	4	58.03
808	5	129	8.6 K5	0 55 18.638	310.46	.39	5 36 6.68	1946.2	-5.8	2	58.85
817	26	161	7.2 K2	0 55 46.474	323.39	1.04	26 30 58.19	1945.2	-6.1	2	57.79
820	21	126	8.8 K0	0 55 52.996	320.46	.88	22 9 2.00	1945.0	-6.1	2	58.27
821	15	144	7.6 K0	0 55 53.194	316.60	.68	16 2 38.16	1945.0	-6.0	2	58.81
823	73	47	8.1 K0	0 55 59.380	417.98	8.75	73 43 6.30	1944.7	-7.8	2	58.21
833	40	199	8.5 A0	0 56 35.913	335.40	1.71	40 40 22.05	1943.4	-6.4	2	57.68
840	1	185	7.8 K2	0 57 31.188	308.70	.31	2 21 50.02	1941.5	-6.0	2	57.29
851	- 1	131	8.6 K2	0 58 16.176	306.57	.22	- 1 17 27.71	1939.8	-6.1	2	60.35
858	7	146	8.2 G5	0 58 35.648	311.93	.46	7 45 55.09	1939.1	-6.2	2	58.32
860	10	115	8.1 G5	0 58 36.829	313.85	.54	10 54 42.97	1939.1	-6.2	2	57.22
872	29	168	8.5 G5	0 59 29.196	327.04	1.19	29 53 39.88	1937.1	-6.5	2	58.21
880	32	177	8.0 K5	1 0 11.662	329.90	1.33	33 3 18.34	1935.5	-6.7	2	57.78
883	12	126	7.8 K0	1 0 28.458	315.23	.60	12 46 49.98	1934.9	-6.4	2	57.67
892	52	248	8.8 K0	1 1 2.393	353.32	2.70	52 35 55.40	1933.6	-7.2	4	59.48
894	36	187	7.8 G5	1 1 12.961	333.49	1.50	36 33 54.81	1933.2	-6.8	4	59.80
896	37	199	7.0 M0	1 1 16.435	335.33	1.60	38 25 14.65	1933.1	-6.9	2	58.29
902	- 0	163	8.3 K5	1 1 43.664	307.54	.27	0 20 50.77	1932.0	-6.4	2	58.31
905	8	166	8.1 K0	1 2 1.624	313.19	.50	9 19 6.67	1931.3	-6.5	3	57.41
918	5	144	8.2 M0	1 2 55.356	311.01	.41	5 48 11.85	1929.2	-6.6	2	57.21
946	4	182	8.4 K2	1 4 38.673	310.41	.39	4 44 19.59	1925.1	-6.7	2	58.22
947	33	169	7.9 K5	1 4 38.839	332.16	1.37	33 43 45.17	1925.0	-7.1	3	57.46
956	59	188	7.9 G5	1 5 10.200	371.91	3.76	59 52 11.19	1923.8	-8.0	2	58.31
964	25	170	8.9 K0	1 5 39.121	325.45	1.03	25 38 29.98	1922.6	-7.1	2	57.73
967	9	132	6.6 M0	1 5 44.777	313.75	.52	9 38 29.69	1922.4	-6.9	2	58.31
978	39	268	8.8 K2	1 6 20.153	339.49	1.72	40 8 27.08	1920.9	-7.5	2	57.78
989	30	177	8.7 G5	1 7 16.989	330.29	1.24	30 42 21.53	1918.5	-7.4	2	58.22
997	48	355	7.2 K2	1 7 55.581	352.06	2.38	48 53 54.40	1916.9	-7.9	2	58.23
999	5	150	8.8 K2	1 7 58.285	311.77	.44	6 29 6.33	1916.8	-7.0	2	59.00
1007	13	175	7.9 K0	1 8 37.329	317.47	.67	14 25 35.38	1915.1	-7.2	2	58.43
1008	20	171	8.6 K5	1 8 38.837	322.81	.89	21 26 23.89	1915.0	-7.3	2	58.87
1015	- 1	156	8.0 G5	1 9 17.617	306.83	.26	- 0 42 38.15	1913.3	-7.1	2	58.90

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P.M.).

T in centuries from 1900.0, T' in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
1020	52	279	8.1 K0	1 9 49.958	361.11	2.85	53 17 56.47	1911.9	-8.3	2	58.29
1022	56	221	8.3 K0	1 9 54.442	368.92	3.33	56 55 3.22	1911.7	-8.5	2	59.00
1025	62	224	7.4 K0	1 10 3.895	384.79	4.39	62 33 52.78	1911.3	-8.8	2	58.78
1039	24	190	7.6 K2	1 10 49.819	326.06	1.01	24 44 28.91	1909.3	-7.6	2	59.31
1047	8	187	8.0 G5	1 11 4.858	313.57	.51	8 42 35.92	1908.6	-7.4	2	58.22
1049	70	87	7.7 K0	1 11 5.403	424.69	7.47	70 50 12.18	1908.6	-9.9	2	57.75
1056	- 2	184	8.4 F5	1 11 31.727	305.62	.22	- 2 22 43.72	1907.4	-7.2	2	58.82
1059	18	163	7.9 G5	1 11 43.820	321.38	.81	18 51 45.87	1906.9	-7.6	2	57.75
1065	59	220	7.7 K0	1 12 20.551	379.92	3.93	60 15 18.38	1905.2	-9.0	2	58.94
1075	6	185	8.0 K2	1 12 57.041	312.23	.46	6 41 32.61	1903.6	-7.6	2	57.79
1077	49	335	7.5 K5	1 13 4.760	356.60	2.47	49 37 57.29	1903.2	-8.6	2	57.67
1079	80	34	7.6 G5	1 13 13.825	581.54	26.01	81 17 50.64	1902.8	-13.7	2	58.22
1083	12	155	8.7 K0	1 13 31.793	317.42	.65	13 28 19.09	1902.0	-7.7	2	58.81
1103	43	262	6.5 K5	1 14 46.519	349.22	2.04	44 22 8.23	1898.5	-8.6	2	58.83
1111	76	39	7.2 K2	1 15 4.590	486.89	13.05	76 32 2.00	1897.7	-11.8	2	57.41
1114	0	215	8.0 A5	1 15 8.397	307.99	.31	0 53 19.39	1897.5	-7.6	2	57.84
1122	39	301	7.1 G5	1 16 0.915	343.45	1.74	39 42 4.04	1895.0	-8.6	2	58.89
1125	21	173	8.8 K0	1 16 13.994	325.08	.93	22 8 47.57	1894.4	-8.1	2	58.22
1130	6	195	8.0 G5	1 16 20.844	312.83	.48	7 10 5.29	1894.1	-7.9	2	57.24
1131	33	205	7.7 K2	1 16 46.195	337.51	1.45	34 29 25.54	1892.9	-8.5	2	58.76
1139	11	167	8.1 F5	1 17 4.233	316.61	.61	11 53 1.27	1892.0	-8.0	2	58.23
1144	64	150	7.7 K0	1 17 26.441	401.55	5.11	64 49 19.85	1890.9	-10.1	2	57.75
1145	36	224	8.5 K2	1 17 27.187	341.21	1.60	37 24 37.91	1890.9	-8.6	2	57.42
1156	14	204	7.2 G5	1 18 0.837	319.64	.72	15 26 3.56	1889.3	-8.2	2	57.21
1158	68	94	8.3 K0	1 18 12.766	423.67	6.71	68 58 31.01	1888.7	-10.7	2	57.28
1165	- 4	189	8.8 G0	1 19 9.495	304.40	.21	- 3 41 53.87	1885.9	-7.9	2	57.76
1172	13	204	8.0 G5	1 19 33.520	318.73	.68	14 4 47.08	1884.7	-8.3	3	57.15
1176	25	228	7.4 K0	1 19 52.255	329.88	1.09	26 18 5.78	1883.8	-8.6	4	58.58
1182	32	245	7.7 K5	1 20 23.126	337.18	1.38	33 1 44.44	1882.2	-8.8	2	58.76
1185	47	398	7.5 K2	1 20 46.287	358.76	2.38	48 6 56.63	1881.1	-9.4	2	58.78
1187	22	221	8.3 G0	1 20 48.350	326.62	.96	22 41 46.03	1881.0	-8.6	2	58.31
1189	7	204	8.5 A3	1 21 3.155	313.77	.51	7 55 42.51	1880.2	-8.3	2	58.34
1191	58	230	8.0 K0	1 21 7.385	383.46	3.73	58 41 10.38	1880.0	-10.1	2	58.32
1193	56	264	7.1 K5	1 21 15.044	378.58	3.44	56 56 16.59	1879.6	-10.0	2	58.24
1210	- 1	182	7.8 A5	1 22 7.810	306.32	.28	- 1 13 48.42	1876.9	-8.2	2	57.78
1214	34	243	7.8 G5	1 22 17.479	340.78	1.51	35 28 24.38	1876.4	-9.1	2	58.31
1230	- 2	213	7.8 G0	1 23 33.514	305.28	.25	- 2 27 37.08	1872.5	-8.3	2	58.76
1232	17	206	8.7 K0	1 23 49.476	322.80	.80	17 56 37.32	1871.7	-8.8	4	58.54
1241	24	212	7.2 K0	1 24 20.286	329.93	1.06	25 10 50.32	1870.1	-9.1	2	57.28
1244	51	308	7.5 K0	1 24 32.247	368.00	2.75	51 33 0.91	1869.4	-10.1	2	58.79
1245	1	262	8.8 K2	1 24 33.157	308.90	.36	1 52 12.95	1869.4	-8.5	2	58.89
1267	48	448	8.3 M2	1 26 24.155	363.72	2.48	48 54 9.74	1863.5	-10.2	2	58.29
1269	8	238	8.4 K2	1 26 33.314	315.50	.56	9 25 10.25	1863.0	-8.9	2	57.28
1273	65	173	7.8 K5	1 26 54.387	418.33	5.65	65 58 58.56	1861.9	-11.7	2	58.22
1275	59	261	6.9 K2	1 27 1.420	391.49	3.95	59 31 26.88	1861.5	-11.0	3	57.89
1278	72	75	8.2 K0	1 27 6.482	465.70	9.28	72 37 12.31	1861.2	-13.0	2	57.79
1289	- 1	199	8.6 K2	1 28 0.550	306.37	.29	- 1 5 44.32	1858.3	-8.8	2	59.34
1295	57	308	7.8 K0	1 28 9.211	387.33	3.66	57 55 24.28	1857.8	-11.0	2	58.83
1296	5	196	8.6 G5	1 28 13.812	312.35	.46	5 42 58.69	1857.6	-8.9	2	58.78
1309	50	299	8.4 G0	1 29 26.231	369.14	2.67	50 34 3.59	1853.6	-10.6	2	57.89

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
1317	12 189	8.1 K0	1 30 6.302	319.06	.66	12 54 18.89	1851.3	-9.3	3	57.77
1321	54 315	6.8 K2	1 30 15.668	379.71	3.17	54 41 19.26	1850.8	-11.0	2	58.31
1325	- 0 247	8.4 K0	1 30 25.121	307.21	.32	- 0 7 46.58	1850.3	-9.0	4	58.84
1327	41 300	8.5 K0	1 30 28.724	353.72	1.93	42 4 17.99	1850.1	-10.3	2	58.88
1335	29 260	8.1 A3	1 30 48.068	337.26	1.27	30 8 0.00	1849.0	-9.9	2	57.37
1341	- 2 242	8.6 G5	1 31 3.735	305.41	.27	- 2 7 18.21	1848.1	-9.0	3	58.48
1342	16 172	8.0 K0	1 31 5.055	323.56	.80	17 25 45.56	1848.0	-9.5	4	59.07
1344	18 207	8.7 K0	1 31 10.855	324.67	.83	18 31 26.95	1847.7	-9.6	2	57.88
1349	3 216	8.3 F5	1 31 28.375	310.84	.42	3 52 22.45	1846.7	-9.2	2	58.80
1361	13 238	8.1 G5	1 32 14.407	320.50	.70	14 7 47.96	1844.1	-9.5	4	57.73
1363	7 234	7.0 K0	1 32 15.039	314.70	.53	8 1 9.51	1844.1	-9.4	2	57.35
1367	51 338	7.2 K2	1 32 28.904	374.26	2.83	51 54 32.38	1843.3	-11.1	2	58.30
1375	9 189	8.4 K0	1 32 54.648	316.91	.59	10 18 22.93	1841.8	-9.5	2	57.22
1380	46 397	7.1 G5	1 33 20.020	364.22	2.34	47 4 16.22	1840.3	-10.9	2	57.28
1384	47 462	8.0 K0	1 33 35.323	365.88	2.41	47 49 6.19	1839.5	-11.0	2	57.90
1386	23 211	8.8 K0	1 33 38.869	330.92	1.03	23 57 43.20	1839.2	-10.0	3	58.12
1390	32 280	7.6 K0	1 33 57.354	341.39	1.39	32 35 56.87	1838.2	-10.3	2	57.79
1412	9 194	7.6 F5	1 35 18.604	316.37	.57	9 30 34.32	1833.4	-9.7	4	57.53
1416	28 273	8.2 K2	1 35 39.281	336.85	1.22	28 35 30.55	1832.2	-10.3	2	58.33
1440	2 244	8.2 G0	1 37 8.540	310.40	.41	3 12 8.78	1826.9	-9.7	4	57.54
1453	- 2 270	8.6 F0	1 37 54.016	305.53	.29	- 1 51 16.06	1824.2	-9.6	2	58.43
1458	22 257	7.6 G5	1 38 21.488	330.67	.99	22 46 22.54	1822.5	-10.5	2	58.86
1464	17 247	7.8 A2	1 38 49.601	325.91	.84	18 23 59.79	1820.8	-10.3	2	57.75
1466	44 352	8.6 K	1 38 51.992	363.84	2.20	45 19 30.79	1820.6	-11.5	2	57.83
1478	3 230	8.7 A0	1 39 20.089	311.67	.45	4 25 14.55	1818.9	-9.9	2	59.34
1483	15 251	7.6 K0	1 39 45.091	322.98	.76	15 31 36.34	1817.4	-10.3	2	57.78
1487	24 250	8.4 M0	1 39 55.857	333.70	1.08	25 3 4.71	1816.7	-10.7	2	57.79
1493	10 225	8.5 F0	1 40 10.623	318.15	.62	10 50 4.61	1815.8	-10.2	2	58.76
1503	13 266	8.7 A3	1 41 1.310	322.02	.72	14 27 4.62	1812.7	-10.4	3	57.44
1504	5 232	7.9 K0	1 41 1.904	312.81	.48	5 29 39.70	1812.6	-10.1	2	58.30
1513	- 0 264	8.4 G5	1 41 26.332	306.91	.33	- 0 25 12.01	1811.1	-10.0	5	59.99
1525	1 313	7.2 K0	1 42 29.926	309.60	.40	2 15 10.72	1807.1	-10.1	2	57.76
1527	26 290	7.8 K2	1 42 44.702	336.67	1.15	26 52 9.62	1806.2	-11.0	2	58.35
1535	40 362	7.6 F5	1 43 20.034	357.47	1.87	40 44 1.79	1804.0	-11.7	2	57.78
1537	- 4 269	8.2 G5	1 43 26.252	302.76	.25	- 4 28 40.98	1803.6	-10.0	4	58.84
1560	0 289	8.0 G5	1 44 47.459	307.91	.36	0 33 45.80	1798.4	-10.3	2	58.30
1561	12 231	8.8 K5	1 44 49.256	320.65	.68	12 43 34.16	1798.3	-10.7	2	58.34
1563	- 0 274	8.1 G5	1 45 2.091	307.23	.35	- 0 5 37.77	1797.4	-10.3	2	58.30
1577	41 353	8.5 F0	1 46 13.873	360.63	1.95	41 44 27.92	1792.8	-12.1	2	57.75
1578	34 311	8.3 G5	1 46 18.071	348.65	1.52	34 39 21.91	1792.5	-11.7	2	58.77
1583	61 334	7.8 G5	1 46 28.411	419.46	4.65	61 54 11.64	1791.8	-14.1	3	57.16
1586	32 323	8.8 K0	1 46 33.356	345.89	1.42	32 46 5.08	1791.5	-11.7	2	57.29
1589	26 303	8.3 F0	1 47 9.581	338.30	1.17	27 13 1.30	1789.1	-11.5	2	57.78
1606	42 388	7.5 K0	1 48 4.614	364.49	2.07	43 16 40.95	1785.5	-12.4	2	57.79
1619	17 273	8.2 G0	1 48 48.239	327.48	.85	18 15 41.18	1782.6	-11.3	2	57.37
1621	15 273	8.3 K0	1 48 55.450	325.03	.78	16 9 7.21	1782.1	-11.2	2	57.85
1630	46 467	8.5 K2	1 49 26.918	374.17	2.42	47 25 29.22	1780.0	-12.9	2	58.79
1638	0 302	8.5 A5	1 50 3.438	308.42	.38	1 0 41.15	1777.6	-10.8	2	58.31
1641	3 257	8.2 G5	1 50 11.337	312.10	.46	4 25 1.08	1777.0	-10.9	2	58.31
1655	6 296	7.6 K2	1 51 0.349	315.39	.54	7 23 18.45	1773.7	-11.1	4	58.55

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
1657	23	254	8.9 A3	1 51 21.887	335.02	1.05	23 55 38.12	1772.3	-11.8	2	58.34
1658	40	400	8.2 K0	1 51 27.259	360.94	1.88	40 38 40.48	1771.9	-12.7	2	58.79
1662	53	419	7.3 G5	1 51 41.527	393.27	3.17	53 56 38.54	1770.9	-13.8	2	57.86
1671	13	296	7.5 G5	1 52 5.780	322.41	.71	13 30 42.97	1769.3	-11.4	2	58.78
1674	69	123	7.3 K5	1 52 29.632	479.99	7.99	69 57 34.27	1767.6	-16.9	2	57.27
1694	51	444	7.8 K5	1 53 36.586	389.40	2.95	52 14 43.76	1763.0	-13.9	2	57.30
1696	34	338	8.5 K2	1 53 42.368	352.53	1.56	35 24 10.49	1762.6	-12.6	2	57.29
1736	62	332	8.7 M0	1 55 50.044	432.47	4.93	62 39 47.75	1753.7	-15.6	2	57.29
1738	15	286	8.0 G0	1 55 55.485	325.51	.78	15 41 14.92	1753.3	-11.9	2	57.31
1739	28	335	8.2 G5	1 56 1.820	342.68	1.24	28 37 13.33	1752.8	-12.5	2	57.33
1744	55	466	7.6 G5	1 56 12.293	401.64	3.41	55 28 21.59	1752.1	-14.6	2	57.85
1749	40	415	7.1 G5	1 56 40.613	364.16	1.92	41 6 28.25	1750.1	-13.3	2	57.27
1752	81	67	7.9 M0	1 56 48.947	790.20	40.25	82 18 39.15	1749.5	-28.5	3	57.44
1758	39	450	8.2 G5	1 57 28.989	361.78	1.83	39 43 32.39	1746.6	-13.3	2	57.29
1759	6	314	7.6 K5	1 57 35.016	315.00	.53	6 40 34.74	1746.2	-11.7	4	58.55
1768	47	544	8.1 K5	1 58 4.318	379.68	2.45	47 42 9.19	1744.1	-14.0	2	57.76
1769	12	264	7.8 F5	1 58 7.433	322.71	.70	13 8 35.73	1743.9	-12.0	2	58.30
1773	4	340	8.0 G5	1 58 31.080	313.22	.49	5 5 43.75	1742.2	-11.7	2	59.32
1776	- 1	276	8.5 K0	1 58 48.183	306.03	.35	- 1 7 34.25	1740.9	-11.4	2	58.44
1777	31	354	8.4 K0	1 58 50.698	348.52	1.39	31 52 49.54	1740.8	-13.0	2	58.30
1778	44	406	8.2 G5	1 58 54.647	373.71	2.22	45 3 12.52	1740.5	-13.9	2	57.37
1780	0	335	8.6 F5	1 59 4.777	308.60	.40	1 6 8.66	1739.8	-11.5	4	59.12
1784	42	430	7.8 K0	1 59 20.356	368.47	2.03	42 36 32.04	1738.6	-13.7	2	57.24
1785	36	394	8.2 F0	1 59 31.229	357.96	1.67	37 15 32.16	1737.8	-13.4	2	57.29
1787	18	261	8.4 A0	1 59 35.628	330.45	.89	19 8 57.99	1737.5	-12.4	2	58.34
1790	14	328	7.9 K0	1 59 46.055	325.52	.76	15 15 17.66	1736.8	-12.2	2	59.36
1792	8	316	7.4 G5	1 59 56.415	317.71	.59	8 50 29.22	1736.0	-11.9	2	59.92
1796	63	277	7.1 K5	2 0 5.452	444.39	5.36	63 59 52.30	1735.3	-16.6	2	58.31
1798	35	396	7.9 K0	2 0 11.286	355.70	1.60	35 52 15.17	1734.9	-13.3	2	58.80
1807	17	306	8.4 A2	2 0 44.359	329.27	.85	18 5 15.99	1732.5	-12.4	4	58.60
1808	22	298	8.2 K7	2 0 49.641	335.36	1.00	22 37 59.84	1732.1	-12.7	2	58.30
1814	56	416	8.5 A0	2 1 15.436	410.58	3.65	56 50 56.07	1730.2	-15.5	2	57.77
1827	59	403	8.3 K0	2 2 24.602	425.33	4.30	60 2 24.26	1725.1	-16.1	2	57.30
1829	9	266	7.4 K5	2 2 43.462	319.15	.62	9 50 17.49	1723.7	-12.3	2	58.89
1836	4	348	8.6 F5	2 3 18.156	313.40	.50	5 4 2.15	1721.1	-12.1	2	57.30
1842	12	282	7.3 K0	2 3 47.504	323.47	.71	13 13 26.67	1718.9	-12.5	2	57.29
1846	69	136	8.6 G5	2 4 2.303	492.86	7.96	69 38 38.47	1717.8	-18.9	2	58.30
1848	3	284	8.6 M0	2 4 10.550	311.74	.46	3 39 58.35	1717.2	-12.1	2	58.36
1849	51	500	8.4 A2	2 4 10.942	395.18	2.93	51 53 30.44	1717.2	-15.2	2	58.31
1851	0	352	7.8 K0	2 4 13.690	308.78	.41	1 12 15.82	1717.0	-12.0	2	57.75
1862	5	285	7.0 K5	2 5 9.849	314.31	.51	5 44 52.56	1712.7	-12.3	2	58.28
1863	15	305	7.6 K0	2 5 20.215	326.69	.78	15 34 5.23	1711.9	-12.8	3	57.44
1866	10	292	7.6 K5	2 5 26.593	320.79	.65	10 57 13.03	1711.5	-12.5	2	57.86
1870	- 1	296	7.6 K2	2 5 53.828	306.53	.37	- 0 39 22.24	1709.4	-12.0	2	59.33
1878	- 3	320	8.8 K5	2 6 17.059	303.12	.31	- 3 26 31.41	1707.6	-11.9	2	57.88
1885	53	459	7.7 K5	2 6 42.045	404.24	3.22	54 5 44.14	1705.7	-15.8	2	57.89
1886	31	370	7.7 K2	2 6 44.097	351.32	1.40	32 4 49.06	1705.5	-13.8	2	59.88
1888	21	291	8.8 K7	2 6 44.992	335.36	.98	21 46 25.97	1705.5	-13.2	2	58.30
1889	22	309	8.5 G5	2 6 46.289	337.10	1.02	22 58 58.92	1705.4	-13.3	2	58.79
1900	11	288	8.1 G0	2 7 26.620	322.16	.67	11 52 42.81	1702.3	-12.8	3	57.82

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900.0, T' in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
1901	45	557	8.0 G5	2 7 27.114	379.59	2.28	45 41 31.03	1702.2	-15.0	2	58.34
1905	65	234	7.9 G5	2 7 47.259	468.24	6.25	66 16 46.08	1700.7	-18.4	2	57.75
1908	35	416	8.4 K0	2 7 57.159	358.35	1.59	35 47 12.38	1699.9	-14.2	2	58.43
1920	47	583	7.7 K5	2 9 38.945	387.82	2.52	48 20 15.84	1692.0	-15.5	3	57.81
1924	9	280	8.3 F0	2 9 49.720	320.09	.63	10 5 41.81	1691.2	-12.9	2	57.81
1925	58	399	7.5 K0	2 9 54.339	426.56	4.08	58 57 45.30	1690.8	-17.1	2	57.79
1927	13	351	7.1 K0	2 9 59.947	324.81	.73	13 41 4.51	1690.4	-13.1	2	58.29
1928	19	332	7.7 K0	2 10 6.812	332.89	.91	19 35 15.03	1689.9	-13.4	2	58.43
1929	- 2	379	8.1 K0	2 10 9.324	304.24	.33	- 2 27 42.57	1689.6	-12.3	2	58.86
1941	46	538	8.6 K5	2 11 6.937	385.05	2.40	47 3 17.67	1685.1	-15.6	2	58.92
1942	25	368	7.4 G5	2 11 10.254	343.24	1.15	26 23 36.72	1684.8	-13.9	2	58.86
1950	18	284	8.9 A5	2 11 54.269	332.12	.88	18 49 37.21	1681.4	-13.5	2	57.29
1951	49	602	8.4 K0	2 11 54.203	394.29	2.72	50 5 39.63	1681.4	-16.0	2	57.77
1956	20	358	8.8 K2	2 12 6.299	334.95	.94	20 46 24.82	1680.4	-13.7	2	58.77
1966	41	430	7.4 K5	2 12 37.927	373.68	2.00	42 14 10.78	1677.9	-15.3	2	58.79
1968	77	78	7.9 K0	2 12 54.006	637.89	18.09	77 30 42.80	1676.6	-25.8	2	57.27
1971	10	306	8.3 A0	2 13 11.657	321.76	.66	11 7 40.35	1675.2	-13.2	2	57.81
1973	48	642	7.9 G5	2 13 16.300	390.71	2.56	48 38 49.30	1674.8	-16.0	2	57.22
1983	29	385	8.9 K7	2 13 51.467	349.39	1.29	29 43 10.48	1672.0	-14.4	2	58.31
1984	1	403	7.5 G5	2 13 53.131	309.91	.44	2 0 24.54	1671.9	-12.8	4	58.89
1987	9	294	8.8 A0	2 13 59.082	319.71	.62	9 32 2.44	1671.4	-13.2	2	59.30
1990	3	345	8.7 K0	2 14 18.022	303.28	.33	- 3 8 7.24	1669.9	-12.6	2	58.90
1991	16	266	8.0 G0	2 14 18.528	330.04	.82	17 5 6.68	1669.8	-13.7	2	58.29
1996	33	399	8.1 K0	2 14 31.431	356.38	1.47	33 32 25.57	1668.8	-14.7	2	59.47
2001	44	456	8.3 K2	2 14 57.925	381.49	2.22	44 58 48.86	1666.6	-15.8	2	57.89
2006	- 2	389	8.1 K0	2 15 14.860	304.38	.35	- 2 16 15.91	1665.3	-12.7	2	58.86
2011	36	458	8.0 K2	2 15 33.938	363.14	1.65	36 50 13.24	1663.7	-15.1	2	58.79
2015	7	362	7.0 K0	2 16 2.436	317.76	.58	7 57 3.06	1661.4	-13.3	2	57.31
2031	31	403	7.4 K5	2 17 5.239	354.51	1.40	32 5 23.17	1656.3	-14.9	2	57.89
2036	54	525	7.3 K0	2 17 30.958	415.80	3.39	55 10 46.68	1654.2	-17.5	2	58.31
2038	58	450	7.1 K0	2 17 37.746	433.08	4.10	59 1 11.39	1653.6	-18.2	2	57.75
2045	30	379	8.4 G5	2 18 8.118	351.85	1.32	30 26 48.02	1651.1	-14.9	2	57.31
2046	9	306	8.6 G5	2 18 12.344	320.39	.62	9 46 42.14	1650.7	-13.6	2	57.82
2049	22	331	7.2 M0	2 18 24.223	339.84	1.03	23 11 55.15	1649.8	-14.3	2	57.30
2055	11	326	8.4 F0	2 19 10.509	323.58	.68	12 1 54.54	1645.9	-13.8	2	58.35
2057	0	391	7.4 K2	2 19 14.550	308.31	.42	0 44 31.73	1645.6	-13.2	2	58.46
2060	37	538	8.1 G5	2 19 20.022	365.83	1.68	37 28 17.19	1645.1	-15.6	4	59.52
2072	- 0	357	8.5 K0	2 19 48.940	307.28	.40	- 0 2 4.48	1642.7	-13.2	2	58.42
2073	78	82	7.9 K2	2 19 51.796	714.54	24.06	79 21 1.70	1642.5	-30.2	2	57.77
2079	7	375	7.6 F0	2 20 17.094	318.55	.59	8 19 6.81	1640.4	-13.7	2	57.24
2083	35	465	8.7 G5	2 20 28.934	362.37	1.57	35 36 24.65	1639.4	-15.5	2	57.29
2084	10	318	7.6 G5	2 20 33.019	321.74	.65	10 36 35.43	1639.0	-13.9	2	57.84
2090	55	609	8.5 A3	2 21 9.290	422.68	3.56	56 12 42.88	1636.0	-18.1	2	58.43
2092	46	565	7.6 K0	2 21 13.980	390.57	2.40	47 8 48.68	1635.6	-16.8	2	58.41
2095	59	483	7.7 K0	2 21 43.751	443.09	4.39	60 17 29.80	1633.1	-19.1	2	57.76
2096	28	409	7.4 K0	2 21 45.833	350.31	1.26	29 1 8.49	1632.9	-15.2	4	59.18
2100	73	136	8.1 K5	2 22 0.678	584.48	12.52	74 21 31.60	1631.6	-25.1	2	57.84
2109	31	418	7.3 K2	2 22 29.353	356.30	1.40	32 10 57.01	1629.2	-15.5	2	57.30
2114	- 3	375	8.4 K5	2 22 41.707	302.64	.33	- 3 26 33.37	1628.2	-13.2	2	59.21
2121	6	360	8.6 G5	2 22 58.597	316.92	.56	7 0 18.46	1626.7	-13.8	4	58.65

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
2129	16	291	8.3 G0	2 23 56.814	331.89	.84	17 22 27.21	1621.8	-14.6	2	57.79
2131	22	347	8.0 G5	2 24 8.327	340.13	1.00	22 39 17.18	1620.8	-14.9	2	57.85
2142	- 1	338	7.1 K5	2 24 56.234	305.98	.38	- 0 58 30.71	1616.6	-13.5	2	58.32
2155	23	330	8.4 A2	2 25 56.711	342.12	1.04	23 38 51.87	1611.4	-15.2	2	57.76
2162	52	587	8.3 K0	2 26 17.737	412.37	3.04	52 50 21.20	1609.6	-18.3	2	58.88
2165	30	399	7.7 K0	2 26 23.846	354.52	1.32	30 38 34.49	1609.1	-15.7	2	58.43
2168	43	504	7.9 K2	2 26 36.724	384.18	2.11	43 56 1.57	1607.9	-17.1	2	58.30
2171	5	343	8.1 K2	2 26 54.426	315.08	.52	5 32 42.44	1606.4	-14.1	2	58.30
2176	47	640	7.6 K0	2 27 7.088	395.04	2.44	47 37 55.16	1605.3	-17.6	2	58.35
2185	18	315	8.2 K0	2 27 42.842	334.10	.87	18 26 34.78	1602.2	-15.0	2	57.86
2213	- 4	412	8.7 A5	2 29 5.754	301.38	.32	- 4 12 0.80	1594.9	-13.6	2	57.94
2217	20	416	7.2 G5	2 29 25.418	338.28	.95	20 53 52.65	1593.1	-15.3	2	58.46
2221	6	380	7.6 K0	2 29 33.677	316.57	.55	6 29 50.34	1592.4	-14.3	2	58.30
2222	- 1	352	7.9 K2	2 29 35.801	305.32	.38	- 1 24 53.39	1592.2	-13.9	2	57.94
2224	14	418	8.6 F2	2 29 53.878	329.02	.76	14 56 34.55	1590.6	-14.9	2	59.34
2226	80	80	7.9 K5	2 29 57.863	846.65	35.72	81 25 31.02	1590.3	-37.9	2	57.79
2228	29	434	7.2 K0	2 30 10.652	353.86	1.28	29 44 43.38	1589.1	-16.1	2	58.35
2235	5	356	8.0 K0	2 30 49.934	315.17	.53	5 28 51.40	1585.6	-14.4	2	57.29
2254	2	400	8.2 G5	2 32 15.173	310.83	.46	2 26 3.36	1578.0	-14.3	2	58.32
2260	- 0	387	8.6 K0	2 32 20.307	306.48	.40	- 0 35 18.34	1577.6	-14.1	2	58.35
2261	30	414	8.6 K0	2 32 24.000	355.82	1.31	30 27 47.72	1577.2	-16.3	2	57.37
2266	62	426	7.5 K0	2 32 36.198	471.29	5.19	63 16 46.81	1576.1	-21.6	2	57.84
2268	38	510	8.1 K0	2 32 41.163	374.99	1.77	39 19 50.60	1575.7	-17.2	2	57.78
2270	28	437	8.2 A3	2 32 45.801	353.13	1.24	29 0 15.47	1575.3	-16.2	2	59.31
2272	15	354	8.1 K2	2 32 54.664	331.65	.80	16 23 41.34	1574.5	-15.3	2	58.30
2273	74	112	8.0 G0	2 32 56.611	619.54	13.77	75 9 53.42	1574.3	-28.3	2	57.84
2275	13	410	7.8 K5	2 32 58.491	327.34	.73	13 35 58.11	1574.1	-15.1	2	58.34
2276	9	339	8.8 K5	2 33 0.998	321.77	.63	9 54 18.36	1573.9	-14.9	2	59.35
2278	26	432	8.4 G5	2 33 14.719	349.44	1.16	26 56 57.96	1572.7	-16.1	2	58.78
2283	72	141	8.1 K2	2 33 39.459	585.31	11.35	73 22 16.20	1570.4	-26.8	2	58.34
2286	36	524	8.4 K0	2 33 51.630	370.27	1.64	37 8 16.23	1569.3	-17.1	2	60.03
2289	17	403	8.5 A3	2 34 0.979	333.90	.84	17 42 52.27	1568.5	-15.5	2	59.93
2298	11	365	7.4 G5	2 35 2.613	325.20	.69	12 3 12.81	1562.9	-15.2	2	57.28
2308	19	394	7.4 K0	2 35 48.506	337.09	.90	19 30 44.51	1558.7	-15.8	3	57.51
2325	7	408	8.3 K0	2 37 5.985	319.20	.58	7 59 18.60	1551.5	-15.1	2	57.89
2328	70	198	7.2 K0	2 37 14.407	559.05	9.42	71 24 47.13	1550.7	-26.1	2	57.74
2333	35	531	8.1 K5	2 37 26.537	368.42	1.56	35 47 31.03	1549.6	-17.4	2	58.30
2338	12	370	7.3 K0	2 37 43.118	327.41	.72	13 18 48.29	1548.1	-15.5	2	58.34
2339	17	414	7.6 F5	2 37 45.053	335.54	.86	18 23 8.41	1547.9	-15.9	2	58.32
2340	20	444	8.2 G5	2 37 49.657	339.94	.94	21 0 31.67	1547.5	-16.1	2	58.32
2343	67	222	7.0 K2	2 38 2.771	516.18	7.04	67 51 6.11	1546.3	-24.3	2	59.31
2346	- 2	469	8.5 K0	2 38 8.786	304.15	.37	- 2 8 17.59	1545.7	-14.4	2	58.42
2350	24	381	8.1 A0	2 38 16.496	347.74	1.09	25 24 4.09	1545.0	-16.5	2	58.99
2351	40	568	8.1 G0	2 38 17.948	380.46	1.86	40 40 5.27	1544.9	-18.0	2	59.36
2355	44	560	7.7 K5	2 38 36.031	391.96	2.17	44 47 19.93	1543.2	-18.6	2	57.38
2357	21	366	8.2 K0	2 38 39.286	341.84	.97	22 1 53.44	1542.9	-16.2	2	57.78
2384	1	474	7.9 M0	2 40 43.542	309.61	.44	1 31 5.90	1531.3	-14.9	2	57.28
2385	23	362	7.6 K0	2 40 44.918	345.47	1.04	23 51 42.39	1531.1	-16.6	2	57.79
2393	54	602	8.8 A0	2 41 23.974	429.76	3.28	54 45 14.80	1527.5	-20.6	2	57.90
2394	44	569	7.7 F8	2 41 28.786	395.06	2.21	45 23 20.93	1527.0	-18.9	2	58.31

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
2399	8	416	8.5 G0	2 41 44.966	321.08	.61	9 1 9.92	1525.5	-15.5	2	58.77
2403	28	456	8.4 K2	2 42 11.321	354.78	1.22	28 38 46.98	1523.0	-17.1	2	58.32
2409	13	446	8.1 A0	2 42 41.346	328.59	.72	13 43 19.66	1520.1	-15.9	2	58.27
2411	33	503	7.8 K2	2 42 43.607	366.56	1.47	34 13 11.73	1519.9	-17.7	3	60.77
2413	16	342	7.3 K0	2 42 55.945	333.67	.81	16 48 40.30	1518.7	-16.2	2	57.94
2420	64	346	8.0 G5	2 43 28.408	490.43	5.56	64 28 36.12	1515.7	-23.7	3	58.81
2422	38	551	8.7 K0	2 43 38.247	377.94	1.72	38 54 13.51	1514.7	-18.4	2	58.90
2428	42	628	7.3 K0	2 44 7.198	389.68	2.02	43 11 36.92	1511.9	-19.0	2	58.43
2431	21	374	8.2 G5	2 44 16.102	343.50	.98	22 23 42.85	1511.1	-16.8	2	57.89
2442	17	438	7.7 K5	2 44 44.730	336.43	.85	18 18 8.16	1508.3	-16.5	2	57.90
2454	19	424	8.3 A3	2 45 30.137	339.12	.90	19 48 9.47	1504.0	-16.7	2	56.96
2465	32	507	8.6 K0	2 46 3.072	364.77	1.40	32 58 7.86	1500.8	-17.9	2	57.75
2468	20	467	8.9 G5	2 46 18.109	341.46	.93	21 3 8.20	1499.3	-16.8	2	59.30
2470	- 4	476	7.0 K5	2 46 32.186	300.44	.34	- 4 25 54.41	1497.9	-14.9	2	57.78
2496	44	591	7.6 K5	2 48 24.410	396.46	2.14	44 51 16.48	1487.1	-19.7	2	58.53
2499	51	640	7.7 G5	2 48 29.377	422.01	2.87	51 59 42.36	1486.6	-20.9	2	58.43
2511	6	436	8.0 G5	2 48 55.919	318.90	.57	7 20 41.21	1484.0	-15.9	2	59.31
2513	15	397	8.0 K5	2 49 5.292	333.60	.79	16 17 35.01	1483.1	-16.7	2	57.78
2517	75	109	7.9 G5	2 49 49.906	678.08	15.79	76 19 33.44	1478.7	-33.7	2	59.34
2523	28	473	8.4 A0	2 50 4.396	357.91	1.22	29 15 25.42	1477.3	-17.9	2	58.92
2534	14	484	7.7 M0	2 50 52.922	330.71	.74	14 28 1.28	1472.5	-16.7	2	58.00
2536	18	370	8.8 A5	2 50 57.725	337.55	.85	18 25 51.69	1472.0	-17.0	2	58.39
2549	10	388	8.1 A3	2 51 38.028	325.19	.65	11 6 24.54	1468.0	-16.4	2	57.78
2554	46	656	6.9 K0	2 52 10.518	405.48	2.32	47 6 9.46	1464.8	-20.5	2	58.32
2557	37	660	8.4 G5	2 52 15.423	378.09	1.63	37 47 50.82	1464.3	-19.1	2	57.90
2562	- 3	459	8.2 K0	2 52 26.814	301.73	.35	- 3 30 30.80	1463.2	-15.3	2	58.90
2567	22	405	8.9 K7	2 52 37.261	345.62	.98	22 43 56.68	1462.1	-17.5	2	58.34
2580	85	50	8.8 B9	2 53 4.742	1515.90	127.34	85 39 59.31	1459.3	-76.0	2	59.35
2585	72	153	7.9 G5	2 53 21.325	597.69	10.29	72 28 21.85	1457.7	-30.2	2	59.45
2586	5	420	7.2 K0	2 53 25.438	316.93	.54	5 58 24.19	1457.3	-16.2	2	59.44
2608	17	461	7.3 K0	2 55 6.139	336.68	.82	17 36 49.29	1447.2	-17.3	2	57.78
2627	26	496	8.4 K2	2 57 0.506	354.20	1.11	26 41 26.81	1435.6	-18.3	2	57.40
2635	- 0	471	8.4 K0	2 57 34.219	307.39	.42	0 2 15.83	1432.2	-16.0	2	58.35
2637	74	128	7.6 G5	2 57 42.910	649.55	12.93	74 42 48.89	1431.3	-33.4	2	58.30
2638	22	416	7.3 G5	2 57 42.931	346.32	.97	22 37 52.93	1431.3	-18.0	2	57.90
2642	12	422	8.4 K5	2 58 1.455	328.59	.69	12 47 15.80	1429.4	-17.1	4	59.40
2643	35	607	7.2 K2	2 58 7.315	375.21	1.52	35 55 15.40	1428.8	-19.5	2	58.43
2650	42	681	8.4 A2	2 58 19.007	393.28	1.92	42 30 17.03	1427.6	-20.4	2	58.84
2668	40	653	8.7 K0	2 59 34.398	389.49	1.81	41 3 46.86	1419.9	-20.3	2	57.94
2669	37	688	8.9 A2	2 59 34.802	380.31	1.61	37 44 13.96	1419.8	-19.9	2	57.87
2677	19	449	8.3 K0	3 0 18.211	342.02	.88	20 8 27.46	1415.3	-18.0	2	57.83
2682	10	405	7.8 K5	3 0 33.684	325.27	.64	10 43 44.76	1413.8	-17.1	2	58.89
2686	13	494	7.8 K0	3 0 47.423	331.45	.72	14 16 33.93	1412.3	-17.4	2	58.42
2688	50	691	8.7 G5	3 1 1.650	425.24	2.70	51 10 17.59	1410.9	-22.3	2	58.34
2692	45	700	8.8 G5	3 1 27.012	406.28	2.19	46 8 36.65	1408.2	-21.4	2	58.31
2694	- 4	520	8.0 K5	3 1 41.744	299.80	.34	- 4 31 15.27	1406.7	-15.9	2	58.43
2703	8	461	8.2 K0	3 1 59.654	322.14	.59	8 50 4.75	1404.8	-17.0	2	58.46
2711	25	484	8.6 A5	3 2 33.845	353.25	1.06	25 40 32.13	1401.3	-18.7	2	57.93
2712	27	477	8.5 A0	3 2 36.140	357.44	1.13	27 40 35.41	1401.1	-18.9	2	59.35
2715	22	431	7.7 K5	3 2 46.879	347.72	.97	22 54 3.86	1399.9	-18.4	2	57.94

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
2718	17	489	8.4 A2	3 2 57.915	338.40	.82	17 59 12.27	1398.8	-18.0	2	58.30
2720	58	556	7.6 K0	3 3 4.763	463.01	3.79	58 24 29.73	1398.1	-24.5	2	58.88
2726	11	434	7.2 K5	3 3 33.433	326.80	.65	11 28 22.25	1395.1	-17.4	2	58.46
2730	3	431	8.0 A2	3 3 45.625	313.40	.48	3 37 3.95	1393.8	-16.7	2	58.31
2731	53	616	8.4 A0	3 3 48.503	440.95	3.09	54 17 37.35	1393.5	-23.4	2	57.40
2743	4	496	8.6 K2	3 4 36.862	315.47	.51	4 49 41.19	1388.4	-16.9	2	57.85
2752	0	522	7.4 K0	3 5 4.965	309.37	.44	1 12 53.03	1385.5	-16.6	2	56.95
2754	12	441	8.2 K0	3 5 27.666	329.62	.68	12 58 44.69	1383.1	-17.7	2	58.42
2781	- 3	502	8.8 A5	3 6 56.616	301.51	.36	- 3 25 25.51	1373.6	-16.3	2	57.83
2800	6	492	8.3 K0	3 8 29.918	318.79	.54	6 40 44.33	1363.7	-17.3	2	57.93
2807	73	171	6.7 M0	3 8 48.766	650.53	11.83	74 3 24.00	1361.7	-35.1	2	57.85
2809	29	534	8.2 A2	3 8 55.428	363.15	1.19	29 38 39.21	1361.0	-19.7	2	57.81
2813	7	481	8.4 B9	3 9 1.289	321.00	.57	7 55 50.97	1360.4	-17.5	2	57.87
2823	30	505	7.8 K2	3 10 7.034	366.27	1.24	30 52 57.88	1353.3	-20.0	2	57.96
2825	24	451	8.8 A2	3 10 11.384	353.99	1.03	25 19 43.13	1352.8	-19.3	2	58.34
2840	63	404	8.8 B8	3 10 53.284	508.00	5.07	63 46 22.75	1348.3	-27.7	2	59.00
2842	32	585	8.5 G5	3 11 3.623	372.41	1.34	33 20 29.87	1347.2	-20.4	2	57.81
2850	8	480	8.2 G5	3 11 41.753	323.06	.59	9 0 59.34	1343.1	-17.8	2	58.30
2851	12	453	8.6 A0	3 11 42.058	330.02	.67	12 53 18.57	1343.0	-18.1	2	58.42
2859	- 2	581	7.4 M0	3 12 4.525	302.96	.37	- 2 31 5.10	1340.6	-16.7	2	59.33
2861	59	616	7.3 K0	3 12 10.307	478.96	4.03	59 55 54.35	1340.0	-26.2	2	57.96
2862	3	447	8.8 A0	3 12 18.269	314.48	.49	4 6 55.43	1339.1	-17.3	4	59.46
2863	15	453	8.0 G0	3 12 18.304	335.97	.75	16 4 16.16	1339.1	-18.5	2	58.45
2873	41	641	8.3 A5	3 12 49.967	396.01	1.79	41 40 35.32	1335.7	-21.8	2	57.94
2880	- 1	466	8.4 G5	3 12 58.589	306.17	.40	- 0 39 48.20	1334.8	-16.9	2	59.37
2883	61	546	8.8 K0	3 13 20.796	491.53	4.40	61 32 45.34	1332.3	-27.0	2	58.34
2893	2	510	8.8 K2	3 14 9.922	311.99	.46	2 39 58.66	1327.0	-17.3	2	58.30
2896	53	639	8.4 F8	3 14 13.663	443.74	2.92	53 42 42.66	1326.6	-24.5	2	57.41
2902	81	107	7.0 M0	3 14 50.765	1019.07	39.59	81 58 13.96	1322.5	-56.1	2	57.28
2917	42	738	8.4 K0	3 15 57.672	399.49	1.83	42 25 45.19	1315.2	-22.2	2	57.37
2922	67	256	7.2 K0	3 16 11.612	560.62	6.86	68 16 37.22	1313.6	-31.1	2	57.86
2923	47	802	8.2 A0	3 16 11.638	418.20	2.24	47 41 23.78	1313.6	-23.3	2	57.94
2924	36	676	7.9 K0	3 16 15.596	382.55	1.48	36 41 44.43	1313.2	-21.3	2	57.97
2932	45	740	7.5 K5	3 16 54.878	411.00	2.06	45 41 37.19	1308.9	-23.0	2	57.97
2933	57	715	7.8 K0	3 16 56.893	467.38	3.52	57 41 40.99	1308.6	-26.1	2	59.32
2934	19	507	8.4 A2	3 16 59.697	344.36	.85	20 5 48.84	1308.3	-19.3	4	59.62
2937	0	565	7.5 K0	3 17 10.101	309.13	.43	1 1 6.81	1307.2	-17.4	2	58.86
2939	24	471	7.7 K0	3 17 29.946	353.25	.98	24 21 49.04	1305.0	-19.8	2	58.31
2943	5	479	8.8 A0	3 17 36.177	318.06	.52	6 2 29.64	1304.3	-17.9	3	59.53
2945	26	542	8.0 G5	3 17 38.803	358.47	1.05	26 44 51.34	1304.0	-20.1	2	58.90
2946	82	82	7.3 K0	3 17 41.594	1178.08	55.78	83 21 7.44	1303.7	-65.5	2	58.41
2953	- 4	570	8.6 G5	3 18 7.858	299.27	.34	- 4 31 57.33	1300.8	-16.9	2	59.35
2956	7	500	8.2 B9	3 18 19.599	322.12	.56	8 16 19.05	1299.5	-18.1	4	58.99
2958	10	432	7.9 F8	3 18 34.929	326.11	.61	10 27 3.82	1297.8	-18.4	2	57.85
2980	48	904	8.0 K2	3 20 20.553	423.70	2.30	48 37 47.34	1286.0	-24.0	2	56.95
2989	16	436	8.2 F5	3 21 3.250	337.85	.75	16 32 41.31	1281.2	-19.2	2	57.87
2991	19	523	6.9 K5	3 21 8.520	344.18	.83	19 43 49.42	1280.6	-19.6	2	57.39
3000	14	559	8.3 A2	3 21 57.129	334.56	.70	14 47 52.66	1275.2	-19.1	2	58.36
3007	62	566	7.3 G5	3 22 18.457	510.08	4.68	63 1 15.17	1272.8	-29.0	3	59.26
3009	1	590	8.3 K5	3 22 20.380	310.57	.44	1 48 2.07	1272.6	-17.8	2	57.82

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
3011	65 345	7.4 K0	3 22 21.512	539.60	5.71	66 2 12.79	1272.4	-30.7	2	57.42
3012	55 785	7.4 K5	3 22 25.156	460.22	3.17	55 58 0.87	1272.0	-26.2	2	58.88
3014	6 527	8.8 F8	3 22 26.373	320.41	.54	7 13 6.26	1271.9	-18.3	2	58.90
3042	- 0 546	7.1 K0	3 24 15.502	307.06	.41	- 0 8 51.74	1259.6	-17.7	2	57.38
3047	23 456	8.1 G5	3 24 52.471	353.72	.94	24 0 36.82	1255.4	-20.4	2	56.95
3050	32 629	8.1 G0	3 25 2.898	374.08	1.25	32 38 20.10	1254.2	-21.5	2	58.77
3052	39 789	7.3 K0	3 25 12.259	394.82	1.62	39 59 55.82	1253.2	-22.8	2	58.99
3054	16 444	8.2 F2	3 25 19.227	339.21	.75	16 59 42.91	1252.3	-19.6	2	57.84
3069	15 493	8.2 F0	3 26 30.584	337.42	.72	16 1 38.07	1244.2	-19.5	2	57.84
3073	44 717	8.3 A0	3 27 9.163	411.08	1.92	44 39 45.49	1239.8	-23.8	2	57.40
3075	57 727	8.8 K7	3 27 21.041	477.59	3.52	58 19 26.44	1238.4	-27.6	2	58.30
3082	9 447	7.3 K0	3 27 42.949	326.42	.59	10 17 19.33	1235.9	-19.0	2	58.86
3091	7 514	8.4 K5	3 28 11.934	322.51	.55	8 11 55.39	1232.6	-18.8	2	57.88
3094	6 540	7.9 K0	3 28 21.131	320.32	.53	7 1 42.86	1231.5	-18.7	2	57.94
3108	18 494	8.1 A0	3 28 52.143	342.93	.78	18 37 52.01	1228.0	-20.0	2	58.76
3111	29 571	8.2 A0	3 29 5.394	367.94	1.13	29 50 14.16	1226.4	-21.5	2	58.88
3117	27 519	8.5 K5	3 29 35.354	364.08	1.06	28 11 51.20	1223.0	-21.3	2	58.43
3131	13 568	7.4 G5	3 30 34.459	333.05	.66	13 36 54.76	1216.1	-19.6	2	57.39
3136	62 581	8.1 K2	3 30 45.821	510.26	4.37	62 21 31.68	1214.8	-29.8	2	58.42
3137	14 575	8.0 M0	3 30 48.249	334.84	.68	14 30 39.85	1214.5	-19.7	2	57.27
3141	73 188	8.2 K5	3 30 57.501	666.26	10.50	73 29 46.81	1213.4	-38.9	2	57.85
3142	9 453	8.6 K2	3 31 1.411	325.16	.57	9 31 0.44	1213.0	-19.1	3	58.83
3161	2 563	8.2 K0	3 32 16.494	313.29	.45	3 11 40.89	1204.3	-18.5	2	58.40
3162	10 460	7.6 G0	3 32 19.366	327.86	.60	10 52 47.33	1203.9	-19.4	2	58.31
3167	46 774	7.4 G5	3 32 34.241	419.67	2.02	46 25 8.92	1202.2	-24.7	2	57.94
3171	52 703	6.9 K5	3 32 41.419	448.06	2.63	52 46 0.37	1201.4	-26.4	2	58.42
3172	79 106	8.6 K0	3 32 45.919	934.03	26.89	80 18 46.59	1200.9	-54.8	2	57.99
3173	65 352	8.9 K2	3 33 0.729	543.83	5.36	65 38 36.92	1199.1	-32.0	2	58.90
3181	8 537	7.7 K0	3 33 29.612	323.78	.55	8 43 18.54	1195.7	-19.2	2	58.87
3190	30 557	8.0 G5	3 34 0.859	371.76	1.15	30 57 40.82	1192.0	-22.0	2	58.30
3199	36 732	7.2 G5	3 34 41.153	389.24	1.41	37 16 3.64	1187.3	-23.1	2	58.46
3202	0 622	8.0 K0	3 35 3.639	309.13	.42	0 57 33.50	1184.7	-18.4	2	57.86
3206	60 720	8.1 K0	3 35 12.253	503.15	4.00	61 9 39.69	1183.7	-29.8	2	57.84
3232	15 516	8.3 A0	3 37 10.702	338.85	.70	16 11 56.83	1169.7	-20.3	2	57.39
3234	26 596	8.5 A3	3 37 12.610	361.97	.98	26 43 36.04	1169.5	-21.7	2	57.39
3249	77 131	8.5 K0	3 38 6.239	815.04	17.69	77 54 11.18	1163.1	-48.6	2	57.29
3252	34 712	7.8 K0	3 38 11.229	383.03	1.28	34 49 14.57	1162.5	-23.0	2	58.76
3257	18 521	8.3 A0	3 38 33.465	345.34	.77	19 13 44.39	1159.9	-20.8	2	57.83
3259	38 788	8.1 K0	3 38 42.832	394.56	1.46	38 39 53.68	1158.8	-23.7	2	58.46
3275	20 616	8.0 F8	3 39 46.107	349.58	.81	21 7 23.49	1151.2	-21.1	2	57.88
3280	11 510	8.2 F5	3 40 6.882	330.20	.60	11 48 8.16	1148.8	-20.0	2	57.39
3285	44 782	7.4 K5	3 40 37.287	415.95	1.82	44 43 38.84	1145.1	-25.1	2	57.38
3300	48 987	8.0 K2	3 41 32.674	430.89	2.09	48 19 52.14	1138.5	-26.1	2	57.87
3301	- 2 707	8.5 K0	3 41 35.043	303.24	.37	- 2 7 42.22	1138.2	-18.4	2	58.31
3307	1 656	8.2 K2	3 42 4.607	310.75	.42	1 46 56.32	1134.7	-18.9	2	58.88
3309	31 644	7.9 K2	3 42 18.480	376.55	1.16	32 7 53.79	1133.0	-22.8	2	58.88
3310	6 581	8.4 A2	3 42 22.640	319.85	.50	6 28 49.73	1132.5	-19.5	2	57.86
3318	2 603	7.8 K2	3 42 57.767	313.28	.44	3 5 3.59	1128.3	-19.1	2	57.89
3323	36 749	8.5 K0	3 43 12.204	390.58	1.35	36 59 35.04	1126.5	-23.8	2	58.39
3326	10 479	7.7 G5	3 43 22.317	327.61	.56	10 23 37.80	1125.3	-20.0	2	58.99

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
3327	46	795	7.4 K2	3 43 27.345	423.72	1.93	46 27 48.90	1124.7	-25.8	2	59.03
3332	49	1024	7.5 K0	3 43 57.380	440.31	2.24	50 12 36.62	1121.1	-26.8	2	58.88
3333	84	66	8.4 M0	3 44 3.180	1494.86	78.23	84 40 13.45	1120.4	-90.6	2	58.28
3335	4	588	8.6 A0	3 44 11.382	316.49	.47	4 43 35.29	1119.4	-19.4	2	59.34
3339	12	508	8.4 G5	3 44 38.704	331.64	.60	12 21 16.96	1116.1	-20.3	2	57.90
3343	66	290	7.2 G5	3 44 52.087	569.13	5.63	67 0 48.58	1114.5	-34.7	2	57.87
3346	55	827	8.4 A0	3 45 6.764	470.34	2.86	55 42 57.13	1112.7	-28.7	2	57.94
3349	26	617	7.9 K2	3 45 17.456	362.61	.94	26 26 10.78	1111.4	-22.2	2	58.89
3354	30	576	9.0 G0	3 45 28.804	372.87	1.07	30 30 14.78	1110.0	-22.9	2	58.91
3368	8	573	8.1 G5	3 46 48.620	323.65	.52	8 18 56.52	1100.3	-19.9	2	58.45
3378	15	537	8.1 F5	3 47 23.393	339.09	.66	15 50 58.38	1096.1	-20.9	2	57.94
3387	65	373	7.3 G0	3 48 4.617	551.94	4.94	65 22 57.17	1091.0	-34.0	4	59.14
3399	43	832	8.4 A2	3 48 39.449	413.95	1.67	43 31 23.32	1086.8	-25.6	2	57.42
3401	11	530	8.4 G0	3 48 41.183	331.03	.58	11 55 19.11	1086.6	-20.5	2	57.89
3403	75	151	8.2 M0	3 48 46.941	753.00	12.82	75 51 22.80	1085.9	-46.4	2	57.98
3405	47	904	8.4 M0	3 48 57.702	431.96	1.98	47 57 45.27	1084.5	-26.7	2	58.90
3409	2	618	8.4 A2	3 49 8.696	312.47	.42	2 37 6.48	1083.2	-19.4	2	59.35
3417	- 3	625	8.6 F5	3 49 36.212	300.31	.34	- 3 33 55.75	1079.8	-18.7	2	59.32
3425	22	588	8.6 K2	3 50 23.312	355.16	.82	22 58 33.57	1074.0	-22.1	2	59.02
3427	45	836	7.5 K0	3 50 29.557	421.62	1.77	45 21 53.71	1073.3	-26.2	2	57.96
3434	49	1057	8.4 K0	3 50 55.308	440.10	2.10	49 36 19.27	1070.1	-27.3	2	58.94
3435	14	624	8.1 G5	3 50 59.692	337.68	.64	15 2 15.49	1069.5	-21.0	2	58.40
3437	40	855	8.4 K0	3 51 11.688	406.22	1.51	41 10 31.55	1068.1	-25.3	2	59.47
3440	62	622	8.1 G0	3 51 32.206	529.38	4.15	62 59 39.64	1065.5	-32.9	4	59.40
3443	25	642	8.4 K0	3 51 39.650	361.42	.89	25 32 23.05	1064.6	-22.5	2	58.99
3445	16	528	8.5 B9	3 51 45.210	342.38	.68	17 11 51.32	1063.9	-21.4	2	58.30
3453	4	602	8.3 A0	3 52 3.141	316.85	.45	4 48 14.02	1061.7	-19.8	2	59.33
3462	10	502	8.5 G5	3 52 27.201	329.71	.56	11 9 31.87	1058.7	-20.6	2	58.92
3470	33	747	8.1 G0	3 53 26.414	384.09	1.16	34 0 38.98	1051.4	-24.1	2	57.29
3477	19	625	8.6 A2	3 53 58.191	348.65	.73	19 56 22.89	1047.5	-21.9	2	57.39
3478	2	628	7.2 K0	3 54 0.884	313.12	.42	2 54 50.02	1047.1	-19.7	2	58.30
3495	51	817	7.3 K2	3 55 5.611	450.24	2.22	51 21 24.02	1039.1	-28.3	2	57.96
3496	15	557	7.9 G5	3 55 9.533	338.99	.63	15 29 7.52	1038.6	-21.4	4	59.10
3508	8	605	8.7 K5	3 56 3.814	325.23	.51	8 53 3.23	1031.8	-20.5	4	59.16
3517	66	301	8.5 A2	3 56 20.249	576.16	5.27	66 54 22.11	1029.7	-36.2	2	58.28
3520	45	858	8.6 A0	3 56 23.085	424.23	1.73	45 33 25.43	1029.4	-26.7	2	57.42
3533	63	470	8.1 K0	3 57 6.470	545.12	4.35	64 13 4.31	1024.0	-34.4	4	59.14
3541	9	525	8.2 A0	3 57 48.530	327.67	.52	10 1 38.61	1018.7	-20.8	2	58.30
3542	13	627	7.5 K0	3 57 49.024	335.49	.59	13 45 8.23	1018.7	-21.3	2	57.85
3543	47	927	6.9 K0	3 57 49.539	432.08	1.84	47 18 39.19	1018.5	-27.3	2	57.96
3548	38	832	8.0 K2	3 58 14.941	399.05	1.32	38 31 34.59	1015.4	-25.3	2	57.53
3565	6	617	8.4 G5	3 59 23.658	320.26	.46	6 23 8.29	1006.7	-20.4	2	57.42
3576	18	574	8.8 G5	4 0 16.914	346.14	.68	18 31 52.83	1000.0	-22.1	2	57.84
3577	14	643	8.1 F8	4 0 17.840	336.94	.60	14 20 46.96	999.9	-21.5	2	58.31
3578	8	625	6.9 K0	4 0 27.818	325.14	.50	8 44 43.37	998.6	-20.8	2	58.89
3583	2	641	7.4 K2	4 0 44.308	313.51	.42	3 3 2.67	996.6	-20.0	2	57.96
3605	- 3	676	8.1 F0	4 2 1.874	300.26	.33	- 3 28 30.95	986.7	-19.3	2	57.96
3606	39	921	7.5 K0	4 2 5.554	405.51	1.36	40 9 59.99	986.2	-25.9	2	57.85
3612	31	700	7.3 K5	4 2 24.009	378.28	1.01	31 21 44.27	983.8	-24.3	2	57.88
3613	22	629	8.5 K0	4 2 25.338	356.82	.77	23 2 1.56	983.7	-22.9	2	57.99

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
3618	76	149	8.6 G5	4 2 52.785	806.64	13.56	76 51 43.98	980.2	-51.5	2	58.28
3629	- 0	642	8.4 G5	4 3 35.400	307.01	.37	- 0 9 18.72	974.8	-19.8	2	58.42
3631	21	591	8.0 K2	4 3 36.822	354.08	.74	21 49 21.67	974.6	-22.8	2	58.86
3646	7	597	8.4 K0	4 4 12.378	323.88	.48	8 3 30.28	970.1	-20.9	2	58.43
3661	3	563	8.4 F5	4 5 15.415	315.86	.42	4 9 54.54	962.1	-20.4	2	57.97
3668	25	678	7.6 K0	4 5 36.812	363.90	.82	25 44 45.66	959.3	-23.5	2	57.85
3672	9	543	6.8 M0	4 5 57.977	327.97	.50	9 58 6.23	956.6	-21.2	2	57.99
3691	55	852	7.5 K5	4 7 13.524	480.49	2.53	55 46 52.47	946.9	-31.1	2	56.94
3705	13	651	8.6 K0	4 8 10.469	337.08	.57	14 8 55.15	939.6	-21.9	2	57.82
3708	21	603	8.7 G5	4 8 24.151	354.88	.72	21 55 57.19	937.8	-23.1	2	58.34
3710	1	713	7.8 M0	4 8 33.316	311.85	.39	2 11 23.10	936.7	-20.3	2	58.43
3715	36	844	8.0 K0	4 8 57.513	395.41	1.16	36 41 7.10	933.5	-25.7	2	58.86
3721	69	243	7.7 K0	4 9 8.021	621.69	5.91	69 22 48.32	932.2	-40.3	2	58.32
3728	47	953	8.8 K2	4 9 25.034	437.77	1.75	47 46 49.74	930.0	-28.5	2	59.02
3729	17	694	8.2 K2	4 9 45.369	345.14	.63	17 42 26.93	927.3	-22.5	2	59.34
3732	33	811	8.4 G5	4 9 47.437	386.08	1.03	33 36 55.42	927.1	-25.2	2	58.99
3737	10	548	7.8 F2	4 10 1.467	330.46	.51	11 2 40.79	925.2	-21.6	2	58.90
3742	28	632	8.3 M0	4 10 17.607	373.06	.89	28 59 47.71	923.2	-24.3	2	57.95
3743	39	956	7.3 K5	4 10 20.856	405.29	1.26	39 33 14.66	922.8	-26.4	2	59.34
3746	44	881	8.0 A5	4 10 40.129	424.48	1.52	44 37 26.00	920.3	-27.7	2	58.44
3758	14	672	8.3 K0	4 11 30.428	337.91	.56	14 25 24.38	913.8	-22.1	2	58.34
3766	7	620	8.1 G0	4 12 21.682	322.57	.45	7 17 24.10	907.1	-21.2	2	57.89
3772	8	656	8.7 A0	4 12 36.222	324.73	.46	8 18 18.68	905.2	-21.3	2	57.81
3784	61	690	7.8 M0	4 13 16.078	534.00	3.45	62 13 26.66	900.0	-35.0	2	57.51
3788	25	690	7.8 K5	4 13 38.191	366.21	.80	26 14 6.09	897.1	-24.1	2	57.86
3796	74	197	8.0 K5	4 14 7.590	739.85	9.44	74 32 29.37	893.3	-48.5	2	58.30
3806	52	806	8.0 K2	4 14 41.046	465.40	2.09	52 51 10.61	888.9	-30.6	2	57.83
3807	2	673	7.6 G5	4 14 41.076	312.36	.38	2 24 28.04	888.9	-20.6	2	57.99
3809	19	692	7.5 K0	4 14 43.150	349.59	.64	19 26 21.44	888.7	-23.0	2	58.34
3812	21	617	8.4 F5	4 14 52.895	356.30	.70	22 13 57.45	887.4	-23.5	2	57.99
3814	17	702	8.6 F8	4 15 1.054	344.60	.60	17 16 40.82	886.3	-22.7	2	58.86
3827	5	622	8.3 F2	4 15 54.759	319.09	.42	5 35 48.97	879.3	-21.1	2	57.39
3832	30	651	7.8 K5	4 16 20.859	378.87	.90	30 45 48.50	875.9	-25.0	2	58.32
3844	12	577	7.7 K0	4 16 59.663	335.04	.52	12 57 59.37	870.8	-22.2	2	57.53
3848	63	494	8.8 K0	4 17 5.136	551.04	3.69	63 42 52.77	870.1	-36.4	2	58.00
3857	68	319	8.9 G5	4 17 44.846	611.40	5.12	68 22 35.33	864.9	-40.4	2	58.34
3860	27	656	8.0 K2	4 18 10.259	369.41	.80	27 13 56.42	861.4	-24.5	2	57.99
3864	0	734	7.8 K2	4 18 29.741	309.60	.36	1 4 35.22	858.9	-20.6	2	58.86
3866	- 4	806	7.6 G5	4 18 31.812	299.23	.30	- 3 50 12.88	858.7	-19.9	2	57.99
3881	32	778	7.1 K5	4 19 21.664	383.93	.93	32 21 5.00	852.1	-25.5	2	56.96
3885	- 0	690	7.9 K0	4 19 54.921	305.92	.33	- 0 40 5.06	847.7	-20.4	2	57.41
3889	- 2	883	8.4 A2	4 20 11.195	302.33	.32	- 2 21 36.62	845.5	-20.2	2	59.02
3900	7	637	8.4 G5	4 20 54.898	324.26	.43	7 56 36.30	839.8	-21.6	2	58.44
3912	44	942	7.5 K2	4 21 36.254	425.68	1.38	44 15 4.17	834.3	-28.4	2	56.96
3920	25	710	7.9 F5	4 22 7.578	365.69	.74	25 38 8.94	830.2	-24.4	2	57.85
3922	46	882	7.7 K5	4 22 13.849	437.52	1.53	46 56 43.82	829.3	-29.2	2	58.34
3925	29	712	8.3 K0	4 22 29.993	375.94	.83	29 24 48.88	827.2	-25.1	2	56.98
3929	5	649	7.4 K0	4 22 57.106	319.13	.40	5 31 56.45	823.6	-21.4	4	58.15
3933	51	924	7.0 K5	4 23 8.742	462.69	1.87	51 53 25.21	822.0	-30.9	2	58.87
3938	0	754	8.8 K2	4 23 28.288	308.54	.34	0 34 5.72	819.4	-20.7	2	57.99

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900.0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
3940	55 882	8.5 K5	4 23 37.175	488.63	2.27	56 4 5.64	818.2	-32.7	2	58.88
3943	47 993	8.7 B5	4 23 53.372	443.75	1.59	48 11 10.77	816.1	-29.7	2	58.43
3944	- 0 702	7.4 K2	4 23 54.001	306.00	.33	- 0 37 22.23	816.0	-20.5	2	57.99
3963	23 698	8.8 M0	4 25 19.003	361.83	.68	24 0 29.00	804.7	-24.3	2	57.95
3965	11 616	7.7 K0	4 25 37.408	332.36	.47	11 33 21.90	802.2	-22.4	2	57.27
3978	75 182	8.0 K0	4 26 20.606	796.30	10.12	75 55 22.20	796.4	-53.4	2	57.83
3991	35 875	8.2 K2	4 27 9.245	396.55	.98	36 0 5.05	789.9	-26.7	2	58.34
3993	15 635	8.1 M0	4 27 13.603	342.69	.53	16 3 48.35	789.3	-23.1	2	58.32
3994	- 4 851	8.1 K0	4 27 14.825	297.22	.29	- 4 42 19.11	789.2	-20.1	2	58.43
3997	41 884	8.0 G5	4 27 29.079	417.46	1.21	41 52 7.59	787.3	-28.1	2	59.01
3999	8 702	8.8 K5	4 27 39.545	326.41	.42	8 49 26.67	785.9	-22.1	2	59.02
4007	82 118	8.3 M0	4 28 29.421	1228.00	30.48	82 23 2.34	779.2	-82.6	2	57.85
4008	2 726	8.8 K0	4 28 32.126	313.37	.35	2 48 28.76	778.8	-21.2	2	58.43
4022	52 843	7.6 K5	4 29 21.756	469.19	1.84	52 42 1.09	772.1	-31.7	2	57.39
4023	59 811	8.0 F0	4 29 21.871	515.60	2.57	59 22 24.82	772.1	-34.8	2	57.95
4034	12 606	8.6 F8	4 30 8.491	334.66	.47	12 28 46.86	765.9	-22.7	4	57.97
4040	34 891	8.5 A0	4 30 48.085	392.92	.91	34 41 47.72	760.5	-26.7	2	58.34
4047	- 4 865	8.0 K0	4 31 5.590	298.50	.29	- 4 5 0.56	758.2	-20.3	2	58.39
4049	1 768	8.7 K0	4 31 11.683	311.01	.34	1 42 23.29	757.3	-21.1	2	58.43
4054	20 776	8.7 G0	4 31 37.805	354.86	.59	21 0 11.25	753.8	-24.1	4	59.94
4055	7 667	8.2 A2	4 31 39.698	324.91	.40	8 5 2.37	753.6	-22.1	2	59.33
4065	76 165	8.1 K0	4 32 1.730	838.64	10.89	76 52 26.47	750.5	-56.8	2	57.83
4066	37 941	7.8 K2	4 32 3.170	402.04	.99	37 23 48.24	750.4	-27.3	2	56.97
4068	44 991	7.3 K5	4 32 8.446	431.73	1.31	45 6 45.70	749.7	-29.3	2	59.01
4072	- 0 724	8.4 K5	4 32 18.919	306.44	.31	- 0 24 38.18	748.3	-20.9	2	58.42
4073	32 815	8.2 F8	4 32 21.982	386.24	.84	32 28 40.68	747.8	-26.3	2	58.42
4076	21 668	8.1 K0	4 32 37.895	357.23	.60	21 55 8.66	745.7	-24.3	2	57.40
4090	25 720	7.5 K2	4 34 20.786	367.00	.66	25 37 40.20	731.8	-25.1	2	59.32
4091	58 761	8.0 B5	4 34 20.913	510.82	2.34	58 33 46.90	731.7	-34.8	2	58.30
4093	10 598	7.8 A0	4 34 22.574	330.93	.43	10 44 30.95	731.5	-22.6	2	57.86
4096	45 969	7.0 K0	4 34 26.978	436.77	1.33	46 8 4.31	730.9	-29.8	2	56.97
4101	66 336	8.8 A0	4 34 47.709	597.36	3.90	66 46 11.65	728.1	-40.7	4	59.89
4102	56 954	8.0 G5	4 34 49.404	495.70	2.10	56 32 22.51	727.9	-33.8	2	58.42
4105	42 1015	8.1 K0	4 34 53.196	422.90	1.17	42 52 11.65	727.3	-28.9	2	57.53
4112	8 728	7.7 K0	4 35 32.200	326.17	.40	8 35 44.89	722.0	-22.3	2	58.47
4114	18 666	8.4 A0	4 35 36.162	349.36	.53	18 38 7.01	721.5	-23.9	2	59.01
4118	52 866	7.7 G5	4 36 0.987	471.21	1.73	52 43 20.16	718.1	-32.2	2	57.93
4121	6 730	8.4 M0	4 36 5.014	322.03	.38	6 43 20.07	717.6	-22.1	2	58.29
4123	11 636	8.7 A0	4 36 9.065	333.62	.44	11 53 57.92	717.0	-22.9	2	58.44
4126	50 1028	8.2 K0	4 36 23.464	461.53	1.60	51 0 37.62	715.1	-31.6	2	57.83
4132	39 1042	7.4 K2	4 36 39.245	410.97	1.02	39 41 29.81	712.9	-28.1	2	57.53
4139	17 762	7.8 K0	4 36 58.791	346.46	.51	17 23 32.90	710.3	-23.8	2	58.58
4141	64 470	8.7 A0	4 37 10.092	575.36	3.36	65 0 0.72	708.7	-39.4	2	58.42
4142	80 147	7.7 K0	4 37 11.194	1050.35	18.46	80 27 4.54	708.6	-71.8	2	57.99
4147	36 924	8.4 A3	4 37 23.814	400.71	.92	36 45 15.10	706.8	-27.5	2	57.90
4150	87 33	8.6 F2	4 37 41.965	4169.41	422.78	88 8 41.96	704.3	-284.6	2	57.97
4155	- 2 982	8.2 G5	4 38 25.553	302.85	.29	- 2 2 44.42	698.4	-20.8	2	58.30
4156	78 162	8.5 F8	4 38 26.596	909.51	12.48	78 15 3.90	698.3	-62.3	2	58.89
4162	26 735	8.9 G5	4 38 49.505	370.87	.66	26 53 9.78	695.1	-25.5	4	59.95
4178	25 725	8.8 K5	4 40 0.380	368.97	.63	26 8 58.93	685.4	-25.4	2	58.65

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
4180	17 774	8.1 K5	4 40 5.173	346.24	.49	17 13 3.41	684.8	-23.9	2	57.90
4191	61 727	8.4 K5	4 40 44.401	539.47	2.60	61 33 52.01	679.4	-37.1	2	58.86
4203	- 4 928	8.6 A3	4 41 21.109	297.66	.27	- 4 23 29.60	674.4	-20.6	2	58.95
4204	21 692	8.3 A2	4 41 24.033	357.06	.55	21 33 56.91	674.0	-24.7	2	56.95
4205	- 3 869	8.1 K0	4 41 36.308	300.16	.27	- 3 15 30.74	672.3	-20.8	2	59.33
4212	55 922	7.2 K0	4 42 14.303	491.10	1.85	55 33 54.13	667.1	-33.9	2	58.90
4226	70 320	7.7 G5	4 43 8.035	662.42	4.80	70 26 18.84	659.7	-45.7	2	59.91
4236	19 777	8.4 K2	4 43 39.835	351.81	.50	19 24 18.62	655.3	-24.4	2	58.92
4237	6 752	8.8 A0	4 43 41.322	321.50	.35	6 24 22.20	655.1	-22.3	2	59.00
4241	59 831	7.9 K2	4 44 8.260	521.08	2.21	59 24 36.83	651.4	-36.1	2	58.99
4244	72 238	8.5 K5	4 44 12.814	716.37	5.95	72 49 50.34	650.7	-49.5	2	58.00
4246	0 845	8.2 K0	4 44 19.224	308.49	.30	0 31 43.54	649.9	-21.4	2	58.30
4253	12 649	8.2 G0	4 44 51.534	336.60	.42	13 1 36.42	645.4	-23.4	2	58.38
4262	53 817	7.7 K5	4 45 29.115	480.26	1.64	53 47 21.87	640.2	-33.3	2	57.53
4266	- 0 774	8.2 K5	4 45 42.513	306.27	.29	- 0 28 41.52	638.4	-21.3	2	58.43
4269	56 975	8.6 K7	4 45 45.766	498.60	1.86	56 29 11.04	637.9	-34.6	2	58.90
4274	- 2 1021	8.8 F0	4 45 51.843	303.01	.27	- 1 57 12.25	637.1	-21.1	2	58.95
4277	7 725	7.2 K5	4 45 58.621	324.58	.36	7 45 11.25	636.1	-22.6	2	58.31
4281	28 698	7.6 K0	4 46 7.748	375.47	.64	28 15 53.02	634.9	-26.1	2	59.92
4284	11 655	8.2 A3	4 46 22.084	333.73	.40	11 45 55.85	632.9	-23.2	2	59.90
4288	3 684	8.3 K0	4 46 38.519	314.38	.31	3 11 0.20	630.6	-21.9	2	58.34
4291	50 1070	7.4 M0	4 46 48.685	460.26	1.38	50 19 26.37	629.2	-32.0	2	58.98
4293	13 720	7.4 K2	4 47 5.813	338.04	.42	13 36 14.17	626.9	-23.5	2	57.40
4325	4 768	8.2 K0	4 49 32.331	317.59	.32	4 36 34.24	606.5	-22.2	2	56.98
4329	60 843	8.6 A0	4 49 46.750	532.56	2.20	60 30 24.22	604.5	-37.1	2	57.99
4333	8 789	8.7 K0	4 49 58.884	325.88	.35	8 16 57.27	602.8	-22.8	2	58.87
4340	36 958	7.3 G5	4 50 34.767	402.31	.79	36 40 34.57	597.9	-28.1	2	57.90
4341	18 747	7.6 K5	4 50 39.698	351.23	.47	18 59 30.25	597.1	-24.6	2	58.39
4343	45 999	7.7 G0	4 50 54.192	437.62	1.08	45 36 2.40	595.2	-30.6	2	58.90
4353	43 1124	7.0 K5	4 51 40.610	427.85	.99	43 20 15.72	588.7	-29.9	2	57.53
4361	41 1003	8.5 G5	4 52 1.667	422.56	.94	42 2 36.17	585.8	-29.6	2	56.96
4367	71 280	8.5 K2	4 52 26.792	685.19	4.63	71 18 21.70	582.2	-47.9	2	57.99
4374	- 0 802	8.4 B9	4 52 48.976	306.36	.27	- 0 25 54.30	579.2	-21.5	2	57.51
4375	47 1076	8.5 B9	4 52 59.442	445.80	1.13	47 15 42.81	577.7	-31.2	2	58.43
4377	13 737	7.8 B9	4 53 2.930	338.17	.39	13 33 8.24	577.2	-23.7	2	58.87
4378	7 756	8.8 F5	4 53 11.969	323.78	.33	7 19 32.67	576.0	-22.7	2	58.42
4384	33 926	8.0 G5	4 53 34.793	393.37	.70	33 53 58.71	572.8	-27.6	2	58.48
4385	- 4 978	8.0 K2	4 53 34.792	298.41	.24	- 3 58 54.31	572.8	-21.0	2	58.57
4387	37 996	9.1 F8	4 53 35.336	406.61	.79	37 47 18.52	572.7	-28.5	2	58.34
4394	5 773	8.6 A3	4 54 11.824	320.69	.31	5 57 10.97	567.6	-22.5	2	57.93
4403	34 930	8.8 A2	4 55 0.308	397.35	.71	35 3 34.96	560.8	-27.9	2	57.41
4407	- 4 987	7.7 G5	4 55 19.867	296.71	.24	- 4 43 50.42	558.1	-20.9	2	58.31
4409	18 765	8.9 F2	4 55 25.612	351.31	.44	18 55 3.94	557.3	-24.7	2	57.95
4415	57 849	8.7 A0	4 56 0.129	511.60	1.75	57 50 21.96	552.4	-36.0	2	57.99
4426	61 746	8.7 A0	4 56 46.311	549.96	2.19	62 4 54.22	545.9	-38.7	2	58.34
4438	65 449	7.7 K2	4 57 34.297	589.67	2.70	65 29 48.23	539.2	-41.5	3	56.99
4455	82 132	8.1 G8	4 58 21.367	1278.76	21.96	82 26 47.68	532.6	-90.0	2	57.99
4457	15 719	7.8 K2	4 58 28.913	343.47	.39	15 40 19.87	531.6	-24.2	2	58.87
4462	53 842	8.3 K5	4 58 45.357	482.69	1.37	53 41 15.97	529.2	-34.0	3	58.81
4473	77 179	8.8 F5	4 59 18.404	910.78	9.14	77 56 13.28	524.6	-64.2	2	59.08

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
4475	86 65	8.5 G0	4 59 19.657	2618.52	112.07	86 48 22.13	524.4	-184.3	2	57.95
4482	73 269	7.9 K0	5 0 11.251	758.24	5.45	74 1 27.07	517.2	-53.5	4	59.63
4485	47 1089	7.2 K0	5 0 18.416	448.70	1.03	47 35 43.82	516.1	-31.7	2	59.00
4488	59 847	8.1 K0	5 0 31.306	532.01	1.85	60 6 39.74	514.3	-37.6	2	58.45
4498	6 819	7.5 K0	5 1 4.368	322.21	.30	6 34 17.36	509.7	-22.8	2	57.40
4507	83 129	8.6 G8	5 1 40.767	1438.26	27.49	83 28 37.73	504.5	-101.6	2	57.97
4515	55 956	7.7 F8	5 2 24.154	494.14	1.40	55 17 12.16	498.4	-35.0	2	58.55
4529	51 1027	7.9 K5	5 3 6.406	470.98	1.17	51 38 25.14	492.4	-33.4	2	57.64
4530	58 807	7.6 G5	5 3 8.592	518.92	1.63	58 31 37.03	492.1	-36.8	2	57.99
4531	35 976	7.7 G0	5 3 9.741	399.71	.65	35 29 46.46	492.0	-28.3	2	58.99
4533	5 805	8.6 K5	5 3 19.741	320.00	.28	5 35 11.66	490.6	-22.7	2	58.87
4534	3 767	7.6 K0	5 3 27.202	315.76	.27	3 43 19.72	489.5	-22.4	2	59.02
4537	- 1 800	7.8 G5	5 3 37.927	304.36	.24	- 1 18 36.33	488.0	-21.6	2	59.30
4541	26 787	8.2	5 3 58.377	373.19	.49	26 55 49.73	485.1	-26.5	2	58.45
4546	0 945	8.1 G5	5 4 14.209	308.71	.25	0 36 43.52	482.9	-21.9	2	59.08
4548	32 892	7.8 K0	5 4 21.553	390.59	.58	32 41 57.91	481.8	-27.7	2	59.07
4561	15 749	7.2 K2	5 5 13.574	344.04	.36	15 47 28.62	474.5	-24.5	2	57.95
4577	18 783	7.8 G5	5 6 15.710	351.81	.38	18 53 45.01	465.7	-25.0	2	57.39
4585	14 840	8.0 M0	5 6 39.392	340.45	.34	14 17 36.70	462.3	-24.2	2	57.99
4586	65 459	8.4 A0	5 6 42.565	598.75	2.41	65 57 19.34	461.9	-42.6	2	57.97
4593	52 930	8.4 A0	5 7 0.730	478.10	1.15	52 42 22.58	459.3	-34.0	2	58.87
4605	39 1198	8.2 G5	5 7 35.199	413.54	.69	39 13 15.42	454.4	-29.5	2	57.93
4626	24 782	8.2 F0	5 9 8.490	365.96	.42	24 13 11.63	441.1	-26.1	2	57.97
4633	33 973	8.7 G5	5 9 26.409	395.37	.56	34 1 50.85	438.6	-28.2	2	57.82
4648	61 771	8.9 G5	5 10 4.116	545.48	1.68	61 17 10.15	433.2	-38.9	2	57.85
4653	3 812	8.1 G0	5 10 47.229	315.61	.25	3 37 44.99	427.1	-22.6	2	57.99
4662	41 1124	7.9 K0	5 11 18.050	421.99	.69	41 16 43.05	422.7	-30.2	2	57.94
4686	8 904	8.2 K2	5 12 55.500	327.50	.27	8 46 6.29	408.8	-23.5	4	58.44
4702	12 758	7.9 K0	5 14 3.949	336.01	.29	12 21 20.82	399.0	-24.1	2	57.40
4705	45 1084	7.1 K5	5 14 6.803	443.28	.77	46 4 29.96	398.6	-31.7	2	57.50
4711	- 2 1201	8.6 A2	5 14 40.152	302.72	.21	- 2 0 57.15	393.8	-21.7	2	57.99
4713	57 873	8.5 F5	5 14 42.022	517.47	1.29	58 3 29.17	393.6	-37.1	2	58.44
4716	47 1124	8.3 A2	5 14 47.558	449.20	.80	47 16 37.11	392.8	-32.2	2	58.87
4729	39 1251	7.6 K5	5 15 45.493	415.53	.59	39 31 36.08	384.5	-29.8	2	58.39
4730	0 1003	8.0 A5	5 15 48.040	308.56	.22	0 32 27.27	384.1	-22.2	2	59.41
4733	14 873	8.3 A3	5 16 16.923	341.11	.30	14 26 29.51	380.0	-24.5	2	58.47
4742	15 787	8.1 A0	5 16 46.745	344.31	.30	15 44 7.32	375.7	-24.7	2	58.32
4746	- 4 1102	8.6 A0	5 17 2.324	297.25	.19	- 4 23 29.32	373.5	-21.4	2	57.97
4749	- 1 860	8.3 A0	5 17 6.328	304.67	.21	- 1 9 31.49	372.9	-21.9	4	59.23
4758	34 1004	7.8 K2	5 17 31.457	396.64	.49	34 13 5.49	369.3	-28.5	2	57.98
4759	67 380	8.4 K0	5 17 37.371	624.61	2.18	67 30 45.27	368.5	-44.8	2	58.43
4772	4 905	8.6 B8	5 18 24.371	317.51	.23	4 25 45.65	361.7	-22.8	4	59.88
4775	73 285	6.6 M0	5 18 40.730	755.73	3.69	73 39 39.61	359.4	-54.3	2	58.99
4780	22 884	9.3 K0	5 18 56.999	362.88	.35	22 54 21.67	357.1	-26.1	2	59.02
4783	3 864	7.8 K5	5 19 27.691	315.43	.22	3 31 27.10	352.7	-22.7	2	57.90
4798	52 955	7.6 K2	5 20 28.837	476.94	.86	52 11 6.21	343.9	-34.3	2	58.08
4800	6 915	8.2 G5	5 20 30.204	323.51	.23	7 0 36.82	343.7	-23.3	2	57.31
4801	1 992	7.5 K2	5 20 30.908	310.18	.21	1 14 35.98	343.6	-22.4	2	58.54
4804	18 839	7.4 K2	5 20 34.767	351.52	.30	18 33 17.05	343.0	-25.3	2	59.11
4807	- 1 879	8.2 A0	5 20 55.553	304.92	.20	- 1 2 53.08	340.1	-22.0	2	58.96

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
4808	55 991	9.0 K7	5 21 7.999	498.00	.98	55 22 1.38	338.3	-35.8	2	57.95
4817	45 1115	8.5 A0	5 21 38.162	439.93	.64	45 11 4.25	333.9	-31.7	2	57.99
4822	9 823	8.1 K2	5 22 15.544	330.42	.24	9 56 13.77	328.6	-23.8	2	57.52
4826	80 168	7.6 K0	5 22 23.457	1141.22	9.94	81 1 1.73	327.4	-82.1	2	58.43
4827	46 1015	8.2 K0	5 22 30.454	447.60	.66	46 46 34.31	326.4	-32.3	2	58.34
4831	21 839	8.7 K0	5 22 53.800	359.92	.32	21 44 34.46	323.1	-25.9	2	59.02
4834	9 830	8.2 K5	5 22 57.611	328.65	.24	9 11 8.51	322.5	-23.7	2	57.98
4838	5 916	7.5 K0	5 23 9.973	320.99	.22	5 54 48.05	320.7	-23.2	2	58.87
4840	65 474	8.5 K2	5 23 34.738	598.92	1.65	65 39 18.81	317.2	-43.2	2	59.01
4842	24 831	8.4 A5	5 23 39.228	368.77	.34	24 58 10.30	316.5	-26.6	2	58.65
4851	48 1274	6.9 K0	5 24 10.382	455.68	.67	48 20 25.38	312.0	-32.9	2	57.99
4852	1 1015	8.6 B9	5 24 12.007	312.00	.20	2 1 35.32	311.8	-22.5	2	57.90
4873	20 961	7.4 K0	5 25 59.606	356.48	.29	20 24 9.68	296.3	-25.8	2	57.49
4875	35 1133	8.3 G5	5 26 1.511	402.81	.43	35 50 52.25	296.0	-29.1	2	57.64
4877	21 857	8.2 F8	5 26 16.081	358.80	.29	21 16 37.85	293.9	-25.9	2	57.53
4881	1 1028	8.2 K0	5 26 31.328	309.90	.19	1 6 55.86	291.7	-22.4	2	58.30
4883	13 908	7.9 F5	5 26 37.808	338.80	.24	13 23 19.42	290.8	-24.5	2	58.99
4886	40 1310	7.4 K0	5 26 51.127	420.14	.48	40 28 13.75	288.9	-30.4	2	58.17
4889	23 922	8.3 G5	5 27 0.355	365.43	.30	23 43 14.70	287.5	-26.4	2	57.98
4895	53 917	8.3 A0	5 27 9.219	484.84	.76	53 18 49.07	286.3	-35.0	2	58.39
4905	50 1184	7.5 K0	5 27 57.331	470.67	.68	50 59 30.74	279.3	-34.0	2	59.00
4922	52 967	8.3 K0	5 28 55.910	477.35	.69	52 5 35.82	270.9	-34.5	2	58.00
4933	56 1034	8.8 K5	5 29 53.841	510.08	.83	56 50 30.30	262.5	-36.9	2	58.47
4942	17 950	8.9 K2	5 30 24.381	348.96	.24	17 26 30.61	258.1	-25.3	2	57.51
4956	14 948	8.3 K0	5 31 10.102	341.50	.23	14 27 25.38	251.5	-24.7	2	59.00
4958	2 1003	8.2 A2	5 31 26.642	314.33	.18	3 1 28.50	249.1	-22.8	2	57.95
4962	47 1174	7.3 K2	5 31 50.503	454.85	.54	48 2 47.66	245.6	-33.0	2	58.60
4969	6 962	8.1 K0	5 32 4.380	322.49	.19	6 31 17.43	243.7	-23.4	4	58.95
4983	18 887	7.6 K5	5 32 48.256	352.31	.24	18 43 37.15	237.3	-25.5	2	58.14
4993	56 1041	7.1 K0	5 33 12.994	507.50	.73	56 27 29.30	233.7	-36.8	2	57.51
5005	15 866	7.6 K0	5 33 56.951	344.36	.22	15 35 18.54	227.3	-25.0	2	57.64
5013	7 951	8.2 A2	5 34 38.943	325.14	.19	7 38 23.87	221.2	-23.6	4	59.26
5019	39 1367	8.7 K5	5 35 8.976	418.44	.37	39 54 44.79	216.9	-30.4	2	57.99
5027	51 1096	8.2 A2	5 35 33.688	473.21	.54	51 18 30.90	213.3	-34.3	2	57.99
5035	23 982	7.8 K5	5 36 12.410	364.56	.24	23 17 46.45	207.7	-26.5	2	58.07
5040	43 1325	6.8 K5	5 36 26.539	432.57	.39	43 17 54.48	205.7	-31.4	2	58.15
5042	11 898	7.8 M0	5 36 40.201	334.31	.19	11 28 35.24	203.7	-24.3	2	56.98
5044	72 283	8.1 F5	5 36 54.179	723.32	1.81	72 16 38.96	201.6	-52.5	2	57.08
5045	14 978	8.3 K5	5 36 56.575	342.38	.20	14 46 23.11	201.3	-24.9	2	57.99
5052	34 1135	7.9 K0	5 37 6.585	398.78	.30	34 31 25.79	199.8	-29.0	3	57.71
5093	46 1041	9.0 K5	5 39 29.027	447.07	.39	46 23 57.04	179.2	-32.5	2	56.97
5094	8 1044	7.8 K0	5 39 30.992	326.86	.17	8 21 1.67	178.9	-23.8	3	58.64
5096	18 920	7.3 K0	5 39 32.125	353.06	.20	18 57 53.11	178.7	-25.7	2	58.15
5103	- 0 1059	7.0 K0	5 39 59.186	307.24	.15	- 0 2 19.35	174.8	-22.3	2	57.99
5110	57 910	7.3 K2	5 40 33.412	514.09	.56	57 13 21.05	169.8	-37.4	3	59.44
5117	3 1018	7.8 F0	5 41 3.830	316.60	.15	3 58 58.33	165.4	-23.0	2	57.96
5125	38 1277	7.6 K0	5 41 30.147	413.18	.28	38 28 43.53	161.6	-30.0	2	57.64
5131	- 2 1358	8.5 F2	5 41 57.763	300.50	.14	- 2 55 55.20	157.6	-21.9	2	58.60
5145	83 149	8.0 K0	5 42 44.648	1494.58	8.63	83 35 48.00	150.8	-108.6	2	57.97
5157	50 1225	7.3 K0	5 43 26.197	466.55	.37	50 4 15.30	144.7	-33.9	2	56.97

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.		M + Sp.		R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
						1st Term	2nd Term		1st Term	2nd Term		
5172	61	826	7.9	K0	5 44 46.153	551.28	.55	61 20 34.38	133.1	-40.1	2	57.96
5175	2	1063	8.0	K5	5 44 56.435	314.06	.14	2 53 23.64	131.6	-22.9	2	58.59
5187	- 0	1086	8.2	K0	5 45 37.380	305.55	.13	- 0 45 53.15	125.6	-22.3	2	58.60
5200	75	237	8.3	K2	5 46 9.938	836.61	1.61	75 51 22.92	120.9	-60.9	2	59.10
5201	32	1098	8.6	K0	5 46 29.150	393.81	.21	32 57 30.33	118.2	-28.7	2	58.88
5208	- 4	1251	8.6	G5	5 47 10.768	296.90	.13	- 4 28 13.45	112.1	-21.6	2	58.99
5209	46	1054	8.6	A0	5 47 14.732	446.95	.27	46 18 12.27	111.5	-32.5	2	59.13
5214	66	410	8.0	K0	5 47 24.927	619.61	.64	66 52 0.20	110.0	-45.1	2	58.49
5218	31	1119	8.3	K5	5 47 46.546	389.43	.19	31 36 23.34	106.9	-28.4	3	58.79
5221	77	217	8.2	G5	5 47 53.588	930.49	1.86	77 54 51.56	105.8	-67.7	2	59.35
5225	81	194	7.9	G5	5 48 17.935	1185.12	3.30	81 21 21.36	102.3	-86.3	2	59.00
5226	56	1073	8.2	G5	5 48 18.683	505.64	.34	56 3 50.75	102.2	-36.8	2	58.67
5239	- 2	1391	8.6	K0	5 48 57.632	300.50	.12	- 2 55 44.47	96.5	-21.9	2	58.99
5247	52	1006	8.3	G5	5 49 43.394	482.11	.27	52 37 48.28	89.8	-35.1	2	59.11
5255	40	1446	8.0	A2	5 50 3.633	420.98	.19	40 24 37.96	86.9	-30.7	2	58.18
5258	36	1282	7.3	K0	5 50 14.173	404.75	.18	36 7 14.73	85.4	-29.5	2	57.64
5261	25	1020	7.8	G5	5 50 25.342	369.76	.15	25 3 50.03	83.7	-26.9	2	57.60
5263	42	1433	8.4	K2	5 50 30.480	429.95	.20	42 34 0.83	83.0	-31.3	2	58.09
5264	9	995	7.5	K2	5 50 33.081	329.79	.13	9 32 57.08	82.6	-24.0	2	58.14
5271	45	1194	8.4	A0	5 51 7.198	442.42	.20	45 20 9.17	77.6	-32.2	2	58.44
5279	- 1	1059	7.7	M0	5 51 50.028	304.80	.12	- 1 5 5.96	71.4	-22.2	3	59.14
5282	5	1043	8.0	G5	5 51 55.830	319.82	.12	5 20 43.89	70.6	-23.3	2	58.99
5283	64	555	7.9	K5	5 51 57.824	583.01	.36	64 9 20.87	70.3	-42.5	2	57.53
5284	17	1051	7.2	K5	5 52 3.807	349.16	.13	17 23 39.02	69.4	-25.4	2	58.17
5289	0	1211	8.2	K0	5 52 22.757	308.66	.12	0 34 11.37	66.6	-22.5	3	58.06
5296	35	1283	8.6	K0	5 52 40.370	401.41	.15	35 9 46.31	64.1	-29.3	2	57.97
5315	68	417	8.4	G5	5 54 11.851	640.33	.34	68 8 36.30	50.7	-46.7	2	57.14
5329	24	1045	7.8	G5	5 55 32.088	369.04	.11	24 47 40.53	39.1	-26.9	2	57.90
5335	7	1072	7.6	K0	5 55 44.601	325.76	.11	7 51 25.07	37.2	-23.7	2	58.12
5351	62	801	7.6	K0	5 56 27.137	561.97	.17	62 18 55.01	31.0	-41.0	2	58.61
5353	11	986	8.5	K0	5 56 32.839	335.14	.10	11 45 36.34	30.2	-24.4	2	58.42
5358	66	420	6.9	K5	5 57 5.982	620.56	.17	66 53 58.12	25.4	-45.2	2	57.97
5359	9	1040	8.2	A3	5 57 8.034	329.76	.10	9 31 55.38	25.1	-24.0	2	58.45
5361	0	1242	8.0	F5	5 57 17.709	307.45	.10	0 3 16.21	23.7	-22.4	3	59.07
5366	32	1155	8.7	M0	5 57 27.777	391.22	.10	32 7 25.79	22.2	-28.5	2	58.92
5375	82	155	8.3	K2	5 57 48.457	1317.11	.70	82 27 45.33	19.1	-96.0	2	57.14
5388	37	1389	8.9	G5	5 58 45.628	410.74	.09	37 44 17.66	10.8	-29.9	2	56.64
5403	17	1101	7.6	K0	6 0 2.056	349.89	.09	17 40 2.40	-.4	-25.5	2	56.63
5431	8	1173	8.0	K0	6 1 55.004	326.64	.08	8 13 31.47	-16.8	-23.8	2	58.12
5446	0	1270	7.2	K5	6 2 48.254	308.77	.09	0 37 5.23	-24.6	-22.5	2	56.65
5455	3	1123	8.4	K0	6 3 36.972	315.13	.08	3 20 29.89	-31.6	-23.0	2	57.64
5459	33	1244	8.3	K2	6 3 48.006	394.30	.04	33 3 45.54	-33.2	-28.7	2	58.09
5461	41	1356	8.4	M0	6 3 50.320	424.31	.02	41 12 26.46	-33.6	-30.9	2	58.17
5463	19	1212	8.3	G5	6 3 58.788	354.56	.06	19 28 8.78	-34.8	-25.8	2	58.42
5464	6	1116	7.8	A5	6 3 58.947	323.11	.08	6 44 13.25	-34.8	-23.5	2	58.49
5469	35	1341	8.8	K0	6 4 9.228	403.36	.03	35 42 32.39	-36.3	-29.4	2	56.98
5482	74	275	8.0	F8	6 4 50.654	790.27	-.50	74 32 16.85	-42.3	-57.6	2	58.44
5490	25	1128	8.2	K0	6 5 22.012	372.41	.04	25 58 30.15	-46.9	-27.1	2	56.66
5494	49	1459	7.1	K5	6 5 48.205	461.38	-.04	49 4 21.78	-50.8	-33.6	2	57.16
5498	27	1006	7.8	K0	6 6 18.525	375.98	.03	27 12 12.56	-55.2	-27.4	2	57.97

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
5510	8	1210	8.2 K5	6 7 4.758	327.89	.06	8 45 17.58	-61.9	-23.9	2	57.99
5516	62	819	8.7 K2	6 7 22.229	569.21	-.24	62 58 50.97	-64.4	-41.4	2	58.08
5525	43	1474	6.9 K2	6 7 54.205	435.44	-.05	43 48 41.85	-69.1	-31.7	2	56.65
5531	15	1097	7.5 G5	6 8 20.822	344.54	.04	15 34 26.71	-73.0	-25.1	2	56.97
5536	45	1259	8.3 K0	6 8 36.443	441.13	-.06	45 3 38.48	-75.3	-32.1	2	57.97
5544	55	1062	7.6 G5	6 9 16.456	502.30	-.17	55 35 55.89	-81.1	-36.6	4	58.95
5548	59	952	8.4 K7	6 9 35.731	531.71	-.24	59 14 55.05	-83.9	-38.7	2	58.57
5549	35	1362	8.0 G5	6 9 37.414	402.07	-.03	35 21 44.40	-84.1	-29.3	2	58.12
5550	- 3	1339	8.0 G5	6 9 57.719	298.87	.07	- 3 37 23.44	-87.1	-21.7	2	58.16
5552	33	1275	8.8 A0	6 10 2.058	394.60	-.02	33 10 30.45	-87.7	-28.7	2	57.56
5554	- 1	1147	8.4 A0	6 10 6.169	304.25	.07	- 1 19 11.92	-88.3	-22.2	2	57.16
5564	50	1285	8.5 F8	6 10 36.490	470.93	-.15	50 47 30.10	-92.8	-34.3	2	56.62
5579	87	41	8.1 K5	6 12 0.064	3166.00	-33.40	87 19 39.00	-104.9	-230.4	2	58.98
5581	52	1049	7.3 K2	6 12 5.226	479.36	-.19	52 12 10.65	-105.7	-34.9	2	57.90
5586	25	1180	7.7 K5	6 12 19.418	370.54	-.01	25 21 1.91	-107.7	-26.9	2	58.95
5587	64	575	7.4 K0	6 12 22.973	591.51	-.49	64 51 1.21	-108.2	-43.0	2	58.54
5602	- 2	1530	8.6 K5	6 13 16.111	301.81	.06	- 2 22 3.91	-116.0	-21.9	2	59.35
5610	26	1156	8.4 K0	6 13 44.223	373.86	-.02	26 30 43.25	-120.1	-27.2	2	58.11
5615	39	1575	7.3 K0	6 14 6.652	418.75	-.10	39 52 40.31	-123.3	-30.4	2	58.09
5619	5	1164	8.4 K5	6 14 16.079	321.23	.04	5 57 0.76	-124.7	-23.3	2	58.90
5625	48	1369	8.6 K0	6 14 51.576	455.27	-.19	47 58 22.60	-129.9	-33.1	2	57.96
5627	13	1187	8.4 B9	6 15 5.819	338.23	.02	13 3 4.93	-131.9	-24.6	2	58.61
5637	21	1190	7.8 K2	6 15 40.488	359.04	-.02	21 12 5.98	-137.0	-26.1	2	58.12
5646	46	1129	7.9 G5	6 16 25.231	448.60	-.20	46 40 8.66	-143.5	-32.6	2	58.17
5650	- 3	1386	8.4 G0	6 16 38.286	299.37	.05	- 3 25 0.58	-145.4	-21.7	2	57.97
5651	42	1533	7.4 G5	6 16 40.481	430.83	-.16	42 49 20.82	-145.7	-31.3	2	58.16
5657	75	253	8.2 G5	6 17 5.082	829.35	-1.98	75 40 53.04	-149.3	-60.2	2	58.90
5661	25	1223	7.8 K5	6 17 29.646	371.25	-.05	25 37 54.61	-152.9	-27.0	2	57.56
5663	45	1288	8.4 M0	6 17 39.315	441.16	-.20	45 7 51.17	-154.2	-32.0	2	57.60
5680	19	1313	7.4 G5	6 18 37.831	355.58	-.03	19 54 59.59	-162.7	-25.8	2	58.49
5682	6	1208	8.4 G5	6 18 45.034	322.49	.02	6 29 40.34	-163.8	-23.4	2	58.45
5686	50	1296	8.8 K5	6 19 14.597	468.48	-.31	50 26 12.15	-168.1	-34.0	2	58.17
5692	- 1	1212	8.7 A3	6 19 29.926	302.67	.05	- 2 0 15.05	-170.3	-21.9	4	58.97
5696	53	1013	7.9 M0	6 19 52.549	485.62	-.37	53 15 16.99	-173.6	-35.2	2	56.65
5699	34	1331	8.2 K0	6 20 14.911	398.09	-.13	34 17 30.23	-176.8	-28.9	2	58.14
5705	40	1583	7.2 K5	6 20 22.718	422.35	-.19	40 50 7.78	-178.0	-30.6	2	58.17
5713	41	1431	8.5 M0	6 20 54.771	426.48	-.21	41 50 37.64	-182.6	-30.9	2	58.44
5714	18	1203	8.0 F0	6 20 55.580	351.81	-.03	18 29 3.41	-182.8	-25.5	2	58.09
5721	62	840	7.0 K5	6 21 22.860	565.29	-.74	62 43 7.12	-186.7	-41.0	2	59.00
5722	- 4	1490	7.3 K0	6 21 25.365	296.39	.05	- 4 42 4.21	-187.1	-21.5	2	58.92
5723	78	225	8.1 K2	6 21 28.753	950.64	-3.61	78 18 58.74	-187.6	-68.9	3	59.14
5725	13	1229	7.2 G5	6 21 38.949	338.14	-.01	13 2 35.28	-189.0	-24.5	2	59.63
5726	77	239	8.3 F8	6 21 43.823	884.76	-3.01	77 1 39.08	-189.8	-64.1	2	58.45
5733	55	1077	7.7 G5	6 21 58.912	502.54	-.49	55 43 58.67	-191.9	-36.4	2	58.17
5736	58	925	7.7 G5	6 22 14.881	523.91	-.58	58 26 52.67	-194.3	-38.0	2	58.61
5758	0	1418	7.5 G5	6 24 9.146	308.45	.02	0 29 6.84	-210.8	-22.3	2	57.99
5765	6	1246	8.2 K5	6 24 33.732	322.56	.00	6 32 31.10	-214.4	-23.3	2	57.16
5797	- 2	1624	8.2 K0	6 26 20.515	301.59	.03	- 2 28 32.86	-229.9	-21.8	2	57.08
5804	7	1306	8.0 G5	6 26 39.957	324.88	-.01	7 31 57.52	-232.7	-23.5	2	57.16
5808	61	890	7.5 G5	6 26 55.987	550.56	-.86	61 23 7.91	-235.0	-39.8	2	58.46

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900.0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession 1st Term	 2nd Term	Decl. 1950	Precession 1st Term	 2nd Term	No. Obs.	Epoch 1900+
5810	43 1548	7.5 K0	6 27 7.607	435.08	-.32	43 54 58.12	-236.7	-31.4	4	59.08
5819	25 1302	8.7 K0	6 27 34.226	371.80	-.12	25 55 10.76	-240.5	-26.8	2	58.44
5823	32 1316	7.4 M0	6 27 43.279	392.94	-.19	32 50 28.48	-241.8	-28.4	2	59.02
5826	37 1525	8.9 K2	6 28 11.786	408.98	-.24	37 28 24.03	-246.0	-29.5	2	57.99
5844	16 1183	8.2 G5	6 29 38.533	346.76	-.07	16 34 18.98	-258.5	-25.0	2	57.42
5847	29 1263	8.2 K0	6 29 52.449	382.11	-.17	29 26 40.80	-260.5	-27.6	2	57.61
5856	- 1 1271	8.3 F2	6 30 33.056	303.49	.01	- 1 39 40.32	-266.4	-21.9	4	59.01
5867	7 1343	8.2 K0	6 31 4.270	324.24	-.03	7 16 44.88	-270.9	-23.4	2	58.44
5879	54 1050	8.3 A0	6 31 42.068	493.76	-.68	54 37 48.72	-276.4	-35.6	2	58.60
5887	25 1326	7.9 K2	6 31 56.887	368.92	-.14	24 57 41.77	-278.5	-26.6	2	58.09
5889	72 324	8.4 F5	6 32 3.155	737.25	-2.66	72 53 36.80	-279.4	-53.2	2	58.63
5896	0 1489	8.2 A0	6 32 24.039	308.58	.00	0 32 41.35	-282.4	-22.2	2	56.97
5902	17 1306	7.4 K0	6 32 58.983	349.62	-.10	17 44 3.80	-287.5	-25.2	2	57.60
5906	67 440	8.6 A2	6 33 22.067	620.76	-1.63	67 7 50.39	-290.8	-44.7	2	57.49
5909	60 985	8.1 G5	6 33 37.543	537.56	-1.00	60 8 21.36	-293.0	-38.7	2	57.99
5929	23 1428	8.8 K2	6 34 37.522	364.94	-.15	23 33 46.17	-301.7	-26.2	2	58.09
5938	39 1689	7.9 K5	6 35 6.760	414.89	-.34	39 9 51.69	-305.9	-29.8	2	57.99
5946	75 262	8.5 K0	6 35 41.856	826.92	-4.11	75 44 44.89	-311.0	-59.5	2	57.61
5954	36 1471	8.6 G5	6 35 57.529	405.70	-.31	36 42 4.50	-313.2	-29.1	2	58.12
5956	68 447	8.0 K0	6 36 6.450	645.69	-2.00	68 41 39.63	-314.5	-46.4	2	57.51
5971	35 1464	8.2 F0	6 37 17.379	401.74	-.31	35 36 22.26	-324.7	-28.8	2	57.15
5978	- 4 1610	7.6 K5	6 37 47.140	297.15	.01	- 4 24 50.84	-329.0	-21.3	4	58.31
5981	80 217	7.3 K0	6 38 4.010	1077.75	-8.86	80 17 36.54	-331.4	-77.4	2	56.65
5987	20 1531	8.5 A0	6 38 21.492	355.32	-.14	20 0 53.60	-333.9	-25.5	2	57.90
6037	22 1453	8.5 K2	6 41 23.608	362.13	-.18	22 37 51.34	-360.0	-25.9	2	57.16
6046	24 1386	7.6 K2	6 42 19.593	367.81	-.21	24 43 32.09	-368.1	-26.3	2	57.51
6047	37 1578	7.9 K5	6 42 21.755	409.32	-.40	37 49 53.41	-368.4	-29.2	2	58.09
6059	29 1342	8.1 K5	6 43 22.139	382.77	-.28	29 53 40.59	-377.0	-27.3	2	58.43
6062	36 1501	8.5 K2	6 43 32.135	404.15	-.39	36 25 25.57	-378.4	-28.8	2	57.10
6075	55 1125	8.6 A0	6 44 28.680	496.73	-1.00	55 18 29.79	-386.5	-35.4	2	57.53
6080	5 1406	8.0 G5	6 44 40.645	320.02	-.06	5 31 46.42	-388.2	-22.8	2	57.51
6082	67 452	7.3 K5	6 44 46.909	624.87	-2.25	67 34 13.68	-389.1	-44.6	2	59.47
6083	41 1513	7.2 K2	6 44 50.401	422.71	-.50	41 21 31.15	-389.6	-30.1	2	58.63
6085	22 1475	8.8 K0	6 44 57.019	360.82	-.20	22 12 12.59	-390.6	-25.7	2	59.07
6090	66 467	8.1 G0	6 45 25.621	606.28	-2.07	66 20 14.85	-394.7	-43.2	2	58.94
6097	- 1 1387	7.6 K5	6 45 50.311	303.30	-.02	- 1 45 40.75	-398.2	-21.6	4	59.01
6102	- 3 1600	8.6 F5	6 45 59.548	299.45	-.01	- 3 26 28.27	-399.5	-21.3	2	58.12
6113	32 1416	8.4 G0	6 46 33.727	389.65	-.34	32 10 16.67	-404.4	-27.7	2	57.61
6115	74 303	7.5 G5	6 46 39.010	769.67	-4.41	74 11 49.19	-405.2	-54.9	2	58.65
6118	3 1414	7.2 K0	6 46 51.525	315.90	-.06	3 44 59.46	-406.9	-22.5	2	58.63
6120	39 1756	7.9 G5	6 46 53.373	416.27	-.49	39 47 2.24	-407.2	-29.6	2	59.01
6124	17 1409	7.7 K0	6 47 11.859	348.94	-.17	17 38 55.07	-409.8	-24.8	2	58.44
6126	12 1310	6.9 M0	6 47 14.454	335.41	-.12	12 7 0.41	-410.2	-23.8	3	58.85
6133	20 1589	8.2 K2	6 47 52.757	355.03	-.20	20 2 59.92	-415.7	-25.2	2	58.63
6147	49 1556	7.5 K2	6 49 15.606	460.69	-.82	49 35 45.82	-427.5	-32.7	2	58.57
6153	1 1565	8.0 K5	6 49 47.404	309.77	-.05	1 4 18.47	-432.0	-22.0	2	57.59
6159	38 1637	8.0 K5	6 50 17.336	410.60	-.50	38 22 30.56	-436.3	-29.1	2	57.99
6174	10 1315	7.8 K5	6 51 20.345	331.68	-.12	10 35 17.81	-445.2	-23.5	2	58.13
6176	- 4 1714	8.3 K5	6 51 27.306	297.47	-.02	- 4 19 44.10	-446.2	-21.1	2	57.62
6179	17 1441	8.0 K2	6 51 45.042	349.01	-.20	17 44 54.54	-448.8	-24.7	2	58.43

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
6186	- 1 1447	8.4 K0	6 52 16.622	304.56	-.04	- 1 13 5.33	-453.2	-21.5	2	57.11
6187	14 1486	8.1 K5	6 52 20.217	340.48	-.16	14 17 34.95	-453.7	-24.1	2	57.59
6195	- 2 1829	7.8 K0	6 52 37.752	301.84	-.04	- 2 24 59.05	-456.2	-21.3	2	58.65
6196	36 1528	8.5 A5	6 52 46.405	404.62	-.49	36 47 30.61	-457.5	-28.6	2	58.90
6198	7 1520	8.4 K0	6 52 51.020	324.46	-.11	7 30 8.81	-458.1	-22.9	4	59.58
6204	85 98	8.1 M2	6 53 6.846	2014.40	-54.93	85 38 37.21	-460.3	-142.8	2	58.65
6214	47 1373	8.0 A2	6 53 34.372	448.41	-.80	47 20 39.31	-464.3	-31.7	2	57.62
6226	41 1557	7.3 K0	6 54 13.346	419.83	-.60	40 53 48.13	-469.8	-29.6	2	57.11
6229	57 1021	8.1 G5	6 54 35.074	512.69	-1.40	57 41 43.40	-472.9	-36.2	4	59.01
6247	17 1461	8.5 M0	6 55 44.302	348.31	-.21	17 32 12.41	-482.7	-24.5	2	57.60
6255	16 1346	7.8 K2	6 56 12.955	344.76	-.20	16 6 35.96	-486.7	-24.3	2	57.18
6268	1 1622	7.6 K0	6 56 56.952	309.56	-.07	0 59 12.14	-492.9	-21.8	2	57.10
6288	29 1430	7.7 G5	6 58 2.725	379.88	-.39	29 17 18.87	-502.2	-26.7	2	58.60
6292	50 1381	7.9 K5	6 58 18.736	460.94	-.99	49 54 33.34	-504.5	-32.4	2	57.17
6293	61 928	8.0 F2	6 58 19.664	544.31	-1.87	61 22 50.25	-504.6	-38.3	2	58.00
6295	73 360	7.6 G5	6 58 22.338	743.91	-5.04	73 30 6.25	-505.0	-52.4	2	57.64
6312	43 1639	8.9 M0	6 59 30.096	429.85	-.75	43 29 38.66	-514.5	-30.2	2	57.60
6331	- 4 1793	8.3 K0	7 0 57.812	297.88	-.04	- 4 11 30.19	-526.9	-20.8	2	57.62
6333	16 1372	8.2 K0	7 1 0.347	344.92	-.22	16 15 26.09	-527.2	-24.1	2	56.61
6346	63 686	8.1 K0	7 1 41.165	559.26	-2.18	62 55 15.66	-533.0	-39.2	2	56.63
6350	64 616	8.1 F5	7 1 46.390	577.31	-2.43	64 29 49.29	-533.7	-40.4	2	57.99
6388	- 4 1820	8.7 K0	7 4 3.413	296.42	-.05	- 4 51 23.01	-553.0	-20.7	2	57.60
6400	68 464	8.1 K5	7 4 54.869	635.83	-3.50	68 40 3.62	-560.1	-44.4	2	57.18
6403	- 3 1750	8.4 M0	7 5 16.959	299.95	-.06	- 3 17 28.95	-563.2	-20.9	2	58.14
6407	82 194	7.3 K5	7 5 24.771	1284.50	-23.87	82 31 29.81	-564.3	-89.7	2	58.00
6420	30 1431	7.5 K0	7 6 8.008	381.97	-.47	30 13 44.88	-570.4	-26.6	2	57.96
6423	47 1404	8.5 M0	7 6 24.727	444.46	-.98	46 57 44.66	-572.7	-30.9	2	57.08
6425	2 1576	7.5 K0	7 6 31.526	312.55	-.10	2 20 4.68	-573.6	-21.7	3	59.13
6427	54 1111	8.4 K0	7 6 40.631	486.48	-1.42	54 27 18.75	-574.9	-33.8	2	58.61
6428	13 1570	8.5 K2	7 6 42.418	338.61	-.22	13 44 6.92	-575.2	-23.5	2	58.10
6429	22 1596	7.8 K2	7 6 44.269	360.20	-.34	22 26 47.02	-575.4	-25.0	2	59.63
6431	59 1053	7.4 K0	7 6 54.955	521.54	-1.85	59 8 51.08	-576.9	-36.3	2	57.63
6436	50 1399	8.3 G5	7 7 13.492	459.68	-1.14	49 59 5.07	-579.5	-31.9	2	57.69
6437	45 1394	7.8 K0	7 7 13.730	436.72	-.92	45 19 47.72	-579.5	-30.3	2	57.65
6451	24 1549	7.7 M0	7 8 12.268	366.21	-.38	24 44 50.04	-587.7	-25.4	2	59.10
6459	- 0 1635	8.4 K0	7 8 57.787	305.22	-.08	- 0 56 50.61	-594.0	-21.1	2	58.09
6460	40 1807	8.1 K5	7 8 59.988	414.77	-.75	40 5 43.67	-594.3	-28.7	2	57.61
6469	10 1453	7.5 K0	7 9 44.541	330.45	-.19	10 16 59.37	-600.5	-22.9	2	57.05
6481	42 1678	8.4 K0	7 10 37.832	424.53	-.85	42 37 47.64	-608.0	-29.4	2	57.53
6489	4 1627	7.7 G5	7 11 24.372	317.71	-.14	4 39 53.35	-614.4	-21.9	2	57.59
6503	23 1648	8.9 K0	7 12 10.157	362.11	-.38	23 19 32.86	-620.8	-25.0	2	57.17
6504	78 243	8.4 K0	7 12 18.651	898.04	-10.66	77 51 51.41	-621.9	-62.1	2	57.61
6507	- 1 1613	8.7 K2	7 12 26.051	302.89	-.08	- 2 0 6.41	-623.0	-20.8	2	57.16
6510	22 1620	7.0 K5	7 12 34.347	358.77	-.36	22 3 18.74	-624.1	-24.7	2	57.19
6517	14 1615	7.9 K0	7 12 52.384	338.86	-.25	13 57 11.41	-626.6	-23.3	2	57.99
6523	37 1694	8.3 K5	7 13 26.808	404.07	-.71	37 20 15.88	-631.4	-27.8	2	57.59
6537	41 1628	7.3 K0	7 14 11.984	417.58	-.84	41 2 8.81	-637.6	-28.7	2	56.70
6549	- 4 1885	8.5 G5	7 14 37.302	297.83	-.07	- 4 17 25.85	-641.1	-20.4	2	57.16
6563	59 1070	8.2 M0	7 15 34.056	524.45	-2.16	59 47 22.01	-648.9	-36.0	2	57.17
6564	49 1615	8.4 A3	7 15 41.059	456.62	-1.26	49 44 48.28	-649.9	-31.3	2	57.99

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900.0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
6593	18 1577	7.8 K0	7 17 37.202	348.18	-.32	17 57 31.88	-665.9	-23.8	2	56.17
6594	23 1681	8.6 A2	7 17 44.909	362.70	-.42	23 43 30.61	-667.0	-24.8	2	56.72
6595	15 1544	8.8 K0	7 17 47.349	341.07	-.28	14 59 37.62	-667.3	-23.3	2	57.97
6619	30 1489	8.1 K0	7 18 59.766	381.04	-.57	30 22 33.15	-677.2	-26.0	2	57.17
6631	14 1649	8.1 F5	7 19 55.236	339.53	-.28	14 23 4.70	-684.8	-23.1	2	57.18
6644	28 1377	7.9 K2	7 20 49.816	373.70	-.53	27 53 34.31	-692.3	-25.4	2	56.64
6648	16 1466	7.4 K0	7 20 55.404	345.12	-.32	16 46 23.01	-693.1	-23.5	2	57.60
6655	33 1520	8.6 K2	7 21 13.563	389.14	-.65	33 8 16.22	-695.6	-26.4	2	57.61
6656	56 1208	7.6 K2	7 21 17.903	497.66	-1.92	56 38 35.68	-696.2	-33.9	2	58.18
6677	13 1663	7.6 K2	7 22 46.137	336.58	-.27	13 10 23.07	-708.2	-22.8	2	57.63
6679	5 1652	7.9 K5	7 22 47.805	318.15	-.17	4 57 2.62	-708.4	-21.5	2	57.99
6685	44 1627	7.6 K0	7 23 11.117	430.42	-1.09	44 34 47.32	-711.6	-29.2	2	56.61
6694	24 1659	8.7 A2	7 23 56.926	362.95	-.46	24 1 45.01	-717.9	-24.5	2	57.17
6700	- 4 1950	8.3 K0	7 24 19.441	296.17	-.08	- 5 6 55.77	-720.9	-20.0	2	57.60
6705	48 1535	7.7 G5	7 24 38.391	446.51	-1.30	48 9 46.47	-723.5	-30.2	2	57.19
6708	1 1811	7.0 K0	7 24 43.580	310.71	-.14	1 33 16.57	-724.2	-21.0	2	58.18
6735	6 1690	8.4 K2	7 26 51.436	322.05	-.20	6 45 56.63	-741.5	-21.6	2	58.13
6737	84 152	7.6 K5	7 26 51.972	1552.63	-50.86	84 18 27.71	-741.7	-105.0	2	56.71
6744	25 1689	8.7 K2	7 27 21.090	366.63	-.51	25 33 13.69	-745.6	-24.6	2	57.60
6749	51 1324	8.7 A3	7 27 33.800	463.94	-1.59	51 37 57.90	-747.3	-31.2	2	58.17
6760	62 935	8.2 G0	7 28 23.995	547.35	-2.97	62 42 57.21	-754.1	-36.8	2	57.53
6763	24 1683	7.5 K0	7 28 37.937	362.70	-.49	24 6 23.71	-756.0	-24.3	2	56.18
6764	58 1045	8.8 F2	7 28 38.567	510.32	-2.32	58 37 57.90	-756.0	-34.3	2	57.18
6772	46 1277	7.4 G5	7 29 1.232	438.29	-1.27	46 38 33.86	-759.1	-29.4	2	56.19
6784	22 1717	8.7 K7	7 30 3.185	358.87	-.47	22 39 52.34	-767.4	-24.0	2	56.68
6793	41 1680	7.6 K5	7 30 17.922	415.65	-1.02	41 16 57.29	-769.4	-27.8	2	56.61
6805	60 1063	8.7 G5	7 31 7.785	527.32	-2.70	60 45 6.68	-776.1	-35.3	2	56.66
6812	14 1699	7.9 M0	7 31 36.295	338.50	-.32	14 12 40.13	-779.9	-22.6	2	56.70
6815	- 1 1765	8.0 G5	7 31 47.253	304.73	-.13	- 1 12 29.50	-781.4	-20.3	4	57.90
6817	65 579	7.2 K0	7 31 48.154	573.70	-3.64	65 12 26.60	-781.6	-38.3	4	57.94
6822	79 243	8.1 K5	7 32 6.852	982.66	-17.59	79 40 49.06	-784.1	-65.7	2	57.17
6826	49 1645	8.2 G0	7 32 15.917	449.29	-1.47	49 6 30.85	-785.3	-30.0	2	58.17
6830	6 1720	7.8 M0	7 32 22.579	320.91	-.21	6 18 19.14	-786.1	-21.3	2	57.62
6845	16 1524	8.4 G5	7 33 39.498	342.92	-.36	16 11 17.25	-796.5	-22.8	4	58.37
6858	10 1579	7.9 G5	7 34 33.966	329.83	-.28	10 24 58.85	-803.7	-21.8	2	57.07
6863	5 1726	7.6 K2	7 34 41.283	319.15	-.21	5 31 5.96	-804.7	-21.2	2	57.18
6867	- 1 1779	7.4 K5	7 34 57.385	303.22	-.13	- 1 55 24.32	-806.9	-20.1	2	57.60
6870	33 1560	7.3 G5	7 35 7.038	387.64	-.77	33 18 3.90	-808.1	-25.7	2	58.17
6872	31 1634	8.6 G5	7 35 9.287	380.24	-.69	30 48 36.43	-808.5	-25.2	2	58.17
6880	44 1653	8.4 K2	7 35 33.665	425.43	-1.20	44 1 49.27	-811.7	-28.2	3	59.14
6887	36 1659	8.9 K0	7 35 52.320	395.96	-.86	35 58 36.16	-814.2	-26.2	2	57.64
6890	0 2029	7.1 M0	7 36 23.261	307.02	-.15	- 0 8 42.74	-818.3	-20.3	4	58.63
6891	- 4 2031	8.4 B9	7 36 24.585	297.34	-.10	- 4 40 44.10	-818.5	-19.6	3	57.18
6899	8 1841	8.0 K0	7 37 4.527	324.35	-.25	7 57 25.97	-823.8	-21.4	2	56.69
6900	83 191	7.8 K0	7 37 8.807	1327.10	-39.63	83 11 21.96	-824.4	-88.0	2	57.62
6903	11 1641	7.2 K0	7 37 16.565	331.45	-.30	11 12 19.53	-825.4	-21.8	2	58.15
6909	51 1342	8.4 K0	7 37 36.106	457.93	-1.69	51 3 46.45	-828.0	-30.2	4	58.92
6914	76 292	8.4 K0	7 38 7.855	802.03	-10.90	76 11 42.29	-832.2	-53.0	2	57.20
6924	0 2041	8.2 A0	7 38 23.401	308.91	-.16	0 44 39.02	-834.3	-20.3	2	58.20
6931	48 1563	7.6 K2	7 38 56.785	445.18	-1.53	48 38 29.24	-838.7	-29.3	2	57.61

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
6933	58 1057	8.1 K5	7 39 7.916	504.94	-2.53	58 27 15.91	-840.1	-33.2	2	58.54
6938	- 3 2019	8.5 K5	7 39 42.434	300.12	-.12	- 3 24 2.74	-844.7	-19.7	2	58.60
6941	- 2 2251	8.2 A0	7 40 7.656	301.90	-.13	- 2 33 53.55	-848.0	-19.8	2	57.18
6946	45 1476	7.4 K0	7 40 45.651	430.32	-1.35	45 29 20.55	-853.1	-28.2	2	57.10
6953	- 1 1816	8.0 K2	7 41 4.228	304.74	-.15	- 1 13 40.66	-855.5	-19.9	2	58.17
6961	27 1464	8.4 K0	7 41 29.870	370.45	-.64	27 36 6.45	-858.9	-24.2	2	57.71
6964	32 1615	8.3 F0	7 41 32.974	384.13	-.78	32 28 1.66	-859.3	-25.1	2	57.63
6967	41 1717	8.0 K0	7 41 36.459	413.42	-1.13	41 18 56.29	-859.8	-27.0	2	57.72
6978	44 1670	8.5 G5	7 42 13.916	425.40	-1.30	44 24 25.39	-864.7	-27.8	2	57.19
6980	43 1733	8.6 K0	7 42 15.618	420.90	-1.24	43 17 44.66	-864.9	-27.5	2	59.64
6982	26 1638	8.1 K0	7 42 29.009	366.38	-.61	26 6 39.18	-866.7	-23.9	2	58.09
6988	38 1815	8.2 K0	7 43 16.793	402.64	-1.01	38 23 42.12	-873.0	-26.2	2	56.69
6989	16 1551	7.8 K0	7 43 17.810	343.09	-.41	16 33 40.91	-873.1	-22.3	2	58.14
6992	47 1484	7.7 K0	7 43 42.003	438.29	-1.51	47 27 43.36	-876.3	-28.5	2	57.61
7008	1 1905	7.6 G5	7 44 35.117	309.51	-.18	1 2 34.22	-883.2	-20.1	2	58.17
7024	31 1668	8.5 F0	7 45 34.825	379.34	-.77	31 2 8.75	-891.0	-24.6	2	56.65
7032	- 0 1828	8.4 K0	7 46 3.854	306.04	-.16	- 0 37 7.64	-894.8	-19.8	2	56.69
7034	20 1913	7.7 K0	7 46 18.254	350.58	-.49	19 53 44.80	-896.7	-22.7	2	56.17
7049	55 1226	6.8 K5	7 47 21.470	476.72	-2.22	54 51 36.72	-904.9	-30.8	2	56.17
7057	73 387	8.1 G0	7 47 58.519	693.64	-7.98	72 52 14.08	-909.7	-44.8	2	56.20
7069	57 1110	7.2 K2	7 48 22.856	491.53	-2.52	57 8 47.85	-912.9	-31.7	2	56.70
7071	14 1769	8.4 K0	7 48 35.426	337.63	-.38	14 17 56.42	-914.5	-21.7	2	56.64
7077	33 1608	8.7 K0	7 49 24.120	383.90	-.85	32 49 43.03	-920.8	-24.7	2	56.70
7087	20 1933	8.1 K7	7 50 9.152	351.18	-.51	20 18 32.33	-926.7	-22.5	2	57.17
7090	15 1689	8.1 K0	7 50 25.724	340.68	-.42	15 43 46.71	-928.8	-21.8	2	58.20
7092	17 1696	7.3 K0	7 50 34.294	343.46	-.44	16 58 35.91	-929.9	-22.0	2	57.06
7094	50 1485	7.9 K0	7 51 2.410	447.82	-1.79	49 55 0.71	-933.5	-28.7	2	57.07
7097	5 1824	8.5 A0	7 51 11.689	318.79	-.25	5 32 21.53	-934.7	-20.4	2	56.63
7118	18 1778	7.4 K2	7 51 56.203	346.20	-.48	18 13 57.62	-940.3	-22.1	2	56.72
7124	27 1501	8.4 G5	7 52 4.787	367.98	-.70	27 12 43.96	-941.5	-23.4	2	56.71
7127	36 1712	8.7 G5	7 52 20.660	393.28	-.99	36 5 47.43	-943.6	-25.1	2	56.16
7128	9 1813	7.2 G5	7 52 27.605	327.01	-.31	9 28 57.09	-944.5	-20.8	2	56.72
7133	25 1794	7.7 K0	7 53 0.765	361.71	-.63	24 47 56.31	-948.8	-23.0	2	56.73
7139	64 661	8.7 G5	7 53 19.599	553.40	-4.09	64 27 13.79	-951.2	-35.3	2	56.19
7141	37 1804	8.0 K0	7 53 26.979	396.03	-1.04	37 1 50.73	-952.1	-25.2	2	56.63
7152	14 1790	8.3 A2	7 53 52.920	337.65	-.41	14 28 35.12	-955.4	-21.4	2	56.70
7155	7 1873	8.1 A2	7 54 3.306	322.77	-.29	7 29 31.12	-956.8	-20.5	2	56.72
7157	46 1335	8.6 G5	7 54 26.450	431.25	-1.57	46 34 23.14	-959.7	-27.4	2	57.60
7161	33 1623	8.3 K0	7 54 46.813	383.67	-.89	33 4 36.33	-962.3	-24.3	2	57.19
7170	75 321	8.0 G5	7 55 32.937	762.58	-11.40	75 35 16.74	-968.2	-48.5	2	57.18
7183	35 1722	7.5 M0	7 56 10.976	388.56	-.97	34 49 0.81	-973.1	-24.5	2	56.69
7185	74 340	8.7 G5	7 56 19.961	724.89	-9.92	74 22 35.58	-974.2	-46.0	2	57.61
7189	15 1722	8.2 K0	7 56 32.997	339.70	-.43	15 30 9.53	-975.9	-21.4	2	57.18
7205	40 1978	7.6 K0	7 57 33.166	405.18	-1.21	40 2 55.02	-983.5	-25.5	4	57.62
7211	76 302	8.4 G5	7 57 47.709	799.30	-13.33	76 41 37.50	-985.4	-50.5	2	57.06
7225	14 1808	8.0 G5	7 58 47.064	336.65	-.41	14 10 48.26	-992.9	-21.1	2	58.14
7230	27 1524	8.0 K0	7 59 8.308	365.85	-.71	26 46 41.31	-995.6	-22.9	2	56.70
7235	68 517	7.9 K0	7 59 16.926	591.58	-5.44	67 48 47.84	-996.7	-37.2	4	58.96
7241	6 1858	8.4 G5	7 59 41.947	320.99	-.29	6 43 50.65	-999.8	-20.1	4	59.16
7251	10 1710	7.8 K2	8 0 30.612	327.88	-.35	10 5 2.52	-1006.0	-20.5	2	57.70

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
7257	55	1243	7.8 G5	8 0 50.392	476.14	-2.53	55 37 37.17	-1008.5	-29.8	2	56.71
7267	34	1735	8.3 G5	8 1 15.011	384.56	-.96	33 48 19.88	-1011.6	-24.0	2	56.70
7271	62	976	8.5 K5	8 1 26.474	530.58	-3.82	62 41 14.13	-1013.0	-33.1	2	57.17
7279	12	1762	8.4 K0	8 2 7.916	332.47	-.39	12 19 17.74	-1018.2	-20.7	2	56.61
7282	31	1726	8.5 K0	8 2 27.473	377.68	-.88	31 27 33.37	-1020.7	-23.5	2	58.17
7284	18	1839	7.8 K5	8 2 29.840	344.16	-.50	17 45 54.69	-1021.0	-21.4	3	59.09
7285	5	1869	8.6 A0	8 2 39.213	318.52	-.27	5 33 44.40	-1022.2	-19.8	2	58.09
7287	13	1832	7.1 K0	8 2 45.625	335.22	-.42	13 38 51.76	-1023.0	-20.8	3	58.53
7293	19	1925	8.7 A5	8 3 10.985	346.60	-.53	18 53 25.29	-1026.2	-21.5	2	56.70
7296	81	263	8.4 G5	8 3 19.115	1048.40	-29.13	81 11 57.23	-1027.2	-65.4	3	57.88
7297	50	1508	8.6 F2	8 3 20.223	444.24	-1.95	50 2 16.02	-1027.3	-27.6	2	57.64
7311	40	1995	8.2 K2	8 4 17.684	403.31	-1.26	39 59 14.05	-1034.5	-25.0	2	57.17
7317	48	1612	7.8 K5	8 4 35.265	435.72	-1.82	48 18 34.79	-1036.7	-27.0	2	58.16
7324	69	455	8.5 G5	8 5 1.802	614.25	-6.50	69 35 13.71	-1040.0	-38.0	2	57.18
7354	59	1144	8.1 K0	8 6 35.704	499.21	-3.21	59 20 27.65	-1051.7	-30.7	2	57.20
7358	- 4	2235	7.4 M0	8 6 46.403	298.57	-.14	- 4 24 19.86	-1053.0	-18.3	4	58.48
7361	17	1776	8.1 K0	8 7 3.218	342.93	-.51	17 23 59.12	-1055.1	-21.0	2	56.72
7377	31	1753	8.0 K0	8 8 22.960	376.57	-.92	31 27 15.19	-1064.9	-23.0	2	58.16
7381	23	1905	8.5 A0	8 8 32.397	356.83	-.67	23 37 54.97	-1066.1	-21.8	2	57.61
7394	25	1872	8.6 F0	8 9 4.081	360.81	-.72	25 19 50.77	-1070.0	-22.0	2	57.08
7402	40	2010	8.3 K0	8 9 50.961	402.39	-1.32	40 8 17.83	-1075.8	-24.5	2	56.69
7403	11	1784	7.8 K5	8 9 53.570	329.94	-.39	11 20 31.12	-1076.1	-20.1	2	57.72
7406	74	350	7.9 K5	8 10 20.908	717.37	-11.03	74 38 49.50	-1079.5	-43.8	2	56.71
7410	17	1797	8.3 K2	8 10 47.243	341.27	-.51	16 47 55.77	-1082.7	-20.7	2	57.18
7412	38	1881	8.5 K0	8 10 53.185	394.86	-1.21	37 54 22.58	-1083.4	-24.0	2	58.20
7413	22	1886	8.5 F5	8 10 53.889	353.73	-.65	22 25 54.08	-1083.5	-21.5	2	57.64
7420	1	2035	8.4 K2	8 11 14.932	310.09	-.23	1 24 32.63	-1086.1	-18.8	3	58.50
7435	70	502	7.8 K0	8 12 25.416	620.47	-7.20	70 19 55.18	-1094.7	-37.6	2	56.71
7437	44	1728	9.0 G5	8 12 28.730	417.03	-1.60	44 25 52.53	-1095.1	-25.2	2	58.15
7441	0	2232	8.2 K5	8 12 51.706	307.45	-.21	0 3 58.84	-1097.9	-18.5	2	57.17
7442	30	1677	9.0 G5	8 12 53.352	371.34	-.88	29 47 53.99	-1098.1	-22.4	2	57.71
7455	9	1915	7.7 K2	8 13 32.299	326.12	-.37	9 33 40.22	-1102.8	-19.6	2	57.71
7477	- 1	2001	8.4 K0	8 14 46.962	304.06	-.18	- 1 40 58.82	-1111.9	-18.2	2	57.18
7490	6	1924	8.4 K5	8 15 43.379	319.23	-.31	6 7 41.82	-1118.8	-19.1	4	59.47
7493	67	534	6.8 M0	8 16 0.826	577.21	-5.88	67 41 6.68	-1120.9	-34.6	2	57.73
7495	45	1561	8.2 K2	8 16 4.994	420.52	-1.72	45 37 29.36	-1121.4	-25.2	2	58.72
7501	57	1131	7.8 G5	8 16 19.502	480.79	-3.04	57 27 45.56	-1123.1	-28.8	2	57.64
7506	31	1784	8.5 K2	8 16 27.572	373.47	-.94	30 52 26.98	-1124.1	-22.3	2	58.65
7508	51	1409	8.5 M0	8 16 39.867	446.21	-2.24	51 28 46.61	-1125.6	-26.7	2	58.72
7512	- 0	1962	8.2 K0	8 17 2.643	306.11	-.20	- 0 37 51.84	-1128.3	-18.2	3	58.79
7513	19	1979	8.6 M0	8 17 8.197	346.66	-.59	19 36 40.92	-1129.0	-20.6	2	57.11
7515	38	1897	8.2 K2	8 17 16.800	395.12	-1.28	38 30 15.84	-1130.0	-23.5	2	58.65
7519	59	1161	8.0 A0	8 17 36.996	492.66	-3.38	59 15 14.20	-1132.5	-29.4	4	59.68
7521	78	284	8.3 A0	8 17 45.008	830.24	-17.96	78 5 58.06	-1133.4	-49.7	2	57.71
7526	22	1914	8.1 G5	8 18 8.950	352.23	-.67	22 11 28.19	-1136.3	-20.9	2	57.70
7533	- 3	2314	8.5 K0	8 18 35.157	299.15	-.15	- 4 15 12.16	-1139.4	-17.7	2	57.74
7537	13	1899	8.2 K2	8 18 43.613	332.64	-.44	12 58 23.82	-1140.5	-19.7	2	58.22
7538	49	1729	7.5 K0	8 18 48.197	436.58	-2.07	49 38 20.78	-1141.0	-25.9	2	56.68
7541	14	1878	7.6 K0	8 19 0.805	335.68	-.48	14 28 44.63	-1142.5	-19.9	2	57.18
7550	11	1824	7.4 K0	8 19 39.430	328.27	-.40	10 49 20.97	-1147.2	-19.4	2	57.72

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P.M.).

T in centuries from 1900.0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
7556	62 996	7.8 B9	8 19 54.461	517.30	-4.14	62 27 42.48	-1148.9	-30.6	2	57.10
7558	47 1572	8.6 G5	8 20 6.901	424.48	-1.85	46 57 19.80	-1150.4	-25.1	2	58.16
7562	36 1808	8.3 K2	8 20 32.069	388.12	-1.20	36 28 35.31	-1153.4	-22.9	2	56.71
7567	7 1971	7.6 K5	8 20 49.860	320.68	-.33	6 58 30.25	-1155.5	-18.8	2	57.65
7568	31 1806	7.4 K0	8 20 59.067	374.10	-.99	31 27 47.94	-1156.7	-22.0	2	57.18
7575	56 1295	8.8 K5	8 21 32.532	468.45	-2.87	55 56 14.73	-1160.6	-27.6	2	56.68
7587	30 1706	8.7 K0	8 22 14.901	369.62	-.93	29 48 54.99	-1165.7	-21.7	2	57.18
7589	24 1921	8.6 K0	8 22 19.855	356.88	-.75	24 30 49.03	-1166.2	-20.9	2	58.21
7600	- 3 2341	7.2 K5	8 23 18.714	299.73	-.15	- 4 0 49.31	-1173.2	-17.5	2	56.72
7605	10 1798	7.8 K0	8 23 33.215	325.85	-.39	9 42 27.40	-1174.9	-19.0	2	56.68
7614	66 553	7.9 K0	8 24 27.353	554.16	-5.51	66 22 48.32	-1181.3	-32.4	2	56.72
7616	61 1052	8.7 A5	8 24 30.441	502.91	-3.88	61 6 35.84	-1181.7	-29.4	2	56.70
7617	27 1613	8.9 K0	8 24 30.329	362.35	-.84	27 0 42.39	-1181.7	-21.1	2	58.14
7636	17 1852	9.0 G5	8 25 35.914	340.25	-.56	17 1 8.69	-1189.4	-19.7	4	58.13
7644	71 459	7.9 F8	8 26 17.474	622.42	-8.26	71 11 35.45	-1194.2	-36.2	2	56.68
7649	76 326	8.1 G5	8 26 28.772	734.50	-13.72	75 54 27.22	-1195.5	-42.7	2	57.72
7667	19 2021	8.4 K2	8 27 38.988	344.35	-.61	19 6 42.09	-1203.7	-19.8	2	57.71
7673	38 1916	7.4 K5	8 27 48.689	392.14	-1.34	38 27 37.77	-1204.9	-22.6	2	58.16
7685	7 1988	8.4 K5	8 28 32.125	320.74	-.35	7 10 32.56	-1210.0	-18.4	2	57.71
7688	63 784	8.2 K5	8 28 46.088	516.43	-4.45	63 1 18.66	-1211.6	-29.7	2	57.64
7694	29 1772	7.2 G5	8 29 13.852	367.43	-.94	29 29 23.16	-1214.8	-21.0	2	58.18
7697	42 1886	7.9 G5	8 29 21.995	404.02	-1.58	42 18 37.45	-1215.7	-23.2	2	58.18
7698	13 1936	7.6 K0	8 29 25.529	331.79	-.47	12 58 22.68	-1216.1	-19.0	2	59.73
7712	31 1833	8.5 K2	8 30 5.020	372.73	-1.04	31 40 47.91	-1220.7	-21.3	4	58.69
7719	27 1627	8.3 G5	8 30 37.027	362.44	-.88	27 31 0.04	-1224.4	-20.7	3	58.54
7726	- 2 2613	7.9 K5	8 31 0.693	302.15	-.18	- 2 48 19.55	-1227.1	-17.2	2	58.26
7732	18 1978	7.1 K2	8 31 32.071	342.76	-.61	18 34 11.95	-1230.7	-19.5	2	57.71
7733	52 1322	7.5 G5	8 31 32.041	444.13	-2.50	52 22 23.40	-1230.7	-25.3	2	57.17
7753	49 1750	7.0 M0	8 33 6.132	430.36	-2.20	49 33 0.98	-1241.5	-24.4	2	56.68
7754	79 277	8.5 K2	8 33 8.893	860.97	-22.82	79 16 24.14	-1241.8	-49.0	2	57.23
7757	29 1785	8.0 K0	8 33 20.049	365.14	-.94	28 52 54.32	-1243.1	-20.6	2	57.18
7769	19 2049	8.5 A2	8 34 26.668	343.37	-.63	19 2 41.91	-1250.7	-19.3	2	57.62
7777	54 1247	8.2 K0	8 34 55.711	450.26	-2.73	53 53 55.33	-1254.0	-25.3	4	59.15
7786	17 1896	7.7 F5	8 35 39.235	339.58	-.58	17 14 9.99	-1259.0	-19.0	2	58.19
7787	12 1881	8.4 K0	8 35 39.425	330.69	-.47	12 39 50.74	-1259.0	-18.5	2	58.72
7798	2 2034	8.2 K0	8 36 29.678	311.52	-.26	2 19 7.61	-1264.7	-17.3	2	57.62
7799	41 1864	7.6 K2	8 36 31.629	399.16	-1.58	41 32 36.25	-1264.9	-22.3	2	58.73
7806	- 4 2410	8.0 K2	8 36 54.770	298.85	-.15	- 4 40 59.32	-1267.5	-16.6	2	57.69
7815	38 1940	7.8 K0	8 37 29.546	389.01	-1.39	38 20 14.68	-1271.4	-21.6	2	57.71
7826	63 789	7.1 K5	8 37 44.880	515.53	-4.78	63 38 3.82	-1273.1	-28.7	2	57.18
7830	57 1162	8.4 G5	8 37 52.018	465.37	-3.21	56 52 3.13	-1274.0	-25.9	2	57.18
7845	61 1070	7.4 K0	8 38 56.285	493.54	-4.09	61 6 37.10	-1281.2	-27.4	2	56.68
7862	18 2022	7.9 K0	8 40 17.840	341.21	-.62	18 19 52.09	-1290.3	-18.8	2	56.17
7871	17 1919	8.4 F0	8 40 37.669	338.67	-.59	17 3 51.02	-1292.5	-18.6	2	56.71
7879	9 2038	7.3 K0	8 40 59.295	324.43	-.41	9 31 16.36	-1294.9	-17.8	2	56.72
7882	3 2041	8.2 K0	8 41 33.298	313.10	-.28	3 14 41.39	-1298.7	-17.1	2	57.16
7883	44 1783	8.4 F8	8 41 39.704	406.83	-1.80	44 21 59.92	-1299.4	-22.3	2	56.68
7896	54 1253	8.4 K5	8 42 15.295	447.55	-2.82	54 5 56.37	-1303.4	-24.5	2	58.16
7898	38 1953	8.3 K0	8 42 16.291	388.17	-1.42	38 32 6.17	-1303.5	-21.2	2	56.70
7910	10 1867	8.0 K0	8 43 20.293	325.40	-.43	10 8 5.69	-1310.5	-17.7	2	58.17

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
7914	5 2050	8.4 G5	8 43 34.013	317.00	-.33	5 28 12.94	-1312.1	-17.2	2	57.16
7921	72 429	8.3 K0	8 43 45.396	621.80	-9.58	72 12 19.20	-1313.3	-34.0	2	57.25
7924	54 1254	8.7 A0	8 44 5.689	449.08	-2.91	54 34 53.74	-1315.5	-24.4	2	56.70
7927	36 1870	8.3 K2	8 44 12.732	382.27	-1.33	36 38 26.51	-1316.3	-20.7	2	58.18
7932	9 2053	8.2 A5	8 44 28.094	324.30	-.42	9 34 3.73	-1318.0	-17.5	3	59.13
7935	23 1999	9.2 F2	8 44 40.892	350.59	-.78	23 16 28.83	-1319.4	-18.9	2	57.71
7936	63 798	7.8 G5	8 44 45.859	509.08	-4.84	63 30 32.73	-1320.0	-27.6	2	58.62
7942	56 1336	8.2 K2	8 45 16.566	459.02	-3.22	56 30 45.52	-1323.3	-24.8	2	57.17
7947	43 1858	8.5 K0	8 45 33.018	401.90	-1.75	43 19 59.51	-1325.1	-21.7	2	57.19
7949	31 1884	8.6 K0	8 45 43.455	366.73	-1.05	30 39 55.15	-1326.3	-19.8	2	58.19
7955	89 13	7.0 A2	8 45 53.673	4973.05	-1446.5	88 46 13.73	-1327.5	-271.3	2	57.73
7957	13 1995	7.8 G5	8 46 0.003	330.03	-.49	12 46 54.31	-1328.1	-17.7	2	59.68
7962	- 4 2461	7.7 K0	8 46 34.045	298.50	-.15	- 5 3 12.42	-1331.8	-16.0	2	57.73
7963	70 536	7.0 M0	8 46 36.676	589.05	-8.22	70 29 11.39	-1332.1	-31.8	2	58.72
7971	26 1848	8.1 K0	8 47 11.499	357.08	-.90	26 32 28.33	-1335.8	-19.1	3	58.82
7983	46 1446	7.2 K5	8 47 58.418	410.60	-1.99	46 7 16.60	-1340.9	-22.0	2	56.69
7985	18 2059	8.1 K5	8 48 7.655	340.00	-.64	18 13 16.52	-1341.9	-18.1	2	58.16
7988	16 1833	7.3 G5	8 48 22.950	336.10	-.58	16 11 13.24	-1343.6	-17.9	2	58.65
7993	35 1883	8.2 K5	8 49 0.572	377.65	-1.29	35 24 55.16	-1347.7	-20.1	3	59.21
8001	19 2113	8.8 K0	8 49 12.930	341.51	-.66	19 5 0.29	-1349.0	-18.1	2	57.23
8003	25 2003	8.4 F5	8 49 15.777	354.13	-.86	25 20 52.37	-1349.3	-18.8	2	57.20
8014	42 1940	8.2 K5	8 50 8.500	396.53	-1.69	42 10 31.39	-1355.0	-21.0	2	56.16
8015	57 1178	8.2 G5	8 50 14.120	461.64	-3.44	57 28 14.60	-1355.6	-24.5	2	57.71
8018	10 1897	8.3 G0	8 50 26.117	325.27	-.44	10 20 15.12	-1356.9	-17.2	2	57.71
8019	62 1028	8.1 F5	8 50 28.589	495.22	-4.56	62 22 34.72	-1357.1	-26.3	2	58.61
8021	8 2136	8.6 G5	8 50 35.554	321.08	-.39	7 58 2.91	-1357.9	-16.9	2	57.74
8023	2 2084	8.0 K2	8 50 58.693	310.93	-.27	2 6 10.52	-1360.4	-16.4	2	58.18
8025	69 490	8.2 K0	8 51 7.390	558.36	-7.12	68 39 39.07	-1361.3	-29.6	2	59.73
8027	53 1290	7.8 K0	8 51 17.848	438.07	-2.76	53 8 49.58	-1362.4	-23.1	2	56.71
8028	30 1792	8.0 G5	8 51 21.177	364.83	-1.06	30 24 30.70	-1362.8	-19.2	2	57.25
8029	27 1685	6.9 K5	8 51 22.786	357.49	-.93	27 6 52.02	-1362.9	-18.8	2	57.65
8030	20 2234	7.5 M0	8 51 23.562	342.53	-.69	19 45 58.67	-1363.0	-18.0	4	59.68
8032	- 0 2087	8.3 K2	8 51 25.535	306.61	-.22	- 0 25 17.62	-1363.2	-16.1	2	58.74
8044	- 4 2491	8.4 A5	8 52 2.154	298.60	-.14	- 5 6 15.77	-1367.1	-15.6	2	58.72
8046	60 1157	8.0 K0	8 52 9.136	480.14	-4.10	60 31 41.67	-1367.9	-25.3	2	57.70
8049	65 672	8.7 K2	8 52 25.703	517.13	-5.47	65 3 47.40	-1369.6	-27.2	2	56.73
8060	18 2082	8.2 K5	8 53 1.461	338.68	-.63	17 51 25.41	-1373.4	-17.7	2	58.17
8062	23 2015	8.6 F2	8 53 9.546	349.14	-.80	23 15 48.80	-1374.3	-18.2	2	57.23
8063	39 2174	7.5 K0	8 53 9.787	386.10	-1.50	39 0 16.53	-1374.3	-20.2	2	57.20
8069	41 1889	7.6 M0	8 53 55.892	393.20	-1.67	41 32 1.53	-1379.2	-20.5	2	57.72
8076	16 1862	7.7 G0	8 54 30.699	335.93	-.60	16 28 33.26	-1382.9	-17.4	2	56.18
8077	21 1946	8.0 K5	8 54 33.684	345.50	-.75	21 32 38.93	-1383.2	-17.9	2	58.24
8078	67 569	8.2 G0	8 54 36.207	538.10	-6.44	67 16 9.21	-1383.5	-28.1	2	57.74
8082	56 1351	7.9 G5	8 54 44.477	450.88	-3.23	56 3 19.26	-1384.3	-23.5	2	58.61
8083	47 1625	7.6 K0	8 54 53.232	410.69	-2.10	46 56 44.75	-1385.3	-21.3	3	59.11
8084	75 355	8.4 K0	8 54 54.118	684.06	-14.21	75 37 26.36	-1385.3	-35.7	2	57.72
8089	48 1705	8.8 K0	8 55 0.277	415.44	-2.23	48 14 36.70	-1386.0	-21.6	3	58.55
8098	2 2114	8.2 K0	8 55 43.856	311.14	-.27	2 16 2.52	-1390.6	-16.0	2	58.23
8125	29 1851	7.7 K5	8 57 20.890	360.01	-1.01	28 51 52.44	-1400.7	-18.5	2	57.17
8126	- 1 2174	7.8 K2	8 57 25.982	303.41	-.19	- 2 21 9.05	-1401.2	-15.5	2	57.65

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession 1st Term	Precession 2nd Term	Decl. 1950	Precession 1st Term	Precession 2nd Term	No. Obs.	Epoch 1900+
8130	54 1270	8.2 G5	8 57 43.698	437.32	-2.89	53 43 22.09	-1403.1	-22.5	2	57.71
8132	59 1212	7.5 K0	8 57 59.637	469.86	-3.94	59 36 47.68	-1404.8	-24.1	2	57.62
8136	37 1938	8.4 G5	8 58 12.262	379.31	-1.41	37 5 14.65	-1406.1	-19.4	2	57.18
8139	63 815	8.3 M2	8 58 29.115	497.60	-4.97	63 26 36.31	-1407.8	-25.5	2	56.18
8146	83 236	8.4 G0	8 58 44.720	1125.26	-57.56	83 22 30.76	-1409.4	-58.0	2	57.26
8157	31 1923	7.8 K5	8 59 39.516	365.46	-1.14	31 33 46.54	-1415.1	-18.6	2	58.18
8159	22 2039	8.0 G5	8 59 52.807	344.98	-.76	21 43 1.73	-1416.5	-17.5	2	58.24
8161	9 2112	8.5 A2	8 59 56.497	321.76	-.41	8 40 55.68	-1416.9	-16.3	3	59.21
8164	57 1189	8.4 K7	9 0 6.513	455.76	-3.53	57 32 4.24	-1417.9	-23.2	2	57.63
8168	27 1708	8.2 K2	9 0 17.133	356.26	-.96	27 24 35.54	-1419.0	-18.0	2	58.65
8180	44 1817	7.7 K2	9 1 9.135	396.98	-1.85	43 38 28.55	-1424.3	-20.1	2	57.17
8181	40 2146	8.8 M0	9 1 11.589	387.79	-1.63	40 34 0.32	-1424.6	-19.6	2	56.70
8193	13 2036	7.4 G5	9 2 13.290	329.87	-.53	13 32 37.73	-1430.9	-16.5	3	59.20
8196	- 4 2533	8.2 K0	9 2 25.683	300.01	-.15	- 4 28 27.88	-1432.2	-15.0	2	58.71
8197	1 2231	8.3 K0	9 2 27.076	309.33	-.25	1 13 37.52	-1432.3	-15.5	2	57.64
8204	17 2004	8.0 A2	9 2 57.266	336.89	-.64	17 35 26.35	-1435.4	-16.8	2	57.73
8206	46 1472	8.4 K0	9 3 4.294	405.11	-2.08	46 22 18.57	-1436.1	-20.3	2	58.67
8207	61 1101	7.9 K0	9 3 8.727	473.56	-4.24	60 43 44.86	-1436.5	-23.8	2	57.73
8209	15 1977	7.6 M0	9 3 35.206	333.07	-.59	15 28 32.45	-1439.2	-16.6	2	56.68
8210	52 1362	7.2 K0	9 3 41.386	425.58	-2.67	51 49 52.96	-1439.9	-21.3	2	58.19
8212	24 2040	8.7 M0	9 3 48.597	349.84	-.87	24 35 25.98	-1440.6	-17.4	2	58.65
8221	69 506	7.7 M0	9 4 29.928	553.89	-7.75	69 24 48.62	-1444.8	-27.7	2	57.24
8226	47 1642	7.5 K0	9 4 42.456	408.74	-2.21	47 37 32.38	-1446.0	-20.3	2	57.73
8229	55 1315	8.6 K0	9 4 54.676	440.76	-3.17	55 17 15.64	-1447.3	-21.9	2	58.74
8233	41 1922	8.2 K5	9 5 14.406	388.55	-1.70	41 20 51.52	-1449.3	-19.3	2	58.17
8234	14 2033	7.3 K5	9 5 21.175	330.75	-.55	14 14 42.27	-1449.9	-16.3	2	58.65
8240	17 2018	7.3 K0	9 5 46.655	335.31	-.62	16 54 17.53	-1452.5	-16.5	2	58.19
8243	4 2126	8.2 F8	9 6 16.835	314.01	-.32	4 9 44.41	-1455.5	-15.4	2	59.19
8246	8 2172	7.0 K0	9 6 22.018	319.77	-.39	7 42 59.74	-1456.0	-15.7	2	59.26
8247	6 2109	7.9 G5	9 6 23.868	316.67	-.35	5 48 38.86	-1456.2	-15.5	2	57.73
8254	32 1845	8.6 K0	9 6 45.977	365.34	-1.19	32 19 56.78	-1458.4	-18.0	2	57.71
8256	43 1885	8.4 A5	9 6 50.884	393.19	-1.84	43 8 39.30	-1458.9	-19.3	5	59.78
8261	23 2055	7.6 K5	9 7 5.223	345.95	-.81	22 52 53.65	-1460.4	-17.0	2	57.72
8264	38 2006	8.0 G5	9 7 35.906	380.08	-1.52	38 33 0.48	-1463.4	-18.6	2	56.71
8268	1 2247	8.1 F5	9 8 1.337	309.38	-.26	1 17 29.29	-1466.0	-15.1	4	57.96
8276	45 1688	7.1 K0	9 8 27.850	398.35	-1.99	45 1 46.03	-1468.6	-19.4	2	57.77
8278	59 1225	7.6 K0	9 8 39.617	458.02	-3.87	58 55 2.45	-1469.8	-22.4	2	56.72
8282	29 1879	8.0 K0	9 8 58.709	357.77	-1.05	29 4 38.31	-1471.6	-17.4	2	56.71
8286	- 2 2808	8.4 K0	9 9 15.456	302.68	-.17	- 2 56 16.30	-1473.3	-14.6	2	57.70
8299	12 1991	8.6 G5	9 10 10.772	327.25	-.51	12 27 20.01	-1478.8	-15.8	2	58.18
8302	24 2054	7.8 K0	9 10 39.115	348.34	-.88	24 30 0.67	-1481.5	-16.8	2	57.62
8307	8 2186	8.2 F5	9 11 4.274	319.64	-.40	7 48 35.07	-1484.0	-15.3	2	57.19
8315	30 1834	8.2 G5	9 11 24.023	359.41	-1.10	30 9 8.26	-1485.9	-17.3	4	58.92
8319	28 1718	8.8 K0	9 11 38.651	354.93	-1.01	27 59 30.10	-1487.4	-17.0	2	56.73
8321	12 1997	8.0 K2	9 11 58.154	325.85	-.49	11 42 17.24	-1489.3	-15.6	2	57.72
8322	23 2062	8.3 K0	9 12 0.293	345.13	-.82	22 55 12.49	-1489.5	-16.5	2	58.23
8324	37 1956	8.2 K0	9 12 1.768	375.35	-1.46	37 16 5.57	-1489.6	-18.0	2	57.18
8332	51 1492	8.5 K0	9 12 39.759	416.95	-2.60	50 53 19.83	-1493.3	-19.9	2	57.19
8344	20 2293	8.4 F0	9 13 14.438	340.17	-.74	20 16 56.36	-1496.7	-16.2	2	57.17
8354	43 1901	7.9 K0	9 13 49.251	390.82	-1.88	43 17 41.62	-1500.1	-18.6	4	57.91

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
8355	78	303	7.8 G5	9 13 52.170	730.61	-20.37	78 10 42.26	-1500.4	-35.0	2	56.69
8363	31	1961	8.1 K0	9 14 26.679	361.49	-1.17	31 30 39.27	-1503.7	-17.1	2	56.24
8368	61	1111	8.5 A2	9 14 49.963	467.04	-4.41	61 5 50.52	-1505.9	-22.1	2	56.73
8369	17	2053	8.1 A0	9 14 51.212	334.14	-.63	16 54 55.50	-1506.0	-15.7	2	56.72
8381	52	1380	8.1 F0	9 15 43.740	419.06	-2.73	51 50 40.62	-1511.1	-19.7	2	57.18
8382	42	1994	8.1 K0	9 15 47.016	386.09	-1.77	41 54 36.02	-1511.4	-18.2	2	56.65
8397	60	1181	7.5 K0	9 16 40.971	458.60	-4.14	59 59 35.06	-1516.5	-21.5	2	58.17
8398	10	1972	7.0 K0	9 16 49.287	322.72	-.45	10 0 6.76	-1517.3	-15.1	2	56.18
8427	12	2024	8.2 K2	9 18 41.787	326.61	-.52	12 34 10.55	-1528.0	-15.1	2	57.10
8431	67	586	8.7 K	9 18 47.775	513.09	-6.61	67 13 0.42	-1528.6	-23.9	2	56.72
8439	22	2082	7.7 K0	9 19 8.604	341.68	-.79	21 42 43.69	-1530.5	-15.8	2	56.72
8445	46	1494	8.8 G5	9 19 22.480	398.11	-2.16	46 29 34.45	-1531.8	-18.4	2	57.15
8446	- 2	2863	8.0 K2	9 19 23.571	303.42	-.18	- 2 35 34.24	-1532.0	-13.9	2	58.17
8448	63	838	8.5 K2	9 19 33.723	479.14	-5.09	63 23 18.86	-1532.9	-22.2	2	57.71
8452	81	295	8.7 K0	9 19 55.373	835.53	-31.53	80 45 38.13	-1534.9	-38.8	2	57.19
8457	55	1331	7.5 K0	9 20 15.409	431.70	-3.25	55 24 27.79	-1536.8	-19.9	2	56.72
8461	71	503	8.6 G5	9 20 50.738	550.96	-8.73	70 39 37.06	-1540.1	-25.4	2	57.17
8473	- 4	2608	7.7 K2	9 21 25.024	299.64	-.13	- 5 8 46.84	-1543.3	-13.6	2	56.19
8482	44	1861	7.7 K0	9 22 2.819	390.05	-1.97	44 14 0.19	-1546.8	-17.7	2	56.71
8489	6	2173	7.8 K0	9 22 44.186	316.94	-.37	6 28 29.33	-1550.6	-14.3	2	57.62
8508	17	2084	7.9 M0	9 23 51.587	332.92	-.64	16 54 56.05	-1556.9	-15.0	2	56.65
8512	- 1	2260	8.5 K0	9 24 16.769	305.06	-.19	- 1 32 49.88	-1559.2	-13.6	2	56.74
8513	29	1903	8.8 K0	9 24 25.433	354.70	-1.09	29 27 7.62	-1559.9	-15.9	2	56.72
8522	49	1841	7.9 K0	9 24 57.580	403.90	-2.43	49 5 59.18	-1562.9	-18.1	2	56.64
8528	28	1761	8.8 K0	9 25 14.557	352.50	-1.05	28 24 27.58	-1564.4	-15.7	2	57.15
8531	10	2002	8.0 K2	9 25 25.852	322.70	-.46	10 26 11.07	-1565.4	-14.4	2	57.24
8532	50	1644	7.4 M0	9 25 36.008	407.56	-2.56	50 14 59.76	-1566.4	-18.2	2	56.19
8539	52	1395	8.8 G5	9 26 5.314	412.86	-2.75	51 46 5.37	-1569.0	-18.4	2	57.64
8541	41	1968	8.0 K0	9 26 14.771	378.65	-1.71	40 38 57.44	-1569.9	-16.8	2	56.72
8543	0	2522	8.4 K0	9 26 18.755	307.37	-.22	0 1 59.35	-1570.2	-13.6	2	57.71
8545	18	2207	7.4 K0	9 26 46.067	334.03	-.67	17 52 17.03	-1572.7	-14.8	2	57.18
8555	25	2105	8.6 K0	9 27 13.235	345.68	-.91	24 54 0.98	-1575.2	-15.2	3	59.14
8559	59	1238	7.3 K2	9 27 31.940	444.47	-3.95	58 58 37.86	-1576.9	-19.7	2	58.25
8573	16	1984	7.6 K0	9 28 53.822	330.78	-.62	15 59 28.32	-1584.2	-14.4	2	56.70
8575	42	2018	8.8 A0	9 29 0.009	382.43	-1.85	42 33 13.30	-1584.7	-16.7	2	57.65
8580	9	2195	8.5 K0	9 29 13.258	320.87	-.44	9 24 34.75	-1585.9	-14.0	3	59.20
8581	48	1779	8.1 K0	9 29 14.387	399.84	-2.38	48 33 12.24	-1586.0	-17.5	2	58.19
8583	37	1995	8.0 A2	9 29 21.256	369.93	-1.50	37 28 57.93	-1586.6	-16.1	2	58.74
8589	20	2335	7.7 K0	9 29 52.316	337.08	-.74	20 4 39.87	-1589.4	-14.6	2	57.26
8590	7	2147	7.4 K2	9 29 53.568	317.73	-.39	7 17 7.41	-1589.5	-13.8	2	59.17
8591	63	848	7.8 G5	9 29 54.231	467.40	-5.01	63 3 0.76	-1589.6	-20.4	2	59.22
8593	31	2000	8.1 K0	9 30 4.198	355.78	-1.16	30 47 30.09	-1590.4	-15.5	2	59.24
8601	61	1131	8.2 K0	9 30 34.585	454.84	-4.48	61 12 20.90	-1593.1	-19.8	2	57.69
8623	8	2243	7.7 M0	9 32 1.892	319.22	-.41	8 24 38.82	-1600.8	-13.7	2	56.61
8636	65	723	8.1 G5	9 32 33.015	476.10	-5.53	64 35 40.60	-1603.6	-20.5	2	56.73
8646	34	2010	8.5 K0	9 33 14.925	361.66	-1.33	34 14 30.28	-1607.2	-15.4	2	57.11
8648	5	2204	7.2 K2	9 33 27.519	313.94	-.33	4 44 20.97	-1608.3	-13.3	2	56.70
8650	17	2108	8.4 K0	9 33 33.838	332.38	-.66	17 27 16.68	-1608.9	-14.1	2	56.70
8668	69	526	8.1 F0	9 34 38.949	519.25	-7.92	69 30 52.16	-1614.5	-22.1	2	57.72
8674	48	1789	8.1 F8	9 34 46.348	394.54	-2.32	47 47 12.85	-1615.2	-16.7	2	57.25

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
8676	11 2067	8.5 K5	9 34 57.905	322.66	-.48	10 58 53.71	-1616.1	-13.6	2	57.26
8685	59 1249	7.1 M0	9 35 22.978	437.36	-3.92	58 46 27.74	-1618.3	-18.5	2	57.09
8695	22 2112	8.5 K0	9 35 52.123	338.71	-.80	21 45 56.22	-1620.8	-14.2	2	58.21
8704	15 2091	8.1 G5	9 36 20.080	327.81	-.58	14 38 55.17	-1623.2	-13.7	2	57.72
8712	- 2 2948	8.4 K5	9 36 49.864	303.99	-.16	- 2 26 39.13	-1625.7	-12.6	2	57.70
8716	3 2249	7.2 G5	9 37 3.624	311.99	-.29	3 25 19.36	-1626.9	-12.9	3	58.53
8723	32 1912	8.7 K5	9 37 43.664	355.56	-1.22	31 49 19.65	-1630.3	-14.7	2	57.09
8743	16 2010	7.7 K0	9 39 1.473	329.41	-.62	15 59 0.67	-1636.9	-13.5	2	56.71
8745	48 1796	8.5 K5	9 39 19.430	391.96	-2.31	47 43 9.79	-1638.4	-16.1	2	56.25
8754	37 2016	7.3 K2	9 40 1.627	365.82	-1.51	37 21 27.38	-1641.9	-14.9	2	56.61
8770	12 2082	7.8 K5	9 41 1.344	324.06	-.51	12 23 21.90	-1646.9	-13.1	2	56.18
8772	1 2352	8.2 F0	9 41 3.983	308.28	-.23	0 42 59.00	-1647.1	-12.4	2	56.71
8774	22 2124	8.8 K0	9 41 5.907	338.54	-.82	22 17 49.78	-1647.3	-13.7	2	57.23
8776	39 2275	8.5 K0	9 41 12.975	368.23	-1.59	38 41 18.72	-1647.9	-14.9	2	57.63
8778	35 2046	7.6 M0	9 41 15.530	360.47	-1.38	34 57 3.23	-1648.1	-14.6	2	57.18
8785	2 2243	8.1 K0	9 41 48.520	310.24	-.26	2 11 54.92	-1650.8	-12.5	2	57.25
8787	17 2125	8.2 G5	9 41 49.462	329.98	-.64	16 38 38.14	-1650.9	-13.3	2	57.20
8808	85 150	7.8 G8	9 44 22.279	1113.35	-84.07	84 42 59.15	-1663.4	-44.9	2	56.71
8809	33 1907	7.5 M0	9 44 22.650	355.76	-1.28	33 0 52.29	-1663.4	-14.1	2	56.69
8817	49 1880	8.0 K2	9 44 46.179	393.70	-2.47	49 16 52.08	-1665.4	-15.6	2	57.17
8820	11 2102	7.8 K0	9 44 48.372	321.88	-.48	11 4 34.32	-1665.5	-12.7	2	57.73
8822	6 2211	8.8 A5	9 45 0.287	314.86	-.34	5 47 30.88	-1666.5	-12.4	2	57.26
8830	55 1349	8.8 K5	9 45 28.495	414.44	-3.28	55 21 39.20	-1668.8	-16.4	2	56.73
8838	47 1707	8.7 A2	9 46 3.844	385.98	-2.23	46 51 18.63	-1671.6	-15.2	2	56.73
8843	18 2274	7.4 K0	9 46 19.859	331.65	-.69	18 17 28.16	-1672.9	-13.0	2	57.17
8844	25 2157	8.8 K2	9 46 21.642	341.13	-.91	24 40 37.86	-1673.1	-13.3	2	57.72
8848	- 4 2728	8.2 M0	9 46 34.448	301.36	-.11	- 4 38 31.33	-1674.1	-11.7	2	56.71
8850	52 1424	7.5 K5	9 46 46.179	400.05	-2.75	51 38 40.26	-1675.0	-15.7	2	57.20
8853	26 2013	8.6 K2	9 47 7.138	342.47	-.95	25 38 33.83	-1676.7	-13.3	2	57.17
8859	75 396	8.4 K0	9 47 36.841	573.31	-12.71	74 39 35.82	-1679.1	-22.5	2	58.71
8861	42 2051	8.5 K0	9 47 46.154	374.13	-1.87	42 30 22.75	-1679.8	-14.5	2	57.23
8864	2 2255	7.8 K0	9 47 56.033	309.95	-.25	2 3 43.01	-1680.6	-12.0	2	57.18
8868	80 302	8.8 K0	9 48 15.173	715.05	-25.98	79 53 49.56	-1682.1	-28.0	2	57.71
8871	1 2370	8.8 A2	9 48 23.186	308.65	-.23	1 2 27.73	-1682.7	-11.9	2	57.26
8872	16 2039	7.9 K0	9 48 29.344	328.89	-.63	16 33 17.53	-1683.2	-12.7	2	58.65
8882	20 2387	7.7 K0	9 49 2.532	334.21	-.76	20 23 59.56	-1685.8	-12.8	2	57.26
8888	36 2006	6.9 M0	9 49 30.852	359.20	-1.43	35 45 35.48	-1688.1	-13.8	2	57.70
8889	41 2021	7.9 K0	9 49 31.155	369.09	-1.73	40 36 43.79	-1688.1	-14.1	2	57.16
8894	23 2156	8.0 K0	9 50 2.822	337.58	-.84	22 51 21.20	-1690.6	-12.9	2	57.23
8895	65 741	7.7 K0	9 50 4.859	461.38	-5.65	65 1 30.61	-1690.8	-17.7	2	57.72
8896	58 1219	8.3 K2	9 50 5.847	423.33	-3.80	58 15 53.27	-1690.8	-16.2	2	57.71
8900	11 2117	8.3 G5	9 50 40.221	321.75	-.48	11 24 25.59	-1693.5	-12.2	2	57.73
8904	15 2127	7.3 G0	9 51 5.305	326.39	-.58	14 58 28.92	-1695.5	-12.3	2	56.63
8913	5 2248	6.8 K5	9 51 29.890	313.77	-.32	5 10 54.50	-1697.3	-11.8	2	56.71
8919	45 1774	8.5 G5	9 51 43.700	378.10	-2.05	44 55 48.82	-1698.4	-14.3	2	57.20
8924	- 1 2319	8.0 K0	9 52 0.773	304.38	-.15	- 2 22 51.09	-1699.8	-11.4	2	57.25
8929	49 1896	8.2 A2	9 52 22.278	387.74	-2.41	48 42 30.03	-1701.4	-14.6	2	56.68
8950	64 762	7.7 G5	9 53 47.288	448.27	-5.14	63 36 53.20	-1707.9	-16.7	2	57.18
8953	47 1724	8.5 K0	9 53 53.310	383.69	-2.29	47 32 30.55	-1708.4	-14.3	2	56.70
8954	0 2588	7.6 K5	9 54 5.604	307.05	-.19	- 0 13 23.86	-1709.3	-11.3	2	57.17

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P.M.).

T in centuries from 1900.0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
8959	24 2156	8.3 G5	9 54 17.861	338.72	-.89	24 15 22.86	-1710.3	-12.5	2	56.70
8962	19 2284	7.8 K0	9 54 37.511	331.98	-.73	19 31 41.58	-1711.8	-12.2	2	56.70
8965	17 2156	7.4 K0	9 54 49.836	328.15	-.63	16 41 51.89	-1712.7	-12.1	2	57.75
8966	35 2086	7.0 K5	9 54 51.583	356.57	-1.40	35 21 47.64	-1712.8	-13.1	2	58.17
8982	30 1940	8.1 K0	9 55 36.526	346.81	-1.13	29 46 26.07	-1716.2	-12.7	2	57.18
8983	76 371	8.0 K2	9 55 45.636	589.84	-15.13	76 17 14.10	-1716.9	-21.8	2	58.25
8989	57 1240	7.4 K0	9 56 10.200	412.02	-3.50	56 42 51.09	-1718.8	-15.1	3	56.84
8999	26 2031	8.6 K0	9 56 48.801	341.30	-.98	26 24 35.63	-1721.6	-12.4	2	56.74
9011	- 4 2775	7.6 K2	9 57 33.047	301.65	-.09	- 4 46 21.17	-1724.9	-10.8	2	57.26
9021	69 551	7.9 K0	9 58 25.005	486.07	-7.59	69 16 56.02	-1728.8	-17.6	2	57.17
9028	7 2219	8.4 F8	9 58 38.610	316.15	-.37	7 27 6.62	-1729.8	-11.3	2	56.69
9036	- 1 2338	8.8 F8	9 59 19.740	304.95	-.15	- 2 1 46.62	-1732.8	-10.8	2	56.70
9038	58 1230	8.9 K0	9 59 29.185	415.12	-3.74	58 6 38.20	-1733.5	-14.8	2	57.72
9045	46 1574	7.5 K0	9 59 57.178	377.60	-2.18	46 26 21.18	-1735.5	-13.4	2	56.63
9054	34 2073	8.8 F2	10 0 38.825	352.62	-1.34	34 16 1.74	-1738.6	-12.4	2	56.68
9058	4 2283	7.2 K0	10 1 2.786	312.21	-.29	4 12 50.60	-1740.3	-10.9	2	56.18
9064	56 1428	7.6 K5	10 1 33.602	404.22	-3.31	55 43 51.78	-1742.5	-14.2	2	56.80
9066	28 1835	8.1 A5	10 1 42.448	342.52	-1.04	28 5 24.25	-1743.2	-11.9	2	57.19
9071	51 1572	7.0 K2	10 1 59.998	387.99	-2.63	50 47 40.45	-1744.4	-13.5	2	56.72
9072	5 2280	7.5 G0	10 2 10.920	313.36	-.31	5 14 49.69	-1745.2	-10.9	2	56.61
9081	20 2430	8.2 G5	10 2 26.381	330.78	-.73	19 40 56.19	-1746.3	-11.5	2	57.80
9082	17 2169	8.6 K0	10 2 34.075	326.99	-.63	16 42 33.34	-1746.9	-11.3	2	58.24
9084	- 2 3052	7.3 K5	10 2 40.528	303.58	-.11	- 3 16 26.32	-1747.3	-10.5	2	57.17
9087	35 2102	7.2 K0	10 2 52.626	353.51	-1.39	35 14 47.18	-1748.2	-12.2	2	56.73
9091	67 634	7.6 K5	10 3 16.760	457.58	-6.16	66 33 32.94	-1749.9	-15.9	2	57.74
9092	31 2097	8.4 G5	10 3 18.491	347.20	-1.20	31 28 31.25	-1750.0	-12.0	2	57.17
9099	61 1165	7.0 K5	10 3 42.497	425.25	-4.39	61 9 51.50	-1751.7	-14.7	2	57.73
9101	42 2086	7.8 K2	10 3 48.299	366.85	-1.86	42 31 58.41	-1752.1	-12.6	2	56.73
9111	11 2166	8.1 K5	10 4 3.961	320.41	-.47	11 25 20.43	-1753.2	-10.9	2	56.64
9113	14 2202	8.8 M0	10 4 20.476	323.92	-.56	14 24 8.87	-1754.4	-11.0	2	57.18
9120	43 1990	8.7 G5	10 4 40.708	367.97	-1.90	43 15 51.01	-1755.8	-12.6	2	56.71
9130	27 1852	8.1 K0	10 5 19.721	340.05	-1.00	27 2 36.58	-1758.6	-11.5	2	57.26
9136	56 1434	7.8 K5	10 6 19.180	399.97	-3.26	55 32 3.53	-1762.7	-13.5	2	57.25
9139	83 280	7.3 K0	10 6 25.923	799.78	-43.09	82 38 51.54	-1763.2	-27.3	2	56.74
9141	49 1923	8.6 A3	10 6 39.113	379.97	-2.42	48 52 39.58	-1764.1	-12.8	2	56.71
9142	27 1853	8.0 F0	10 6 40.536	340.06	-1.01	27 18 1.70	-1764.2	-11.4	2	57.24
9147	10 2116	7.1 M0	10 6 52.444	318.31	-.43	9 50 19.74	-1765.0	-10.6	2	57.72
9148	- 3 2860	8.4 K5	10 6 57.054	303.23	-.09	- 3 42 6.76	-1765.3	-10.1	2	58.19
9150	3 2323	8.2 K0	10 7 6.908	311.09	-.26	3 24 28.88	-1766.0	-10.4	2	57.71
9152	62 1110	8.6 A2	10 7 10.974	427.12	-4.64	62 12 13.73	-1766.3	-14.3	2	58.69
9153	59 1291	8.4 K2	10 7 12.644	411.84	-3.86	58 51 52.94	-1766.4	-13.8	5	58.45
9156	65 756	7.9 K0	10 7 42.838	440.89	-5.44	64 47 25.46	-1768.5	-14.7	2	57.34
9164	- 1 2356	7.8 G5	10 8 28.810	304.96	-.12	- 2 10 5.32	-1771.6	-10.0	2	56.71
9167	67 637	8.6 K0	10 8 32.259	457.76	-6.50	67 27 16.73	-1771.9	-15.2	2	58.28
9169	30 1974	8.5 K0	10 8 54.033	343.85	-1.14	30 23 46.43	-1773.3	-11.3	2	56.73
9170	12 2162	7.8 K5	10 8 54.979	320.89	-.49	12 17 0.46	-1773.4	-10.5	2	57.16
9172	44 1958	8.5 F2	10 8 59.125	366.96	-1.95	43 47 7.81	-1773.7	-12.1	2	57.73
9176	54 1354	8.6 K5	10 9 3.171	394.38	-3.09	54 27 38.93	-1774.0	-13.0	4	59.21
9180	20 2447	7.7 G5	10 9 17.757	330.37	-.74	20 21 57.26	-1774.9	-10.8	4	57.48
9183	25 2212	8.6 K7	10 9 40.712	336.36	-.92	25 8 30.58	-1776.5	-11.0	2	57.28

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
9184	52 1461	7.2 G0	10 9 43.715	385.69	-2.72	51 43 26.25	-1776.7	-12.6	2	58.16
9185	7 2259	8.4 G5	10 9 49.430	314.82	-.34	6 54 52.78	-1777.1	-10.2	2	57.71
9192	23 2190	8.5 A2	10 10 18.473	333.60	-.84	23 7 0.02	-1779.0	-10.8	2	57.18
9198	9 2317	7.4 G5	10 10 51.263	317.51	-.41	9 26 2.96	-1781.2	-10.2	2	57.26
9199	- 0 2308	8.4 F8	10 10 51.480	306.59	-.16	- 0 41 33.78	-1781.3	-9.9	2	56.71
9201	1 2414	8.4 F0	10 10 56.077	308.06	-.19	0 41 11.21	-1781.6	-9.9	2	56.73
9206	45 1811	7.7 K2	10 11 8.512	369.15	-2.07	45 20 7.85	-1782.4	-11.9	2	57.24
9208	11 2190	7.9 G5	10 11 10.754	319.30	-.45	11 5 24.92	-1782.5	-10.3	2	57.27
9212	- 3 2873	7.9 K0	10 11 22.946	303.20	-.08	- 3 52 33.04	-1783.3	-9.7	2	56.70
9217	16 2098	7.2 K0	10 11 49.240	325.20	-.61	16 23 13.83	-1785.1	-10.4	2	57.23
9218	6 2276	7.9 K0	10 12 6.643	313.70	-.32	5 59 54.16	-1786.2	-10.0	2	56.68
9235	34 2105	8.6 K2	10 13 15.767	347.87	-1.32	34 2 37.38	-1790.8	-11.0	2	57.74
9239	4 2306	8.2 K0	10 13 36.410	311.30	-.26	3 47 55.91	-1792.1	-9.8	2	56.81
9249	2 2310	7.5 K2	10 14 16.969	309.45	-.21	2 2 51.65	-1794.8	-9.7	2	56.71
9250	8 2336	8.7 K0	10 14 17.528	316.21	-.38	8 29 43.22	-1794.8	-9.9	2	57.74
9267	54 1362	8.8 K2	10 15 30.935	387.55	-2.96	53 44 48.42	-1799.6	-12.1	2	57.72
9273	14 2230	8.0 G0	10 15 45.087	322.16	-.54	14 11 3.94	-1800.5	-9.9	2	58.28
9274	40 2313	8.3 M2	10 15 48.834	355.80	-1.63	39 33 44.92	-1800.7	-11.0	2	58.81
9276	49 1939	8.9 K0	10 15 49.792	374.50	-2.38	48 52 9.32	-1800.8	-11.6	2	56.70
9278	70 607	8.6 K2	10 15 58.591	469.44	-7.82	70 7 53.30	-1801.3	-14.6	2	58.29
9279	55 1384	8.0 K0	10 16 1.511	390.89	-3.13	54 58 36.24	-1801.5	-12.1	2	57.25
9287	10 2139	7.8 K2	10 16 49.154	317.76	-.42	10 10 17.91	-1804.5	-9.7	2	56.28
9288	23 2213	8.7 G5	10 16 53.095	331.70	-.82	22 45 29.49	-1804.8	-10.1	2	58.16
9289	16 2110	8.6 G5	10 16 57.823	323.97	-.59	15 59 44.94	-1805.1	-9.9	2	58.73
9291	0 2641	7.8 F0	10 17 5.416	307.37	-.16	0 2 29.69	-1805.6	-9.3	2	58.77
9293	21 2175	7.6 K2	10 17 9.594	329.18	-.75	20 39 20.40	-1805.9	-10.0	2	57.71
9297	26 2072	8.8 G5	10 17 42.671	335.37	-.94	25 55 48.59	-1807.9	-10.2	2	57.26
9298	12 2193	7.7 K0	10 17 46.935	319.16	-.46	11 36 16.63	-1808.2	-9.6	2	57.17
9300	4 2313	8.4 K2	10 17 55.326	311.23	-.25	3 52 28.75	-1808.7	-9.4	2	56.69
9303	46 1619	7.9 K2	10 18 12.863	367.82	-2.15	46 29 52.10	-1809.8	-11.1	2	56.69
9305	69 569	7.7 K0	10 18 21.341	458.09	-7.21	69 10 42.38	-1810.4	-13.9	2	57.74
9313	71 536	8.6 G5	10 18 55.972	477.89	-8.71	71 30 40.92	-1812.5	-14.5	2	58.19
9315	62 1121	8.2 K0	10 18 59.220	412.98	-4.40	61 39 6.21	-1812.7	-12.5	2	58.29
9317	58 1252	9.0 K0	10 19 5.526	399.76	-3.69	58 21 43.21	-1813.1	-12.0	2	57.25
9327	40 2321	8.3 K0	10 19 47.550	355.10	-1.65	40 10 43.15	-1815.7	-10.6	2	58.71
9331	31 2133	7.4 K0	10 20 11.030	341.31	-1.16	31 5 25.57	-1817.1	-10.1	2	57.26
9341	14 2237	8.3 F0	10 20 44.859	321.47	-.53	14 9 31.81	-1819.2	-9.4	2	56.68
9344	3 2357	8.4 K2	10 21 11.810	310.16	-.22	2 54 18.01	-1820.9	-9.1	2	57.71
9350	66 665	7.8 K0	10 21 31.449	433.31	-5.77	66 9 48.30	-1822.1	-12.8	2	57.26
9351	- 4 2861	7.3 K0	10 21 34.928	302.78	-.04	- 4 40 24.81	-1822.3	-8.8	2	58.19
9359	10 2147	8.5 K0	10 22 23.464	317.30	-.41	10 14 12.06	-1825.2	-9.2	2	58.69
9368	59 1309	8.8 K0	10 22 43.663	399.68	-3.83	59 12 45.40	-1826.4	-11.6	2	57.73
9369	41 2089	8.2 K0	10 22 43.858	355.44	-1.73	41 9 55.54	-1826.4	-10.3	2	56.69
9372	23 2221	8.9 K0	10 22 54.979	331.04	-.83	23 21 25.16	-1827.1	-9.5	2	57.19
9376	25 2249	7.3 K0	10 23 29.194	332.76	-.89	24 58 12.01	-1829.1	-9.5	3	57.52
9382	29 2046	8.4 F5	10 23 58.327	337.00	-1.04	28 37 45.95	-1830.9	-9.6	2	58.28
9387	0 2655	7.2 K2	10 24 20.063	307.43	-.15	0 6 24.98	-1832.2	-8.7	2	58.29
9392	22 2217	8.0 K2	10 24 37.429	329.01	-.78	21 52 15.49	-1833.2	-9.3	2	56.71
9398	63 901	8.3 K0	10 24 54.618	413.82	-4.74	63 10 16.16	-1834.2	-11.8	2	58.26
9401	43 2019	8.3 K5	10 25 0.421	357.92	-1.87	43 14 12.54	-1834.5	-10.1	2	57.19

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
9402	- 0	2344	8.5 K0	10 25 2.106	306.67	-.13	- 0 42 27.10	-1834.6	-8.6	2	58.71
9404	19	2345	7.9 K0	10 25 15.878	325.65	-.67	18 50 50.89	-1835.5	-9.1	2	58.79
9412	27	1897	8.1 K0	10 25 57.585	334.70	-.98	27 10 45.40	-1837.9	-9.3	2	57.73
9419	60	1265	8.7 K0	10 26 18.272	400.47	-4.02	60 18 20.89	-1839.1	-11.2	2	57.79
9422	55	1394	7.4 K0	10 26 37.004	383.18	-3.09	55 4 54.52	-1840.2	-10.7	4	57.97
9427	17	2233	8.4 K2	10 27 2.661	323.68	-.62	17 14 10.98	-1841.6	-8.9	2	58.28
9435	38	2147	8.6 K2	10 27 21.273	348.36	-1.52	37 59 5.29	-1842.7	-9.6	2	57.71
9436	64	790	8.0 K5	10 27 22.166	415.71	-4.99	64 8 2.45	-1842.8	-11.5	2	58.71
9441	78	349	7.9 G5	10 27 31.053	549.08	-16.47	77 45 18.46	-1843.3	-15.3	2	58.73
9448	50	1744	8.6 K0	10 27 50.942	369.50	-2.45	49 56 12.21	-1844.4	-10.1	2	58.80
9454	22	2230	8.6 K0	10 28 24.279	328.84	-.79	22 28 52.00	-1846.3	-9.0	2	58.81
9459	31	2148	8.3 K0	10 28 49.451	338.80	-1.15	31 17 56.49	-1847.7	-9.2	2	58.82
9462	- 2	3165	8.4 K0	10 29 1.282	304.97	-.08	- 2 36 34.72	-1848.4	-8.2	2	58.77
9463	18	2372	7.4 G0	10 29 23.396	324.29	-.65	18 14 50.64	-1849.6	-8.7	2	58.28
9464	48	1873	8.6 K2	10 29 27.842	364.03	-2.23	47 47 47.36	-1849.9	-9.8	2	57.24
9469	54	1379	7.9 K5	10 29 42.484	377.52	-2.90	53 50 40.78	-1850.7	-10.2	2	58.23
9470	5	2347	7.0 K0	10 29 42.683	311.73	-.26	4 54 9.36	-1850.7	-8.3	2	58.71
9472	15	2218	8.7 K0	10 30 8.704	320.89	-.54	14 52 42.66	-1852.2	-8.5	2	59.27
9476	77	404	7.6 K0	10 30 28.951	527.50	-14.72	76 59 25.07	-1853.3	-14.2	2	58.25
9477	25	2263	7.9 K0	10 30 31.319	331.45	-.90	25 22 58.74	-1853.4	-8.8	2	58.29
9488	44	1998	8.8 G0	10 31 10.319	355.63	-1.88	43 43 22.67	-1855.6	-9.4	2	58.20
9493	34	2141	9.3 K	10 31 40.905	340.85	-1.27	33 43 6.93	-1857.3	-8.9	2	57.76
9495	4	2351	8.7 K2	10 31 42.910	311.16	-.24	4 22 11.91	-1857.4	-8.1	2	57.79
9507	69	579	8.0 K0	10 32 28.819	438.41	-6.92	69 11 56.67	-1859.9	-11.5	2	58.23
9517	31	2164	8.4 K0	10 33 8.457	336.63	-1.11	30 39 34.76	-1862.0	-8.7	2	57.70
9523	19	2355	8.2 A0	10 33 29.968	324.20	-.66	18 54 45.05	-1863.2	-8.3	2	57.28
9527	71	542	8.9 F8	10 33 37.750	449.50	-7.89	70 55 16.63	-1863.6	-11.7	2	57.80
9530	16	2139	8.4 K0	10 33 52.718	321.66	-.58	16 17 44.24	-1864.4	-8.2	2	58.71
9535	37	2102	7.9 K2	10 34 13.489	344.79	-1.47	37 29 17.53	-1865.5	-8.8	2	57.25
9538	51	1615	9.0 A7	10 34 18.427	367.19	-2.51	50 48 39.48	-1865.8	-9.4	2	57.80
9539	58	1268	9.0 G5	10 34 27.812	385.67	-3.52	58 7 28.86	-1866.3	-9.9	2	56.70
9541	24	2251	8.0 F5	10 34 31.958	328.71	-.83	23 42 35.23	-1866.5	-8.3	2	58.18
9556	49	1977	7.8 K0	10 35 37.216	363.57	-2.36	49 28 6.55	-1869.9	-9.1	4	59.46
9557	7	2339	8.6 G5	10 35 41.207	313.01	-.30	6 44 41.26	-1870.2	-7.8	2	57.72
9559	20	2509	8.2 A3	10 35 50.631	324.67	-.69	19 52 31.27	-1870.7	-8.1	2	57.16
9563	45	1850	8.1 K5	10 36 1.659	355.38	-1.97	45 6 30.57	-1871.2	-8.9	2	58.24
9574	29	2073	8.4 K2	10 36 43.905	333.66	-1.04	29 0 43.60	-1873.4	-8.2	2	57.80
9577	40	2354	7.8 K0	10 36 56.379	346.61	-1.58	39 39 55.90	-1874.1	-8.6	2	56.71
9587	5	2374	8.4 K0	10 37 45.018	311.27	-.24	4 48 5.00	-1876.6	-7.6	2	57.80
9590	42	2140	7.6 K0	10 37 51.875	349.21	-1.71	41 47 17.18	-1876.9	-8.5	2	56.71
9598	- 3	2976	8.8 F5	10 38 37.164	304.49	-.03	- 3 30 2.59	-1879.2	-7.3	2	57.26
9603	14	2281	7.7 M0	10 38 57.675	319.07	-.50	14 14 24.29	-1880.2	-7.7	2	57.72
9606	0	2694	8.1 F8	10 39 1.767	307.32	-.12	- 0 0 38.66	-1880.5	-7.3	2	57.73
9615	37	2112	8.4 G0	10 39 34.774	341.66	-1.40	36 46 53.03	-1882.1	-8.2	2	57.80
9617	3	2403	8.3 K0	10 39 37.528	309.78	-.19	3 3 31.23	-1882.3	-7.4	2	58.26
9619	56	1472	7.3 K5	10 39 47.045	375.65	-3.15	56 9 11.37	-1882.7	-9.0	2	57.28
9624	62	1142	7.4 K5	10 40 3.789	394.96	-4.36	62 28 28.73	-1883.6	-9.4	2	58.73
9626	17	2265	8.4 K0	10 40 6.854	321.62	-.60	17 23 12.96	-1883.7	-7.6	2	58.71
9631	- 3	2980	8.3 K5	10 40 31.141	304.04	-.02	- 4 8 40.78	-1884.9	-7.1	2	58.69
9633	43	2040	7.9 K0	10 40 54.044	348.95	-1.76	42 38 12.71	-1886.1	-8.2	2	57.18

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession 1st Term	Precession 2nd Term	Decl. 1950	Precession 1st Term	Precession 2nd Term	No. Obs.	Epoch 1900+
9634	50 1760	7.0 K0	10 40 56.312	361.30	-2.40	50 3 48.77	-1886.2	-8.5	2	56.81
9638	53 1432	8.0 K0	10 41 22.410	366.27	-2.68	52 40 19.15	-1887.5	-8.6	2	58.26
9642	49 1986	7.8 K0	10 41 55.844	358.33	-2.26	48 48 31.66	-1889.1	-8.3	2	57.70
9645	73 504	7.6 K0	10 42 9.564	448.95	-8.75	72 33 3.64	-1889.8	-10.5	2	57.26
9652	32 2072	8.4 G0	10 42 41.532	335.42	-1.17	32 25 27.51	-1891.3	-7.7	2	57.81
9653	24 2265	8.8 K0	10 42 43.255	326.86	-.82	23 50 33.35	-1891.4	-7.5	2	56.68
9655	1 2477	7.7 K0	10 42 55.114	308.31	-.14	1 16 27.25	-1892.0	-7.0	2	57.28
9657	8 2409	7.6 K0	10 42 57.093	313.35	-.31	7 46 40.13	-1892.0	-7.1	2	57.71
9658	59 1325	9.0 K5	10 42 57.743	381.63	-3.65	59 19 27.36	-1892.1	-8.8	2	57.72
9660	10 2199	8.6 K2	10 43 5.565	315.31	-.38	10 17 6.94	-1892.5	-7.2	2	58.71
9662	6 2347	7.9 A5	10 43 7.465	311.68	-.25	5 38 48.92	-1892.6	-7.1	2	58.34
9667	26 2128	8.4 G5	10 43 33.851	328.55	-.89	25 52 35.53	-1893.8	-7.4	2	57.71
9672	35 2181	8.2 M2	10 43 55.678	337.81	-1.30	34 59 41.17	-1894.9	-7.6	2	58.79
9677	43 2045	7.2 K2	10 44 0.579	348.30	-1.80	43 17 25.47	-1895.1	-7.9	2	57.34
9678	34 2158	8.3 G5	10 44 1.067	336.47	-1.24	33 49 23.55	-1895.1	-7.6	2	57.77
9690	19 2373	7.8 G5	10 45 0.231	322.30	-.65	19 13 36.55	-1897.9	-7.1	2	56.68
9693	45 1866	7.4 K0	10 45 12.962	350.26	-1.93	45 3 57.81	-1898.5	-7.8	2	57.15
9695	14 2299	7.9 F2	10 45 24.562	318.36	-.50	14 28 33.37	-1899.0	-7.0	2	57.81
9701	- 2 3221	8.0 F5	10 45 59.547	305.11	-.03	- 2 59 27.24	-1900.7	-6.7	2	57.26
9706	27 1938	8.4 M2	10 46 16.787	328.91	-.93	27 4 5.79	-1901.5	-7.2	2	57.16
9709	16 2170	8.7 F5	10 46 42.515	319.48	-.55	16 8 31.99	-1902.6	-6.9	2	58.28
9716	61 1204	8.0 G5	10 47 2.819	382.38	-3.91	60 52 26.85	-1903.6	-8.3	2	56.72
9731	7 2374	8.6 A0	10 48 14.913	312.47	-.28	7 7 38.19	-1906.8	-6.6	2	57.71
9734	36 2129	9.3 F8	10 48 19.667	337.31	-1.34	36 6 15.64	-1907.0	-7.2	2	58.26
9737	43 2052	9.0 K0	10 48 35.638	344.88	-1.72	42 30 58.95	-1907.8	-7.3	2	58.71
9738	24 2281	8.8 G5	10 48 45.324	325.24	-.79	23 39 56.80	-1908.2	-6.8	2	57.26
9744	1 2492	8.6 K5	10 49 11.879	308.29	-.13	1 21 41.96	-1909.4	-6.4	2	56.71
9764	15 2257	8.5 F5	10 50 13.934	318.06	-.50	15 0 22.24	-1912.1	-6.5	4	57.49
9767	59 1333	8.5 G5	10 50 16.488	374.78	-3.56	59 18 55.79	-1912.2	-7.8	2	56.73
9772	26 2145	6.8 M0	10 50 51.527	327.10	-.90	26 28 26.95	-1913.7	-6.7	2	56.68
9773	71 552	8.6 G5	10 50 52.440	421.89	-7.30	70 53 25.75	-1913.8	-8.7	2	58.26
9783	13 2322	7.2 K0	10 51 39.545	316.13	-.43	12 38 16.21	-1915.8	-6.4	2	56.81
9785	32 2085	8.5 G5	10 51 43.921	331.83	-1.13	31 59 49.70	-1916.0	-6.7	2	57.71
9786	54 1404	8.3 K0	10 51 43.975	360.99	-2.74	53 50 42.41	-1916.0	-7.3	2	57.72
9788	44 2028	8.9 K0	10 51 45.856	344.98	-1.80	43 50 59.31	-1916.1	-7.0	2	57.81
9790	63 930	8.5 K2	10 51 51.136	384.88	-4.36	63 12 58.92	-1916.3	-7.8	2	58.71
9791	21 2262	8.3 F5	10 51 51.411	322.38	-.70	21 2 23.34	-1916.3	-6.5	2	58.77
9794	6 2368	7.4 K0	10 52 9.860	311.50	-.25	6 6 52.08	-1917.1	-6.2	2	56.80
9796	- 2 3247	8.5 F0	10 52 16.311	305.57	-.02	- 2 34 48.38	-1917.4	-6.1	2	57.71
9799	69 592	8.8 F8	10 53 5.437	406.72	-6.19	68 50 55.90	-1919.5	-8.1	2	56.73
9803	46 1675	7.6 K0	10 53 22.221	347.04	-1.96	46 2 14.28	-1920.2	-6.8	2	57.16
9808	34 2183	8.3 K2	10 53 34.579	332.74	-1.20	33 38 54.25	-1920.7	-6.5	2	57.81
9814	40 2385	8.5 K0	10 53 56.391	339.29	-1.55	40 4 46.82	-1921.6	-6.6	2	57.72
9820	35 2196	8.2 K0	10 54 17.757	334.24	-1.29	35 27 56.73	-1922.5	-6.5	2	56.80
9827	38 2197	9.0 F8	10 54 40.071	336.60	-1.42	37 54 57.57	-1923.4	-6.5	2	57.74
9836	68 624	8.9 K0	10 55 25.449	398.64	-5.72	67 51 38.15	-1925.2	-7.7	2	58.71
9837	25 2319	7.6 K0	10 55 27.042	324.36	-.81	24 38 35.63	-1925.3	-6.2	2	57.34
9841	- 2 3259	8.5 K2	10 55 39.666	305.25	.00	- 3 13 0.27	-1925.8	-5.8	2	58.77
9842	14 2324	7.9 F5	10 55 40.773	316.24	-.45	13 32 46.77	-1925.9	-6.0	2	58.22
9843	62 1156	8.2 K0	10 55 42.983	376.84	-4.01	61 59 1.59	-1925.9	-7.2	2	57.73

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
9848	34 2188	8.1 G0	10 56 8.225	331.73	-1.19	33 35 5.83	-1926.9	-6.2	2	58.24
9852	- 3 3024	8.0 K5	10 56 21.101	304.50	.03	- 4 24 36.18	-1927.5	-5.7	2	58.81
9854	18 2429	7.1 K0	10 56 28.699	319.28	-.59	18 5 42.75	-1927.7	-6.0	2	57.34
9859	5 2425	8.2 K5	10 56 59.555	310.26	-.20	4 37 19.92	-1929.0	-5.7	2	58.79
9871	29 2110	8.3 F0	10 58 5.134	327.49	-1.00	29 29 14.68	-1931.6	-6.0	2	57.72
9876	67 677	8.1 K0	10 58 22.158	389.83	-5.24	66 43 7.93	-1932.2	-7.2	2	56.27
9879	6 2387	8.3 K5	10 58 28.163	310.80	-.22	5 36 8.68	-1932.5	-5.6	6	58.72
9884	50 1788	8.7 K5	10 58 46.810	349.18	-2.26	49 52 42.25	-1933.2	-6.3	2	57.79
9887	38 2205	7.7 K0	10 58 54.065	335.10	-1.42	38 16 36.92	-1933.5	-6.0	2	57.69
9893	46 1685	8.6 K2	10 59 19.147	343.38	-1.91	45 52 50.03	-1934.4	-6.1	2	57.70
9912	41 2155	8.1 K0	11 0 17.373	337.01	-1.57	40 46 26.41	-1936.6	-5.9	2	57.19
9919	33 2072	8.5 K5	11 0 57.479	329.08	-1.12	32 34 26.05	-1938.1	-5.7	2	57.28
9924	8 2452	7.2 K0	11 1 5.323	312.01	-.27	7 51 6.59	-1938.4	-5.4	2	56.78
9925	39 2410	8.1 K0	11 1 5.756	335.06	-1.46	39 13 50.81	-1938.4	-5.8	2	56.77
9928	10 2240	7.7 K2	11 1 20.415	313.43	-.34	10 13 10.69	-1939.0	-5.4	2	57.18
9930	17 2309	8.4 F2	11 1 26.475	317.35	-.52	16 31 34.28	-1939.2	-5.4	2	57.79
9933	15 2282	8.2 K2	11 1 36.274	316.05	-.46	14 31 7.59	-1939.5	-5.4	2	56.69
9953	45 1892	7.7 K2	11 2 56.392	339.76	-1.80	44 34 18.53	-1942.5	-5.7	2	57.33
9954	54 1414	7.6 M0	11 2 58.290	352.82	-2.66	54 7 15.74	-1942.5	-5.9	2	56.70
9956	66 697	8.0 G5	11 3 0.041	381.71	-4.93	66 8 45.33	-1942.6	-6.4	4	59.45
9958	12 2300	8.3 K0	11 3 3.700	314.53	-.40	12 21 33.68	-1942.7	-5.2	2	57.23
9966	25 2338	8.4 G5	11 3 26.710	322.20	-.79	24 29 51.02	-1943.5	-5.3	2	57.25
9967	1 2519	7.2 M0	11 3 28.128	308.17	-.10	1 28 52.25	-1943.6	-5.1	2	57.26
9970	56 1498	7.1 K2	11 3 43.433	356.15	-2.94	56 21 44.04	-1944.1	-5.9	2	56.71
9977	21 2282	7.4 K0	11 4 15.769	319.52	-.65	20 45 14.49	-1945.3	-5.2	4	58.97
9986	49 2020	8.4 A5	11 4 48.052	344.11	-2.14	49 5 36.08	-1946.4	-5.6	2	56.80
9992	23 2308	7.8 K2	11 5 13.675	320.91	-.74	23 14 39.85	-1947.3	-5.1	2	57.73
9995	9 2452	8.1 F5	11 5 29.939	312.48	-.30	9 17 40.75	-1947.9	-4.9	2	57.79
9996	7 2417	8.3 F8	11 5 38.017	311.10	-.23	6 50 40.53	-1948.1	-4.9	2	58.26
9999	- 3 3053	8.4 K5	11 5 45.500	305.34	.04	- 3 37 32.34	-1948.4	-4.8	2	58.25
10000	36 2157	7.4 K0	11 5 50.882	330.29	-1.28	36 16 54.00	-1948.6	-5.2	2	57.35
10003	34 2200	9.0 G0	11 5 56.879	328.50	-1.18	34 8 34.44	-1948.8	-5.2	2	57.80
10004	59 1351	7.4 G5	11 5 58.299	360.28	-3.38	59 29 10.27	-1948.8	-5.7	2	57.78
10005	0 2750	8.0 K2	11 6 1.903	307.17	-.05	- 0 17 30.26	-1948.9	-4.8	2	57.81
10009	58 1303	8.5 K0	11 6 10.463	356.88	-3.12	57 53 20.48	-1949.2	-5.6	2	57.74
10012	28 1971	8.1 F8	11 6 14.514	324.02	-.92	28 15 29.94	-1949.4	-5.1	2	56.71
10035	26 2181	8.8 K0	11 8 26.713	322.06	-.84	26 18 9.56	-1953.8	-4.8	2	56.79
10037	38 2215	8.7 K0	11 8 40.191	330.49	-1.37	37 58 12.21	-1954.2	-4.9	2	57.80
10045	33 2088	8.5 G5	11 9 26.156	326.23	-1.11	32 53 12.64	-1955.7	-4.8	2	57.17
10048	22 2329	8.7 K5	11 9 33.678	319.31	-.69	22 19 39.15	-1955.9	-4.7	2	57.81
10051	13 2369	8.3 K2	11 9 40.921	314.31	-.41	13 29 33.77	-1956.1	-4.6	2	58.29
10056	69 603	8.0 G0	11 9 56.290	382.92	-5.74	69 2 25.56	-1956.6	-5.6	2	57.73
10059	16 2230	8.4 K5	11 10 1.896	315.88	-.50	16 28 47.05	-1956.8	-4.6	2	58.80
10060	10 2260	7.6 K2	11 10 6.789	312.49	-.31	10 8 15.75	-1957.0	-4.5	2	58.25
10068	53 1476	7.9 K0	11 10 43.253	345.33	-2.48	53 7 23.52	-1958.1	-5.0	2	58.23
10069	30 2123	8.5 F8	11 10 43.695	323.67	-.97	29 49 29.65	-1958.1	-4.6	2	57.85
10072	63 947	7.7 G5	11 11 4.522	361.83	-3.86	62 33 15.97	-1958.8	-5.2	2	57.77
10074	4 2439	8.8 F5	11 11 15.667	309.15	-.14	3 41 48.68	-1959.1	-4.3	2	58.82
10077	24 2332	8.0 B9	11 11 26.273	319.91	-.75	24 6 55.16	-1959.4	-4.5	2	58.75
10079	20 2573	7.4 G5	11 11 45.691	317.66	-.62	20 18 12.85	-1960.0	-4.4	2	57.74

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
10080	1 2539	8.3 K2	11 11 46.216	307.89	-.07	1 9 34.04	-1960.0	-4.3	2	58.34
10081	- 1 2499	8.6 F0	11 11 52.225	306.28	.02	- 2 9 19.39	-1960.2	-4.2	3	58.84
10084	74 456	7.2 K5	11 11 56.333	402.70	-8.18	73 44 47.66	-1960.4	-5.7	3	59.55
10097	15 2311	7.1 K0	11 12 48.221	314.85	-.46	15 23 9.99	-1961.9	-4.3	2	57.26
10101	80 350	8.0 K0	11 12 53.182	459.05	-16.23	79 48 32.85	-1962.1	-6.4	2	56.18
10105	65 823	7.2 K0	11 12 59.457	366.17	-4.42	65 10 50.14	-1962.2	-5.0	2	57.70
10110	41 2172	8.6 F5	11 13 23.586	330.62	-1.49	40 48 11.94	-1963.0	-4.4	2	57.79
10127	17 2337	8.0 G5	11 14 38.336	315.47	-.51	17 13 38.78	-1965.1	-4.1	2	56.68
10128	23 2329	8.8 K2	11 14 46.017	318.50	-.70	23 6 4.06	-1965.4	-4.1	2	56.72
10131	25 2362	7.8 K0	11 15 6.014	319.64	-.78	25 19 29.65	-1965.9	-4.1	2	56.26
10133	64 840	8.7 A0	11 15 33.822	361.14	-4.18	64 26 2.43	-1966.7	-4.7	2	57.34
10142	76 423	8.4 F0	11 16 14.876	412.44	-10.28	76 26 21.15	-1967.8	-5.3	2	56.80
10145	10 2274	8.0 A2	11 16 31.053	311.78	-.29	10 1 28.96	-1968.3	-3.9	2	57.73
10151	71 568	8.1 G5	11 16 54.530	380.78	-6.42	71 13 21.98	-1968.9	-4.8	2	57.31
10157	19 2438	7.7 K0	11 17 12.577	316.04	-.57	19 21 23.10	-1969.4	-3.9	2	56.16
10164	30 2137	7.3 K5	11 17 30.419	321.77	-.97	30 23 39.85	-1969.9	-3.9	2	56.70
10175	3 2488	7.9 K0	11 18 13.948	308.65	-.11	3 8 10.82	-1971.0	-3.7	2	57.25
10177	12 2328	8.6 K0	11 18 21.816	312.24	-.33	11 29 35.51	-1971.3	-3.7	2	56.73
10186	36 2180	8.2 K0	11 18 47.671	324.64	-1.21	35 55 11.03	-1972.0	-3.8	2	57.74
10196	41 2183	7.8 G5	11 19 18.182	328.06	-1.49	41 18 5.26	-1972.7	-3.8	2	56.71
10198	0 2777	8.2 K5	11 19 22.759	307.26	-.02	- 0 9 17.27	-1972.9	-3.5	2	56.76
10211	15 2326	8.2 K0	11 20 18.148	313.32	-.42	14 35 51.56	-1974.3	-3.5	2	56.72
10212	63 957	7.7 F0	11 20 21.916	352.43	-3.76	62 59 28.37	-1974.4	-4.0	2	57.28
10225	49 2050	6.8 K5	11 21 48.534	332.72	-1.98	48 52 50.45	-1976.5	-3.6	2	57.70
10226	18 2488	7.4 G5	11 21 48.971	314.36	-.50	17 37 6.03	-1976.5	-3.4	2	57.31
10229	60 1326	7.7 G5	11 21 52.807	345.55	-3.20	59 56 18.76	-1976.6	-3.7	2	56.71
10232	32 2146	7.8 K0	11 22 15.126	321.07	-1.02	32 6 0.65	-1977.1	-3.4	2	56.73
10241	20 2600	8.6 K2	11 22 36.022	315.12	-.57	19 45 33.73	-1977.6	-3.3	2	57.26
10242	6 2448	7.8 K2	11 22 36.449	309.62	-.17	6 0 52.57	-1977.7	-3.3	2	57.25
10249	59 1377	9.0 G5	11 22 59.891	343.13	-3.05	59 2 13.78	-1978.2	-3.6	2	57.72
10263	29 2160	7.6 F0	11 24 18.345	318.67	-.88	28 40 56.84	-1980.0	-3.2	2	56.17
10270	69 608	8.6 A2	11 24 41.364	359.93	-5.10	68 42 12.85	-1980.5	-3.6	4	59.49
10271	24 2357	8.8 K0	11 24 47.805	316.26	-.69	23 35 48.72	-1980.7	-3.1	2	56.70
10276	70 661	8.7 F0	11 25 1.736	363.32	-5.57	70 3 59.61	-1981.0	-3.6	2	57.81
10284	- 1 2528	8.4 K0	11 25 30.418	306.56	.05	- 2 11 47.22	-1981.6	-2.9	4	59.47
10294	51 1668	8.5 G5	11 26 23.457	331.04	-2.08	50 32 16.54	-1982.7	-3.1	2	57.74
10300	7 2452	8.8 K2	11 26 38.260	309.73	-.19	7 4 44.87	-1983.1	-2.9	2	56.32
10301	6 2454	8.6 G5	11 26 38.832	309.49	-.17	6 22 26.44	-1983.1	-2.8	2	57.79
10305	- 0 2444	7.2 K2	11 26 50.734	307.13	.02	- 0 34 24.36	-1983.3	-2.8	2	58.34
10310	17 2363	8.3 A2	11 27 21.938	313.22	-.48	17 15 39.93	-1984.0	-2.8	2	56.68
10327	57 1327	7.5 K5	11 28 39.980	335.81	-2.74	57 24 38.84	-1985.6	-2.9	2	56.24
10334	40 2436	8.3 K2	11 28 50.891	322.72	-1.39	40 22 21.81	-1985.8	-2.8	2	56.79
10339	31 2274	8.0 K0	11 29 0.539	318.26	-.96	31 14 55.59	-1986.0	-2.7	2	57.24
10340	25 2388	6.9 K2	11 29 14.135	315.51	-.71	24 35 15.38	-1986.2	-2.7	2	56.16
10357	61 1247	8.7 G5	11 30 14.702	338.42	-3.20	60 54 29.41	-1987.4	-2.8	2	56.79
10358	34 2230	7.3 K2	11 30 22.826	319.09	-1.08	34 19 40.45	-1987.5	-2.6	2	56.66
10359	20 2616	8.4 G5	11 30 25.414	313.52	-.55	19 48 38.28	-1987.6	-2.5	2	57.23
10368	4 2492	8.8 A3	11 30 50.468	308.63	-.10	4 24 38.20	-1988.1	-2.4	2	57.71
10369	26 2231	8.9 K0	11 30 52.705	315.74	-.77	26 25 22.70	-1988.1	-2.5	3	57.29
10371	8 2520	8.2 K0	11 30 57.286	309.78	-.21	8 15 19.05	-1988.2	-2.4	2	58.25

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
10377	14	2404	7.7 K2	11 31 21.108	311.43	-.36	13 49 43.81	-1988.6	-2.4	2	56.76
10379	49	2066	7.9 G0	11 31 24.311	326.35	-1.89	48 50 41.52	-1988.7	-2.5	2	57.25
10394	44	2107	8.2 G5	11 32 19.090	322.82	-1.56	43 54 11.41	-1989.7	-2.4	2	57.34
10405	10	2310	8.1 F2	11 33 2.424	310.05	-.25	9 51 25.40	-1990.4	-2.2	2	57.23
10406	18	2510	7.0 K0	11 33 4.711	312.46	-.49	18 9 4.06	-1990.4	-2.2	2	56.73
10409	1	2586	8.6 K0	11 33 13.524	307.46	.01	0 29 11.07	-1990.6	-2.2	4	58.04
10417	75	450	8.2 K5	11 33 57.760	365.45	-7.84	75 23 45.28	-1991.3	-2.6	2	57.73
10421	57	1332	7.9 K5	11 34 14.996	330.64	-2.64	57 16 20.37	-1991.6	-2.3	2	58.28
10422	11	2379	8.2 F5	11 34 21.798	310.17	-.27	10 47 14.92	-1991.7	-2.1	2	57.80
10428	62	1190	7.2 M0	11 34 37.468	335.66	-3.36	62 28 23.03	-1992.0	-2.3	2	57.77
10429	0	2811	7.6 K0	11 34 43.102	307.25	.03	- 0 18 5.07	-1992.1	-2.0	2	58.34
10443	59	1394	8.7 G5	11 35 41.033	331.23	-2.88	59 22 34.43	-1993.0	-2.1	2	57.74
10446	20	2631	8.5 A3	11 35 51.568	312.54	-.55	20 22 39.01	-1993.2	-2.0	2	58.23
10450	30	2180	8.9 F5	11 35 59.095	315.41	-.88	30 2 1.39	-1993.3	-2.0	2	57.27
10453	24	2374	7.4 K0	11 36 7.533	313.39	-.65	23 36 26.36	-1993.4	-2.0	2	56.68
10455	39	2460	7.2 K5	11 36 10.830	318.73	-1.30	39 26 58.38	-1993.4	-2.0	2	57.77
10456	8	2533	8.8 K0	11 36 12.134	309.19	-.18	7 40 21.49	-1993.5	-1.9	4	58.03
10461	73	531	8.8 A0	11 36 44.017	351.14	-6.16	72 49 37.35	-1993.9	-2.2	2	57.34
10463	17	2382	8.0 K0	11 36 51.366	311.40	-.43	16 48 54.13	-1994.0	-1.9	2	56.17
10469	26	2243	8.0 K0	11 37 35.660	313.81	-.74	26 25 51.35	-1994.7	-1.8	2	56.79
10470	37	2205	8.2 K0	11 37 35.950	317.06	-1.15	36 45 9.16	-1994.7	-1.8	2	57.73
10491	45	1955	7.4 M0	11 39 0.825	319.32	-1.54	44 28 20.75	-1995.9	-1.7	2	56.78
10494	35	2272	8.2 K0	11 39 19.299	315.63	-1.05	34 35 7.26	-1996.1	-1.6	2	56.70
10500	19	2491	8.8 G0	11 40 2.553	311.34	-.49	19 3 3.93	-1996.7	-1.5	2	56.79
10506	56	1540	7.3 M0	11 40 29.011	324.37	-2.44	56 17 51.21	-1997.0	-1.6	2	56.66
10514	67	717	8.3 K5	11 40 52.782	333.73	-4.10	67 8 2.97	-1997.3	-1.6	2	56.69
10520	24	2386	7.1 K0	11 41 11.068	312.27	-.66	24 17 16.86	-1997.5	-1.5	2	56.17
10528	49	2079	7.3 K2	11 41 49.920	319.41	-1.80	48 47 37.92	-1998.0	-1.4	2	56.24
10529	22	2396	8.2 K0	11 41 52.451	311.52	-.57	21 39 19.70	-1998.0	-1.4	3	58.60
10532	54	1459	8.2 G5	11 41 59.510	321.73	-2.20	53 56 28.92	-1998.1	-1.4	2	57.72
10533	- 0	2479	8.3 M0	11 42 2.384	307.12	.07	- 1 6 25.99	-1998.1	-1.3	2	57.74
10545	17	2394	8.1 K2	11 42 28.743	310.53	-.43	17 26 15.88	-1998.4	-1.3	2	57.79
10546	16	2289	8.3 K2	11 42 29.326	310.18	-.38	15 36 47.64	-1998.4	-1.3	2	56.79
10551	20	2645	7.3 K0	11 42 45.541	311.02	-.52	20 10 2.65	-1998.6	-1.3	2	56.71
10553	7	2477	7.1 K0	11 42 49.926	308.61	-.15	7 18 28.57	-1998.7	-1.3	2	56.73
10562	40	2461	8.1 K2	11 43 20.867	315.37	-1.26	39 40 23.12	-1999.0	-1.2	2	57.26
10574	4	2526	7.6 K0	11 44 12.759	307.93	-.05	3 45 8.00	-1999.5	-1.1	2	57.26
10576	5	2539	8.2 K2	11 44 27.617	308.15	-.09	5 10 14.85	-1999.7	-1.1	4	58.25
10581	25	2418	7.8 K0	11 44 43.633	311.42	-.65	24 42 8.74	-1999.8	-1.1	2	56.73
10588	33	2156	7.6 K5	11 45 18.625	312.84	-.94	32 46 7.77	-2000.1	-1.0	2	56.73
10589	28	2046	7.6 G5	11 45 20.724	311.79	-.75	27 37 6.40	-2000.2	-1.0	2	56.26
10605	12	2381	8.2 K5	11 46 33.230	309.01	-.27	12 9 15.99	-2000.8	-.9	2	57.71
10609	30	2194	7.8 K0	11 46 59.471	311.66	-.82	29 46 36.11	-2001.0	-.9	2	56.72
10618	35	2285	8.5 K0	11 47 36.775	312.39	-1.02	35 4 4.51	-2001.3	-.8	2	56.17
10619	- 1	2576	7.8 G0	11 47 52.850	307.06	.11	- 2 8 24.95	-2001.5	-.8	2	56.80
10620	44	2132	7.6 G5	11 47 59.405	314.07	-1.44	43 56 14.13	-2001.5	-.8	2	56.73
10621	62	1199	7.8 K0	11 47 59.703	320.28	-2.94	61 38 0.36	-2001.5	-.8	2	57.27
10627	71	588	8.4 K0	11 48 22.122	327.45	-4.95	71 23 18.07	-2001.7	-.8	2	57.26
10629	23	2396	8.7 K0	11 48 29.229	310.18	-.59	23 1 16.54	-2001.7	-.7	2	57.80
10634	58	1340	7.9 G5	11 48 44.228	317.80	-2.48	57 55 8.81	-2001.8	-.7	2	58.28

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
10636	7 2489	7.6 K5	11 49 0.020	308.13	-.13	7 9 16.28	-2001.9	-.7	2	57.74
10638	68 664	9.0 A2	11 49 13.340	322.98	-4.04	68 8 3.84	-2002.0	-.7	2	57.79
10655	63 981	8.0 G5	11 50 20.540	318.47	-3.10	63 12 6.88	-2002.5	-.6	2	57.79
10656	14 2445	7.3 K0	11 50 21.832	308.70	-.30	13 41 58.55	-2002.5	-.5	2	56.87
10658	74 475	7.5 K0	11 50 39.915	325.77	-5.60	73 34 11.45	-2002.6	-.5	2	57.27
10661	- 3 3197	8.3 K5	11 50 53.914	306.99	.16	- 3 36 19.43	-2002.7	-.5	2	58.23
10668	11 2409	8.1 K0	11 51 19.444	308.35	-.23	11 23 50.95	-2002.8	-.4	2	57.26
10669	60 1360	8.2 K0	11 51 21.730	316.03	-2.66	59 57 30.84	-2002.8	-.4	2	57.74
10672	21 2373	8.6 K7	11 51 24.245	309.23	-.50	20 46 5.86	-2002.8	-.4	2	58.28
10676	5 2555	7.8 K5	11 51 30.694	307.77	-.07	5 9 25.44	-2002.9	-.4	2	58.26
10679	18 2539	7.5 F8	11 51 33.366	308.97	-.43	18 26 52.41	-2002.9	-.4	2	57.24
10684	4 2541	8.4 K0	11 51 54.905	307.68	-.04	4 18 54.60	-2003.0	-.4	2	57.74
10689	- 1 2587	8.6 K0	11 52 21.007	307.16	.13	- 2 5 47.90	-2003.1	-.3	2	57.20
10691	0 2858	8.2 F2	11 52 27.103	307.31	.08	- 0 16 40.94	-2003.2	-.3	2	58.34
10692	2 2493	8.2 K5	11 52 30.144	307.45	.03	1 35 43.35	-2003.2	-.3	2	57.84
10694	56 1554	8.3 K0	11 52 41.877	313.71	-2.26	56 17 20.66	-2003.2	-.3	2	58.26
10716	33 2172	8.1 K0	11 54 11.984	309.48	-.89	32 28 52.80	-2003.6	-.1	2	56.81
10717	6 2529	7.6 K0	11 54 14.481	307.66	-.07	5 37 24.22	-2003.6	-.1	2	56.26
10718	53 1516	8.6 K0	11 54 14.926	311.84	-1.99	53 22 16.44	-2003.6	-.1	2	57.26
10722	41 2252	6.8 K2	11 54 32.029	310.06	-1.22	40 34 1.72	-2003.7	-.1	2	56.72
10723	27 2071	8.7 K0	11 54 38.117	308.95	-.70	27 26 16.78	-2003.7	-.1	2	57.79
10726	45 1977	8.7 M0	11 54 41.959	310.43	-1.46	45 17 19.78	-2003.8	-.1	2	58.80
10727	23 2408	8.7 F8	11 54 45.021	308.64	-.57	23 15 17.06	-2003.7	-.1	2	58.28
10743	55 1500	8.2 K0	11 56 6.482	310.54	-2.08	54 45 51.18	-2004.0	.0	2	57.20
10745	38 2294	7.7 K2	11 56 10.828	309.08	-1.11	38 9 18.86	-2004.0	.1	2	57.79
10747	16 2323	8.5 K5	11 56 21.384	307.92	-.33	15 32 39.17	-2004.0	.1	2	57.82
10755	- 3 3217	8.4 K5	11 57 11.564	307.22	.18	- 3 40 35.39	-2004.1	.2	2	57.34
10761	52 1601	8.7 G5	11 57 24.923	309.26	-1.85	52 2 59.03	-2004.1	.2	2	57.32
10766	17 2422	7.9 G0	11 57 40.874	307.74	-.37	16 52 58.43	-2004.2	.2	2	56.80
10776	8 2559	8.2 K2	11 58 27.832	307.46	-.13	8 11 36.87	-2004.2	.3	2	56.80
10781	25 2448	8.3 K0	11 58 43.923	307.66	-.59	24 29 45.44	-2004.2	.3	4	58.55
10783	66 742	7.1 K2	11 58 50.083	308.88	-3.36	66 24 4.26	-2004.2	.3	2	56.18
10785	0 2878	8.3 G	11 58 54.206	307.32	.09	- 0 6 1.51	-2004.2	.3	2	57.33
10793	56 1558	8.7 K5	11 59 15.360	307.97	-2.14	56 6 19.98	-2004.2	.4	2	57.73
10795	1 2641	8.1 K2	11 59 47.590	307.33	.07	0 50 31.75	-2004.3	.4	2	58.23
10797	12 2416	8.6 K0	12 0 5.419	307.32	-.23	12 9 20.96	-2004.3	.4	4	58.06
10799	78 404	8.7 F8	12 0 18.495	306.48	-6.87	77 58 17.17	-2004.3	.5	2	57.81
10801	41 2265	7.7 F5	12 0 26.659	307.10	-1.22	41 20 36.71	-2004.3	.5	2	56.20
10802	47 1923	8.2 K0	12 0 38.672	306.92	-1.53	47 26 58.84	-2004.2	.5	2	56.73
10806	29 2251	8.4 K2	12 0 45.078	307.08	-.74	29 23 57.47	-2004.2	.5	2	57.34
10812	62 1214	7.7 K0	12 1 26.374	305.77	-2.64	61 40 54.28	-2004.2	.6	2	56.86
10818	45 1991	8.2 K0	12 1 40.300	306.36	-1.38	44 43 43.45	-2004.2	.6	2	58.28
10819	8 2566	8.6 F8	12 1 44.810	307.19	-.11	7 40 38.99	-2004.2	.6	2	57.86
10820	64 877	8.2 G5	12 1 44.958	305.20	-2.97	64 22 19.89	-2004.2	.6	2	58.35
10821	5 2580	7.3 M0	12 1 45.108	307.23	-.04	5 12 36.92	-2004.2	.6	2	58.74
10823	36 2235	7.3 K0	12 2 7.474	306.43	-.98	35 50 44.80	-2004.2	.6	2	58.26
10824	17 2430	7.3 F8	12 2 8.899	306.96	-.35	16 32 51.01	-2004.1	.7	2	58.82
10827	33 2189	8.2 K0	12 2 18.033	306.45	-.87	33 7 47.14	-2004.2	.7	2	58.34
10830	21 2388	8.6 K0	12 2 30.909	306.78	-.46	20 30 9.80	-2004.1	.7	2	56.73
10836	15 2408	8.5 K0	12 2 40.173	306.91	-.30	15 7 46.58	-2004.1	.7	2	57.27

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
10844	27 2092	8.9 F8	12 3 0.369	306.45	-.64	26 38 21.99	-2004.1	.7	2	58.25
10862	0 2894	7.6 K0	12 4 37.714	307.34	.12	- 0 21 6.03	-2003.8	.9	2	56.19
10863	69 645	8.1 G5	12 4 38.345	300.15	-3.67	69 21 14.81	-2003.8	.9	2	57.26
10867	20 2683	7.6 K2	12 4 49.876	306.32	-.42	19 37 53.55	-2003.8	.9	2	56.78
10868	5 2587	8.2 K0	12 4 59.282	307.08	-.02	4 47 29.67	-2003.8	.9	2	57.26
10870	14 2474	7.5 K0	12 5 2.668	306.60	-.26	13 47 42.42	-2003.7	.9	2	57.32
10871	42 2274	7.5 K5	12 5 3.381	304.64	-1.23	42 20 57.54	-2003.8	.9	2	58.25
10874	- 2 3466	8.5 F8	12 5 15.159	307.48	.18	- 2 51 7.69	-2003.7	.9	3	57.98
10875	72 558	8.5 A2	12 5 25.060	297.59	-4.20	72 2 17.85	-2003.7	.9	3	58.31
10878	6 2555	8.1 K0	12 5 29.121	306.97	-.06	6 18 53.23	-2003.7	1.0	2	57.82
10880	- 3 3239	7.6 K0	12 5 38.540	307.56	.21	- 4 0 32.16	-2003.7	1.0	2	57.82
10881	31 2332	7.9 K2	12 5 42.874	305.36	-.76	30 33 13.28	-2003.6	1.0	2	57.73
10885	38 2304	8.8 K2	12 6 17.527	304.45	-1.05	38 8 0.78	-2003.5	1.0	2	57.26
10886	49 2116	7.4 K0	12 6 22.468	302.98	-1.58	49 27 49.37	-2003.5	1.0	2	57.36
10909	17 2444	7.5 K2	12 7 34.896	306.00	-.33	16 42 18.72	-2003.2	1.2	2	57.73
10911	49 2118	8.1 K0	12 7 41.729	302.20	-1.52	48 48 32.70	-2003.1	1.2	2	57.26
10913	29 2263	7.6 K0	12 7 55.677	304.73	-.71	29 20 46.33	-2003.1	1.2	2	57.33
10914	45 2001	8.5 F8	12 8 12.925	302.46	-1.36	45 27 13.51	-2003.0	1.2	2	56.81
10917	15 2422	8.6 K2	12 8 27.313	306.03	-.27	14 42 9.42	-2002.9	1.2	2	56.82
10929	0 2907	7.6 K0	12 8 51.702	307.28	.11	0 28 18.53	-2002.8	1.3	2	56.81
10942	65 874	7.6 K2	12 9 38.576	295.41	-2.79	64 44 30.69	-2002.5	1.3	2	57.32
10944	87 104	8.0 K0	12 9 43.153	190.98	-7.29	87 12 36.76	-2002.5	1.0	2	57.25
10951	74 489	8.7 F5	12 10 1.892	286.93	-4.39	74 0 8.39	-2002.3	1.3	2	58.35
10955	22 2450	8.5 K0	12 10 23.632	304.94	-.45	21 29 27.86	-2002.2	1.4	2	56.73
10959	61 1283	8.4 A2	12 10 35.232	296.34	-2.34	60 41 16.16	-2002.1	1.4	2	57.81
10960	12 2435	7.8 K5	12 10 41.054	306.02	-.19	11 47 39.06	-2002.1	1.5	2	56.80
10961	67 735	8.5 F8	12 10 42.526	292.37	-3.10	67 21 5.17	-2002.1	1.4	2	58.28
10973	27 2105	7.4 G5	12 11 46.216	303.86	-.61	26 46 58.42	-2001.6	1.6	2	57.28
10979	40 2513	6.7 K5	12 12 6.412	301.49	-1.06	39 37 13.07	-2001.5	1.6	2	56.81
10983	34 2301	8.2 F5	12 12 27.884	302.51	-.83	33 32 2.54	-2001.3	1.6	2	57.34
10988	59 1431	8.3 K5	12 12 40.486	294.92	-2.17	59 13 32.46	-2001.2	1.6	2	57.31
10990	17 2454	7.0 K2	12 12 41.054	305.04	-.33	17 11 5.91	-2001.2	1.7	2	56.28
10994	53 1535	7.7 K0	12 12 58.519	297.30	-1.72	52 59 42.28	-2001.0	1.7	2	57.37
10998	7 2526	7.7 K0	12 13 42.214	306.42	-.04	6 30 3.23	-2000.7	1.8	2	57.28
10999	- 3 3257	8.3 K0	12 13 42.153	307.91	.24	- 4 10 25.66	-2000.7	1.8	2	58.28
11002	- 1 2639	8.0 K0	12 14 10.171	307.68	.20	- 2 27 41.50	-2000.4	1.8	2	58.71
11007	1 2676	8.2 K0	12 14 24.709	307.23	.12	0 37 47.35	-2000.3	1.8	2	58.34
11011	36 2257	9.0 K2	12 15 2.208	301.01	-.90	35 48 38.33	-1999.9	1.9	2	56.34
11023	3 2626	8.2 A2	12 15 45.674	306.78	.05	3 22 43.75	-1999.5	2.0	2	57.80
11027	8 2586	7.8 K0	12 15 54.672	305.97	-.08	8 20 33.18	-1999.4	2.0	2	56.81
11028	- 2 3494	8.4 K2	12 16 0.438	307.77	.21	- 2 44 40.64	-1999.4	2.0	2	57.82
11029	41 2287	8.1 G5	12 16 6.559	299.11	-1.09	41 11 37.92	-1999.3	2.0	2	58.27
11033	18 2587	8.7 F8	12 16 25.556	304.29	-.32	17 36 25.42	-1999.1	2.0	2	58.28
11039	66 754	7.9 K2	12 16 34.907	285.99	-2.69	65 38 40.86	-1999.0	1.9	2	57.73
11040	47 1949	8.7 K0	12 16 36.696	297.12	-1.32	46 31 29.24	-1999.0	2.0	2	56.81
11041	53 1537	8.0 K0	12 16 40.061	294.57	-1.65	52 42 58.67	-1999.0	2.0	2	57.79
11049	63 1009	7.9 A3	12 17 16.892	287.88	-2.37	62 38 12.06	-1998.6	2.0	2	58.80
11052	48 2017	8.6 A3	12 17 23.597	296.04	-1.39	48 4 49.09	-1998.5	2.1	2	58.77
11054	44 2180	7.4 G5	12 17 30.105	297.52	-1.20	43 53 10.19	-1998.4	2.1	2	57.25
11062	84 274	7.8 G5	12 18 18.479	211.50	-4.87	83 39 4.22	-1997.9	1.7	2	57.79

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
11064	80 383	8.3 K2	12 18 32.266	244.21	-4.97	80 17 35.15	-1997.7	1.9	2	57.88
11068	32 2234	8.8 F5	12 18 40.063	300.64	-.73	31 34 46.95	-1997.6	2.2	2	57.34
11069	4 2606	8.3 F2	12 18 40.900	306.57	.04	3 59 7.09	-1997.6	2.2	2	57.79
11070	35 2333	7.1 K0	12 18 41.405	299.72	-.84	34 57 51.98	-1997.6	2.2	2	57.73
11074	0 2932	8.2 K2	12 19 4.170	307.30	.14	0 7 9.58	-1997.3	2.3	2	56.86
11080	28 2109	8.6 G0	12 19 25.559	301.42	-.60	27 35 11.86	-1997.1	2.3	2	58.28
11082	33 2225	7.4 K0	12 19 31.778	299.84	-.78	33 22 3.71	-1997.0	2.3	2	56.33
11090	20 2713	7.9 K2	12 20 10.652	302.96	-.39	20 25 34.15	-1996.6	2.4	2	56.82
11092	40 2529	8.3 K0	12 20 21.867	297.53	-.99	39 33 9.71	-1996.3	2.3	2	57.26
11093	50 1915	8.9 M0	12 20 24.874	293.00	-1.47	50 19 23.64	-1996.3	2.3	2	58.26
11094	60 1396	8.0 K0	12 20 26.846	286.38	-2.10	60 22 54.29	-1996.3	2.3	2	57.73
11102	71 613	8.4 K0	12 20 44.098	273.04	-3.12	70 36 2.33	-1996.1	2.2	2	56.80
11114	58 1373	7.9 K2	12 21 35.681	287.16	-1.91	58 3 39.68	-1995.4	2.4	4	57.76
11118	5 2623	7.8 K0	12 21 59.285	306.29	.04	4 36 30.29	-1995.0	2.6	2	56.85
11124	26 2347	8.3 F8	12 22 31.859	300.98	-.53	25 50 14.50	-1994.6	2.6	2	57.81
11125	38 2331	8.7 K0	12 22 38.272	297.21	-.91	37 29 52.15	-1994.5	2.6	2	57.81
11131	10 2421	8.0 K5	12 22 58.760	304.96	-.10	10 1 43.37	-1994.2	2.6	2	57.78
11141	55 1531	7.7 K2	12 23 56.947	287.52	-1.67	54 51 55.10	-1993.3	2.6	2	57.34
11144	76 449	8.5 K5	12 24 8.032	251.01	-3.60	75 59 44.33	-1993.2	2.3	2	57.71
11145	14 2502	8.6 K0	12 24 21.351	303.71	-.21	14 19 14.48	-1992.9	2.8	4	58.56
11146	49 2139	8.2 G5	12 24 23.466	291.03	-1.36	48 56 17.73	-1992.9	2.7	2	57.80
11148	- 2 3520	8.5 K2	12 24 36.162	308.08	.24	- 3 0 38.10	-1992.7	2.8	2	58.72
11156	28 2116	7.3 K0	12 25 3.230	299.45	-.60	28 23 8.52	-1992.3	2.8	2	56.28
11159	5 2630	8.1 K0	12 25 6.186	306.13	.05	4 41 38.67	-1992.3	2.9	2	56.80
11160	6 2615	8.0 G5	12 25 6.691	305.68	.00	6 25 50.74	-1992.2	2.9	2	56.87
11162	9 2629	8.5 G5	12 25 21.201	304.94	-.07	9 10 29.07	-1992.0	2.9	2	57.26
11166	16 2377	8.2 F8	12 25 39.264	303.08	-.25	15 53 41.34	-1991.7	2.9	2	57.74
11171	79 393	8.5 K0	12 26 8.639	232.54	-3.56	78 30 11.74	-1991.2	2.4	2	57.81
11172	- 3 3302	8.4 F0	12 26 10.216	308.40	.27	- 4 0 50.39	-1991.2	3.0	2	57.73
11179	- 1 2674	7.6 M0	12 26 35.672	307.91	.23	- 2 9 11.71	-1990.8	3.0	2	56.78
11180	54 1530	9.0 A2	12 26 43.351	286.29	-1.56	53 32 13.98	-1990.6	2.9	2	56.86
11181	43 2227	8.3 K0	12 26 43.604	292.68	-1.09	43 17 29.00	-1990.6	2.9	2	57.82
11185	- 0 2583	8.7 K5	12 26 48.981	307.59	.19	- 0 57 24.18	-1990.6	3.0	2	58.72
11190	15 2469	7.5 K0	12 27 15.405	303.10	-.22	14 55 34.87	-1990.1	3.1	2	58.31
11196	63 1017	8.8 G	12 27 44.439	275.49	-2.14	63 7 25.50	-1989.6	2.8	2	57.88
11204	34 2319	8.4 F2	12 28 8.968	296.27	-.75	34 1 30.43	-1989.2	3.1	2	58.27
11209	32 2252	7.4 F5	12 28 32.276	297.08	-.68	31 41 57.93	-1988.7	3.1	2	57.80
11220	77 475	7.6 K0	12 28 59.285	234.52	-3.18	76 57 45.52	-1988.2	2.6	2	57.71
11229	18 2622	8.8 F5	12 29 31.943	301.77	-.29	17 56 21.03	-1987.6	3.2	2	57.82
11231	21 2428	8.6 F2	12 29 39.613	300.64	-.37	21 11 42.72	-1987.5	3.3	2	56.78
11248	8 2618	8.6 G5	12 31 2.418	304.93	-.01	7 33 24.33	-1985.9	3.4	2	57.73
11249	25 2522	7.2 M0	12 31 2.762	299.02	-.46	24 43 27.23	-1985.9	3.4	2	57.25
11251	5 2643	7.6 K0	12 31 4.034	305.91	.07	4 29 46.54	-1985.9	3.4	2	57.79
11252	28 2133	8.5 F2	12 31 8.269	297.56	-.57	28 21 25.45	-1985.8	3.4	2	57.87
11260	42 2322	8.8 K2	12 32 6.226	290.56	-1.00	41 56 45.50	-1984.6	3.4	2	57.73
11266	59 1448	8.4 A2	12 32 17.648	276.69	-1.74	58 30 47.05	-1984.4	3.3	2	57.28
11269	47 1970	7.7 K5	12 32 19.258	286.99	-1.20	47 16 58.54	-1984.4	3.4	2	57.31
11270	28 2134	8.8 G0	12 32 25.667	297.42	-.54	27 43 51.87	-1984.2	3.5	2	58.28
11284	17 2500	8.9 F5	12 33 15.899	301.38	-.25	17 6 19.32	-1983.2	3.6	2	58.74
11288	46 1797	7.3 K5	12 33 29.746	287.14	-1.14	46 3 20.60	-1982.9	3.5	2	57.25

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession 1st Term	Precession 2nd Term	Decl. 1950	Precession 1st Term	Precession 2nd Term	No. Obs.	Epoch 1900+
11295	1 2724	8.8 G0	12 33 48.349	306.87	.15	1 19 11.00	-1982.5	3.7	2	57.28
11299	21 2434	7.6 F5	12 34 18.798	299.87	-.33	20 30 44.78	-1981.8	3.7	2	56.89
11300	15 2483	8.7 G0	12 34 31.238	302.14	-.18	14 31 36.87	-1981.5	3.7	2	57.86
11308	13 2561	8.2 G5	12 34 50.919	302.56	-.15	13 15 30.35	-1981.1	3.8	2	56.81
11312	19 2590	8.8 F8	12 35 7.853	300.34	-.29	18 54 15.63	-1980.8	3.8	2	56.74
11325	- 3 3329	6.8 K5	12 36 8.882	308.84	.30	- 4 5 55.41	-1979.4	4.0	4	57.49
11333	61 1307	7.6 K0	12 36 43.739	268.38	-1.81	61 18 11.93	-1978.6	3.5	2	56.27
11343	37 2306	8.6 A0	12 37 31.746	290.75	-.81	37 16 21.47	-1977.4	3.9	2	56.79
11345	43 2249	9.1 K0	12 37 36.393	286.94	-.99	43 2 54.92	-1977.3	3.8	2	57.33
11346	25 2544	8.9 K5	12 37 36.627	297.03	-.45	25 15 47.06	-1977.3	4.0	2	57.72
11349	34 2341	7.1 K2	12 37 42.678	292.32	-.71	34 26 25.36	-1977.2	3.9	4	57.77
11350	8 2626	8.2 G5	12 38 2.952	304.23	.00	7 58 26.71	-1976.7	4.1	4	59.27
11352	75 479	8.3 K2	12 38 3.995	226.60	-2.34	74 41 42.44	-1976.7	3.2	2	57.36
11376	- 4 3331	8.2 G5	12 39 24.854	309.31	.33	- 4 56 47.34	-1974.7	4.3	2	57.32
11380	9 2661	8.8 K0	12 39 28.785	303.59	-.03	9 16 38.23	-1974.6	4.2	2	57.73
11381	33 2261	8.8 G0	12 39 38.446	292.31	-.66	33 8 14.17	-1974.4	4.1	2	57.80
11383	0 2972	8.4 F5	12 39 43.797	307.34	.20	- 0 2 3.72	-1974.2	4.3	2	56.28
11390	57 1388	7.4 K2	12 40 16.354	270.98	-1.53	57 16 22.62	-1973.4	3.9	2	56.72
11399	40 2566	9.1 F2	12 41 0.681	287.43	-.86	39 54 45.66	-1972.3	4.1	2	57.34
11405	11 2487	8.4 F2	12 41 30.121	302.56	-.07	11 11 41.94	-1971.5	4.4	2	57.26
11412	1 2746	8.2 M0	12 41 51.833	306.98	.19	0 48 36.40	-1970.9	4.5	2	56.87
11417	18 2655	8.4 F8	12 42 12.940	299.39	-.24	17 58 25.56	-1970.3	4.4	2	56.89
11423	28 2148	7.6 K0	12 42 36.212	294.38	-.49	27 40 1.37	-1969.7	4.4	2	57.27
11440	- 0 2608	8.1 K0	12 43 58.525	307.57	.23	- 0 32 55.59	-1967.4	4.7	2	56.79
11441	17 2532	8.7 A2	12 43 59.145	299.63	-.20	16 47 40.81	-1967.5	4.6	2	57.36
11444	37 2324	9.0 F5	12 44 15.814	287.92	-.75	37 7 16.93	-1967.0	4.4	2	57.70
11445	48 2055	7.8 M0	12 44 18.121	279.17	-1.09	47 38 43.09	-1966.9	4.3	3	58.37
11446	43 2258	7.7 F8	12 44 27.088	282.95	-.94	43 25 30.28	-1966.7	4.4	2	57.83
11450	33 2269	7.7 K5	12 44 42.426	290.61	-.62	32 50 26.26	-1966.2	4.5	2	58.39
11451	7 2575	8.5 K0	12 44 42.780	304.02	.03	7 16 50.48	-1966.2	4.7	2	58.28
11452	- 3 3360	8.1 K2	12 44 59.369	309.34	.33	- 4 24 30.06	-1965.8	4.8	2	58.72
11453	53 1568	7.6 K0	12 45 4.078	272.51	-1.28	53 8 3.33	-1965.6	4.3	2	57.31
11460	24 2495	7.2 G5	12 45 31.801	295.39	-.39	24 22 4.21	-1964.8	4.7	2	56.81
11464	21 2458	8.3 K2	12 45 54.831	297.17	-.30	20 54 34.79	-1964.2	4.7	2	57.34
11472	61 1319	7.6 K2	12 46 19.111	258.76	-1.58	61 5 33.68	-1963.5	4.2	2	58.73
11475	16 2427	8.7 F0	12 46 21.511	299.79	-.17	15 41 12.23	-1963.4	4.8	2	56.82
11483	34 2358	8.5 K0	12 46 37.547	289.08	-.65	34 3 10.02	-1962.9	4.7	2	57.83
11484	55 1555	8.4 A3	12 46 41.033	269.40	-1.32	54 31 13.19	-1962.8	4.4	2	57.73
11486	36 2309	8.1 K0	12 46 52.415	287.90	-.69	35 35 35.03	-1962.5	4.7	2	57.27
11491	39 2568	8.0 K0	12 47 19.740	285.42	-.77	38 38 24.19	-1961.7	4.7	4	57.83
11494	22 2517	8.6 A2	12 47 21.873	296.30	-.32	21 54 45.91	-1961.6	4.8	2	57.38
11504	46 1824	8.0 K0	12 48 18.617	278.03	-1.01	46 20 20.40	-1959.9	4.7	2	56.28
11505	59 1468	8.8 K7	12 48 18.727	260.18	-1.47	59 19 46.79	-1959.9	4.4	2	57.79
11511	15 2512	8.8 F8	12 48 54.951	299.67	-.15	15 7 51.32	-1958.8	5.0	2	57.36
11512	50 1954	8.0 K2	12 49 1.635	274.07	-1.11	49 32 26.59	-1958.6	4.7	2	56.73
11515	58 1397	7.4 M0	12 49 9.041	261.81	-1.41	58 0 11.41	-1958.3	4.5	2	56.89
11520	26 2399	7.5 K5	12 49 27.346	293.41	-.42	25 56 46.50	-1957.8	5.0	2	57.41
11523	- 0 2622	7.8 K5	12 49 38.245	307.66	.25	- 0 39 27.07	-1957.4	5.2	2	58.25
11529	51 1792	8.1 F5	12 50 5.284	272.12	-1.13	50 33 11.66	-1956.6	4.7	2	56.82
11530	34 2365	8.9 K0	12 50 6.850	287.70	-.63	34 6 27.04	-1956.5	5.0	2	58.27

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
11539	47 1998	7.2 M0	12 51 2.294	275.76	-1.00	46 55 39.09	-1954.8	4.9	2	56.88
11540	60 1425	7.6 K2	12 51 3.935	255.72	-1.45	60 13 23.96	-1954.7	4.5	2	57.81
11541	5 2690	7.6 K0	12 51 7.572	305.00	.12	4 30 34.12	-1954.6	5.3	2	57.77
11548	25 2571	8.0 K2	12 51 28.792	293.51	-.38	24 54 25.74	-1953.9	5.2	2	57.39
11549	63 1038	8.4 F8	12 51 28.941	249.24	-1.52	62 52 13.32	-1953.9	4.5	4	58.28
11550	27 2189	7.0 K2	12 51 29.687	292.13	-.43	27 3 3.70	-1953.8	5.2	2	56.82
11554	37 2334	8.5 G5	12 51 44.874	284.57	-.70	37 15 30.03	-1953.4	5.1	2	57.82
11561	40 2590	8.4 K5	12 52 30.263	281.87	-.77	39 59 35.24	-1951.9	5.1	2	57.36
11562	2 2599	8.8 K0	12 52 35.901	306.39	.20	1 45 21.08	-1951.6	5.5	2	58.74
11570	33 2284	8.4 G5	12 52 49.595	287.40	-.58	33 8 12.23	-1951.2	5.2	2	58.69
11572	13 2607	8.1 K0	12 52 59.433	300.28	-.08	12 58 22.01	-1950.9	5.4	2	56.79
11575	64 923	8.6 A5	12 53 3.772	243.14	-1.52	64 28 2.71	-1950.8	4.5	2	57.79
11585	53 1577	8.4 K0	12 53 29.927	266.29	-1.17	53 0 47.83	-1949.9	4.9	2	56.81
11588	24 2508	9.0 M0	12 53 36.982	293.64	-.34	23 50 40.71	-1949.7	5.4	2	57.73
11590	30 2345	9.1 A5	12 53 50.255	289.44	-.49	29 53 52.90	-1949.2	5.3	2	57.28
11591	79 407	7.9 K0	12 53 59.948	150.23	.44	78 46 13.47	-1948.9	3.0	2	57.82
11596	11 2515	8.4 A0	12 54 15.109	301.36	-.02	10 46 46.44	-1948.4	5.6	2	57.36
11597	51 1797	8.9 K7	12 54 17.657	268.11	-1.10	51 21 0.90	-1948.3	5.0	2	58.34
11608	26 2409	8.7 K2	12 55 19.249	291.61	-.39	26 12 22.31	-1946.2	5.5	2	57.39
11612	18 2681	8.3 K5	12 55 37.882	296.87	-.19	18 2 17.70	-1945.5	5.6	2	56.34
11613	49 2175	9.0 K0	12 55 52.219	270.87	-.99	48 30 14.78	-1945.0	5.2	2	58.74
11614	- 0 2637	8.5 A2	12 55 53.620	307.77	.26	- 0 46 55.68	-1944.9	5.8	2	57.70
11624	59 1475	8.3 F5	12 56 19.931	253.97	-1.29	58 38 36.53	-1944.0	4.9	2	56.82
11628	62 1268	7.1 K0	12 56 28.080	246.07	-1.38	61 59 11.69	-1943.7	4.8	2	56.28
11633	- 4 3390	8.0 K2	12 56 48.560	309.99	.37	- 4 38 13.80	-1943.0	6.0	2	57.84
11645	3 2719	8.6 F5	12 57 35.691	305.79	.18	2 39 12.76	-1941.3	6.0	2	57.26
11650	4 2683	7.4 K5	12 57 57.629	305.06	.15	3 52 22.58	-1940.5	6.0	2	56.81
11653	55 1571	8.9 G	12 58 7.285	260.32	-1.15	54 30 25.27	-1940.1	5.2	2	56.82
11655	88 76	7.5 K2	12 58 21.980	-618.70	200.26	87 55 5.74	-1939.6	-10.9	2	57.87
11657	39 2589	8.5 K0	12 58 29.341	279.82	-.70	39 11 44.23	-1939.3	5.6	2	56.72
11661	46 1836	7.9 K2	12 58 39.387	272.03	-.90	46 13 4.21	-1939.0	5.4	2	56.81
11665	26 2416	8.8 K0	12 58 54.643	290.85	-.37	25 52 11.03	-1938.4	5.8	2	57.80
11666	2 2614	7.6 M0	12 58 57.152	306.27	.21	1 47 20.77	-1938.3	6.1	2	56.80
11668	22 2537	7.0 K5	12 59 8.264	293.87	-.26	21 32 16.00	-1937.9	5.9	2	56.25
11672	19 2628	8.7 K2	12 59 34.389	295.58	-.20	18 53 40.10	-1936.9	6.0	2	56.79
11683	46 1839	7.4 M0	13 0 28.700	271.67	-.87	45 39 11.01	-1934.9	5.6	2	56.72
11687	51 1802	8.1 K0	13 0 42.335	263.65	-1.02	51 18 27.25	-1934.4	5.4	2	56.87
11699	31 2445	7.4 G5	13 1 26.076	285.83	-.49	31 16 10.78	-1932.7	5.9	2	56.78
11713	10 2509	8.0 K0	13 2 13.957	301.19	.03	9 43 2.71	-1930.8	6.3	2	57.81
11714	66 787	8.9 G	13 2 15.554	226.26	-1.26	66 8 34.82	-1930.8	4.8	4	58.32
11717	54 1566	7.4 K2	13 2 31.406	257.55	-1.07	54 7 30.22	-1930.1	5.5	2	57.80
11719	36 2336	9.2 F2	13 2 45.794	280.60	-.60	36 29 6.73	-1929.6	5.9	3	57.94
11731	27 2212	7.6 K0	13 3 16.498	288.89	-.37	26 51 10.81	-1928.3	6.2	2	57.86
11742	34 2389	8.3 K0	13 4 15.380	282.12	-.55	34 17 10.65	-1926.0	6.1	2	57.81
11748	29 2369	8.6 K2	13 4 46.505	286.69	-.42	28 58 46.88	-1924.7	6.2	2	57.32
11749	60 1445	8.1 G5	13 4 51.023	241.60	-1.16	60 25 18.56	-1924.6	5.3	2	58.25
11753	2 2626	7.8 F5	13 5 3.282	306.19	.23	1 44 29.83	-1924.1	6.7	2	57.89
11760	43 2300	8.2 K2	13 5 36.166	272.59	-.74	42 38 27.68	-1922.7	6.0	2	57.33
11762	72 600	7.5 K0	13 5 42.001	193.35	-.82	71 39 38.47	-1922.5	4.4	2	57.36
11766	63 1053	7.6 K0	13 6 11.075	232.78	-1.16	62 57 25.41	-1921.3	5.2	2	57.87

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
11768	23 2541	8.7 K0	13 6 18.226	290.96	-.28	23 14 16.52	-1921.0	6.5	2	57.33
11774	19 2642	7.2 K2	13 6 38.561	294.22	-.18	18 53 30.59	-1920.1	6.6	2	57.35
11775	31 2456	8.3 F5	13 6 44.096	284.72	-.44	30 30 35.59	-1919.9	6.4	2	56.26
11776	50 1982	7.8 K2	13 6 50.329	262.00	-.91	49 43 7.40	-1919.6	5.9	2	56.81
11780	6 2700	8.2 F0	13 7 5.583	303.11	.12	6 14 45.69	-1919.0	6.8	2	57.34
11784	17 2596	8.4 K0	13 7 20.711	295.68	-.12	16 44 37.60	-1918.3	6.7	2	58.28
11790	16 2470	8.8 G5	13 7 43.889	296.46	-.09	15 36 15.60	-1917.4	6.7	2	58.72
11795	0 3030	8.6 K2	13 8 9.318	307.43	.28	- 0 9 10.87	-1916.3	7.0	2	57.36
11806	27 2224	8.4 K0	13 9 4.588	287.41	-.34	26 39 8.15	-1914.0	6.6	2	57.34
11808	20 2806	8.2 G5	13 9 8.675	292.81	-.19	20 4 51.90	-1913.7	6.7	2	57.36
11809	41 2364	7.1 K0	13 9 12.534	272.71	-.68	41 3 28.56	-1913.6	6.3	2	57.81
11810	35 2419	8.1 F2	13 9 14.332	279.74	-.53	34 45 9.29	-1913.5	6.5	2	57.87
11811	47 2027	8.2 K5	13 9 17.900	264.33	-.82	47 13 3.62	-1913.3	6.1	2	58.35
11812	13 2643	8.2 K0	13 9 19.566	298.14	-.03	12 59 44.89	-1913.3	6.9	2	57.36
11815	11 2543	8.1 F5	13 9 35.373	299.21	.01	11 29 8.52	-1912.6	6.9	4	58.86
11816	56 1645	9.0 K0	13 9 36.372	247.65	-1.01	56 11 31.65	-1912.5	5.8	2	57.33
11823	9 2727	8.6 G5	13 10 22.869	301.18	.07	8 39 30.14	-1910.5	7.0	2	57.27
11848	10 2523	8.3 K0	13 11 33.454	300.06	.04	10 2 17.84	-1907.4	7.1	2	56.72
11852	45 2096	8.7 F5	13 12 12.569	265.27	-.76	45 26 41.15	-1905.6	6.4	2	56.33
11854	23 2551	8.8 K2	13 12 37.037	289.38	-.25	23 18 52.90	-1904.5	7.0	2	56.88
11855	61 1344	8.9 G5	13 12 37.957	232.17	-1.01	61 0 44.83	-1904.4	5.7	2	56.89
11868	51 1824	8.5 G5	13 13 23.275	255.21	-.86	51 5 47.11	-1902.4	6.3	2	57.26
11877	18 2708	7.4 G0	13 14 2.723	293.90	-.12	17 33 49.41	-1900.6	7.2	2	56.78
11878	54 1584	8.8 K5	13 14 3.677	249.98	-.90	53 30 4.58	-1900.5	6.2	2	56.87
11893	29 2386	8.4 K2	13 14 35.076	283.35	-.37	29 18 28.01	-1899.1	7.0	2	56.81
11922	3 2755	8.3 K2	13 16 21.466	305.18	.23	2 48 22.08	-1894.0	7.7	2	56.87
11926	34 2411	8.5 G5	13 16 32.884	278.11	-.46	33 42 3.77	-1893.5	7.0	2	57.25
11934	37 2396	7.5 G5	13 17 30.302	274.36	-.51	36 38 8.28	-1890.7	7.0	2	56.90
11940	9 2744	7.6 K2	13 18 2.503	300.65	.10	8 30 25.24	-1889.2	7.7	2	57.31
11947	65 927	8.2 F5	13 18 37.145	209.31	-.79	65 22 3.58	-1887.5	5.5	2	56.82
11952	24 2570	8.7 K0	13 18 45.263	287.51	-.24	23 45 32.55	-1887.1	7.5	2	57.27
11958	3 2761	7.9 K5	13 19 4.364	304.87	.22	3 6 56.57	-1886.1	7.9	2	57.34
11962	31 2474	8.7 G0	13 19 18.749	280.33	-.38	30 46 59.56	-1885.4	7.3	2	57.26
11972	0 3049	8.0 K0	13 19 54.981	307.58	.31	- 0 19 2.73	-1883.6	8.1	2	56.90
11978	45 2106	8.3 A0	13 20 34.530	261.35	-.67	44 58 33.60	-1881.7	7.0	2	56.87
11982	52 1698	7.5 M0	13 20 53.246	248.39	-.79	51 54 50.55	-1880.7	6.7	2	56.80
11986	46 1865	7.5 K0	13 21 11.247	258.68	-.68	46 23 0.57	-1879.8	6.9	2	57.40
11987	51 1837	9.0 F8	13 21 12.948	250.74	-.76	50 40 15.20	-1879.7	6.7	3	57.35
11990	19 2667	7.5 G0	13 21 19.105	291.02	-.13	19 21 6.94	-1879.4	7.8	2	58.25
11991	- 4 3470	8.3 K0	13 21 20.466	311.30	.43	- 4 53 17.06	-1879.3	8.3	2	57.34
11992	- 1 2815	8.3 G5	13 21 40.101	308.83	.35	- 1 50 48.64	-1878.3	8.3	2	57.82
11994	35 2445	8.2 G5	13 21 54.550	274.66	-.46	34 56 38.63	-1877.6	7.4	2	57.42
11999	5 2742	7.6 K5	13 22 10.700	303.50	.20	4 39 43.46	-1876.8	8.2	2	57.80
12005	55 1602	8.3 A5	13 22 52.324	239.42	-.80	55 9 26.81	-1874.6	6.6	4	58.07
12006	11 2563	8.3 K0	13 22 54.199	298.12	.05	11 0 56.94	-1874.6	8.1	2	57.77
12007	66 807	8.2 K0	13 23 0.676	198.83	-.61	66 25 29.53	-1874.2	5.5	2	58.34
12008	17 2626	8.5 G5	13 23 1.534	293.02	-.07	16 48 42.02	-1874.2	8.0	2	57.74
12009	26 2460	8.4 F2	13 23 2.132	284.42	-.26	25 48 30.07	-1874.1	7.7	2	56.79
12013	- 2 3684	7.3 K0	13 23 33.431	310.16	.39	- 3 24 5.13	-1872.5	8.5	3	57.36
12028	84 310	8.9 K5	13 24 41.841	-131.41	23.89	83 43 21.89	-1869.0	-3.1	3	57.99

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900.0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
12044	27 2255	8.2 F5	13 25 34.099	282.39	-.28	27 6 0.94	-1866.2	7.9	2	57.33
12056	- 3 3476	8.3 A3	13 26 6.595	310.93	.42	- 4 12 26.22	-1864.4	8.7	2	58.34
12061	34 2426	8.2 K0	13 26 18.684	274.27	-.41	33 55 32.87	-1863.8	7.7	2	57.32
12066	20 2837	8.3 F5	13 26 30.025	289.36	-.13	20 2 54.59	-1863.2	8.2	2	57.36
12075	2 2685	8.6 G0	13 27 0.309	305.63	.27	1 57 58.46	-1861.6	8.7	4	58.55
12077	53 1624	7.4 K0	13 27 17.842	240.35	-.72	53 26 6.98	-1860.6	6.9	2	58.73
12079	67 786	8.2 G5	13 27 29.005	188.33	-.41	67 17 59.62	-1860.0	5.5	2	57.90
12083	50 2006	8.3 K0	13 27 34.265	247.01	-.69	50 26 38.34	-1859.7	7.1	2	57.82
12091	61 1359	7.9 G5	13 28 9.743	218.30	-.69	60 36 40.44	-1857.8	6.4	3	58.66
12097	75 507	8.0 K0	13 28 40.676	117.32	1.59	75 8 17.60	-1856.1	3.6	2	57.79
12098	22 2589	8.8 K0	13 28 46.769	287.35	-.15	21 35 25.54	-1855.8	8.3	2	57.40
12104	17 2641	8.7 F5	13 29 24.731	291.41	-.06	17 23 17.43	-1853.7	8.5	2	58.77
12107	27 2264	7.9 K5	13 29 28.839	281.57	-.25	26 51 28.38	-1853.4	8.2	2	56.87
12109	10 2556	8.4 K2	13 29 42.021	297.97	.09	10 24 15.91	-1852.7	8.7	2	57.79
12114	40 2663	8.3 F0	13 30 18.715	264.97	-.49	39 32 52.62	-1850.6	7.8	4	58.51
12119	65 943	8.5 G5	13 30 39.658	198.26	-.50	64 43 46.01	-1849.5	6.0	2	56.91
12120	57 1446	8.8 K0	13 30 53.238	228.63	-.68	56 44 33.36	-1848.7	6.8	2	57.33
12121	1 2826	8.2 K5	13 30 56.362	306.20	.30	1 14 40.83	-1848.5	9.0	2	57.81
12128	3 2792	8.8 K5	13 31 17.545	304.26	.25	3 23 16.94	-1847.3	9.0	2	57.33
12129	17 2645	8.2 K0	13 31 23.864	291.93	-.04	16 31 45.26	-1847.0	8.7	3	57.31
12137	19 2688	8.2 F0	13 31 47.242	289.72	-.08	18 40 16.81	-1845.7	8.6	2	57.36
12140	14 2636	7.2 K0	13 31 53.736	293.97	.01	14 22 0.67	-1845.3	8.8	4	59.28
12141	73 595	8.4 K0	13 31 57.049	133.30	.97	73 18 31.35	-1845.1	4.2	2	57.32
12145	47 2069	8.6 K0	13 32 19.009	251.82	-.59	46 39 47.60	-1843.8	7.6	2	57.40
12161	35 2466	8.0 K0	13 33 13.473	269.99	-.40	35 13 58.67	-1840.7	8.2	2	57.73
12165	0 3079	8.7 K5	13 33 25.530	307.63	.34	- 0 19 20.97	-1840.0	9.3	5	58.93
12168	24 2604	7.9 G5	13 33 44.366	283.46	-.18	24 11 20.71	-1838.9	8.6	2	56.91
12170	20 2848	8.4 K5	13 33 56.547	287.69	-.11	20 14 43.70	-1838.2	8.7	2	57.36
12186	60 1476	7.9 K2	13 35 2.465	214.24	-.58	59 57 24.05	-1834.4	6.7	2	56.90
12191	34 2435	7.3 K2	13 35 22.949	270.90	-.36	33 59 31.43	-1833.1	8.4	2	57.34
12194	42 2424	7.7 M0	13 35 29.781	257.85	-.50	42 27 18.10	-1832.8	8.0	2	56.87
12197	44 2289	9.0 G5	13 35 43.795	255.67	-.52	43 37 14.70	-1831.9	7.9	2	57.34
12202	51 1858	7.8 G5	13 36 4.048	239.66	-.60	51 12 49.52	-1830.7	7.5	2	56.91
12203	10 2573	8.1 K0	13 36 14.448	297.49	.11	10 14 3.78	-1830.1	9.2	2	56.88
12204	- 1 2847	8.0 K5	13 36 19.543	309.50	.39	- 2 16 39.10	-1829.8	9.6	2	58.71
12205	55 1624	8.6 K5	13 36 23.866	228.48	-.61	55 19 2.69	-1829.6	7.2	2	57.78
12208	39 2665	8.7 K0	13 36 31.858	263.66	-.43	38 38 0.00	-1829.1	8.2	2	57.36
12218	58 1459	8.7 K0	13 37 11.829	218.37	-.57	58 16 50.33	-1826.7	6.9	2	58.25
12221	78 464	8.0 F5	13 37 33.163	44.50	5.00	78 8 39.02	-1825.4	1.7	2	57.26
12222	26 2481	7.8 G5	13 37 40.402	280.17	-.21	26 10 45.38	-1825.0	8.8	2	56.41
12223	- 4 3533	8.0 F5	13 37 49.006	312.16	.46	- 4 59 34.42	-1824.5	9.8	2	57.81
12224	29 2446	8.7 K0	13 37 57.904	276.27	-.26	29 16 49.93	-1823.9	8.7	2	57.36
12227	62 1308	8.9 F0	13 38 12.603	201.72	-.44	62 16 3.72	-1823.0	6.5	2	57.91
12229	45 2124	8.0 K0	13 38 14.785	251.32	-.52	45 14 24.06	-1822.9	8.0	2	56.87
12232	40 2677	8.8 K0	13 38 21.052	260.27	-.45	40 14 33.47	-1822.5	8.3	2	57.80
12235	9 2796	8.6 A2	13 38 28.093	298.18	.13	9 20 3.53	-1822.1	9.4	2	57.28
12237	16 2539	8.2 K0	13 38 44.617	291.13	-.01	16 10 52.38	-1821.1	9.2	2	57.88
12239	70 753	8.5 G5	13 39 6.575	152.53	.40	70 6 43.58	-1819.7	5.0	2	57.88
12247	64 961	8.4 F5	13 39 31.130	191.47	-.32	64 7 5.44	-1818.3	6.3	3	58.67
12248	2 2710	8.4 K0	13 39 36.089	304.93	.28	2 26 28.49	-1817.9	9.7	2	56.87

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900.0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
12257	15 2609	7.7 K2	13 40 6.728	291.76	.01	15 23 56.03	-1816.0	9.4	2	56.81
12263	- 0 2727	7.8 K0	13 40 23.482	308.27	.36	- 0 57 24.65	-1815.0	9.9	2	57.87
12275	36 2406	8.1 G5	13 41 25.513	265.81	-.36	35 57 57.66	-1811.2	8.7	4	58.29
12281	80 421	7.0 K5	13 41 54.954	-34.51	10.23	80 27 17.95	-1809.3	-.7	2	57.34
12287	56 1682	7.5 K2	13 42 15.052	222.22	-.52	55 53 7.98	-1808.1	7.4	2	57.80
12289	60 1486	7.5 K0	13 42 27.889	208.83	-.45	59 36 31.01	-1807.3	7.0	2	57.82
12299	41 2422	8.7 K0	13 43 6.560	257.40	-.43	40 40 18.40	-1804.8	8.5	2	56.88
12301	16 2551	8.1 K0	13 43 14.084	290.42	0.00	16 12 32.21	-1804.3	9.6	2	57.87
12302	35 2480	7.3 G5	13 43 20.754	266.71	-.33	34 53 51.04	-1803.9	8.9	2	57.86
12304	43 2350	8.7 K0	13 43 31.996	252.49	-.45	43 13 49.84	-1803.2	8.4	2	57.35
12310	1 2847	8.8 K0	13 43 54.186	306.62	.33	0 41 43.33	-1801.8	10.2	2	57.80
12319	52 1739	8.6 F8	13 44 30.893	231.34	-.51	52 14 41.90	-1799.4	7.8	2	58.86
12321	11 2601	8.8 K5	13 44 53.832	295.65	.11	11 11 11.86	-1798.0	9.9	2	57.79
12323	48 2152	7.8 M0	13 45 10.240	241.64	-.49	47 58 41.57	-1796.9	8.2	2	57.87
12326	4 2783	8.5 G5	13 45 23.257	303.08	.26	4 5 44.37	-1796.1	10.2	2	58.72
12343	2 2727	8.7 K0	13 46 1.622	305.37	.31	1 52 55.75	-1793.6	10.3	2	58.42
12344	24 2641	8.0 K0	13 46 3.981	281.14	-.13	23 41 51.53	-1793.4	9.5	2	57.79
12360	63 1094	7.9 K2	13 47 10.693	188.62	-.22	63 5 46.33	-1789.1	6.6	2	58.36
12364	74 554	8.9 G5	13 47 26.298	94.48	2.21	74 9 56.67	-1788.0	3.5	2	56.82
12372	3 2819	8.7 K5	13 47 53.987	304.40	.29	2 45 36.74	-1786.2	10.4	2	56.82
12377	55 1637	8.6 F8	13 48 11.211	220.18	-.45	55 7 0.26	-1785.1	7.7	2	57.34
12378	85 234	7.7 G8	13 48 17.830	-356.01	48.60	84 45 42.48	-1784.6	-11.4	2	57.34
12383	36 2414	8.5 K0	13 48 40.008	262.74	-.32	36 9 37.20	-1783.1	9.1	2	57.38
12384	46 1906	8.6 G5	13 48 50.712	244.56	-.44	45 46 11.75	-1782.4	8.5	2	58.26
12397	6 2802	8.6 A3	13 49 38.967	300.59	.22	6 14 51.95	-1779.2	10.5	2	57.80
12403	51 1874	7.9 F2	13 50 2.257	230.03	-.45	51 23 41.55	-1777.6	8.1	2	57.88
12404	1 2857	7.8 K0	13 50 5.083	306.17	.33	1 4 16.13	-1777.5	10.7	2	57.34
12405	17 2676	6.5 K5	13 50 8.384	288.47	.01	16 58 32.02	-1777.2	10.1	2	58.31
12413	9 2820	8.7 K5	13 50 57.421	297.06	.16	9 22 24.23	-1773.9	10.5	2	57.34
12422	58 1474	8.6 K0	13 51 32.523	206.69	-.35	58 9 33.32	-1771.5	7.4	2	57.89
12428	64 970	8.0 G5	13 52 4.375	175.78	-.01	64 29 26.39	-1769.3	6.4	3	58.59
12435	16 2577	8.0 K0	13 52 19.248	289.86	.04	15 31 22.46	-1768.3	10.3	2	58.34
12437	8 2786	8.2 K5	13 52 19.939	298.58	.19	7 55 15.93	-1768.3	10.6	2	57.80
12442	- 3 3549	8.4 K5	13 52 48.973	311.88	.46	- 4 7 40.08	-1766.3	11.1	5	58.54
12446	20 2897	8.2 K2	13 52 59.303	284.77	-.03	19 37 54.49	-1765.6	10.2	2	57.26
12450	50 2034	8.9 G0	13 53 27.443	230.90	-.41	50 17 8.44	-1763.6	8.4	4	58.79
12452	61 1387	8.6 G5	13 53 29.022	193.77	-.22	60 47 23.82	-1763.5	7.1	2	58.85
12453	14 2681	8.4 K5	13 53 32.877	291.50	.07	13 59 38.18	-1763.3	10.5	2	57.88
12464	32 2412	8.0 F0	13 54 6.851	267.26	-.24	32 7 32.41	-1760.9	9.7	2	57.72
12468	70 762	7.5 K0	13 54 22.338	129.91	.97	70 10 44.50	-1759.8	4.9	4	58.29
12469	76 504	8.7 K0	13 54 23.781	40.75	4.44	76 30 30.21	-1759.7	1.8	2	58.25
12477	44 2312	7.4 G0	13 54 53.024	244.17	-.37	44 31 33.31	-1757.7	8.9	2	57.42
12483	38 2494	8.7 G5	13 55 4.801	257.06	-.31	38 0 39.68	-1756.8	9.4	2	57.81
12499	3 2836	7.8 K0	13 55 35.242	303.92	.30	3 1 35.69	-1754.7	11.1	2	58.36
12500	33 2390	7.3 K0	13 55 44.144	265.60	-.24	32 50 37.13	-1754.1	9.7	2	57.26
12506	47 2108	6.8 M0	13 56 46.803	237.83	-.37	46 50 19.20	-1749.6	8.8	2	56.34
12523	42 2455	7.6 K0	13 57 37.678	247.65	-.34	42 17 28.40	-1746.0	9.2	2	57.39
12525	56 1700	8.7 F8	13 57 51.529	209.67	-.31	56 3 34.65	-1745.0	7.9	2	57.36
12526	35 2516	8.3 K2	13 58 2.794	261.89	-.25	34 36 57.56	-1744.2	9.8	2	57.80
12527	- 1 2888	8.4 A5	13 58 5.743	309.44	.41	- 1 50 29.05	-1744.0	11.5	2	58.34

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
12532	6 2819	8.6 F8	13 58 44.406	300.12	.24	6 12 40.84	-1741.2	11.2	2	57.80
12533	31 2574	8.9 K0	13 58 48.762	267.66	-.19	30 55 40.17	-1740.9	10.0	2	57.74
12540	29 2483	7.9 A2	13 59 4.008	271.08	-.16	28 39 1.50	-1739.8	10.2	2	57.32
12547	50 2041	8.4 K0	13 59 23.264	227.00	-.35	50 22 47.39	-1738.4	8.6	2	57.34
12552	71 673	8.4 K0	13 59 52.041	111.07	1.47	71 13 5.28	-1736.3	4.4	2	57.37
12554	44 2319	7.4 G5	14 0 5.745	243.21	-.34	43 47 57.94	-1735.3	9.2	2	57.42
12559	- 1 2897	8.3 K0	14 0 16.710	309.82	.42	- 2 8 7.90	-1734.5	11.7	2	56.90
12560	18 2815	8.6 K0	14 0 27.664	285.25	.02	18 13 40.29	-1733.8	10.8	2	57.26
12563	14 2692	8.6 M0	14 0 43.697	290.73	.09	13 52 39.88	-1732.5	11.0	2	57.77
12570	33 2402	7.6 K2	14 1 0.239	263.52	-.22	33 3 13.16	-1731.3	10.0	2	57.39
12573	55 1650	7.8 G5	14 1 4.293	211.48	-.29	54 54 21.11	-1731.0	8.1	2	57.36
12578	13 2742	6.9 K0	14 1 29.150	291.78	.12	12 57 57.07	-1729.2	11.1	2	56.82
12582	3 2847	8.0 K0	14 1 47.326	303.96	.31	2 50 47.69	-1727.9	11.6	2	57.34
12583	59 1553	8.5 K0	14 1 54.226	193.15	-.16	59 18 33.82	-1727.4	7.5	2	57.78
12584	37 2490	8.5 K0	14 2 4.962	255.38	-.26	37 26 11.72	-1726.6	9.8	2	57.42
12586	22 2659	8.7 A0	14 2 10.119	280.41	-.04	21 37 37.16	-1726.2	10.8	2	56.82
12599	17 2699	8.2 K0	14 2 52.178	286.55	.04	16 55 48.60	-1723.1	11.0	2	58.74
12603	2 2771	8.5 F2	14 3 33.451	305.23	.34	1 45 7.74	-1720.0	11.8	2	56.82
12608	- 3 3580	8.3 K2	14 3 48.074	312.04	.47	- 3 55 32.88	-1718.9	12.1	2	57.36
12610	24 2685	8.1 F5	14 3 59.637	277.22	-.06	23 37 35.50	-1718.0	10.8	2	57.42
12612	28 2292	8.0 F2	14 4 10.114	270.75	-.13	27 57 50.40	-1717.2	10.5	2	56.90
12627	6 2839	8.8 A0	14 5 11.626	300.26	.26	5 48 44.00	-1712.6	11.7	2	57.28
12630	0 3135	7.2 K5	14 5 16.353	307.11	.38	0 10 51.74	-1712.2	12.0	2	56.82
12636	16 2612	8.7 K5	14 5 29.852	286.99	.06	16 17 46.77	-1711.2	11.3	2	57.79
12650	52 1776	8.5 K0	14 6 38.400	218.11	-.28	51 49 43.74	-1706.0	8.7	2	56.90
12651	32 2435	8.6 K2	14 6 43.339	263.04	-.18	32 15 18.64	-1705.6	10.4	2	56.82
12653	3 2859	6.7 K0	14 6 56.253	303.61	.32	3 2 0.80	-1704.6	12.0	2	57.26
12658	82 411	8.8 M2	14 7 5.340	-183.56	19.92	81 50 37.39	-1703.9	-6.7	4	59.33
12661	15 2670	8.3 K0	14 7 16.426	288.91	.10	14 39 4.46	-1703.1	11.5	2	57.34
12672	- 4 3633	8.4 K0	14 7 54.337	313.79	.50	- 5 13 19.77	-1700.1	12.5	2	56.82
12673	41 2471	6.8 K2	14 7 56.825	245.77	-.26	41 0 48.72	-1700.0	9.9	2	57.80
12683	2 2782	7.9 G5	14 8 45.861	305.08	.35	1 48 26.24	-1696.2	12.2	2	56.90
12692	63 1120	8.0 F5	14 9 28.788	168.39	.19	62 45 24.67	-1692.8	6.9	2	58.36
12701	43 2392	8.0 K5	14 10 9.359	241.13	-.26	42 38 44.69	-1689.6	9.8	2	57.80
12704	8 2827	7.8 K0	14 10 18.415	296.91	.22	8 14 32.28	-1688.9	12.0	2	57.33
12708	10 2649	8.7 K0	14 10 25.465	294.52	.18	10 4 55.10	-1688.4	11.9	2	57.40
12713	17 2717	8.4 F8	14 10 56.793	285.60	.07	16 44 16.11	-1685.9	11.6	2	57.41
12715	51 1898	8.4 G0	14 11 5.279	219.27	-.25	50 36 0.33	-1685.2	9.0	4	59.33
12720	7 2760	7.6 K0	14 11 24.992	297.97	.24	7 21 17.57	-1683.7	12.1	2	57.35
12732	- 4 3645	8.3 K0	14 11 59.837	313.81	.51	- 5 5 39.19	-1680.9	12.8	2	57.34
12752	45 2165	8.0 K2	14 13 3.808	235.08	-.25	44 35 25.47	-1675.8	9.8	2	57.87
12757	13 2771	8.2 G5	14 13 33.743	290.77	.14	12 41 11.14	-1673.4	12.0	2	56.88
12766	23 2671	8.7 G0	14 14 16.826	276.10	-.02	22 54 23.37	-1670.0	11.5	2	57.34
12772	38 2538	8.6 K2	14 14 32.603	249.54	-.20	37 58 56.58	-1668.7	10.4	2	57.26
12774	74 573	8.8 F8	14 14 37.261	56.29	3.12	73 33 54.20	-1668.3	2.6	2	56.80
12782	12 2677	7.8 K0	14 15 10.825	292.12	.17	11 33 56.92	-1665.6	12.2	2	57.87
12787	14 2722	8.4 K2	14 15 25.596	288.58	.12	14 8 4.25	-1664.4	12.1	2	57.42
12792	4 2847	7.0 K0	14 15 58.530	302.23	.32	3 54 16.97	-1661.7	12.7	2	58.34
12802	18 2861	7.6 K0	14 16 21.701	283.59	.07	17 34 58.69	-1659.8	11.9	2	57.36
12803	20 2957	8.4 K0	14 16 28.901	279.92	.03	20 5 7.44	-1659.2	11.8	2	57.79

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession 1st Term	Precession 2nd Term	Decl. 1950	Precession 1st Term	Precession 2nd Term	No. Obs.	Epoch 1900+
12809	0 3162	8.0 K2	14 16 53.340	307.04	.39	0 12 57.01	-1657.2	12.9	2	56.34
12810	54 1661	7.7 K5	14 16 56.110	203.22	-.13	54 10 12.23	-1657.0	8.7	2	57.34
12815	15 2695	8.6 K0	14 17 2.759	286.94	.11	15 9 53.34	-1656.5	12.1	2	57.87
12817	79 443	8.3 K2	14 17 14.454	-101.72	11.62	79 34 1.25	-1655.5	-3.8	2	58.35
12821	84 322	8.3 K	14 17 46.453	-433.48	46.68	84 10 30.29	-1652.9	-17.5	2	57.82
12827	25 2759	8.9 F8	14 18 15.194	272.02	-.04	24 58 24.81	-1650.5	11.6	2	57.79
12830	76 520	7.9 K0	14 18 32.932	5.02	5.19	75 53 52.49	-1649.0	.6	2	57.33
12835	19 2796	6.8 K5	14 18 49.044	280.52	.05	19 24 28.96	-1647.7	12.0	2	56.86
12844	34 2522	8.9 K5	14 19 46.434	256.09	-.14	33 48 14.93	-1642.9	11.0	2	58.69
12847	7 2774	8.8 F5	14 19 53.518	297.61	.26	7 13 57.69	-1642.3	12.8	2	56.88
12852	36 2478	8.0 G0	14 20 7.850	251.85	-.16	35 52 32.12	-1641.1	10.9	2	57.81
12857	18 2870	8.1 K0	14 20 27.908	282.83	.08	17 40 49.06	-1639.5	12.2	2	57.33
12861	24 2728	8.5 K0	14 20 42.695	272.52	-.02	24 20 0.39	-1638.2	11.8	2	57.90
12864	46 1960	8.5 K2	14 20 55.392	226.54	-.19	46 20 34.74	-1637.1	9.9	2	56.88
12871	64 997	7.3 K2	14 21 34.054	145.06	.58	64 30 10.44	-1633.9	6.5	2	56.33
12872	44 2350	7.8 K0	14 21 37.189	233.39	-.19	43 41 5.73	-1633.6	10.2	2	58.36
12875	50 2070	7.3 K0	14 21 48.394	216.16	-.16	49 37 53.40	-1632.7	9.5	3	58.67
12879	- 1 2951	7.3 M0	14 22 0.644	310.19	.45	- 2 7 1.99	-1631.6	13.5	2	57.38
12888	6 2878	7.2 K0	14 22 33.522	299.36	.29	5 50 27.25	-1628.8	13.1	2	57.97
12889	20 2975	8.4 K0	14 22 39.936	279.38	.05	19 44 7.45	-1628.3	12.2	2	58.33
12891	18 2877	8.6 K2	14 22 44.592	281.28	.07	18 28 47.54	-1627.9	12.3	2	56.79
12894	77 541	8.8 G5	14 23 10.254	-28.21	6.63	76 53 22.74	-1625.7	-.9	2	57.82
12908	83 415	8.8 K5	14 23 53.833	-328.92	31.30	82 58 3.95	-1622.0	-13.7	2	57.82
12914	28 2325	8.3 F8	14 24 21.996	265.70	-.05	27 52 9.43	-1619.6	11.8	2	56.86
12919	53 1711	8.5 K0	14 24 51.008	203.14	-.09	52 50 58.01	-1617.1	9.1	2	56.82
12920	48 2202	8.3 K0	14 25 0.100	218.86	-.15	48 13 59.78	-1616.3	9.8	2	57.87
12923	15 2714	7.2 K0	14 25 7.062	286.17	.13	14 58 40.42	-1615.8	12.7	2	56.89
12924	35 2561	8.5 F5	14 25 7.407	252.07	-.12	34 56 44.92	-1615.7	11.2	2	57.79
12925	51 1921	8.4 G5	14 25 11.136	210.92	-.12	50 38 3.56	-1615.4	9.4	2	57.36
12936	63 1132	7.8 K5	14 25 40.932	153.42	.44	62 43 53.94	-1612.8	7.0	2	57.42
12938	29 2538	7.8 G5	14 25 47.581	262.44	-.07	29 29 13.11	-1612.2	11.7	2	56.90
12941	6 2891	7.5 M0	14 25 58.939	299.11	.29	5 54 14.35	-1611.2	13.3	2	58.33
12943	38 2557	8.0 G5	14 26 6.695	245.68	-.14	37 46 46.23	-1610.6	11.0	3	59.01
12950	1 2939	8.6 K0	14 26 24.496	305.55	.38	1 16 43.64	-1609.0	13.6	2	58.34
12958	11 2684	7.9 K0	14 26 36.976	291.44	.19	11 15 55.69	-1607.9	13.0	2	58.81
12961	40 2785	7.5 K0	14 26 54.947	240.66	-.14	39 50 27.41	-1606.4	10.8	2	57.88
12968	20 2981	8.7 K5	14 27 34.543	278.44	.06	19 48 27.16	-1602.9	12.5	2	57.79
12971	- 2 3855	8.1 K0	14 28 6.520	311.38	.47	- 2 53 17.89	-1600.2	14.0	2	56.34
12973	25 2786	8.0 G5	14 28 13.688	269.25	-.01	25 18 39.84	-1599.5	12.2	2	56.90
12974	69 751	8.1 K5	14 28 18.388	91.86	1.73	69 30 3.95	-1599.0	4.4	2	57.42
12975	56 1742	8.7 A2	14 28 27.132	186.28	.05	56 20 7.53	-1598.3	8.5	2	57.35
12979	43 2414	8.5 G5	14 28 45.115	232.63	-.15	42 45 50.17	-1596.7	10.6	2	58.39
12984	46 1966	7.8 K5	14 29 22.552	223.93	-.14	45 48 55.55	-1593.4	10.2	2	57.86
12985	72 645	8.5 K5	14 29 23.367	50.55	2.98	72 28 48.44	-1593.3	2.6	2	57.87
12988	- 1 2963	8.2 G5	14 29 28.206	309.55	.44	- 1 34 8.14	-1592.9	14.0	2	57.97
12991	31 2627	8.5 K2	14 29 39.892	257.50	-.07	31 32 28.49	-1591.9	11.7	2	57.87
12993	22 2714	8.4 G5	14 29 45.180	274.01	.04	22 17 58.99	-1591.4	12.5	2	57.80
13000	33 2471	8.9 A0	14 30 15.276	253.59	-.09	33 24 48.83	-1588.7	11.6	2	58.72
13007	41 2510	8.3 M0	14 30 57.966	236.08	-.13	41 3 32.34	-1584.9	10.9	2	57.34
13016	2 2836	8.5 K0	14 31 46.420	304.61	.37	1 53 48.49	-1580.6	14.0	2	57.79

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession 1st Term	Precession 2nd Term	Decl. 1950	Precession 1st Term	Precession 2nd Term	No. Obs.	Epoch 1900+
13018	8 2883	8.3 K5	14 31 52.891	296.13	.26	7 45 27.91	-1580.0	13.6	2	57.79
13019	22 2718	9.2 K2	14 31 57.229	274.72	.05	21 37 35.81	-1579.6	12.7	2	56.34
13020	39 2778	8.4 K5	14 31 57.993	240.35	-.12	39 9 29.23	-1579.5	11.1	2	57.87
13022	75 539	7.9 M0	14 32 5.811	-10.87	5.35	75 29 47.50	-1578.9	-.2	2	58.35
13024	- 0 2845	8.7 F8	14 32 13.406	309.04	.43	- 1 11 38.96	-1578.2	14.2	2	57.40
13026	6 2912	8.7 K0	14 32 20.233	298.17	.29	6 20 14.13	-1577.6	13.7	2	58.77
13036	19 2824	8.0 G0	14 32 56.613	278.15	.08	19 25 58.28	-1574.3	12.9	2	57.86
13043	41 2513	8.9 K0	14 33 16.551	233.88	-.12	41 33 22.00	-1572.5	10.9	2	58.35
13045	0 3207	7.8 G5	14 33 25.649	306.70	.40	0 26 13.20	-1571.7	14.2	2	58.88
13047	35 2581	8.8 K2	14 33 27.280	249.47	-.09	34 54 14.17	-1571.5	11.6	2	59.27
13053	27 2396	8.9 K0	14 33 51.533	265.66	-.01	26 37 32.91	-1569.3	12.4	2	57.80
13058	48 2220	8.8 K0	14 34 16.132	215.11	-.09	47 54 25.36	-1567.1	10.1	4	58.59
13059	24 2745	7.5 K5	14 34 16.975	270.52	.03	23 50 17.86	-1567.0	12.6	2	56.82
13067	15 2732	8.6 K0	14 34 40.285	285.07	.15	14 55 41.31	-1564.9	13.3	2	58.39
13069	50 2098	7.4 K5	14 34 44.347	208.70	-.06	49 44 33.81	-1564.5	9.8	4	58.07
13070	28 2349	8.5 A3	14 34 45.635	262.82	-.02	28 3 9.44	-1564.4	12.3	2	57.88
13079	55 1699	7.5 K0	14 35 20.556	187.34	.07	55 4 16.87	-1561.2	8.9	5	58.76
13093	30 2541	7.8 K0	14 36 31.081	258.19	-.04	30 13 48.28	-1554.7	12.2	2	57.33
13095	69 761	8.2 K0	14 36 46.499	91.15	1.67	68 39 52.51	-1553.3	4.5	2	58.95
13102	22 2727	8.6 A0	14 37 30.825	272.39	.05	22 23 44.67	-1549.2	12.9	2	58.28
13104	10 2720	8.4 F8	14 37 43.667	292.22	.23	10 5 44.28	-1548.0	13.9	2	57.26
13107	38 2578	7.6 K2	14 37 59.485	240.15	-.09	38 19 27.48	-1546.6	11.5	2	56.89
13108	9 2928	7.5 K0	14 38 11.401	293.56	.25	9 11 31.03	-1545.5	14.0	2	57.86
13115	12 2725	8.2 G5	14 38 42.824	288.69	.20	12 19 24.14	-1542.6	13.8	2	57.91
13118	67 847	8.8 F2	14 38 45.337	102.24	1.38	67 24 34.77	-1542.3	5.1	2	57.79
13122	0 3223	8.1 K0	14 38 53.032	306.85	.41	0 18 59.80	-1541.6	14.6	2	57.34
13124	- 0 2855	7.8 K5	14 39 1.175	309.08	.44	- 1 10 30.69	-1540.9	14.7	2	57.86
13130	70 799	8.6 K0	14 39 16.612	71.61	2.15	70 2 58.65	-1539.4	3.7	2	58.35
13142	- 4 3736	8.2 K0	14 39 48.009	314.64	.51	- 4 52 22.31	-1536.5	15.1	2	57.89
13144	2 2854	8.1 G5	14 39 59.373	303.57	.36	2 30 27.53	-1535.4	14.5	2	58.87
13150	21 2677	8.3 K0	14 40 18.087	274.82	.08	20 42 12.87	-1533.7	13.2	2	58.41
13155	80 451	7.3 K0	14 40 22.461	-180.75	14.61	80 0 2.90	-1533.2	-8.2	2	57.88
13156	49 2319	8.8 G5	14 40 26.037	207.12	-.03	49 20 10.80	-1532.9	10.1	2	57.86
13172	23 2729	8.8 G5	14 41 51.784	270.50	.05	23 0 32.65	-1524.8	13.1	2	57.33
13176	66 867	8.4 K0	14 42 9.836	111.32	1.16	66 6 5.75	-1523.1	5.6	2	57.87
13177	51 1945	8.6 F8	14 42 11.979	200.72	.01	50 49 32.93	-1522.9	9.8	2	56.89
13180	4 2909	8.0 G5	14 42 24.539	301.71	.34	3 41 41.08	-1521.7	14.6	2	57.34
13184	32 2511	8.0 K0	14 42 40.361	252.19	-.03	32 20 23.97	-1520.2	12.3	2	57.36
13191	39 2797	8.9 F8	14 43 2.592	236.12	-.06	39 13 21.71	-1518.1	11.6	2	58.72
13192	34 2559	7.6 M0	14 43 8.359	247.15	-.05	34 35 9.50	-1517.6	12.1	2	58.40
13194	61 1456	7.8 K0	14 43 11.071	149.95	.50	60 58 55.70	-1517.3	7.5	2	57.42
13197	56 1757	8.3 K0	14 43 19.612	179.34	.17	55 40 59.11	-1516.5	8.9	2	58.86
13200	17 2783	7.5 K2	14 43 33.557	280.57	.14	17 0 26.98	-1515.1	13.7	2	57.34
13209	26 2598	8.0 K5	14 44 15.040	264.22	.03	26 9 27.97	-1511.2	13.0	2	57.36
13214	44 2391	8.4 F5	14 44 26.342	223.45	-.05	43 40 28.50	-1510.1	11.0	2	57.33
13230	48 2240	8.0 F8	14 45 39.147	208.76	-.01	48 7 2.07	-1503.1	10.4	2	56.85
13236	38 2591	8.5 K0	14 46 5.535	238.43	-.05	37 52 39.70	-1500.6	11.8	2	56.89
13242	53 1737	7.8 K2	14 46 40.331	190.16	.09	52 49 57.90	-1497.2	9.5	2	56.42
13246	21 2692	8.2 K0	14 46 52.347	273.89	.09	20 36 28.81	-1496.0	13.6	2	57.86
13250	2 2869	8.0 K0	14 47 5.991	304.67	.38	1 42 40.58	-1494.7	15.1	2	57.33

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
13251	4 2924	7.7 K0	14 47 13.736	300.98	.34	4 4 39.81	-1493.9	14.9	2	57.87
13253	64 1031	8.2 G0	14 47 18.659	125.18	.88	63 55 55.95	-1493.5	6.4	2	57.87
13255	54 1708	6.9 K2	14 47 35.559	182.52	.15	54 26 17.33	-1491.8	9.2	2	58.72
13256	50 2120	7.9 F8	14 47 37.468	200.80	.04	50 2 38.65	-1491.7	10.1	2	58.35
13271	31 2668	8.5 K0	14 48 42.105	254.20	.00	30 38 5.11	-1485.3	12.8	2	57.87
13276	14 2796	8.1 G5	14 48 59.676	285.10	.19	13 53 52.19	-1483.6	14.3	2	57.33
13281	66 873	6.8 K5	14 49 28.488	106.49	1.22	65 51 3.74	-1480.8	5.5	2	56.90
13295	44 2399	8.7 K0	14 50 25.827	218.66	-.02	44 25 43.87	-1475.1	11.1	2	56.87
13333	60 1572	6.8 K2	14 52 51.118	150.65	.48	59 43 2.49	-1460.7	7.8	2	56.90
13335	7 2865	6.8 K5	14 52 54.626	296.12	.30	6 59 12.02	-1460.4	15.1	2	57.39
13337	1 3002	8.4 G5	14 53 0.019	305.84	.40	0 56 0.61	-1459.8	15.6	2	57.77
13338	28 2381	8.9 K5	14 53 2.885	259.06	.03	27 47 39.91	-1459.5	13.2	2	56.87
13343	33 2510	7.3 K0	14 53 14.965	247.74	0.00	33 1 32.17	-1458.3	12.7	4	59.11
13349	40 2827	7.3 K0	14 53 33.727	230.70	-.02	39 51 15.01	-1456.5	11.9	4	58.14
13350	87 143	6.9 K0	14 53 34.561	1731.71	296.53	87 25 20.06	-1456.4	-86.4	2	58.41
13358	- 4 3779	8.6 F5	14 54 6.242	315.27	.51	- 4 55 47.46	-1453.2	16.1	2	58.80
13360	17 2803	7.6 G0	14 54 10.592	278.65	.16	17 18 16.39	-1452.8	14.3	2	57.96
13363	4 2939	8.2 K0	14 54 23.017	300.56	.34	4 12 4.10	-1451.5	15.4	2	58.82
13365	48 2248	8.5 A5	14 54 27.651	203.95	.04	48 16 46.23	-1451.0	10.6	2	59.88
13374	67 858	8.5 K0	14 55 19.222	91.23	1.48	66 49 8.92	-1445.9	4.9	2	56.33
13375	57 1544	8.7 K2	14 55 21.776	163.47	.34	57 14 41.87	-1445.6	8.6	2	56.87
13384	0 3286	8.4 K0	14 56 22.374	307.56	.42	- 0 8 37.00	-1439.5	15.9	2	57.87
13391	25 2856	7.5 G5	14 56 37.803	263.43	.07	25 14 48.41	-1437.9	13.7	2	56.89
13395	35 2634	8.9 G5	14 56 48.955	242.82	.00	34 42 4.50	-1436.8	12.6	2	57.80
13400	20 3051	8.6 K2	14 57 11.706	272.31	.12	20 34 10.36	-1434.5	14.2	2	57.79
13402	30 2596	8.0 K5	14 57 26.060	253.25	.03	30 3 56.35	-1433.0	13.2	2	58.34
13407	8 2955	7.1 K2	14 57 51.264	294.43	.29	7 50 46.02	-1430.5	15.4	2	58.86
13411	61 1473	8.2 K0	14 58 8.261	136.21	.67	61 17 33.18	-1428.7	7.3	4	57.87
13418	2 2900	8.5 G5	14 58 39.442	303.96	.38	2 3 3.07	-1425.5	15.9	2	56.40
13430	77 565	7.4 K0	14 59 32.076	-92.34	7.68	76 43 31.55	-1420.1	-4.4	2	56.96
13434	46 2017	8.9 A2	14 59 38.891	209.73	.03	45 58 19.94	-1419.4	11.1	2	57.87
13437	15 2808	7.9 F0	14 59 54.255	281.52	.18	15 16 51.66	-1417.8	14.8	2	57.41
13442	42 2559	7.9 K0	15 0 15.700	221.41	.02	42 14 53.67	-1415.6	11.7	2	57.78
13452	24 2814	8.9 K0	15 0 49.127	264.74	.08	24 11 4.41	-1412.2	14.0	2	56.89
13454	5 2962	7.8 F5	15 0 50.744	298.98	.33	5 1 45.19	-1412.0	15.8	2	56.96
13456	18 2972	7.6 K0	15 0 54.814	276.19	.15	18 10 14.31	-1411.6	14.6	2	57.49
13463	48 2258	8.3 G5	15 1 19.879	202.06	.07	47 55 33.91	-1408.9	10.8	2	57.84
13471	11 2762	7.9 K5	15 1 39.305	288.95	.24	10 55 45.68	-1407.0	15.3	2	57.93
13473	84 339	8.2 K0	15 1 42.653	-633.76	53.71	84 13 28.75	-1406.6	-32.6	2	58.91
13488	12 2785	7.9 K5	15 3 6.178	286.89	.23	12 3 1.07	-1397.9	15.3	2	56.40
13500	- 1 3020	8.4 K2	15 4 24.849	310.87	.46	- 2 6 20.92	-1389.7	16.6	2	56.94
13508	0 3304	7.9 K0	15 4 51.128	306.96	.41	0 13 14.60	-1386.9	16.4	4	58.60
13514	6 3000	7.8 K0	15 5 5.933	296.39	.31	6 27 38.60	-1385.3	15.9	4	59.11
13527	18 2977	8.9 F5	15 5 52.570	275.74	.16	18 3 42.10	-1380.4	14.9	2	56.87
13533	27 2457	7.7 K0	15 6 4.742	258.14	.07	26 54 7.01	-1379.1	13.9	2	57.86
13544	58 1552	7.2 M0	15 6 58.574	152.51	.46	57 50 51.54	-1373.4	8.4	2	56.44
13549	4 2971	8.1 K0	15 7 17.039	300.69	.35	3 53 51.61	-1371.5	16.3	2	56.33
13555	61 1484	7.6 K2	15 7 52.070	131.23	.72	60 59 8.97	-1367.7	7.3	2	56.34
13560	27 2461	8.4 K0	15 8 14.592	256.16	.07	27 36 43.72	-1365.3	14.0	2	57.34
13562	70 826	8.0 G5	15 8 18.215	33.52	2.70	70 20 10.30	-1365.0	2.1	2	56.92

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900.0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession 1st Term	Precession 2nd Term	Decl. 1950	Precession 1st Term	Precession 2nd Term	No. Obs.	Epoch 1900+
13565	45 2262	8.7 F8	15 8 27.611	209.22	.08	45 3 30.45	-1363.9	11.5	2	56.96
13567	7 2909	8.0 K0	15 8 33.069	294.41	.30	7 30 46.10	-1363.4	16.0	2	57.43
13582	55 1736	8.6 K0	15 9 27.724	163.71	.35	55 36 36.29	-1357.5	9.1	4	57.65
13589	0 3318	7.5 K5	15 10 3.437	307.66	.42	- 0 11 40.40	-1353.7	16.8	2	56.40
13591	59 1632	7.2 K5	15 10 13.141	141.65	.58	59 14 28.94	-1352.6	7.9	2	56.88
13595	- 4 3832	8.0 A3	15 10 32.776	315.06	.50	- 4 28 45.08	-1350.5	17.3	2	56.87
13603	89 28	8.9 K3	15 10 50.513	5742.60	2361.80	89 3 49.81	-1348.8	-309.3	4	59.39
13607	53 1771	7.9 K0	15 10 58.168	175.54	.26	53 6 58.80	-1347.8	9.8	2	57.34
13609	5 2981	7.8 K2	15 11 2.725	298.27	.33	5 13 50.00	-1347.3	16.4	2	57.43
13610	49 2363	7.2 K0	15 11 6.495	194.43	.14	48 45 59.70	-1346.9	10.8	4	58.30
13614	16 2752	8.7 K0	15 11 12.385	278.74	.19	16 6 29.75	-1346.3	15.3	2	57.43
13617	12 2809	8.8 K5	15 11 22.710	285.86	.24	12 13 35.15	-1345.1	15.7	2	58.40
13629	73 664	8.1 K5	15 12 10.136	-18.85	4.17	73 3 27.38	-1340.0	-.7	2	58.42
13641	34 2617	8.2 F0	15 13 1.343	240.85	.05	33 41 48.16	-1334.4	13.4	2	56.89
13646	76 557	8.0 M0	15 13 30.850	-83.29	6.48	75 39 23.36	-1331.2	-4.3	2	56.88
13652	27 2469	8.5 K2	15 13 55.611	257.03	.09	26 41 19.98	-1328.5	14.3	2	57.43
13655	19 2945	7.7 F5	15 14 9.934	272.18	.15	19 20 33.05	-1327.0	15.1	2	56.36
13658	24 2838	8.1 K2	15 14 18.205	263.29	.11	23 43 40.44	-1326.1	14.7	2	58.36
13660	39 2858	8.5 G5	15 14 34.371	226.19	.05	38 58 24.47	-1324.3	12.7	4	59.65
13661	14 2856	8.5 G5	15 14 34.690	281.56	.21	14 24 26.94	-1324.3	15.7	2	58.95
13665	29 2646	8.9 A2	15 14 52.635	252.43	.08	28 39 59.19	-1322.3	14.1	2	57.87
13666	21 2751	8.5 K0	15 15 0.829	268.40	.14	21 10 44.76	-1321.4	15.0	2	58.88
13667	25 2891	8.8 K2	15 15 1.093	259.65	.10	25 23 18.15	-1321.4	14.5	2	57.82
13669	- 0 2948	7.2 G5	15 15 5.964	308.73	.43	- 0 48 10.05	-1320.8	17.2	2	58.41
13671	4 2993	8.7 K5	15 15 12.142	300.37	.35	3 57 35.99	-1320.2	16.8	2	56.87
13684	7 2937	8.6 K2	15 16 34.115	294.62	.31	7 10 9.39	-1311.2	16.5	2	56.81
13687	52 1865	7.9 K0	15 16 38.229	178.88	.24	51 47 53.91	-1310.7	10.1	2	56.88
13688	15 2842	8.9 K2	15 16 41.887	279.57	.20	15 20 54.62	-1310.3	15.7	4	57.91
13689	45 2277	7.8 K0	15 16 56.965	205.42	.10	45 11 53.25	-1308.6	11.6	2	57.36
13698	30 2643	8.7 K0	15 17 31.147	249.37	.08	29 44 52.78	-1304.8	14.1	2	57.41
13700	60 1603	7.8 K5	15 17 40.408	133.65	.66	59 42 5.84	-1303.8	7.7	2	58.82
13709	61 1495	7.1 G0	15 18 18.882	119.55	.85	61 33 18.28	-1299.6	6.9	2	56.92
13711	0 3348	8.4 G5	15 18 33.051	307.42	.41	- 0 3 8.00	-1298.0	17.3	2	58.33
13718	23 2804	8.2 G0	15 19 7.815	263.26	.13	23 21 33.87	-1294.1	14.9	2	56.87
13719	68 828	8.5 K0	15 19 19.845	54.63	2.00	67 59 54.01	-1292.8	3.3	2	56.91
13721	18 3008	8.2 K0	15 19 27.217	272.91	.17	18 37 2.90	-1292.0	15.5	2	58.34
13722	48 2284	8.9 K2	15 19 28.457	192.25	.16	48 24 13.52	-1291.8	11.0	2	56.89
13726	40 2874	8.6 K0	15 19 42.144	220.49	.08	40 20 32.43	-1290.3	12.6	2	58.48
13727	22 2824	8.4 K0	15 19 42.797	266.72	.14	21 39 32.65	-1290.2	15.1	2	57.34
13728	78 510	7.5 K2	15 19 47.638	-198.75	11.42	78 34 26.48	-1289.7	-10.8	2	58.42
13733	43 2491	8.7 K5	15 20 7.111	212.57	.09	42 46 49.69	-1287.5	12.1	2	56.89
13742	- 2 3985	8.8 K0	15 20 34.153	312.86	.46	- 3 5 25.29	-1284.5	17.8	2	57.88
13746	28 2425	7.3 K0	15 20 39.755	252.23	.10	28 14 3.18	-1283.9	14.4	2	58.33
13750	56 1798	7.3 K5	15 20 49.407	155.87	.43	55 52 4.73	-1282.8	9.0	2	57.86
13758	9 3031	7.5 K5	15 21 34.576	290.87	.28	9 4 55.00	-1277.7	16.6	2	57.87
13759	25 2908	8.2 F5	15 21 42.607	258.29	.12	25 27 41.76	-1276.8	14.8	2	58.34
13763	65 1052	8.7 G0	15 21 59.379	84.19	1.39	65 12 4.58	-1274.9	5.0	2	57.83
13766	63 1194	7.3 K0	15 22 9.845	102.15	1.08	63 18 23.42	-1273.8	6.0	2	59.39
13767	17 2859	8.6 K0	15 22 11.468	276.06	.19	16 51 30.35	-1273.6	15.8	2	58.87
13770	8 3026	8.0 G5	15 22 29.753	292.87	.29	7 58 1.23	-1271.5	16.8	4	58.91

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
13777	29 2663	8.6 K0	15 22 57.970	249.22	.10	29 19 17.12	-1268.3	14.4	2	57.42
13796	59 1655	8.7 K7	15 24 13.914	133.09	.66	59 11 10.24	-1259.7	7.8	2	56.92
13797	44 2464	6.5 K5	15 24 16.290	205.27	.12	44 28 34.35	-1259.5	11.9	2	57.87
13799	- 3 3784	8.6 G0	15 24 26.033	313.48	.47	- 3 23 18.03	-1258.4	18.0	2	58.88
13803	- 1 3057	8.4 K0	15 24 42.971	310.34	.44	- 1 39 24.13	-1256.4	17.9	2	57.94
13807	1 3080	8.4 G5	15 24 51.163	305.49	.39	1 0 41.35	-1255.5	17.6	2	59.35
13811	37 2644	8.9 M0	15 25 5.478	229.52	.08	36 44 17.09	-1253.9	13.3	2	56.89
13812	- 0 2971	8.5 A2	15 25 11.495	308.13	.42	- 0 26 29.94	-1253.2	17.8	2	58.35
13816	73 678	8.7 K0	15 25 28.446	-34.54	4.22	73 1 17.06	-1251.3	-1.7	2	57.80
13824	7 2968	8.8 A5	15 26 9.722	294.31	.31	7 5 38.43	-1246.5	17.1	2	57.36
13827	3 3039	8.8 K0	15 26 15.754	300.70	.35	3 37 13.19	-1245.9	17.4	2	58.94
13832	2 2968	8.8 F8	15 27 4.996	303.79	.38	1 55 46.09	-1240.2	17.7	2	57.37
13835	16 2790	7.4 K0	15 27 26.137	276.47	.20	16 21 46.01	-1237.8	16.1	2	56.88
13843	19 2973	8.0 K0	15 27 54.029	270.67	.17	19 11 57.71	-1234.6	15.8	2	56.87
13844	33 2594	8.3 G0	15 27 57.795	239.51	.09	32 47 20.12	-1234.2	14.0	2	57.93
13852	- 3 3793	8.5 K0	15 28 29.504	315.06	.48	- 4 11 34.74	-1230.6	18.4	2	58.28
13853	46 2074	7.5 K2	15 28 31.397	195.96	.16	46 33 21.87	-1230.3	11.5	3	59.03
13865	14 2889	7.9 G5	15 29 19.241	280.11	.22	14 25 43.88	-1224.8	16.4	2	58.34
13868	49 2398	9.0 K0	15 29 41.994	185.45	.21	49 0 46.00	-1222.2	11.0	2	57.37
13874	40 2896	7.4 K0	15 29 54.604	218.89	.11	39 50 48.99	-1220.7	12.9	4	58.86
13879	10 2871	8.2 K5	15 30 9.505	288.71	.27	9 57 18.82	-1219.0	17.0	2	56.96
13882	21 2783	8.7 K2	15 30 24.951	266.12	.16	21 13 1.76	-1217.2	15.7	2	57.79
13884	64 1075	8.9 G5	15 30 30.954	86.54	1.28	64 18 52.34	-1216.5	5.3	2	58.42
13891	13 2960	8.6 G5	15 30 56.416	282.26	.23	13 15 50.27	-1213.6	16.6	2	57.35
13896	69 801	8.0 K2	15 31 26.906	25.04	2.46	69 19 35.59	-1210.0	1.7	2	57.87
13907	53 1790	7.9 K5	15 32 13.934	164.32	.35	53 14 52.81	-1204.6	9.8	2	56.91
13909	0 3375	7.8 K0	15 32 15.786	307.29	.40	0 1 10.48	-1204.4	18.2	2	57.93
13910	18 3040	8.4 K5	15 32 21.777	271.77	.18	18 24 28.10	-1203.7	16.1	2	58.41
13926	- 2 4021	8.4 K2	15 33 36.742	311.73	.44	- 2 21 7.26	-1194.9	18.5	2	56.82
13927	35 2705	9.1 K0	15 33 42.465	231.49	.10	35 14 55.82	-1194.2	13.8	4	58.12
13928	50 2195	7.2 K5	15 33 44.606	180.04	.25	49 51 49.06	-1194.0	10.8	2	56.82
13931	28 2447	8.1 F8	15 33 55.347	248.84	.12	28 34 25.83	-1192.7	14.8	2	56.95
13933	45 2307	8.3 K2	15 34 0.405	197.59	.17	45 36 45.44	-1192.1	11.8	2	57.87
13951	- 0 2990	8.1 K2	15 34 54.404	308.68	.41	- 0 43 17.20	-1185.8	18.4	2	56.91
13967	79 470	8.4 G0	15 35 36.191	-267.50	13.37	79 21 46.57	-1180.9	-15.5	2	57.93
13968	7 2996	8.4 F0	15 35 37.186	292.95	.30	7 35 6.74	-1180.8	17.5	2	57.80
13975	6 3076	8.2 K0	15 36 12.092	295.19	.31	6 24 7.12	-1176.6	17.7	2	57.40
13983	63 1216	8.5 K0	15 36 35.328	94.96	1.10	62 58 48.14	-1173.9	5.9	2	58.42
13984	39 2895	9.0 K0	15 36 40.528	218.41	.12	39 22 43.32	-1173.3	13.2	2	58.34
13987	9 3080	8.7 G5	15 37 9.778	289.83	.28	9 9 31.52	-1169.8	17.4	2	57.88
13989	33 2611	9.0 K0	15 37 20.300	236.63	.11	33 4 25.63	-1168.6	14.3	2	57.90
13994	52 1890	8.4 K0	15 37 27.876	169.66	.31	51 43 51.84	-1167.7	10.3	2	57.43
13995	57 1598	7.5 K0	15 37 34.299	135.60	.60	57 40 55.72	-1166.9	8.3	2	58.46
14004	34 2674	8.0 K0	15 38 21.027	232.71	.11	34 25 14.21	-1161.4	14.1	2	56.34
14011	19 3002	8.6 A2	15 39 5.267	269.08	.18	19 18 33.07	-1156.1	16.3	2	57.33
14012	41 2622	8.5 G0	15 39 8.761	212.08	.14	41 6 20.20	-1155.7	12.9	2	57.82
14014	65 1069	7.9 K2	15 39 12.447	75.06	1.39	64 49 18.42	-1155.3	4.7	2	57.42
14017	- 0 3001	8.0 K0	15 39 46.770	309.71	.42	- 1 15 2.31	-1151.2	18.7	2	56.88
14032	75 574	8.6 K0	15 40 31.460	-114.53	6.22	75 25 57.88	-1145.8	-6.6	2	57.85
14033	27 2528	8.6 G5	15 40 37.344	251.45	.13	27 0 8.41	-1145.1	15.3	2	57.40

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
14041	2 2987	7.6 K0	15 41 15.057	302.34	.36	2 35 49.43	-1140.6	18.4	2	57.35
14044	55 1773	8.7 K0	15 41 22.842	152.13	.44	54 41 36.18	-1139.7	9.4	2	57.36
14047	13 2993	8.1 K5	15 41 33.718	281.99	.24	12 58 30.86	-1138.4	17.2	2	56.44
14049	- 2 4040	8.6 K2	15 41 44.225	312.82	.44	- 2 51 21.08	-1137.1	19.0	2	58.34
14052	48 2322	8.2 K0	15 41 51.139	185.40	.22	47 55 31.50	-1136.3	11.4	2	56.92
14068	67 915	8.7 K0	15 43 22.546	38.30	1.98	67 39 27.57	-1125.3	2.5	2	56.34
14070	24 2919	8.9 K2	15 43 28.608	257.50	.15	24 14 59.30	-1124.6	15.8	2	57.82
14075	6 3096	7.6 K2	15 43 45.987	295.17	.31	6 15 57.34	-1122.5	18.1	2	57.87
14077	- 3 3824	8.1 K5	15 43 53.118	314.88	.46	- 3 54 20.39	-1121.6	19.3	2	58.39
14078	53 1807	7.9 K0	15 43 57.510	161.24	.37	52 49 55.45	-1121.1	10.0	2	57.40
14085	55 1775	7.4 K5	15 44 15.874	146.59	.48	55 24 19.97	-1118.8	9.1	4	58.49
14091	- 4 3975	8.2 G5	15 44 43.837	316.97	.47	- 4 57 54.71	-1115.5	19.4	2	58.90
14098	27 2538	8.0 K2	15 45 6.652	249.77	.14	27 22 43.86	-1112.7	15.4	2	58.42
14100	19 3018	7.9 K2	15 45 11.142	269.12	.19	18 58 5.26	-1112.2	16.6	2	59.00
14108	35 2731	9.3 K0	15 45 36.074	228.98	.12	35 8 38.15	-1109.1	14.1	2	57.85
14114	74 630	7.7 K0	15 46 8.316	-81.13	4.86	73 59 22.33	-1105.2	-4.7	2	58.90
14127	10 2911	7.9 F0	15 46 56.457	287.16	.27	10 13 57.49	-1099.3	17.7	2	56.88
14128	7 3037	8.4 K0	15 47 2.739	292.34	.30	7 38 14.68	-1098.6	18.1	2	57.88
14130	25 2973	8.5 G5	15 47 26.120	253.69	.15	25 36 39.71	-1095.8	15.7	2	57.80
14131	49 2428	8.9 G5	15 47 27.605	179.34	.27	48 50 19.47	-1095.6	11.2	2	57.40
14139	81 531	6.9 K2	15 47 54.804	-406.92	19.47	81 5 7.98	-1092.2	-24.6	2	58.42
14141	21 2827	8.8 K0	15 48 15.913	263.38	.17	21 23 52.57	-1089.7	16.3	2	58.42
14142	47 2272	8.1 G5	15 48 17.128	184.41	.24	47 37 24.40	-1089.5	11.5	2	57.95
14145	63 1228	7.9 F0	15 48 24.177	84.33	1.16	63 17 36.10	-1088.6	5.4	2	58.42
14147	39 2922	8.5 K2	15 48 36.167	216.52	.14	38 58 17.72	-1087.2	13.5	2	58.82
14149	16 2835	8.3 K5	15 48 53.403	274.50	.21	16 17 20.19	-1085.1	17.1	2	57.38
14151	38 2708	7.6 K0	15 49 1.342	220.46	.14	37 42 9.43	-1084.1	13.7	2	57.86
14152	61 1543	8.2 K0	15 49 1.857	100.44	.95	61 29 18.15	-1084.0	6.4	4	59.12
14154	59 1682	8.6 K5	15 49 5.967	119.03	.73	59 9 47.09	-1083.5	7.5	2	58.90
14158	19 3024	8.2 K2	15 49 18.529	267.63	.18	19 26 17.79	-1082.0	16.6	2	58.47
14174	44 2516	8.6 K5	15 50 36.269	196.52	.19	44 28 10.01	-1072.4	12.3	2	56.87
14176	20 3163	8.9 K0	15 50 38.428	265.05	.18	20 31 44.83	-1072.1	16.5	2	57.36
14185	28 2487	8.1 K2	15 51 4.690	247.32	.14	27 57 42.55	-1068.9	15.5	2	57.82
14187	0 3423	8.4 K0	15 51 6.921	306.45	.38	0 26 40.12	-1068.6	19.1	2	57.41
14194	13 3027	8.7 K2	15 51 49.234	280.07	.23	13 31 49.56	-1063.4	17.5	2	58.90
14196	2 3020	7.7 K5	15 51 55.822	302.80	.35	2 17 19.58	-1062.6	18.9	2	57.95
14202	32 2642	8.3 A3	15 52 14.641	235.12	.13	32 29 19.43	-1060.3	14.8	2	56.35
14220	8 3108	8.2 K2	15 53 40.237	291.17	.29	8 4 52.45	-1049.7	18.3	2	56.87
14224	10 2927	7.5 K0	15 53 48.724	286.34	.27	10 26 30.96	-1048.6	18.0	2	57.42
14228	54 1780	8.2 K0	15 54 8.263	149.44	.45	54 10 34.21	-1046.2	9.5	2	57.82
14230	21 2851	8.4 K0	15 54 14.882	262.67	.17	21 23 24.64	-1045.4	16.6	2	57.89
14231	31 2799	7.9 M0	15 54 16.407	237.83	.14	31 21 58.61	-1045.2	15.0	2	56.95
14235	56 1844	8.1 K5	15 54 22.635	138.50	.53	55 57 41.56	-1044.4	8.8	2	58.39
14236	- 2 4077	8.4 A0	15 54 26.217	313.00	.42	- 2 50 42.54	-1044.0	19.7	2	58.41
14237	- 0 3040	7.7 K5	15 54 26.431	308.52	.39	- 0 36 6.14	-1043.9	19.4	2	58.41
14241	57 1620	8.2 F8	15 54 55.450	128.56	.62	57 25 36.10	-1040.3	8.2	2	57.88
14243	17 2938	7.7 G0	15 54 59.133	271.69	.20	17 19 44.87	-1039.9	17.2	2	57.42
14248	19 3042	8.7 K0	15 55 32.144	266.76	.19	19 31 33.04	-1035.7	16.9	2	57.39
14253	13 3037	7.9 K0	15 56 3.833	280.93	.24	12 58 39.02	-1031.8	17.8	2	57.88
14255	72 703	7.5 K0	15 56 8.590	-56.84	3.81	72 32 7.22	-1031.2	-3.3	2	57.86

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
14257	48	2346	8.8 K2	15 56 27.361	180.75	.26	47 49 34.31	-1028.8	11.5	2	57.82
14261	34	2716	8.6 K2	15 56 42.040	228.95	.14	34 20 3.44	-1027.0	14.5	2	56.41
14274	1	3154	7.4 K5	15 57 29.119	305.80	.37	0 45 50.22	-1021.2	19.4	3	58.64
14286	41	2655	8.5 K0	15 58 12.964	207.08	.17	41 1 59.04	-1015.6	13.2	2	56.37
14287	53	1832	7.8 K2	15 58 20.456	152.78	.42	53 17 34.16	-1014.7	9.8	2	57.40
14291	66	927	8.0 A3	15 58 31.015	46.01	1.63	66 11 42.78	-1013.3	3.1	2	56.87
14298	29	2752	7.7 G5	15 58 55.013	243.13	.15	29 5 15.54	-1010.3	15.5	2	56.42
14314	- 2	4094	8.1 K2	16 0 12.110	312.04	.40	- 2 19 57.45	-1000.6	19.9	2	56.90
14326	35	2762	8.0 K2	16 1 7.132	225.60	.15	35 9 20.92	-993.6	14.5	2	56.41
14329	47	2292	8.5 A5	16 1 19.289	183.40	.24	46 52 4.32	-992.1	11.8	2	56.89
14340	6	3149	7.6 K0	16 1 51.996	294.80	.30	6 8 50.88	-988.0	18.9	2	56.94
14345	60	1649	8.1 K0	16 2 6.939	100.94	.86	60 35 32.43	-986.1	6.6	2	56.95
14349	13	3062	8.5 K2	16 2 36.915	279.86	.24	13 16 16.83	-982.2	18.0	2	56.95
14362	42	2671	8.3 K0	16 3 42.169	201.58	.19	42 9 41.04	-973.9	13.0	2	57.36
14366	0	3455	8.5 K2	16 3 46.788	307.45	.37	- 0 3 41.32	-973.4	19.8	2	58.42
14369	44	2541	7.8 K0	16 3 49.681	195.10	.20	43 51 12.48	-973.0	12.6	2	57.52
14371	36	2689	7.4 G5	16 3 58.554	220.35	.15	36 39 44.17	-971.9	14.3	2	56.98
14375	45	2370	8.0 F0	16 4 20.854	187.77	.23	45 37 44.47	-969.0	12.2	2	58.41
14376	- 2	4111	8.6 A5	16 4 21.323	313.70	.41	- 3 7 9.41	-969.0	20.2	2	57.41
14378	- 3	3875	7.4 M0	16 4 23.462	314.98	.41	- 3 44 39.99	-968.7	20.3	3	58.11
14379	58	1615	8.5 K0	16 4 24.931	119.93	.66	58 1 29.92	-968.5	7.9	2	58.41
14381	62	1452	8.3 K0	16 4 33.529	82.92	1.05	62 27 33.03	-967.4	5.5	2	57.43
14385	3	3128	8.2 K0	16 4 59.537	300.08	.32	3 32 29.81	-964.1	19.4	2	57.94
14388	16	2885	7.8 K2	16 5 28.104	274.05	.21	15 50 33.53	-960.4	17.7	2	58.04
14397	83	468	7.3 G5	16 5 58.108	-729.65	36.76	83 32 24.55	-956.5	-46.5	2	57.80
14400	5	3147	7.9 K0	16 6 12.659	295.93	.31	5 32 13.17	-954.8	19.2	4	58.69
14403	7	3102	8.4 K5	16 6 20.455	293.36	.29	6 46 37.62	-953.7	19.0	2	58.41
14408	34	2741	8.4 G5	16 6 32.770	228.42	.15	33 51 50.77	-952.1	14.9	3	59.12
14423	11	2926	8.6 A0	16 7 23.287	284.44	.25	10 59 40.18	-945.7	18.5	2	58.90
14431	25	3039	7.2 K0	16 8 0.959	250.76	.16	25 37 1.70	-940.8	16.3	2	57.34
14432	53	1848	7.9 K2	16 8 5.992	150.53	.42	53 2 4.86	-940.2	9.9	2	57.40
14446	48	2369	7.4 K0	16 9 3.455	176.28	.28	47 56 8.66	-932.8	11.6	2	57.36
14450	21	2882	8.4 K0	16 9 14.249	261.75	.18	21 4 11.81	-931.4	17.1	2	56.40
14451	24	2977	8.6 K0	16 9 19.761	254.77	.17	23 56 52.11	-930.7	16.6	2	57.97
14452	67	928	8.7 G5	16 9 19.799	21.71	1.86	67 29 38.34	-930.7	1.6	2	57.90
14460	18	3138	8.6 G5	16 9 48.388	268.59	.20	18 6 20.01	-927.0	17.6	2	57.41
14477	46	2156	7.5 K0	16 11 10.870	184.18	.25	46 1 13.97	-916.3	12.1	2	56.95
14485	4	3140	8.2 G5	16 11 35.511	298.69	.31	4 9 11.20	-913.1	19.6	2	56.82
14486	16	2908	7.8 M0	16 11 36.256	271.96	.21	16 33 35.45	-913.0	17.8	2	57.39
14488	9	3169	8.4 F0	16 11 42.863	287.06	.26	9 39 58.10	-912.1	18.8	2	57.43
14492	0	3477	8.3 K2	16 12 21.568	307.61	.36	- 0 8 8.75	-907.1	20.2	2	57.94
14494	- 1	3159	8.4 G5	16 12 38.810	311.93	.38	- 2 12 38.23	-904.9	20.5	2	58.04
14498	22	2946	8.2 K0	16 12 43.724	257.96	.18	22 29 25.83	-904.2	17.0	2	56.41
14512	48	2380	8.6 K5	16 13 49.362	172.45	.29	48 27 7.54	-895.7	11.4	2	57.89
14514	81	543	7.9 G5	16 13 52.684	-471.23	18.18	81 16 14.41	-895.3	-30.5	2	58.88
14519	66	944	8.1 K0	16 14 14.717	32.16	1.62	66 30 2.49	-892.4	2.3	2	57.51
14523	20	3236	8.4 K0	16 14 39.328	263.92	.19	19 55 26.03	-889.2	17.4	2	56.36
14528	38	2747	7.7 K2	16 14 56.871	211.10	.17	38 46 1.48	-886.9	14.0	2	56.40
14534	61	1577	8.0 K0	16 15 26.029	90.82	.88	61 0 44.07	-883.0	6.1	2	57.43
14541	64	1117	8.3 K0	16 15 49.473	56.82	1.26	64 23 43.05	-880.0	3.9	4	57.95

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900.0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
14553	12 2993	8.1 G5	16 16 50.662	280.27	.23	12 40 35.62	-872.0	18.6	2	56.88
14564	- 2 4160	8.6 K0	16 17 21.915	313.44	.38	- 2 54 21.30	-867.9	20.8	2	57.36
14565	62 1470	7.1 K0	16 17 27.765	75.48	1.03	62 32 37.53	-867.1	5.1	2	57.96
14569	- 4 4095	8.6 K2	16 17 37.352	316.68	.40	- 4 26 20.52	-865.8	21.0	2	57.48
14576	55 1830	7.6 K5	16 18 11.932	135.59	.49	54 54 36.97	-861.3	9.1	2	57.35
14581	0 3503	8.2 K2	16 18 32.402	305.76	.34	0 44 43.64	-858.6	20.3	2	57.95
14583	40 3006	7.8 F2	16 18 34.533	204.65	.18	40 22 40.59	-858.3	13.7	2	56.98
14589	52 1961	8.0 K0	16 19 16.918	152.82	.38	51 57 7.65	-852.7	10.3	2	58.42
14590	29 2816	8.8 G0	16 19 22.394	239.98	.16	29 6 45.26	-852.0	16.0	2	57.87
14595	47 2333	9.0 G	16 19 38.037	178.38	.26	46 49 9.47	-849.9	12.0	4	58.25
14598	3 3173	7.5 K2	16 19 44.379	301.00	.32	2 59 31.38	-849.1	20.1	2	58.41
14604	10 2992	8.3 K5	16 20 0.921	285.92	.25	10 1 28.65	-846.9	19.1	2	57.96
14608	79 493	9.0 G5	16 20 20.802	-336.84	11.15	79 20 44.50	-844.3	-22.1	2	58.44
14619	73 717	8.9 K0	16 20 57.927	-96.98	3.82	73 17 43.20	-839.4	-6.2	2	58.44
14621	32 2717	7.5 K5	16 21 7.252	229.28	.16	32 44 30.85	-838.1	15.4	2	56.89
14649	28 2564	8.6 A5	16 22 44.050	242.94	.16	27 52 3.03	-825.3	16.3	2	56.95
14656	24 3003	7.5 K5	16 23 0.230	252.65	.17	24 10 10.75	-823.1	17.0	2	57.96
14672	23 2934	7.6 M0	16 24 10.201	255.05	.17	23 10 35.34	-813.8	17.2	2	56.96
14673	5 3203	8.2 K0	16 24 11.028	295.69	.28	5 26 44.03	-813.7	19.9	2	58.40
14674	76 606	7.7 K5	16 24 14.125	-203.65	6.34	76 33 31.58	-813.3	-13.4	2	57.97
14675	60 1676	8.1 A3	16 24 14.954	92.21	.81	60 24 56.94	-813.2	6.3	2	58.41
14687	34 2787	8.8 K2	16 25 11.285	223.99	.16	34 15 44.95	-805.7	15.1	2	57.42
14698	33 2733	7.2 K0	16 26 3.509	228.32	.16	32 48 33.88	-798.8	15.4	2	56.96
14700	15 3008	7.4 K0	16 26 7.434	273.25	.21	15 32 27.31	-798.2	18.4	2	57.35
14710	54 1814	8.3 K0	16 26 37.375	134.46	.47	54 38 14.73	-794.2	9.2	2	56.89
14714	40 3020	8.9 F8	16 26 50.393	204.76	.19	39 53 8.41	-792.4	13.9	2	56.96
14716	4 3191	7.8 G2	16 27 5.905	297.27	.29	4 41 4.15	-790.4	20.1	2	57.43
14721	35 2822	7.9 K5	16 27 22.527	218.91	.17	35 44 33.11	-788.1	14.8	2	58.48
14728	56 1892	8.2 K0	16 27 55.119	120.02	.56	56 42 47.36	-783.8	8.2	2	58.41
14734	20 3284	8.5 K2	16 28 29.826	262.43	.18	20 2 6.31	-779.1	17.8	2	57.43
14740	1 3246	7.5 K0	16 28 48.887	304.28	.31	1 24 53.08	-776.6	20.6	2	56.95
14745	37 2762	8.2 G0	16 28 57.445	212.33	.18	37 38 0.89	-775.4	14.4	2	57.83
14751	17 3041	8.3 K0	16 29 10.155	268.21	.20	17 36 22.94	-773.7	18.2	2	56.96
14759	42 2719	7.8 K0	16 29 53.538	195.15	.21	42 16 6.60	-767.9	13.3	4	57.71
14767	28 2581	7.5 K5	16 30 25.694	242.15	.16	27 48 50.90	-763.5	16.5	2	56.89
14773	23 2951	7.9 K0	16 31 2.622	254.26	.17	23 13 17.65	-758.5	17.3	2	56.98
14776	- 4 4128	8.1 K0	16 31 15.886	318.05	.37	- 4 57 6.67	-756.8	21.6	2	56.96
14777	- 3 3964	8.2 K0	16 31 20.252	315.30	.36	- 3 41 11.62	-756.2	21.4	4	58.66
14786	7 3207	8.3 A3	16 32 35.369	292.21	.26	6 57 6.63	-746.0	19.9	2	57.49
14792	54 1819	8.9 K0	16 32 46.465	136.35	.44	54 2 11.39	-744.5	9.4	2	57.97
14793	51 2115	7.9 G5	16 32 51.957	153.71	.35	51 4 18.18	-743.8	10.6	2	58.05
14794	59 1734	7.4 K0	16 33 0.998	94.26	.73	59 46 47.74	-742.6	6.5	2	58.49
14799	19 3127	8.1 K2	16 33 14.155	264.44	.19	19 3 28.47	-740.7	18.1	2	56.98
14802	32 2750	8.1 K5	16 33 28.582	229.53	.16	32 3 43.19	-738.8	15.7	2	57.49
14806	66 959	8.4 G5	16 33 34.175	26.23	1.41	66 9 27.49	-738.1	1.9	2	57.95
14814	30 2843	8.1 G5	16 33 56.127	236.00	.16	29 50 47.77	-735.1	16.2	2	57.90
14816	2 3140	8.7 G5	16 34 7.286	302.69	.30	2 8 2.21	-733.6	20.7	2	57.95
14831	36 2756	7.0 M0	16 34 43.342	216.42	.18	36 8 25.45	-728.6	14.9	2	57.43
14841	19 3135	8.1 K0	16 35 32.544	262.81	.18	19 39 21.39	-722.0	18.0	2	56.89
14851	- 0 3155	8.4 G5	16 36 16.703	308.93	.32	- 0 44 13.67	-716.0	21.2	2	57.48

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
14859	3	3240	8.2 K2	16 36 53.386	299.71	.28	3 29 22.48	-711.0	20.6	2	56.96
14862	46	2199	7.8 K0	16 37 3.602	175.68	.26	46 29 28.31	-709.6	12.1	2	56.89
14876	35	2848	8.3 K0	16 37 46.815	219.17	.17	35 10 8.43	-703.7	15.1	2	56.89
14885	44	2598	8.1 G5	16 38 52.805	185.77	.23	44 7 27.60	-694.7	12.8	2	56.50
14894	12	3064	8.6 K0	16 39 23.051	280.40	.22	12 7 1.37	-690.6	19.3	2	58.48
14898	56	1911	7.7 K0	16 39 37.259	119.44	.51	56 15 44.73	-688.6	8.3	2	57.05
14903	41	2740	8.4 G0	16 39 52.997	196.58	.20	41 25 3.82	-686.4	13.6	2	56.49
14907	0	3569	8.6 G0	16 40 18.562	306.96	.30	0 10 7.13	-683.0	21.2	2	57.88
14908	79	510	8.5 K0	16 40 20.755	-356.57	9.37	79 17 4.80	-682.7	-24.3	2	57.90
14910	- 3	3982	7.7 K5	16 40 34.182	316.24	.34	- 4 3 24.95	-680.8	21.8	2	56.95
14911	53	1883	8.1 K0	16 40 34.388	139.54	.40	53 9 59.01	-680.8	9.7	2	58.05
14912	11	3028	8.2 K5	16 40 36.197	282.82	.22	11 2 5.58	-680.5	19.5	2	58.04
14914	15	3040	7.8 K2	16 40 40.951	271.88	.20	15 44 51.03	-679.9	18.8	2	57.42
14920	6	3282	8.0 K0	16 41 12.412	292.53	.25	6 42 40.43	-675.5	20.2	2	57.03
14924	4	3242	8.2 K0	16 41 24.463	298.29	.27	4 6 41.32	-673.9	20.6	4	59.14
14925	7	3228	8.4 K0	16 41 24.946	290.51	.24	7 36 40.87	-673.8	20.1	2	59.00
14930	9	3259	8.2 K0	16 41 36.689	287.13	.23	9 6 48.29	-672.2	19.9	2	58.50
14938	32	2775	8.3 K5	16 42 22.367	228.84	.16	31 54 55.31	-666.0	15.9	2	57.96
14940	10	3058	8.1 K5	16 42 29.019	285.01	.23	10 2 34.33	-665.1	19.8	2	57.93
14941	17	3081	8.4 K0	16 42 30.248	268.47	.19	17 8 2.33	-664.9	18.6	2	58.93
14944	52	1994	8.1 K0	16 42 46.505	145.86	.36	52 0 40.89	-662.6	10.2	2	57.42
14950	48	2433	7.5 K5	16 43 13.588	165.42	.28	48 21 18.09	-658.9	11.5	2	57.94
14956	27	2681	8.4 K5	16 43 37.861	242.25	.16	27 16 0.73	-655.6	16.8	2	58.44
14965	65	1141	8.1 K0	16 43 57.526	32.31	1.19	65 19 41.06	-652.9	2.4	2	58.05
14969	46	2211	7.6 K0	16 44 23.733	175.81	.25	46 8 2.52	-649.3	12.3	2	56.96
14972	18	3237	8.3 K0	16 44 40.555	266.14	.19	18 2 16.71	-646.9	18.5	2	57.93
14973	58	1669	7.5 K2	16 44 47.202	98.93	.62	58 44 40.69	-646.0	7.0	2	58.07
14975	29	2881	8.4 F8	16 45 3.641	236.28	.16	29 18 48.47	-643.7	16.4	2	58.96
14979	1	3306	8.6 A3	16 45 26.207	304.45	.28	1 18 2.53	-640.6	21.2	2	58.02
14981	20	3332	8.0 K0	16 45 37.156	260.50	.18	20 17 33.11	-639.1	18.1	2	58.93
14982	9	3273	8.4 K0	16 45 39.026	287.44	.23	8 55 26.54	-638.9	20.0	3	59.45
14988	31	2908	8.6 K0	16 45 57.720	229.14	.16	31 40 37.98	-636.3	16.0	2	58.41
14996	6	3296	8.8 K5	16 46 19.616	292.20	.24	6 48 11.52	-633.2	20.3	2	57.94
15002	24	3060	8.9 K0	16 46 49.328	249.91	.17	24 20 56.99	-629.1	17.4	2	57.42
15005	5	3276	8.2 A0	16 47 2.409	295.22	.25	5 27 3.63	-627.3	20.6	2	56.44
15022	19	3175	8.8 M0	16 47 53.123	262.51	.18	19 25 49.87	-620.3	18.3	2	56.88
15034	12	3097	8.7 K0	16 48 48.046	278.93	.20	12 35 4.52	-612.7	19.5	2	58.97
15035	18	3256	7.5 K0	16 48 55.091	265.59	.18	18 9 40.00	-611.7	18.6	4	57.72
15039	48	2445	7.7 K0	16 49 29.096	163.76	.28	48 25 39.15	-607.0	11.5	2	56.44
15040	38	2848	8.5 K0	16 49 38.068	207.69	.18	38 2 8.61	-605.7	14.6	2	58.02
15041	51	2141	7.9 K0	16 49 40.820	148.83	.33	51 12 43.44	-605.3	10.5	2	57.03
15048	35	2878	7.7 K5	16 50 23.159	216.14	.17	35 34 17.40	-599.5	15.2	2	57.98
15050	21	2997	7.4 K5	16 50 31.165	258.23	.17	21 3 19.90	-598.3	18.1	2	58.03
15051	3	3298	8.0 G5	16 50 44.487	300.41	.26	3 6 7.73	-596.5	21.0	2	57.97
15076	- 3	4023	7.6 G5	16 51 48.489	316.45	.31	- 4 5 1.59	-587.6	22.2	2	56.96
15081	71	812	8.1 K0	16 52 8.331	-71.72	2.25	71 22 3.46	-584.8	-4.9	2	57.97
15087	0	3597	8.8 K2	16 52 51.249	306.94	.27	0 10 20.63	-578.8	21.5	2	57.96
15089	32	2810	8.6 K5	16 52 55.886	225.00	.16	32 45 35.79	-578.2	15.8	3	58.46
15090	- 2	4275	8.2 K0	16 52 59.114	312.63	.29	- 2 22 29.16	-577.7	21.9	4	58.76
15093	40	3072	7.8 K0	16 53 4.008	196.92	.19	40 47 17.00	-577.1	13.9	2	57.95

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
15094	37 2821	7.7 K5	16 53 15.995	209.47	.17	37 23 57.13	-575.4	14.7	2	58.99
15095	- 0 3203	8.8 G5	16 53 18.353	309.73	.28	- 1 4 27.03	-575.1	21.7	2	58.48
15099	23 3020	8.9 A5	16 53 22.949	251.81	.16	23 26 39.05	-574.4	17.7	2	58.42
15101	17 3125	8.4 K2	16 53 33.494	267.00	.18	17 28 53.81	-572.9	18.8	4	59.40
15103	40 3074	8.3 K5	16 53 41.978	200.12	.19	39 56 4.96	-571.8	14.1	2	57.97
15109	22 3035	8.4 A2	16 54 12.506	255.07	.17	22 11 4.76	-567.5	17.9	2	58.01
15115	13 3264	8.4 K2	16 54 42.468	277.63	.20	13 2 26.26	-563.3	19.5	2	57.95
15120	10 3102	8.2 K0	16 54 51.976	283.32	.21	10 36 14.56	-562.0	19.9	2	56.95
15125	65 1156	8.4 F2	16 55 7.586	32.10	1.03	65 0 25.50	-559.8	2.4	2	56.49
15128	32 2820	7.7 K0	16 55 19.408	226.17	.16	32 18 37.14	-558.1	15.9	2	57.06
15134	55 1890	8.7 K	16 55 39.268	119.97	.44	55 34 46.86	-555.4	8.5	2	57.96
15135	9 3299	8.3 F0	16 55 43.224	286.74	.21	9 6 29.21	-554.8	20.2	2	56.89
15137	43 2668	7.5 G5	16 55 48.997	184.36	.21	43 45 35.16	-554.0	13.0	2	57.97
15140	57 1718	9.0 F0	16 56 2.069	107.88	.50	57 13 5.87	-552.2	7.7	2	57.44
15148	33 2805	8.1 F8	16 56 22.034	221.38	.16	33 46 33.98	-549.4	15.6	2	56.49
15150	30 2911	8.0 G5	16 56 36.010	231.13	.16	30 39 38.03	-547.4	16.3	2	57.51
15159	8 3322	8.4 K2	16 57 10.609	289.02	.22	8 6 1.79	-542.5	20.4	2	56.96
15160	- 3 4040	7.5 K2	16 57 10.883	316.65	.29	- 4 8 50.69	-542.5	22.4	2	56.98
15169	78 573	7.6 K0	16 58 19.913	-300.50	5.93	78 2 6.46	-532.8	-21.0	2	57.49
15177	47 2419	8.8 A2	16 58 55.889	169.37	.24	46 56 38.72	-527.8	12.0	2	56.49
15197	54 1856	8.2 K0	17 0 41.064	125.12	.39	54 39 59.27	-513.0	8.9	2	57.43
15202	41 2784	7.9 F2	17 0 52.989	193.96	.19	41 15 55.96	-511.3	13.8	2	56.49
15206	29 2927	7.6 K2	17 1 5.575	234.07	.16	29 32 56.05	-509.5	16.6	4	58.68
15212	- 2 4294	7.8 K5	17 1 24.531	313.00	.27	- 2 30 53.80	-506.8	22.2	2	57.49
15213	51 2161	7.7 K0	17 1 25.615	147.61	.31	51 0 43.93	-506.7	10.5	2	57.42
15214	73 754	7.3 K2	17 1 28.440	-122.65	2.60	73 15 54.92	-506.3	-8.5	2	57.43
15217	16 3091	8.1 K0	17 1 39.378	270.02	.18	16 5 29.66	-504.7	19.2	2	56.95
15222	32 2844	8.2 M0	17 2 15.899	224.48	.16	32 37 45.70	-499.6	16.0	2	58.50
15227	45 2487	8.4 K0	17 2 27.213	175.54	.23	45 31 2.18	-498.0	12.5	2	58.07
15228	36 2823	7.7 K2	17 2 30.128	210.42	.17	36 49 16.24	-497.6	15.0	2	57.59
15231	14 3185	8.6 G5	17 2 46.172	275.15	.18	13 57 24.02	-495.3	19.5	2	58.49
15232	53 1915	7.7 K0	17 2 48.751	133.63	.35	53 17 56.00	-494.9	9.5	2	57.99
15234	3 3339	8.8 G5	17 3 1.276	300.77	.23	2 54 1.86	-493.2	21.4	2	57.94
15237	67 984	8.6 K0	17 3 11.637	-1.55	1.20	67 14 55.47	-491.7	.0	2	59.03
15242	25 3197	7.9 K0	17 3 39.147	245.31	.16	25 34 24.02	-487.8	17.4	2	58.89
15244	5 3323	8.0 G5	17 3 43.906	295.45	.22	5 14 4.37	-487.2	21.0	2	57.51
15246	71 823	8.5 K	17 3 48.644	-67.04	1.83	70 54 6.31	-486.5	-4.6	2	57.91
15258	7 3304	8.5 K2	17 4 19.435	290.68	.21	7 18 57.96	-482.1	20.7	2	58.03
15271	- 4 4233	8.2 K0	17 5 23.388	317.01	.27	- 4 15 49.68	-473.1	22.6	4	58.43
15274	60 1735	7.8 K0	17 5 43.441	75.86	.61	60 42 3.95	-470.2	5.5	2	57.03
15275	65 1168	7.9 G5	17 5 50.156	28.69	.91	65 0 18.11	-469.3	2.1	4	58.43
15281	42 2800	9.0 F2	17 6 28.299	189.61	.19	42 9 48.50	-463.9	13.5	2	57.05
15284	44 2659	7.8 K2	17 6 30.318	180.77	.21	44 13 58.47	-463.6	12.9	2	57.49
15286	12 3159	8.4 K5	17 6 36.881	277.97	.18	12 43 32.26	-462.7	19.8	2	57.94
15292	0 3646	8.4 G5	17 7 9.668	305.94	.23	0 36 37.81	-458.0	21.8	2	57.97
15296	47 2435	8.5 A3	17 7 21.419	164.33	.24	47 42 6.65	-456.3	11.8	2	58.50
15308	29 2951	7.8 M0	17 8 29.191	234.45	.15	29 13 42.04	-446.7	16.8	2	56.89
15319	39 3083	8.4 K2	17 9 17.687	201.24	.17	39 8 19.64	-439.8	14.4	2	56.94
15322	6 3365	8.7 A3	17 9 23.902	293.71	.20	5 57 42.20	-438.9	21.0	2	57.03
15326	2 3266	8.4 G0	17 9 50.510	302.35	.22	2 10 59.21	-435.1	21.6	2	59.42

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
15333	48 2489	8.6 K0	17 10 10.150	158.08	.25	48 50 20.80	-432.3	11.3	2	57.97
15350	61 1645	7.9 F2	17 11 8.495	63.08	.63	61 52 4.78	-424.0	4.6	2	56.89
15355	5 3353	8.2 K0	17 11 30.377	295.95	.20	4 58 38.59	-420.9	21.2	2	56.50
15363	14 3205	8.5 K7	17 11 58.600	273.87	.17	14 21 23.90	-416.9	19.6	2	57.56
15374	17 3201	7.7 K5	17 12 55.150	265.19	.16	17 51 25.52	-408.9	19.0	2	57.52
15377	15 3141	8.5 K0	17 13 9.404	272.35	.17	14 57 59.86	-406.8	19.5	2	56.97
15381	30 2956	7.8 G5	17 13 18.026	230.69	.15	30 21 23.35	-405.6	16.6	2	56.96
15416	37 2863	8.6 G0	17 15 27.785	206.13	.16	37 39 48.85	-387.1	14.8	3	58.12
15420	49 2614	7.1 K2	17 15 32.023	152.49	.25	49 44 37.84	-386.4	11.0	2	56.96
15431	- 4 4262	8.4 K5	17 16 18.666	317.09	.23	- 4 15 22.79	-379.8	22.8	2	56.98
15433	27 2787	7.6 K0	17 16 24.192	240.51	.15	26 59 18.88	-379.0	17.3	2	56.96
15437	- 2 4332	7.2 K0	17 16 44.385	313.52	.23	- 2 41 54.17	-376.1	22.5	3	59.84
15448	- 0 3265	8.0 K5	17 17 26.021	307.96	.21	- 0 16 32.68	-370.1	22.1	2	58.91
15449	22 3120	8.0 K2	17 17 28.442	254.29	.15	21 59 34.73	-369.7	18.3	2	56.99
15455	4 3396	8.7 K0	17 17 45.726	297.42	.19	4 18 41.57	-367.3	21.4	2	57.49
15462	17 3225	7.9 K2	17 18 32.222	266.92	.16	17 5 19.55	-360.6	19.2	2	56.96
15464	61 1652	7.2 K5	17 18 38.114	62.10	.56	61 48 26.31	-359.8	4.5	2	57.52
15472	62 1540	8.3 A2	17 19 14.142	52.88	.60	62 40 4.36	-354.6	3.9	2	57.49
15479	9 3372	7.4 K0	17 19 28.089	284.64	.17	9 47 0.84	-352.6	20.5	2	56.93
15484	59 1804	8.3 A2	17 19 43.853	86.22	.45	59 14 50.05	-350.4	6.3	3	56.74
15521	37 2881	7.3 K0	17 22 26.945	208.11	.15	36 58 1.39	-326.9	15.0	3	56.46
15540	45 2531	8.4 K0	17 23 11.744	173.60	.19	45 23 45.22	-320.5	12.6	2	57.42
15559	25 3264	8.9 K2	17 24 5.756	243.91	.14	25 39 51.60	-312.7	17.6	2	56.98
15561	- 0 3285	8.4 K0	17 24 11.706	307.66	.19	- 0 8 34.84	-311.8	22.2	2	57.51
15562	24 3184	8.4 K2	17 24 15.413	247.62	.14	24 20 23.00	-311.3	17.9	2	57.57
15565	- 2 4357	8.2 K2	17 24 40.470	312.75	.20	- 2 21 6.12	-307.7	22.6	2	58.04
15570	- 3 4105	8.4 K2	17 25 6.548	314.44	.20	- 3 5 4.47	-303.9	22.7	2	57.96
15574	73 772	8.2 K0	17 25 21.133	-124.14	1.61	72 58 41.31	-301.9	-8.9	2	57.49
15583	13 3382	8.8 F5	17 26 5.557	274.71	.15	13 51 56.14	-295.5	19.9	2	57.52
15589	9 3399	8.6 F8	17 26 11.528	284.59	.16	9 45 42.01	-294.6	20.6	2	57.95
15594	1 3440	8.1 B9	17 26 39.734	305.08	.18	0 58 25.92	-290.5	22.1	2	56.49
15599	11 3188	8.3 K5	17 27 6.435	279.84	.15	11 44 34.85	-286.7	20.2	2	58.98
15601	41 2839	7.7 K5	17 27 14.747	190.57	.16	41 26 17.38	-285.5	13.8	2	57.42
15603	10 3219	8.5 K0	17 27 19.666	283.05	.16	10 24 8.57	-284.8	20.5	2	57.06
15611	22 3157	7.4 K0	17 28 11.718	253.67	.14	22 4 21.00	-277.2	18.4	2	56.93
15612	77 661	8.7 G5	17 28 14.933	-273.03	2.82	77 9 16.90	-276.8	-19.6	2	56.98
15613	29 3033	8.0 K0	17 28 18.389	232.32	.14	29 32 41.07	-276.3	16.8	2	57.95
15619	45 2540	8.3 K0	17 28 45.266	171.77	.19	45 40 50.54	-272.4	12.5	2	57.49
15628	59 1823	7.9 K0	17 29 20.956	80.47	.39	59 43 32.54	-267.3	5.9	2	57.58
15629	2 3340	8.5 K0	17 29 22.220	302.03	.17	2 17 18.85	-267.1	21.9	2	58.91
15637	40 3162	8.4 A2	17 30 8.017	196.12	.16	40 0 35.19	-260.5	14.2	2	57.52
15649	23 3131	8.9 F5	17 30 43.346	250.19	.14	23 19 20.63	-255.3	18.1	2	56.95
15657	7 3400	7.8 F2	17 31 7.753	290.55	.16	7 12 42.26	-251.8	21.1	2	56.50
15658	32 2941	8.2 A2	17 31 12.024	224.48	.14	32 0 10.83	-251.2	16.3	2	57.05
15660	52 2067	8.0 K0	17 31 24.038	136.85	.24	52 7 42.14	-249.5	10.0	2	57.58
15661	64 1204	7.5 K2	17 31 25.100	28.80	.55	64 32 42.91	-249.3	2.1	2	57.97
15665	21 3153	8.0 K5	17 31 47.491	254.83	.14	21 35 52.94	-246.1	18.5	2	57.98
15674	4 3448	7.8 K0	17 32 9.515	297.75	.16	4 7 52.72	-242.9	21.6	2	58.94
15676	10 3246	8.0 A2	17 32 30.185	283.24	.15	10 17 30.74	-239.9	20.5	2	58.05
15682	43 2763	8.1 M0	17 32 59.654	181.26	.17	43 31 57.45	-235.6	13.2	2	57.49

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
15683	71 847	8.1 K5	17 33 1.101	-91.99	1.10	71 37 7.82	-235.4	-6.6	2	58.05
15694	1 3467	8.2 K0	17 33 48.247	304.37	.16	1 16 35.35	-228.6	22.1	2	57.49
15697	66 1034	8.2 G5	17 34 1.885	.69	.62	66 35 23.43	-226.6	.1	2	57.48
15699	38 2966	8.5 K0	17 34 11.833	203.44	.15	38 2 32.52	-225.2	14.8	2	57.45
15707	11 3210	8.1 K2	17 34 43.089	279.86	.14	11 41 4.50	-220.6	20.3	2	56.50
15710	14 3289	7.5 K0	17 34 46.248	272.04	.14	14 52 50.84	-220.2	19.8	2	56.96
15712	19 3381	8.5 A2	17 34 56.459	260.66	.13	19 21 33.66	-218.7	18.9	2	57.99
15720	31 3062	8.1 G5	17 35 25.616	226.81	.13	31 13 7.91	-214.5	16.5	2	56.95
15724	69 929	8.4 K2	17 35 45.966	-51.17	.80	69 39 48.44	-211.5	-3.7	4	58.44
15730	12 3267	7.5 K0	17 36 6.579	277.22	.14	12 45 52.48	-208.6	20.1	2	57.43
15742	26 3053	8.5 A2	17 36 42.802	240.90	.13	26 33 13.37	-203.3	17.5	2	57.97
15743	68 945	7.4 K5	17 36 44.799	-30.44	.69	68 31 2.63	-203.0	-2.2	2	57.49
15753	7 3434	7.1 K0	17 37 31.407	289.05	.14	7 49 37.68	-196.2	21.0	2	56.51
15760	6 3490	7.4 K2	17 37 53.864	291.96	.15	6 35 25.00	-192.9	21.2	2	57.40
15764	34 3019	8.3 G5	17 38 36.220	216.78	.13	34 14 24.50	-186.8	15.8	2	57.06
15771	35 3040	8.2 K0	17 39 27.799	211.48	.14	35 45 42.88	-179.4	15.4	2	57.13
15773	28 2803	7.9 K0	17 39 37.671	235.85	.13	28 14 11.72	-177.9	17.2	2	56.98
15777	21 3189	8.9 K0	17 39 47.117	255.83	.13	21 9 8.09	-176.6	18.6	2	57.97
15784	70 949	8.2 K5	17 40 6.049	-71.98	.77	70 39 43.47	-173.8	-5.2	2	57.01
15786	23 3162	8.8 K0	17 40 16.259	249.46	.13	23 29 35.82	-172.3	18.1	2	57.42
15789	50 2449	7.5 K0	17 40 34.066	145.77	.19	50 30 31.52	-169.7	10.6	2	56.98
15793	10 3272	8.3 A2	17 40 45.403	282.93	.13	10 23 4.09	-168.1	20.6	2	58.49
15800	18 3445	8.2 K2	17 41 7.415	261.88	.13	18 50 43.82	-164.9	19.1	2	56.47
15805	27 2877	7.1 K2	17 41 27.444	239.34	.13	27 2 39.12	-162.0	17.4	2	57.06
15806	4 3493	8.0 K5	17 41 28.088	297.19	.14	4 21 13.81	-161.9	21.6	2	57.43
15815	- 1 3386	8.2 K2	17 42 5.977	311.33	.15	- 1 43 11.47	-156.4	22.7	2	57.98
15830	22 3205	8.6 G5	17 43 21.500	252.55	.12	22 20 39.87	-145.4	18.4	2	57.49
15831	49 2685	8.6 K2	17 43 21.626	152.66	.17	49 15 5.27	-145.4	11.1	2	57.50
15833	30 3052	7.9 K0	17 43 27.179	228.61	.13	30 34 7.25	-144.6	16.6	2	58.49
15834	42 2909	8.3 K0	17 43 35.699	184.75	.15	42 36 24.87	-143.3	13.5	2	57.49
15835	39 3215	8.0 K2	17 43 46.676	197.92	.14	39 22 50.80	-141.7	14.4	2	58.57
15840	- 3 4172	8.6 A3	17 44 3.252	316.73	.14	- 4 2 7.83	-139.3	23.1	2	59.02
15843	75 640	7.7 K2	17 44 22.503	-210.34	1.18	75 33 33.62	-136.5	-15.3	2	58.07
15846	17 3332	8.4 K2	17 44 43.882	264.25	.12	17 54 19.16	-133.4	19.2	2	57.57
15865	- 0 3361	7.6 K5	17 45 41.155	309.66	.13	- 1 0 2.53	-125.1	22.6	2	57.49
15871	80 555	7.1 M0	17 46 7.584	-473.06	2.45	80 18 5.66	-121.2	-34.4	2	57.44
15873	32 2987	8.4 K0	17 46 10.141	221.80	.12	32 40 16.24	-120.9	16.2	2	57.49
15875	67 1036	8.3 K5	17 46 17.090	-16.99	.44	67 38 41.53	-119.9	-1.2	2	58.50
15909	56 2024	7.3 K5	17 48 42.242	103.07	.21	56 50 25.40	-98.7	7.5	2	57.05
15917	54 1917	8.3 G0	17 49 17.858	118.54	.19	54 44 24.22	-93.6	8.6	2	57.56
15918	38 3011	7.5 G5	17 49 26.935	201.33	.13	38 27 15.07	-92.2	14.7	2	57.44
15939	- 2 4480	8.2 K0	17 50 22.956	312.56	.12	- 2 14 50.81	-84.1	22.8	2	57.42
15954	14 3360	8.6 F0	17 51 7.843	272.03	.11	14 48 23.67	-77.5	19.8	2	58.04
15960	9 3505	8.1 K5	17 51 32.127	284.28	.11	9 47 38.93	-74.0	20.7	3	57.81
15963	23 3207	8.7 K2	17 51 32.339	250.29	.11	23 7 48.82	-74.0	18.2	2	57.10
15976	52 2110	8.2 F2	17 52 20.368	133.96	.16	52 23 38.76	-67.0	9.8	2	57.96
15977	42 2951	7.2 K0	17 52 29.076	184.29	.13	42 39 19.15	-65.7	13.4	2	59.03
15980	12 3324	8.0 K2	17 52 32.419	277.27	.12	12 41 7.26	-65.2	20.2	2	58.06
15986	66 1057	7.7 K0	17 52 55.253	1.23	.28	66 25 38.97	-61.9	.1	2	58.06
15989	45 2620	7.8 G5	17 53 14.197	171.13	.14	45 33 40.26	-59.2	12.5	2	57.50

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
15995	6 3576	8.0 K5	17 54 14.745	291.29	.11	6 50 45.15	-50.3	21.2	2	57.12
15999	32 3010	7.8 K2	17 54 34.950	223.23	.12	32 11 31.91	-47.4	16.3	2	56.88
16004	85 294	7.6 F0	17 54 58.331	1462.55	5.04	85 41 1.49	-43.9	-106.6	2	58.05
16021	47 2563	8.1 K0	17 55 49.007	162.90	.13	47 13 49.83	-36.6	11.9	2	58.91
16028	- 0 3393	8.8 K5	17 56 5.060	308.68	.10	- 0 34 43.15	-34.2	22.5	2	57.14
16030	14 3375	7.9 M0	17 56 6.434	272.49	.11	14 37 2.50	-34.0	19.9	2	57.96
16032	38 3045	8.2 K0	17 56 12.686	202.62	.12	38 5 15.70	-33.1	14.8	2	57.51
16037	54 1925	7.1 K5	17 56 31.792	118.85	.15	54 40 9.17	-30.3	8.7	2	58.05
16038	40 3254	8.6 F8	17 56 33.004	194.76	.12	40 6 56.12	-30.2	14.2	2	58.07
16053	49 2716	8.2 K5	17 57 43.691	152.19	.13	49 15 46.30	-19.9	11.1	2	57.52
16059	56 2044	8.3 K2	17 58 20.097	103.53	.15	56 44 59.76	-14.6	7.5	2	57.89
16066	63 1396	7.2 K5	17 58 45.959	33.87	.17	63 57 32.30	-10.8	2.5	2	57.01
16070	0 3837	8.0 G5	17 58 57.620	307.08	.10	0 6 15.66	-9.1	22.4	2	57.51
16072	41 2955	8.4 K0	17 59 14.049	189.20	.12	41 28 47.09	-6.7	13.8	2	57.06
16076	30 3106	6.8 K5	17 59 30.386	228.17	.11	30 38 40.00	-4.3	16.7	2	57.56
16077	39 3300	8.2 K0	17 59 30.500	199.02	.12	39 1 40.99	-4.3	14.5	2	57.43
16079	20 3642	8.4 F0	17 59 42.787	258.31	.10	20 8 37.45	-2.5	18.8	2	57.52
16086	71 864	7.5 K2	18 0 24.331	-95.13	.16	71 38 1.53	3.5	-6.9	2	57.42
16087	24 3311	8.0 K2	18 0 26.633	245.04	.11	24 59 30.27	3.9	17.9	2	57.12
16097	17 3418	8.2 K0	18 1 3.164	264.93	.10	17 36 19.35	9.2	19.3	2	58.05
16118	21 3292	8.9 K0	18 2 26.843	254.06	.10	21 44 6.57	21.4	18.5	2	56.96
16120	5 3599	8.6 A2	18 2 41.734	293.75	.09	5 48 2.66	23.6	21.4	2	57.07
16121	82 537	8.7 K0	18 2 44.792	-705.69	-.46	82 29 11.94	24.0	-51.4	2	57.13
16128	42 2996	7.1 K0	18 2 58.069	183.36	.11	42 51 21.87	26.0	13.4	2	57.52
16129	29 3180	7.0 K0	18 3 2.434	233.03	.11	29 4 34.38	26.6	17.0	2	57.06
16131	15 3354	7.6 K5	18 3 3.585	269.92	.10	15 38 31.64	26.8	19.7	2	57.06
16132	37 3008	7.7 G5	18 3 7.355	203.58	.11	37 49 45.25	27.3	14.8	2	58.49
16136	79 569	8.4 K0	18 3 10.994	-435.66	-.20	79 48 21.74	27.9	-31.8	2	57.48
16139	64 1242	7.5 K2	18 3 20.413	22.63	.10	64 51 36.25	29.2	1.6	2	58.12
16141	13 3514	8.1 K0	18 3 26.913	275.31	.10	13 28 39.98	30.2	20.1	2	57.98
16143	10 3385	8.8 K0	18 3 33.568	282.72	.09	10 26 12.68	31.1	20.6	2	58.54
16157	54 1940	8.0 K2	18 4 32.137	119.98	.11	54 30 29.13	39.7	8.7	2	58.56
16161	62 1596	7.8 K0	18 5 4.031	52.77	.09	62 18 37.72	44.3	3.8	2	56.49
16164	48 2639	8.8 K2	18 5 9.729	155.86	.11	48 35 21.05	45.2	11.3	2	58.05
16169	3 3597	8.6 K0	18 5 20.395	298.72	.08	3 41 11.01	46.7	21.8	2	57.06
16181	- 4 4405	8.0 K2	18 5 58.059	317.72	.07	- 4 26 56.83	52.2	23.1	2	57.52
16183	0 3859	8.4 K2	18 6 3.819	305.68	.08	0 42 26.92	53.0	22.3	2	57.51
16198	47 2589	8.5 K0	18 7 28.657	163.56	.11	47 6 36.02	65.4	11.9	2	56.40
16205	7 3578	7.4 K2	18 8 12.699	289.45	.08	7 37 26.07	71.8	21.1	2	57.07
16211	29 3195	8.1 G5	18 8 37.716	233.11	.10	29 4 4.14	75.4	17.0	2	56.98
16219	18 3586	8.0 A0	18 9 22.005	263.14	.09	18 18 41.12	81.9	19.1	2	57.51
16224	27 2975	8.5 K0	18 9 45.717	238.21	.10	27 22 27.00	85.3	17.3	2	56.50
16225	72 829	7.7 F5	18 9 46.323	-107.01	-.18	72 8 28.88	85.4	-7.8	2	58.02
16227	77 681	7.8 K0	18 9 54.557	-298.95	-.67	77 34 57.71	86.6	-21.8	2	56.96
16231	61 1728	8.1 K0	18 10 13.325	64.80	.05	61 10 19.44	89.4	4.7	2	57.11
16234	86 275	7.7 K0	18 10 19.897	1910.25	-14.52	86 33 19.87	90.4	-139.1	2	57.97
16240	4 3652	8.4 K2	18 10 38.282	297.81	.07	4 4 36.33	93.0	21.7	2	58.12
16244	37 3043	8.1 K5	18 10 44.534	204.37	.10	37 38 42.89	93.9	14.9	2	56.47
16249	52 2159	8.5 M0	18 11 6.249	136.21	.09	52 2 52.47	97.1	9.9	2	57.51
16250	0 3883	8.0 K0	18 11 10.421	305.77	.06	0 40 11.80	97.7	22.2	2	57.06

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession 1st Term	Precession 2nd Term	Decl. 1950	Precession 1st Term	Precession 2nd Term	No. Obs.	Epoch 1900+
16251	13 3564	8.0 K2	18 11 16.817	274.97	.08	13 37 39.47	98.6	20.0	2	57.58
16253	40 3314	8.4 M0	18 11 19.569	191.78	.10	40 53 10.19	99.0	13.9	2	58.03
16259	5 3656	8.1 A2	18 11 59.200	293.56	.07	5 53 26.72	104.8	21.3	2	57.42
16261	45 2679	7.5 K0	18 12 9.549	170.83	.10	45 39 2.86	106.3	12.4	2	58.14
16263	42 3030	8.1 F0	18 12 9.998	183.50	.10	42 51 48.88	106.4	13.3	2	57.59
16267	63 1415	8.2 F8	18 12 30.992	38.73	-.01	63 35 6.44	109.4	2.8	2	57.58
16271	36 3064	7.7 K5	18 13 6.667	209.11	.10	36 21 44.43	114.6	15.2	2	57.57
16273	74 757	7.6 K5	18 13 29.986	-167.79	-.50	74 19 6.02	118.0	-12.2	2	58.02
16274	15 3415	8.5 F8	18 13 37.949	270.77	.08	15 19 37.24	119.1	19.7	4	57.85
16277	25 3475	8.3 K0	18 13 44.267	242.92	.09	25 46 33.95	120.1	17.6	2	57.53
16305	36 3079	7.7 K2	18 14 59.167	206.83	.10	37 0 27.73	131.0	15.0	2	57.96
16307	48 2668	7.7 K5	18 15 6.073	157.42	.09	48 20 58.20	132.0	11.4	2	57.48
16309	8 3636	8.5 K0	18 15 11.029	286.99	.07	8 40 24.69	132.7	20.8	2	57.49
16324	- 4 4438	7.5 K0	18 16 20.635	316.94	.04	- 4 7 36.40	142.8	23.0	2	57.52
16334	69 973	8.3 F5	18 17 7.322	-52.67	-.28	69 41 21.04	149.6	-3.9	2	57.56
16337	40 3340	8.0 G0	18 17 28.152	191.90	.09	40 54 17.36	152.6	13.9	2	57.06
16342	31 3239	7.9 A0	18 17 55.475	226.90	.09	31 7 18.28	156.6	16.5	2	57.61
16346	39 3385	8.1 K5	18 18 10.221	197.24	.09	39 34 20.45	158.7	14.3	2	58.06
16348	52 2184	6.8 K5	18 18 11.658	132.93	.06	52 37 45.35	158.9	9.6	2	58.59
16350	10 3479	8.0 K5	18 18 14.321	283.65	.06	10 4 48.93	159.3	20.6	2	57.53
16351	55 2054	8.5 G5	18 18 16.560	113.02	.04	55 34 12.95	159.6	8.2	2	59.00
16361	80 577	8.8 A2	18 18 55.111	-494.36	-2.92	80 34 8.74	165.3	-35.9	2	58.02
16365	46 2464	8.1 K0	18 19 29.009	164.69	.08	46 58 23.82	170.2	11.9	2	57.98
16368	61 1741	8.3 K0	18 19 45.737	63.09	-.05	61 24 25.86	172.6	4.5	4	58.76
16370	66 1100	8.0 K2	18 19 47.962	-2.68	-.20	66 45 40.59	172.9	-.2	2	57.60
16376	64 1263	7.4 K0	18 20 3.405	32.25	-.12	64 10 41.55	175.2	2.3	2	59.04
16380	42 3065	7.6 K2	18 20 26.190	186.38	.09	42 15 48.49	178.5	13.5	2	57.04
16381	12 3499	8.8 K0	18 20 39.588	278.89	.06	12 3 50.19	180.4	20.2	2	56.50
16390	43 2962	7.8 G5	18 21 22.356	179.28	.08	43 54 19.53	186.6	13.0	2	56.47
16392	25 3510	8.9 K0	18 21 32.431	243.76	.09	25 32 20.63	188.1	17.7	2	57.50
16396	38 3157	7.5 K5	18 21 42.187	202.37	.09	38 16 30.29	189.5	14.6	2	58.06
16398	17 3565	8.8 M0	18 21 42.608	266.13	.07	17 12 26.40	189.6	19.3	2	58.04
16403	- 3 4279	8.4 A2	18 21 58.243	314.49	.02	- 3 4 59.95	191.8	22.8	2	57.97
16407	13 3632	8.0 K2	18 22 13.871	274.96	.07	13 40 41.89	194.1	19.9	2	57.03
16413	9 3699	8.0 K5	18 22 35.553	284.58	.06	9 42 24.68	197.3	20.6	2	57.50
16420	75 667	8.7 A0	18 22 59.267	-207.55	-1.22	75 31 19.26	200.7	-15.1	2	58.02
16427	41 3051	8.4 K5	18 23 55.500	190.65	.08	41 17 2.82	208.9	13.8	2	57.53
16432	33 3099	8.0 F5	18 24 8.514	220.64	.09	33 7 10.79	210.7	15.9	2	57.58
16433	26 3253	8.5 K5	18 24 8.992	240.16	.08	26 48 52.09	210.8	17.4	2	57.51
16434	19 3643	8.3 K5	18 24 10.905	261.18	.07	19 9 3.05	211.1	18.9	2	57.48
16439	24 3416	8.4 K0	18 24 30.963	247.23	.08	24 20 20.89	214.0	17.9	2	58.05
16446	30 3206	7.1 K0	18 24 57.201	227.72	.09	30 56 11.84	217.8	16.4	2	57.03
16459	59 1898	7.2 K0	18 25 58.400	80.37	-.07	59 40 25.87	226.7	5.8	4	58.48
16464	70 998	8.4 A0	18 26 21.368	-65.23	-.59	70 23 24.42	230.0	-4.8	2	57.48
16469	14 3546	7.6 K2	18 26 36.657	271.88	.06	14 57 20.83	232.2	19.6	2	57.52
16470	77 696	7.3 K0	18 26 36.694	-292.81	-2.13	77 31 48.89	232.2	-21.2	2	58.02
16473	39 3428	8.2 K0	18 26 40.618	196.11	.08	39 57 49.09	232.8	14.1	2	57.03
16478	37 3130	8.0 A2	18 26 58.920	206.54	.08	37 13 6.91	235.4	14.9	2	57.97
16486	57 1874	8.1 G5	18 27 16.288	95.92	-.04	57 53 19.32	237.9	6.9	2	57.05
16498	15 3483	7.1 K0	18 27 44.573	269.52	.06	15 54 34.28	242.0	19.5	4	58.51

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
16501	21 3459	7.3 F8	18 28 8.994	254.20	.07	21 49 53.22	245.6	18.3	2	58.06
16509	13 3667	8.4 K0	18 28 54.650	276.37	.06	13 8 45.34	252.2	19.9	2	59.03
16513	25 3551	7.8 M0	18 29 6.937	245.17	.08	25 7 36.51	253.9	17.7	2	56.94
16528	40 3403	8.1 K0	18 29 56.831	194.85	.08	40 19 52.70	261.1	14.0	2	56.57
16530	0 3960	8.6 F5	18 30 7.958	306.08	.01	0 32 21.80	262.8	22.1	2	57.51
16537	1 3711	8.6 K0	18 30 43.178	303.15	.01	1 48 29.54	267.8	21.8	4	58.76
16541	8 3743	8.8 K5	18 31 3.204	286.23	.04	9 3 10.40	270.7	20.6	3	58.15
16547	4 3791	8.0 K0	18 31 12.131	296.78	.02	4 33 11.17	272.0	21.4	2	57.48
16553	76 694	7.8 K0	18 31 21.102	-231.14	-1.95	76 11 21.05	273.3	-16.7	2	58.10
16567	15 3511	8.4 M2	18 32 19.081	271.41	.05	15 11 19.89	281.7	19.5	2	56.57
16584	27 3053	7.8 K0	18 33 46.215	239.49	.08	27 10 9.95	294.3	17.2	2	58.49
16587	25 3581	8.4 A5	18 33 55.688	243.83	.08	25 39 46.98	295.6	17.5	2	58.04
16597	36 3202	7.5 K0	18 34 22.516	208.04	.08	36 55 35.56	299.5	14.9	2	57.56
16600	18 3747	8.1 K5	18 34 37.813	262.09	.06	18 54 12.32	301.7	18.8	2	58.03
16605	43 3025	7.3 K2	18 34 55.973	180.88	.06	43 45 13.24	304.3	13.0	2	58.58
16608	33 3156	8.2 G5	18 35 6.262	220.98	.08	33 10 49.47	305.8	15.9	2	58.04
16610	72 852	7.6 K0	18 35 10.401	-108.16	-1.14	72 22 9.12	306.4	-7.9	2	58.05
16611	14 3596	8.2 K0	18 35 15.983	272.37	.05	14 49 48.12	307.2	19.6	2	58.03
16630	46 2519	8.2 K2	18 36 37.404	167.02	.04	46 45 53.82	318.9	11.9	2	57.01
16634	59 1908	8.1 K5	18 37 2.749	81.53	-.15	59 42 47.36	322.6	5.8	2	56.97
16641	57 1890	7.9 K0	18 37 22.305	102.73	-.09	57 12 7.95	325.4	7.3	2	57.04
16646	7 3799	7.8 K2	18 37 39.429	289.47	.02	7 42 57.51	327.8	20.7	2	57.52
16647	24 3489	8.4 K0	18 37 46.668	245.97	.07	24 57 41.67	328.9	17.6	2	58.05
16661	53 2113	8.4 A0	18 38 50.038	130.77	-.03	53 16 41.08	338.0	9.3	2	57.08
16663	0 3993	7.8 K2	18 38 53.523	306.14	-.01	0 30 58.50	338.5	21.9	2	57.49
16674	74 789	8.5 A5	18 39 50.968	-169.73	-1.89	74 34 40.51	346.7	-12.3	2	57.50
16681	20 3905	8.0 G5	18 40 39.388	257.82	.06	20 37 37.94	353.7	18.4	2	57.43
16686	- 1 3551	7.3 M0	18 41 1.755	311.02	-.03	- 1 36 36.06	356.9	22.2	4	59.73
16690	29 3326	7.9 M0	18 41 4.872	232.16	.07	29 45 25.33	357.3	16.6	2	58.58
16694	31 3344	8.5 K5	18 41 9.510	225.30	.07	31 57 46.40	358.0	16.1	2	58.03
16695	5 3934	8.2 K0	18 41 18.114	294.24	.01	5 41 9.56	359.2	21.0	2	58.50
16709	49 2849	7.6 K5	18 41 57.371	152.59	.01	49 39 55.39	364.9	10.9	2	57.58
16713	1 3764	8.2 K2	18 42 6.308	302.58	-.01	2 4 6.68	366.1	21.6	2	59.03
16737	11 3599	8.8 K5	18 44 16.422	279.31	.03	12 3 43.92	384.8	19.9	2	57.03
16742	9 3866	8.0 M0	18 44 32.602	285.71	.02	9 21 50.97	387.1	20.3	4	58.70
16744	75 680	8.9 G5	18 44 34.780	-211.83	-2.64	75 49 40.26	387.4	-15.2	2	57.06
16745	30 3294	7.6 K2	18 44 44.145	230.02	.07	30 31 54.04	388.7	16.4	2	57.03
16749	43 3072	7.9 K5	18 44 56.534	182.94	.05	43 30 20.35	390.5	13.0	2	58.06
16758	6 3943	8.0 K0	18 45 36.731	292.17	.00	6 36 8.01	396.3	20.8	2	57.59
16760	28 3086	7.4 K2	18 45 46.908	235.96	.07	28 35 14.61	397.7	16.8	3	59.53
16763	65 1293	8.5 A0	18 45 56.440	13.95	-.58	65 56 50.32	399.1	.9	2	58.04
16772	20 3941	8.5 F8	18 46 23.994	257.66	.05	20 46 44.69	403.0	18.3	4	59.75
16775	32 3220	7.1 K5	18 46 35.957	223.25	.07	32 43 19.56	404.8	15.9	2	56.94
16797	45 2779	8.9 K0	18 47 39.264	175.38	.03	45 15 47.35	413.8	12.4	2	57.50
16804	58 1837	8.6 A0	18 48 44.679	93.00	-.20	58 38 35.59	423.1	6.5	2	58.56
16811	42 3174	7.6 K0	18 48 57.815	186.19	.05	42 51 7.81	424.9	13.2	2	57.03
16814	- 1 3582	8.7 B9	18 49 5.164	311.48	-.05	- 1 49 13.23	426.0	22.1	5	59.68
16821	51 2438	8.0 K2	18 49 22.567	141.39	-.04	51 48 39.47	428.5	10.0	2	58.05
16850	35 3388	7.6 K2	18 50 55.465	214.64	.06	35 25 2.89	441.7	15.2	2	56.97
16853	9 3911	7.9 M0	18 51 7.175	285.30	.01	9 35 44.24	443.4	20.2	2	59.03

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
16857	33 3246	8.4 K	18 51 25.062	221.39	.07	33 24 40.57	445.9	15.6	2	57.03
16861	12 3711	8.7 K2	18 51 51.528	277.27	.02	12 59 50.10	449.7	19.6	2	57.06
16872	7 3894	8.6 A2	18 52 26.397	290.57	-.01	7 20 10.35	454.6	20.5	2	57.10
16878	- 3 4413	8.8 K0	18 52 52.036	313.89	-.07	- 2 53 20.41	458.2	22.2	2	58.03
16883	26 3394	7.9 K0	18 53 19.634	241.26	.07	26 56 14.58	462.2	17.0	2	58.04
16898	49 2898	7.1 K5	18 54 39.682	154.05	-.02	49 44 1.66	473.5	10.8	2	56.96
16899	5 3987	8.4 K2	18 54 45.574	293.79	-.02	5 57 15.48	474.3	20.7	2	57.11
16901	16 3677	8.3 K0	18 54 51.824	268.47	.03	16 39 48.77	475.2	18.9	2	57.52
16908	56 2164	7.8 K5	18 55 9.843	110.57	-.17	56 35 41.23	477.8	7.7	2	58.12
16909	47 2720	8.5 F8	18 55 13.917	165.28	.00	47 35 20.93	478.4	11.6	2	57.56
16911	38 3362	7.2 K5	18 55 24.636	203.28	.06	38 43 51.02	479.9	14.3	2	58.04
16925	25 3683	7.6 K5	18 56 28.223	246.41	.06	25 10 46.15	488.9	17.3	2	58.03
16930	- 1 3613	8.4 A5	18 56 43.003	310.58	-.07	- 1 26 15.18	491.0	21.8	2	57.03
16937	2 3751	7.8 K2	18 57 43.390	300.82	-.04	2 52 46.38	499.5	21.1	2	57.05
16947	62 1670	7.7 K5	18 58 12.724	56.16	-.48	62 45 18.18	503.6	3.9	2	57.53
16950	1 3851	8.4 K0	18 58 17.953	304.37	-.06	1 18 41.98	504.4	21.4	2	56.61
16954	88 114	8.3 K0	18 58 28.833	5773.40	-682.80	88 46 55.21	506.1	-407.2	2	58.63
16960	58 1851	8.7 A2	18 58 42.959	96.06	-.25	58 32 27.04	507.9	6.7	2	57.57
16980	8 3950	8.4 K0	18 59 45.646	287.62	-.02	8 40 47.95	516.7	20.2	2	57.10
16984	70 1039	8.1 K0	18 59 58.762	-59.71	-1.51	70 37 33.06	518.6	-4.3	2	57.58
16986	37 3315	7.8 K0	19 0 26.447	207.49	.06	37 44 17.99	522.5	14.5	2	56.96
17017	80 604	8.0 K0	19 2 20.443	-451.67	-9.23	80 22 32.98	538.5	-31.8	2	58.54
17019	39 3630	7.5 K5	19 2 22.048	199.18	.05	40 2 26.81	538.7	13.9	2	57.14
17024	54 2080	7.2 K5	19 2 50.750	128.24	-.13	54 18 48.76	542.7	8.9	2	57.06
17040	52 2336	8.6 K5	19 3 37.110	138.74	-.09	52 41 1.97	549.2	9.6	2	58.04
17080	46 2627	7.9 K0	19 6 18.565	170.21	-.01	46 57 20.04	571.8	11.8	2	57.08
17095	2 3801	8.5 K2	19 7 11.325	301.99	-.07	2 23 24.29	579.2	20.9	2	56.67
17097	48 2837	8.8 G	19 7 19.848	164.50	-.02	48 9 29.49	580.4	11.4	2	57.58
17100	32 3335	7.6 K0	19 7 25.438	224.96	.06	32 47 15.31	581.2	15.6	2	57.05
17102	64 1330	7.9 K0	19 7 47.947	41.74	-.69	64 18 4.06	584.3	2.8	2	56.96
17112	22 3613	8.2 K0	19 8 24.326	254.05	.04	22 38 38.58	589.4	17.6	2	57.57
17113	40 3613	8.5 F5	19 8 31.415	198.01	.04	40 34 2.62	590.4	13.7	2	57.08
17122	58 1873	7.0 K5	19 8 52.223	99.98	-.30	58 23 8.61	593.3	6.8	2	59.02
17124	7 3988	8.2 G5	19 9 0.822	289.63	-.03	7 53 39.75	594.5	20.0	2	57.58
17132	29 3506	7.3 K0	19 9 34.131	234.28	.06	29 48 21.46	599.1	16.2	2	58.56
17133	- 4 4719	8.3 K0	19 9 43.665	317.46	-.13	- 4 32 52.94	600.4	21.9	4	58.54
17145	21 3695	8.2 A2	19 10 59.646	256.37	.04	21 49 18.20	611.0	17.7	2	58.56
17147	66 1172	8.1 K0	19 11 11.889	8.62	-1.04	66 55 50.67	612.7	.5	2	57.11
17153	- 0 3679	8.2 G5	19 11 24.943	307.24	-.10	0 2 19.35	614.5	21.2	2	57.58
17154	8 4007	7.2 K0	19 11 29.861	287.31	-.03	8 56 47.39	615.2	19.8	2	57.12
17158	34 3468	7.6 K0	19 11 46.748	218.89	.06	34 49 38.96	617.5	15.0	2	58.14
17169	41 3271	8.6 K	19 12 14.011	194.32	.04	41 39 19.98	621.3	13.3	2	57.61
17172	69 1036	8.6 A2	19 12 22.621	-34.58	-1.56	69 37 18.36	622.5	-2.5	2	58.57
17183	49 2965	7.9 K2	19 12 53.547	157.78	-.05	49 40 45.71	626.8	10.8	4	57.87
17184	36 3466	7.8 K0	19 12 56.807	212.04	.05	36 54 0.76	627.2	14.5	2	58.56
17189	52 2376	8.3 K5	19 13 24.522	140.38	-.12	52 46 40.26	631.1	9.6	2	58.60
17190	73 854	7.7 M0	19 13 27.974	-129.30	-2.99	73 48 18.54	631.5	-9.1	2	58.05
17192	14 3849	8.1 G5	19 13 31.659	273.03	.01	15 7 59.97	632.0	18.7	2	57.59
17202	67 1132	8.9 G5	19 14 21.904	-3.30	-1.23	67 49 9.02	639.0	-.4	2	57.11
17204	65 1334	8.2 K2	19 14 32.166	29.89	-.89	65 28 11.36	640.4	1.9	2	58.14

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D.	No.	M + Sp.	R.A. 1950	Precession 1st Term	Precession 2nd Term	Decl. 1950	Precession 1st Term	Precession 2nd Term	No. Obs.	Epoch 1900+
17207	12	3867	8.5 A0	19 14 39.436	278.03	-.01	13 1 43.73	641.4	19.1	2	57.59
17209	20	4095	8.3 A0	19 14 42.467	260.07	.03	20 28 14.94	641.8	17.8	2	58.12
17221	- 1	3702	8.6 K2	19 15 27.547	309.75	-.12	- 1 6 1.29	648.0	21.2	2	57.60
17223	63	1504	8.1 K0	19 15 36.992	55.96	-.66	63 18 9.25	649.3	3.7	2	58.14
17233	33	3403	8.3 K0	19 16 20.963	222.01	.06	34 2 38.86	655.4	15.2	2	59.47
17240	58	1891	8.6 F5	19 16 54.862	100.22	-.35	58 39 8.01	660.1	6.8	2	57.56
17242	84	437	8.6 K5	19 16 58.815	1050.41	-41.34	84 41 30.75	660.7	-72.4	2	58.02
17248	49	2976	7.3 M0	19 17 11.890	156.32	-.07	50 8 6.07	662.4	10.6	2	57.12
17254	5	4115	7.9 G5	19 17 33.407	295.20	-.07	5 29 37.72	665.4	20.2	2	58.12
17268	43	3215	7.9 K0	19 18 16.086	188.01	.02	43 27 43.84	671.3	12.8	2	57.06
17287	3	3990	8.6 F8	19 19 54.369	300.21	-.09	3 14 31.37	684.7	20.4	2	57.61
17289	39	3740	7.5 K0	19 20 19.569	204.28	.04	39 23 27.09	688.2	13.8	2	57.66
17304	62	1704	8.0 K2	19 21 15.757	64.51	-.65	62 42 13.93	695.9	4.3	2	57.56
17307	48	2890	8.0 K5	19 21 26.119	164.30	-.05	48 47 16.22	697.3	11.1	2	57.11
17308	15	3796	8.6 K2	19 21 26.671	272.21	.00	15 39 41.20	697.4	18.4	2	58.06
17310	11	3826	7.6 K0	19 21 42.592	282.21	-.03	11 20 32.99	699.5	19.1	2	58.49
17313	56	2238	7.7 K5	19 21 57.025	115.19	-.28	56 55 8.06	701.5	7.7	2	58.57
17324	28	3319	7.7 K0	19 22 21.931	239.47	.05	28 28 51.70	704.9	16.2	2	58.60
17338	43	3231	8.0 G5	19 23 14.084	189.12	.02	43 25 19.92	712.0	12.7	2	57.61
17339	60	1943	7.5 K0	19 23 25.481	88.87	-.47	60 14 57.95	713.6	5.9	2	59.02
17350	35	3614	7.2 M2	19 24 9.976	216.44	.06	36 5 8.18	719.6	14.6	2	58.05
17357	72	891	8.1 K5	19 24 39.123	-87.47	-2.72	72 29 0.44	723.6	-6.1	2	58.04
17369	1	4004	7.6 K2	19 25 20.308	302.82	-.11	2 4 17.45	729.2	20.4	2	58.12
17374	77	730	8.7 K0	19 25 30.773	-268.53	-6.93	77 48 27.00	730.6	-18.4	2	58.06
17378	32	3441	8.2 K2	19 25 45.710	226.85	.06	32 54 20.57	732.6	15.2	2	57.15
17383	52	2431	8.5 F0	19 25 53.862	144.12	-.14	52 41 50.59	733.7	9.6	2	59.03
17389	47	2837	7.6 K0	19 26 19.454	172.05	-.03	47 25 59.58	737.2	11.5	2	58.55
17405	79	629	7.9 F5	19 27 21.499	-373.82	-10.46	79 40 49.26	745.6	-25.4	2	58.58
17416	20	4167	8.5 K0	19 28 20.256	260.68	.03	20 38 35.61	753.5	17.5	2	57.67
17422	31	3631	7.3 K2	19 28 40.538	230.38	.06	31 52 26.53	756.3	15.4	2	57.65
17433	13	4039	8.1 K2	19 29 24.197	277.63	-.02	13 30 43.64	762.2	18.6	2	58.06
17453	63	1534	7.7 K2	19 30 54.464	52.62	-.87	64 10 45.86	774.3	3.4	2	58.04
17461	69	1052	7.7 K0	19 31 16.402	-20.66	-1.82	69 25 8.45	777.3	-1.6	2	57.15
17474	24	3780	8.6 A2	19 31 58.778	251.33	.04	24 28 40.29	783.0	16.7	2	57.52
17480	74	828	8.5 A5	19 32 23.317	-140.74	-4.14	74 39 38.85	786.2	-9.6	2	57.58
17486	19	4066	8.5 K5	19 32 40.349	262.75	.02	19 56 39.32	788.5	17.4	2	57.67
17487	14	3965	8.5 A2	19 32 55.380	275.86	-.02	14 22 34.90	790.6	18.3	2	59.03
17491	62	1730	7.3 K0	19 33 10.906	71.56	-.70	62 30 7.74	792.6	4.6	2	57.59
17498	44	3179	8.3 M0	19 33 46.815	186.02	.01	44 42 1.13	797.4	12.3	2	57.60
17505	- 4	4855	8.3 K5	19 34 6.765	316.78	-.20	- 4 24 44.05	800.1	21.0	2	57.60
17524	27	3446	7.9 K0	19 35 8.428	242.11	.05	28 4 30.15	808.3	16.0	2	57.60
17529	12	3995	7.9 K0	19 35 27.329	279.51	-.03	12 49 29.26	810.9	18.5	2	58.07
17540	0	4266	8.3 K5	19 36 13.964	306.28	-.14	0 29 26.78	817.1	20.2	2	58.50
17542	42	3403	8.6 F5	19 36 19.835	193.22	.02	43 5 14.95	817.8	12.7	2	57.12
17545	2	3950	8.8 A2	19 36 32.188	302.37	-.12	2 19 34.22	819.5	19.9	2	58.06
17552	10	4006	8.7 M0	19 36 57.957	285.25	-.05	10 16 20.36	822.9	18.8	2	57.66
17554	58	1948	8.2 K5	19 37 8.829	109.27	-.40	58 24 39.27	824.4	7.1	2	57.11
17570	34	3655	8.2 K2	19 38 21.602	221.83	.06	35 7 54.74	834.0	14.5	2	57.06
17593	50	2844	7.8 G5	19 39 53.122	161.64	-.09	50 15 36.85	846.1	10.5	2	57.11
17627	4	4210	7.7 K5	19 42 2.975	297.07	-.11	4 51 30.01	863.3	19.4	2	57.11

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession 1st Term	Precession 2nd Term	Decl. 1950	Precession 1st Term	Precession 2nd Term	No. Obs.	Epoch 1900+
17628	64 1377	8.5 G0	19 42 5.792	53.67	-.99	64 34 32.35	863.6	3.3	2	57.07
17632	- 3 4696	7.4 K0	19 42 32.620	313.97	-.20	- 3 9 25.73	867.1	20.4	2	57.15
17633	70 1085	8.9 F0	19 42 32.655	-39.17	-2.42	70 49 45.68	867.1	-2.8	2	58.05
17650	68 1078	8.5 K	19 43 23.350	-9.68	-1.92	69 13 36.40	873.8	-.8	2	58.56
17656	55 2257	7.4 M0	19 43 54.598	131.08	-.27	55 43 30.69	877.9	8.4	2	57.66
17659	24 3872	8.0 G5	19 44 7.915	251.23	.04	25 2 38.10	879.6	16.3	2	57.51
17660	35 3791	8.0 K2	19 44 8.639	222.23	.06	35 19 43.06	879.7	14.4	2	57.06
17665	37 3600	8.2 K0	19 44 30.343	215.16	.06	37 32 5.68	882.6	13.9	2	57.12
17669	45 2971	7.5 K0	19 44 44.920	184.83	0.00	45 36 44.86	884.5	11.9	2	58.06
17681	58 1981	7.8 G0	19 45 17.225	113.85	-.40	58 14 34.03	888.7	7.3	2	58.06
17686	28 3478	8.1 G5	19 45 26.565	242.70	.06	28 21 40.86	889.9	15.7	2	58.59
17688	9 4264	8.2 K5	19 45 33.728	286.41	-.06	9 54 52.88	890.9	18.5	2	58.13
17701	- 4 4926	7.8 A0	19 46 17.908	316.99	-.23	- 4 37 18.42	896.6	20.5	2	57.15
17708	14 4053	8.1 G5	19 46 59.279	275.18	-.02	15 4 39.66	902.0	17.7	2	57.61
17711	6 4323	8.6 F8	19 47 12.755	292.32	-.09	7 10 24.14	903.8	18.8	2	57.66
17713	61 1912	6.8 K5	19 47 24.323	89.72	-.63	61 17 6.99	905.3	5.6	2	59.02
17714	72 911	7.9 K0	19 47 28.277	-67.03	-3.13	72 20 19.34	905.8	-4.6	2	57.06
17718	32 3587	8.0 A2	19 47 47.173	229.53	.07	33 8 59.00	908.2	14.7	2	58.06
17727	44 3265	8.4 K0	19 48 25.168	188.29	.01	45 1 26.03	913.2	12.0	2	57.11
17731	48 2959	7.8 K2	19 48 46.003	174.10	-.04	48 15 49.06	915.9	11.1	2	57.97
17743	- 2 5136	8.0 K2	19 49 27.847	312.06	-.20	- 2 16 57.35	921.3	20.0	2	57.69
17751	50 2904	7.8 K0	19 50 12.070	162.88	-.09	50 38 38.16	927.0	10.3	2	58.04
17752	25 4006	8.8 M0	19 50 17.405	249.99	.05	25 49 57.09	927.7	16.0	2	57.60
17757	68 1084	8.7 A3	19 50 36.551	7.30	-1.78	68 28 17.93	930.2	.3	4	58.80
17762	65 1409	7.7 G5	19 50 49.682	48.73	-1.15	65 25 3.39	931.9	2.9	2	58.56
17769	11 4035	8.5 K0	19 51 20.163	283.34	-.05	11 28 39.50	935.8	18.1	2	59.03
17773	35 3850	7.6 G5	19 51 32.372	221.31	.07	36 3 59.03	937.4	14.1	2	58.15
17787	48 2979	8.1 K0	19 52 35.018	171.27	-.06	49 6 37.33	945.4	10.8	2	57.15
17793	15 3985	8.3 K2	19 52 49.922	275.08	-.02	15 18 52.10	947.4	17.5	2	58.14
17801	78 694	7.9 K5	19 53 21.453	-270.37	-9.66	78 29 36.43	951.4	-17.5	2	58.13
17808	60 2046	6.8 K5	19 54 0.136	99.93	-.57	60 28 54.71	956.4	6.2	2	57.06
17812	82 598	7.8 G5	19 54 18.902	-563.26	-24.72	82 19 25.91	958.8	-36.3	2	58.06
17815	62 1769	8.1 G5	19 54 25.979	75.14	-.85	63 11 48.87	959.7	4.6	2	57.59
17816	- 1 3864	8.0 K2	19 54 26.479	309.62	-.19	- 1 7 18.29	959.7	19.6	2	58.94
17818	16 4073	8.4 A0	19 54 31.279	273.09	-.01	16 16 26.94	960.3	17.3	2	57.61
17831	53 2328	8.1 K2	19 55 17.315	148.26	-.18	53 38 58.19	966.2	9.3	2	57.67
17832	21 3987	8.0 K0	19 55 18.667	260.93	.03	21 37 17.65	966.4	16.5	2	58.58
17839	- 3 4757	7.0 K5	19 55 55.098	314.86	-.24	- 3 41 23.94	971.0	19.9	2	58.14
17850	36 3794	8.8 A	19 56 44.864	220.03	.07	36 48 32.31	977.4	13.8	2	58.14
17851	55 2291	8.4 K0	19 56 49.464	133.85	-.29	56 5 10.39	978.0	8.3	2	58.05
17853	45 3022	8.9 K2	19 56 52.720	189.61	.01	45 16 8.40	978.4	11.9	2	58.05
17855	25 4050	7.7 K5	19 56 58.105	250.84	.05	25 51 4.88	979.1	15.7	2	57.03
17877	34 3832	7.7 K2	19 58 26.271	225.32	.07	35 13 11.92	990.3	14.1	2	57.59
17888	69 1085	7.8 G5	19 59 14.254	-15.29	-2.39	70 14 1.15	996.3	-1.2	2	57.58
17891	29 3857	7.4 K0	19 59 31.523	240.23	.07	30 4 43.07	998.5	15.0	2	58.05
17895	43 3453	7.9 K0	19 59 36.868	194.98	.04	44 7 29.17	999.2	12.1	2	56.57
17897	42 3563	7.6 M0	19 59 42.235	199.01	.04	43 5 16.27	999.9	12.4	4	58.55
17900	17 4197	8.2 K0	19 59 57.079	271.11	.00	17 22 30.44	1001.8	16.9	2	58.15
17902	- 3 4771	8.1 G5	20 0 0.701	314.37	-.24	- 3 28 58.44	1002.2	19.6	2	57.70
17903	20 4389	8.5 A0	20 0 6.047	263.41	.02	20 47 9.46	1002.9	16.4	2	58.14

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
17906	34 3846	8.3 K5	20 0 9.797	228.33	.08	34 19 58.20	1003.4	14.2	2	57.73
17907	- 1 3885	8.6 K0	20 0 10.439	308.83	-.20	- 0 44 49.93	1003.5	19.3	2	58.15
17909	71 991	7.6 K5	20 0 42.331	-43.18	-3.04	71 45 37.95	1007.5	-2.9	2	58.06
17911	61 1961	7.6 K0	20 0 55.147	90.09	-.73	62 0 45.98	1009.1	5.5	2	59.04
17915	18 4366	8.8 K2	20 1 5.571	268.53	.01	18 34 53.09	1010.4	16.7	2	58.59
17926	37 3744	7.1 M0	20 1 51.091	216.74	.08	38 11 7.42	1016.1	13.4	2	57.56
17945	25 4093	8.9 K2	20 3 7.029	253.01	.05	25 19 18.42	1025.6	15.6	2	57.61
17967	85 340	7.8 K3	20 4 4.630	1187.89	-87.60	85 37 15.27	1032.9	-74.4	2	58.59
17972	87 187	8.1 K0	20 4 29.801	2658.11	-365.59	87 47 27.57	1035.8	-166.1	2	58.18
17973	16 4145	7.8 K0	20 4 33.283	272.96	-.01	16 43 30.55	1036.5	16.8	2	56.57
17990	73 898	8.4 M0	20 5 54.611	-72.81	-3.95	73 18 45.41	1046.6	-4.8	2	57.58
17991	22 3936	8.9 K0	20 5 57.939	258.69	.04	23 7 3.21	1047.0	15.9	2	57.61
17996	9 4414	7.4 K0	20 6 9.280	287.44	-.08	9 54 25.33	1048.3	17.6	2	57.11
18009	45 3066	7.9 G5	20 6 32.272	191.98	.02	45 23 47.32	1051.2	11.7	2	57.10
18025	42 3613	8.9 K2	20 7 37.168	201.12	.05	43 6 56.04	1059.3	12.2	3	57.95
18040	8 4369	7.3 M0	20 8 55.381	290.30	-.09	8 34 3.00	1068.9	17.7	2	57.60
18043	5 4441	7.5 K5	20 8 58.851	295.60	-.12	5 55 21.05	1069.3	18.0	4	58.34
18059	46 2870	7.9 G5	20 9 52.943	187.42	.01	46 46 4.93	1076.0	11.3	2	57.67
18060	10 4205	8.3 K2	20 10 4.095	285.21	-.06	11 6 25.02	1077.4	17.3	2	58.12
18064	14 4223	8.1 K0	20 10 28.663	276.80	-.02	15 10 43.69	1080.4	16.8	2	58.13
18065	19 4322	7.9 K2	20 10 39.979	267.73	.02	19 23 34.01	1081.8	16.2	2	57.68
18074	17 4257	8.2 K2	20 11 26.766	270.81	.00	18 1 19.48	1087.5	16.3	2	58.59
18075	27 3652	8.3 A2	20 11 32.142	248.14	.07	27 48 38.71	1088.2	15.0	2	58.15
18079	- 0 3949	8.3 A5	20 11 46.198	307.34	-.21	- 0 0 30.18	1090.0	18.6	2	58.14
18089	20 4488	8.8 G5	20 12 16.191	265.46	.03	20 29 58.13	1093.6	16.0	2	58.10
18091	2 4121	7.3 K0	20 12 22.880	300.97	-.16	3 15 12.14	1094.4	18.2	2	58.14
18113	43 3541	7.3 K5	20 13 46.936	199.72	.06	43 59 5.32	1104.6	11.9	2	57.67
18120	56 2382	8.6 A2	20 14 17.587	137.72	-.30	56 43 10.98	1108.4	8.1	2	58.59
18126	74 853	8.8 K0	20 14 38.070	-91.13	-4.84	74 24 16.21	1110.9	-5.8	2	58.13
18140	72 945	6.6 M0	20 15 18.718	-43.66	-3.51	72 27 2.63	1115.8	-2.9	2	57.67
18149	9 4476	8.3 K2	20 15 56.915	288.80	-.08	9 29 35.07	1120.4	17.2	2	57.57
18163	61 1996	7.9 K0	20 16 30.973	99.47	-.72	61 58 53.83	1124.5	5.8	2	57.14
18167	- 4 5090	8.5 F5	20 16 42.052	314.89	-.27	- 3 54 42.58	1125.8	18.7	2	57.66
18182	77 770	7.4 K0	20 17 28.327	-205.69	-9.27	77 52 0.68	1131.4	-12.6	2	57.12
18197	33 3864	8.0 G5	20 18 33.268	234.12	.10	33 39 30.75	1139.2	13.8	2	58.05
18201	21 4167	7.8 K5	20 18 48.880	264.37	.04	21 21 29.93	1141.1	15.6	2	57.06
18214	51 2848	7.2 K5	20 19 51.062	165.90	-.09	52 15 2.00	1148.5	9.7	3	57.58
18218	21 4179	8.9 A0	20 20 18.911	262.74	.04	22 10 58.85	1151.8	15.4	2	57.05
18237	- 1 3971	7.7 K0	20 21 34.672	308.71	-.22	- 0 43 47.40	1160.9	18.1	2	58.05
18240	33 3885	8.2 A2	20 21 36.732	233.27	.11	34 12 54.77	1161.1	13.6	2	57.59
18247	- 1 3976	8.0 K0	20 22 6.371	310.56	-.24	- 1 42 15.77	1164.6	18.2	2	58.13
18255	25 4226	7.9 K5	20 22 28.770	254.93	.07	25 45 11.45	1167.3	14.9	2	57.56
18271	14 4293	7.4 K5	20 23 39.881	278.78	-.02	14 46 42.96	1175.7	16.2	2	57.56
18277	75 739	8.1 K2	20 23 50.113	-122.63	-6.39	75 52 50.11	1176.9	-7.5	3	57.63
18278	60 2125	8.1 A2	20 24 5.988	111.29	-.61	61 8 2.46	1178.8	6.3	2	58.04
18280	1 4289	8.1 K5	20 24 8.596	304.02	-.19	1 45 3.78	1179.1	17.7	2	57.59
18291	53 2405	8.0 K2	20 24 59.943	161.04	-.13	53 37 29.09	1185.1	9.2	2	57.10
18319	9 4546	8.0 M0	20 26 33.700	288.11	-.07	10 9 50.82	1196.1	16.6	2	57.59
18321	21 4225	8.6 A0	20 26 34.590	264.12	.05	21 56 51.82	1196.2	15.2	2	58.58
18328	- 4 5153	8.0 K5	20 27 3.022	315.47	-.29	- 4 21 1.41	1199.6	18.2	2	57.66

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
18333	24 4145	7.6 K5	20 27 13.110	257.65	.07	24 54 22.49	1200.7	14.8	2	57.16
18336	67 1252	8.2 K0	20 27 33.291	46.63	-1.68	67 42 36.69	1203.1	2.5	2	58.04
18338	- 1 3988	8.4 K5	20 27 39.922	309.83	-.24	- 1 20 29.23	1203.8	17.8	2	58.04
18358	40 4211	7.1 K2	20 29 18.756	215.98	.11	40 41 16.10	1215.3	12.3	2	57.67
18365	15 4185	8.1 G5	20 29 36.125	277.41	-.01	15 44 33.79	1217.4	15.8	4	58.84
18368	1 4309	7.6 K2	20 29 45.927	303.53	-.19	2 2 58.72	1218.4	17.3	2	58.14
18383	9 4570	8.4 K2	20 30 29.331	289.36	-.08	9 37 58.91	1223.5	16.4	3	57.95
18390	0 4536	8.0 K0	20 31 4.355	305.30	-.20	1 5 50.72	1227.5	17.3	4	59.57
18398	14 4343	7.7 K0	20 31 38.178	279.99	-.02	14 32 27.31	1231.4	15.9	2	58.50
18402	38 4149	8.8 A0	20 31 51.200	223.04	.13	38 39 45.13	1232.9	12.6	4	58.64
18409	10 4325	8.1 K2	20 32 2.921	286.60	-.06	11 8 18.00	1234.3	16.2	2	58.22
18410	24 4165	8.9 A2	20 32 2.930	259.02	.08	24 39 1.27	1234.3	14.6	3	58.25
18416	6 4580	8.4 K5	20 32 39.248	294.26	-.12	7 5 24.74	1238.4	16.6	2	57.56
18417	49 3317	7.0 K5	20 32 44.365	183.92	.02	49 36 1.14	1239.0	10.3	2	57.60
18429	1 4327	7.7 K0	20 34 11.077	303.09	-.19	2 19 16.46	1248.9	17.0	2	58.06
18436	- 1 4015	7.4 G5	20 34 35.792	310.03	-.25	- 1 29 11.53	1251.7	17.4	2	58.05
18437	21 4285	7.7 K2	20 34 46.221	266.47	.05	21 23 39.32	1252.9	14.9	2	57.69
18448	39 4254	8.3 K2	20 35 34.887	221.20	.14	39 37 50.30	1258.5	12.3	2	58.12
18453	34 4098	7.6 K2	20 35 45.517	234.49	.14	35 1 25.16	1259.7	13.0	2	58.05
18459	25 4308	8.7	20 36 11.913	258.02	.09	25 24 51.54	1262.7	14.3	2	58.14
18460	32 3886	7.4 K0	20 36 12.971	239.49	.13	33 10 27.87	1262.8	13.3	4	58.89
18462	63 1640	7.6 K5	20 36 22.060	92.95	-.95	64 11 4.54	1263.8	5.0	2	57.59
18480	27 3820	7.5 K5	20 37 23.398	252.59	.11	27 54 40.48	1270.7	14.0	2	57.10
18482	60 2145	7.7 F8	20 37 27.154	122.93	-.53	60 44 28.70	1271.2	6.7	3	58.89
18505	58 2156	8.4 K7	20 38 50.103	138.16	-.35	58 42 57.31	1280.5	7.5	2	57.12
18514	11 4355	7.8 K2	20 39 18.013	286.66	-.06	11 23 12.84	1283.6	15.8	2	57.21
18519	37 4026	7.9 K2	20 39 47.870	227.13	.15	38 3 34.39	1287.0	12.4	2	57.14
18520	9 4616	8.4 K2	20 39 57.483	288.74	-.07	10 17 34.70	1288.0	15.8	2	57.59
18539	43 3695	9.0 K0	20 41 23.929	209.37	.12	43 53 20.30	1297.7	11.4	2	57.60
18541	72 962	7.2 K2	20 41 33.401	-21.32	-3.71	72 47 39.08	1298.7	-1.5	2	57.09
18550	26 3970	8.2 K0	20 41 48.048	254.91	.11	27 16 21.60	1300.3	13.9	2	58.58
18552	32 3913	8.2 K2	20 41 50.633	241.51	.14	32 55 14.06	1300.6	13.1	2	57.05
18570	31 4210	7.4 K2	20 43 10.572	245.12	.14	31 35 27.99	1309.5	13.2	2	57.24
18575	22 4176	7.7 G5	20 43 27.807	264.78	.08	22 50 3.28	1311.4	14.3	2	57.61
18578	30 4169	8.3 K2	20 43 45.760	247.93	.14	30 28 29.84	1313.3	13.4	2	56.61
18593	15 4256	8.7 M0	20 44 59.407	277.91	.01	16 19 14.23	1321.4	14.9	2	58.14
18609	59 2285	8.3 K2	20 45 59.849	134.58	-.41	59 54 56.68	1328.0	7.1	2	58.60
18610	28 3888	8.0 K0	20 46 4.062	253.36	.13	28 20 37.47	1328.5	13.5	2	57.60
18613	0 4589	7.9 K2	20 46 9.071	304.98	-.21	1 20 30.16	1329.1	16.4	2	57.22
18621	4 4552	8.2 K0	20 46 43.358	298.88	-.15	4 50 20.24	1332.8	16.0	2	58.21
18624	41 3897	7.2 G5	20 46 53.306	218.86	.17	41 34 36.87	1333.9	11.6	2	57.66
18636	1 4374	7.4 K5	20 47 26.991	303.43	-.19	2 14 48.65	1337.5	16.2	2	57.61
18641	11 4397	8.4 A0	20 47 48.620	286.39	-.04	11 53 46.80	1339.9	15.2	2	57.14
18646	50 3209	7.1 K5	20 47 59.792	186.45	.06	50 35 47.26	1341.1	9.8	2	57.20
18669	22 4223	7.0 K5	20 49 37.110	265.16	.09	23 8 32.78	1351.6	14.0	2	57.59
18683	- 0 4121	8.2 K2	20 50 53.485	307.09	-.23	0 8 9.38	1359.8	16.2	2	58.13
18690	0 4610	8.2 K5	20 51 26.282	305.22	-.21	1 14 2.03	1363.3	16.0	2	57.60
18702	10 4403	8.2 K0	20 51 56.707	288.53	-.06	10 53 4.90	1366.5	15.1	2	57.05
18714	53 2514	7.6 K5	20 52 54.013	175.39	-.01	53 34 32.20	1372.7	9.0	4	58.87
18719	19 4564	7.4 K2	20 53 17.218	271.54	.07	20 12 32.20	1375.1	14.1	2	57.12

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
18720	2 4275	8.5 A5	20 53 19.208	301.89	-.17	3 12 2.08	1375.3	15.7	2	57.14
18731	69 1136	8.1 K0	20 54 0.617	44.54	-2.16	69 45 20.85	1379.7	2.1	2	57.12
18738	59 2296	7.6 K5	20 54 24.509	140.88	-.34	59 49 45.55	1382.2	7.1	2	56.65
18752	- 3 5076	8.2 M0	20 54 52.650	313.12	-.30	- 3 25 48.48	1385.2	16.2	2	58.58
18754	22 4248	8.6 K0	20 55 0.196	266.98	.10	22 41 8.33	1386.0	13.8	4	58.88
18762	32 3999	8.2 A2	20 55 34.599	244.54	.18	33 6 25.58	1389.6	12.6	2	57.20
18769	5 4659	8.7 K2	20 55 56.895	298.25	-.14	5 23 46.17	1391.9	15.3	4	58.91
18774	50 3236	8.8 G0	20 56 29.444	190.23	.09	50 40 38.53	1395.4	9.7	2	58.60
18776	40 4373	7.0 K5	20 56 35.329	223.50	.20	41 9 46.96	1396.0	11.4	2	58.13
18782	- 2 5421	8.0 K0	20 56 56.462	310.11	-.26	- 1 39 47.37	1398.2	15.9	2	57.59
18785	67 1279	7.3 K5	20 57 12.393	75.68	-1.46	67 34 7.58	1399.8	3.6	2	57.09
18802	24 4299	8.7 K0	20 58 41.767	263.69	.12	24 40 5.84	1409.1	13.4	2	57.66
18803	- 3 5092	8.0 G0	20 58 46.505	311.82	-.28	- 2 42 39.24	1409.6	15.9	2	58.05
18809	85 359	8.4 A3	20 59 1.050	-947.36	-99.57	85 40 31.40	1411.2	-49.3	2	57.59
18816	- 0 4148	8.8 G5	20 59 31.662	307.68	-.24	- 0 12 55.61	1414.3	15.6	2	57.15
18819	51 2982	7.4 K2	20 59 36.360	186.45	.08	51 56 23.13	1414.8	9.3	2	58.05
18821	73 922	8.4 K0	20 59 52.679	-24.29	-4.45	74 5 21.92	1416.5	-1.6	2	57.56
18823	36 4375	7.7 G5	20 59 59.586	237.41	.22	36 30 11.00	1417.2	11.9	2	56.69
18825	17 4492	8.1 K0	21 0 8.984	277.09	.05	17 45 20.61	1418.2	14.0	3	58.07
18828	49 3440	8.3 K2	21 0 15.420	197.05	.14	49 26 38.96	1418.8	9.8	2	58.57
18840	28 3970	7.6 K0	21 0 47.990	255.60	.17	28 47 11.75	1422.2	12.8	2	58.60
18859	2 4296	8.4 A0	21 2 10.895	303.10	-.18	2 35 0.33	1430.6	15.2	2	56.70
18864	70 1158	8.4 K0	21 2 38.955	31.20	-2.69	71 18 54.29	1433.5	1.3	2	57.66
18869	- 4 5355	7.2 K5	21 2 54.646	314.77	-.32	- 4 33 44.83	1435.1	15.7	2	57.60
18870	41 3993	8.4 K0	21 2 55.492	222.49	.23	42 17 22.35	1435.2	11.0	2	58.13
18877	16 4454	8.1 K5	21 3 18.267	279.42	.04	16 41 3.63	1437.5	13.9	2	58.13
18886	46 3174	7.7 K5	21 3 51.326	208.55	.20	46 45 45.56	1440.9	10.3	2	58.15
18890	27 3970	8.8 A0	21 4 9.920	257.57	.17	28 12 42.72	1442.8	12.7	2	57.69
18892	25 4463	8.0 K5	21 4 17.917	263.18	.14	25 28 1.44	1443.5	13.0	2	56.61
18903	8 4616	7.7 K0	21 5 0.883	292.54	-.07	9 5 37.38	1447.9	14.4	4	58.93
18914	54 2476	7.9 K0	21 5 48.356	176.82	.03	54 48 5.69	1452.7	8.6	2	58.13
18917	12 4553	8.1 K0	21 6 0.069	285.72	-.01	13 13 13.06	1453.8	14.0	2	57.60
18934	38 4362	7.3 K2	21 7 10.914	234.50	.24	38 31 31.68	1460.9	11.4	2	57.15
18951	36 4447	7.8 K2	21 8 42.197	238.15	.24	37 17 35.49	1470.0	11.5	2	58.15
18953	25 4477	8.7 A0	21 8 47.464	263.02	.16	26 0 45.77	1470.5	12.7	2	57.67
18962	8 4627	8.8 A0	21 9 34.291	293.69	-.08	8 34 17.18	1475.2	14.2	2	57.15
18964	22 4331	7.3 K0	21 9 40.177	269.18	.13	22 52 30.73	1475.7	13.0	2	58.05
18971	35 4431	7.3 K2	21 9 58.257	243.07	.24	35 26 19.64	1477.5	11.7	2	57.15
18974	39 4479	7.6 K2	21 10 16.883	231.83	.26	39 56 38.66	1479.4	11.1	2	57.59
18976	32 4088	7.5 K0	21 10 24.617	248.75	.23	33 1 59.77	1480.1	11.9	2	58.22
18980	- 1 4123	7.8 K5	21 10 33.389	309.43	-.26	- 1 20 10.33	1481.0	14.9	2	57.68
18981	63 1703	8.0 K0	21 10 35.959	126.20	-.59	63 34 27.73	1481.2	5.9	2	57.17
18986	27 4007	7.5 K5	21 10 49.276	259.62	.18	27 56 55.32	1482.5	12.4	2	59.19
18989	5 4733	7.9 K5	21 11 10.041	298.26	-.12	5 45 54.41	1484.6	14.3	2	58.14
18993	- 3 5155	8.4 K0	21 11 29.440	311.96	-.29	- 2 57 33.97	1486.5	14.9	2	58.21
19002	4 4631	7.6 K5	21 12 0.682	300.32	-.15	4 28 54.69	1489.5	14.3	2	57.15
19008	13 4647	7.6 K0	21 12 15.413	285.17	.01	13 56 2.79	1491.0	13.6	2	58.65
19009	21 4501	7.6 K0	21 12 18.388	271.29	.12	21 59 3.92	1491.2	12.9	2	57.66
19014	7 4650	8.6 K5	21 12 31.765	295.62	-.09	7 28 47.52	1492.5	14.1	2	57.68
19019	- 0 4189	8.4 K0	21 12 56.824	308.07	-.24	- 0 28 39.34	1495.0	14.6	2	57.60

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
19032	10 4500	8.2 M0	21 13 42.143	290.54	-.04	10 43 15.48	1499.4	13.8	2	57.59
19044	11 4528	8.5 K0	21 14 23.450	288.34	-.02	12 7 27.50	1503.4	13.6	2	57.67
19047	- 4 5404	8.2 K0	21 14 33.566	314.20	-.32	- 4 26 59.08	1504.3	14.8	2	57.70
19058	74 912	8.7 F2	21 15 39.458	-7.44	-4.39	74 24 46.05	1510.7	-.7	2	57.20
19062	17 4546	7.1 K5	21 16 5.185	279.69	.07	17 30 34.56	1513.1	13.1	2	57.23
19067	15 4388	8.7 K5	21 16 21.364	282.05	.05	16 6 36.29	1514.7	13.1	2	57.68
19078	67 1303	8.4 K	21 17 11.278	87.76	-1.40	68 21 16.59	1519.4	3.8	2	57.67
19085	12 4600	7.2 K5	21 17 40.165	287.66	.00	12 45 1.70	1522.2	13.3	2	58.58
19087	49 3501	8.7 F0	21 17 42.703	205.92	.24	49 24 8.41	1522.4	9.4	2	58.21
19088	- 2 5507	8.4 G5	21 17 43.726	309.93	-.26	- 1 43 2.41	1522.5	14.4	2	57.61
19089	5 4759	8.3 A2	21 17 48.674	297.69	-.11	6 19 50.28	1523.0	13.8	2	58.22
19097	36 4520	8.1 M0	21 18 12.958	242.97	.28	36 35 38.91	1525.3	11.2	2	57.67
19109	20 4894	7.8 K2	21 19 10.431	274.04	.12	21 6 11.54	1530.7	12.6	2	58.15
19115	81 735	8.8 K0	21 19 30.937	-272.19	-21.40	81 32 57.60	1532.7	-13.1	2	57.57
19116	41 4109	8.9 A0	21 19 34.062	230.67	.31	41 41 9.41	1532.9	10.5	2	57.14
19122	23 4296	8.9 A3	21 19 42.890	269.73	.16	23 36 40.37	1533.8	12.3	2	57.16
19124	58 2255	8.2 G5	21 19 47.792	165.15	-.05	58 50 16.05	1534.2	7.4	2	57.68
19126	19 4692	8.4 F5	21 19 57.705	276.40	.11	19 48 6.64	1535.1	12.6	2	57.20
19128	7 4671	8.0 K0	21 20 5.525	295.90	-.08	7 34 50.17	1535.9	13.5	2	58.14
19134	63 1720	7.2 K2	21 20 38.258	130.64	-.54	64 9 1.07	1538.9	5.8	2	58.12
19139	38 4472	7.3 K0	21 20 54.790	239.35	.30	38 29 37.26	1540.5	10.8	3	58.93
19148	13 4694	7.5 K2	21 22 16.690	285.76	.03	14 15 37.92	1548.1	12.9	2	58.13
19164	9 4805	8.2 K5	21 23 0.989	293.31	-.05	9 24 50.05	1552.2	13.2	3	57.64
19171	45 3531	7.6 K0	21 23 29.836	220.50	.31	45 50 24.92	1554.8	9.8	2	57.24
19172	54 2536	8.3 G5	21 23 33.931	186.35	.15	55 8 6.14	1555.2	8.2	2	57.60
19185	42 4098	8.1 F5	21 24 30.789	229.40	.33	42 54 8.77	1560.4	10.2	2	57.24
19190	75 788	7.4 K0	21 24 36.622	-22.79	-5.41	75 45 17.84	1561.0	-1.4	2	57.08
19192	55 2587	8.0 K2	21 24 41.560	181.75	.12	56 17 28.71	1561.4	8.0	2	58.07
19202	23 4317	8.2 K5	21 25 12.805	269.94	.18	24 6 48.01	1564.3	12.0	2	57.66
19217	41 4153	8.8 A0	21 26 30.672	233.54	.33	41 39 25.51	1571.3	10.2	2	59.19
19232	38 4509	8.1 M0	21 27 24.532	241.83	.33	38 25 59.83	1576.2	10.6	2	57.66
19240	- 2 5551	8.4 A2	21 27 39.145	309.85	-.26	- 1 45 15.75	1577.5	13.6	2	57.20
19247	29 4426	8.1 A0	21 27 57.321	260.45	.25	29 40 12.40	1579.1	11.3	2	58.11
19258	22 4411	7.3 K0	21 29 5.542	273.43	.17	22 31 14.63	1585.2	11.9	2	57.61
19260	77 823	7.6 K0	21 29 22.974	-67.53	-7.95	77 42 56.08	1586.8	-3.3	2	58.13
19270	49 3544	8.3 A2	21 29 46.130	212.13	.32	49 26 57.36	1588.8	9.1	2	57.68
19276	72 991	8.1 K5	21 30 22.810	37.54	-3.14	73 15 22.52	1592.1	1.3	2	58.20
19285	56 2590	8.0 K0	21 30 59.231	181.26	.14	57 18 59.34	1595.3	7.7	2	57.12
19294	- 0 4238	8.4 K2	21 31 21.727	307.32	-.22	0 0 5.51	1597.3	13.2	4	58.39
19295	26 4197	7.7 K5	21 31 22.732	265.53	.24	27 22 47.96	1597.4	11.3	2	57.65
19313	38 4539	8.8 K0	21 32 43.306	241.81	.36	39 17 27.69	1604.5	10.2	2	58.13
19323	30 4479	8.0 K0	21 33 35.578	259.87	.29	30 47 7.10	1609.0	11.0	2	57.60
19325	5 4824	8.0 K2	21 33 44.398	299.08	-.10	5 54 45.94	1609.8	12.6	2	57.15
19348	14 4647	7.2 K0	21 35 18.444	286.21	.07	14 59 27.42	1617.9	12.0	2	58.13
19349	21 4587	8.2 K5	21 35 25.564	275.91	.17	21 43 56.21	1618.5	11.6	2	57.60
19351	50 3382	7.1 K5	21 35 32.273	210.63	.35	50 50 19.56	1619.1	8.7	2	57.24
19361	- 4 5503	8.4 K2	21 36 2.614	312.55	-.30	- 3 48 33.46	1621.7	13.0	2	58.65
19362	13 4751	8.2 K2	21 36 5.445	288.54	.04	13 27 29.11	1621.9	12.0	2	57.73
19364	27 4122	8.6 A2	21 36 17.462	266.58	.26	27 27 44.30	1623.0	11.1	4	58.92
19373	35 4600	8.2 M0	21 37 0.914	250.99	.35	35 49 2.92	1626.7	10.3	2	57.21

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P.M.).

T in centuries from 1900.0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
19374	44 3892	8.4 K0	21 37 9.753	229.91	.39	44 47 16.41	1627.4	9.4	2	57.58
19376	1 4518	7.9 K0	21 37 13.160	304.73	−.18	1 54 44.21	1627.7	12.6	4	58.89
19381	63 1759	8.0 K5	21 37 27.850	146.59	−.29	64 9 32.06	1629.0	5.9	2	57.24
19388	16 4575	8.8 K2	21 37 59.235	283.48	.11	17 4 58.06	1631.6	11.7	2	58.15
19402	18 4837	8.2 K0	21 39 3.852	281.57	.13	18 28 34.46	1637.1	11.5	2	57.66
19406	46 3407	7.0 K2	21 39 17.955	223.86	.40	47 19 1.08	1638.3	9.0	2	57.09
19410	31 4529	8.6 K5	21 39 36.994	259.59	.32	31 51 14.02	1639.9	10.5	2	57.21
19412	20 4991	8.2 K0	21 39 46.842	277.87	.17	21 0 2.40	1640.7	11.3	2	58.13
19414	70 1192	7.1 K5	21 39 47.464	89.92	−1.60	70 33 28.56	1640.7	3.4	2	58.12
19415	32 4232	8.2 K2	21 39 48.815	257.86	.33	32 48 40.78	1640.9	10.4	2	57.70
19417	8 4720	7.2 K0	21 40 0.686	295.60	−.04	8 42 7.80	1641.8	12.0	2	57.24
19434	10 4608	7.1 K5	21 41 19.842	292.73	.01	10 52 18.40	1648.5	11.8	3	57.66
19439	23 4381	8.4 K0	21 41 35.062	273.71	.22	23 53 37.47	1649.7	11.0	2	57.58
19443	68 1244	7.7 K2	21 41 53.379	111.83	−1.03	68 49 26.85	1651.2	4.3	2	58.57
19449	42 4195	7.2 K5	21 42 45.721	236.60	.44	43 11 54.99	1655.5	9.4	2	57.59
19453	− 3 5296	8.0 F0	21 42 53.135	311.51	−.28	− 3 10 51.61	1656.1	12.4	2	57.70
19455	0 4776	8.6 K2	21 43 11.321	305.44	−.18	1 26 18.47	1657.6	12.2	2	57.21
19467	21 4614	8.4 K2	21 44 9.450	277.77	.19	21 36 8.26	1662.4	11.0	2	57.73
19477	3 4613	7.7 K0	21 44 39.287	301.90	−.12	4 10 15.46	1664.8	11.9	2	58.65
19483	18 4861	7.9 K2	21 45 0.727	281.96	.15	18 51 54.26	1666.5	11.1	2	57.75
19487	73 945	8.8 K5	21 45 27.494	43.19	−3.34	74 20 50.64	1668.7	1.4	3	58.62
19496	69 1197	8.9 K0	21 46 2.619	107.33	−1.18	69 45 51.60	1671.5	4.0	2	58.15
19498	45 3680	7.6 K0	21 46 11.966	232.19	.47	45 34 16.74	1672.3	9.0	2	57.08
19501	75 801	8.5 K2	21 46 26.916	7.05	−5.00	76 14 26.07	1673.5	−.1	2	58.59
19507	57 2402	8.3 A2	21 46 49.238	191.65	.31	57 37 16.34	1675.3	7.3	2	59.09
19508	16 4607	8.2 K0	21 46 53.822	284.44	.13	17 20 20.59	1675.6	11.0	2	58.65
19510	41 4277	7.5 K5	21 47 5.923	241.12	.46	42 7 29.00	1676.6	9.3	2	58.67
19513	80 706	8.3 F2	21 47 16.459	−128.59	−13.79	80 28 37.34	1677.5	−5.5	2	58.60
19514	7 4752	8.7 A0	21 47 16.545	297.01	−.04	8 1 56.68	1677.5	11.5	2	58.65
19516	4 4753	7.4 K0	21 47 20.640	300.96	−.10	4 58 44.13	1677.7	11.7	2	58.14
19542	22 4493	7.6 K0	21 49 0.160	277.20	.23	22 37 29.76	1685.7	10.6	2	57.17
19547	− 1 4212	8.5 F8	21 49 30.023	309.24	−.24	− 1 31 12.88	1688.0	11.8	4	59.14
19548	31 4562	7.5 K2	21 49 32.865	262.89	.36	31 40 37.09	1688.3	10.0	2	57.73
19550	13 4797	8.3 K0	21 49 37.332	288.89	.09	14 21 59.76	1688.6	11.0	2	57.24
19555	47 3584	6.8 K5	21 50 1.689	227.04	.49	48 12 6.40	1690.5	8.5	2	58.12
19560	50 3465	8.4 A2	21 50 18.875	218.24	.48	51 11 46.41	1691.9	8.2	2	58.60
19562	12 4705	7.4 K0	21 50 24.633	290.47	.07	13 15 11.32	1692.3	11.0	2	58.59
19570	77 836	8.6 K0	21 50 50.404	−15.52	−6.42	77 31 59.74	1694.3	−1.0	2	58.20
19576	35 4664	7.8 K5	21 51 13.374	255.81	.42	35 53 26.72	1696.1	9.6	2	58.14
19586	3 4630	8.7 F0	21 51 43.092	302.27	−.11	4 4 29.54	1698.4	11.3	2	58.13
19593	8 4760	8.5 K5	21 52 7.072	296.68	−.02	8 33 17.58	1700.3	11.1	2	58.15
19597	− 4 5570	8.2 K5	21 52 22.369	312.83	−.30	− 4 27 25.80	1701.4	11.7	2	59.06
19606	68 1258	8.3 K2	21 52 46.202	127.98	−.70	68 33 41.59	1703.3	4.6	2	57.73
19613	30 4558	7.5 K0	21 53 11.753	265.82	.36	30 35 27.19	1705.2	9.8	2	58.13
19619	53 2740	7.6 K5	21 53 25.669	211.05	.47	53 56 27.24	1706.3	7.7	2	58.12
19631	11 4695	7.7 K5	21 54 4.277	291.96	.06	12 25 14.21	1709.2	10.7	2	56.69
19641	45 3740	8.5 M0	21 55 3.846	236.61	.52	45 35 3.83	1713.8	8.6	2	57.68
19648	49 3692	7.2 K0	21 55 25.538	224.24	.53	50 15 2.09	1715.4	8.1	2	57.24
19686	0 4807	8.2 G5	21 57 55.154	306.17	−.17	0 58 36.21	1726.6	11.0	3	58.69
19689	2 4457	8.8 F5	21 58 8.723	304.31	−.13	2 33 5.88	1727.6	10.9	2	56.66

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession 1st Term	Precession 2nd Term	Decl. 1950	Precession 1st Term	Precession 2nd Term	No. Obs.	Epoch 1900+
19699	64 1613	7.3 K5	21 58 42.653	161.39	-.02	65 11 31.96	1730.1	5.6	2	56.69
19717	- 1 4236	7.6 K2	21 59 58.695	308.68	-.22	- 1 9 38.32	1735.6	10.9	2	56.66
19750	73 957	7.5 K2	22 2 6.510	84.22	-2.13	73 34 56.18	1744.9	2.6	2	57.11
19754	29 4573	7.7 K5	22 2 20.741	269.87	.38	29 42 58.83	1745.9	9.3	2	56.69
19756	31 4617	8.4 G5	22 2 27.784	266.66	.42	31 48 32.70	1746.4	9.2	2	56.63
19757	20 5074	8.0 K2	22 2 35.408	282.43	.24	20 49 1.21	1747.0	9.7	2	57.66
19761	- 2 5689	8.3 F8	22 2 44.938	309.24	-.22	- 1 40 3.16	1747.7	10.6	2	57.23
19765	61 2243	8.6 A0	22 2 55.884	183.62	.32	62 9 52.68	1748.4	6.2	2	57.67
19770	5 4947	7.5 K0	22 3 11.073	300.79	-.06	5 43 21.55	1749.5	10.4	2	57.23
19771	6 4957	8.6 F0	22 3 17.422	299.62	-.03	6 44 40.39	1749.9	10.3	3	57.98
19774	- 3 5375	8.4 K2	22 3 26.788	311.14	-.26	- 3 20 59.80	1750.6	10.7	2	58.19
19800	24 4537	8.3 F2	22 5 19.905	277.75	.32	24 46 16.47	1758.5	9.4	2	56.69
19804	38 4689	8.0 K5	22 5 37.283	255.36	.54	39 5 53.85	1759.8	8.5	2	57.21
19806	3 4665	8.4 K0	22 5 46.687	302.55	-.08	4 16 21.99	1760.4	10.2	4	57.90
19810	- 0 4310	8.6 F5	22 6 6.590	307.53	-.18	- 0 11 2.46	1761.8	10.3	2	58.20
19823	0 4829	8.6 K0	22 6 49.602	305.81	-.15	1 22 32.26	1764.8	10.2	3	59.00
19825	67 1405	8.1 F5	22 6 53.110	148.47	-.26	68 16 24.91	1765.1	4.8	2	57.11
19832	20 5090	8.3 K0	22 7 34.718	283.29	.25	20 53 51.55	1767.9	9.3	2	56.69
19849	59 2477	8.5 K5	22 8 33.316	200.23	.53	59 45 20.49	1771.9	6.4	2	57.20
19875	54 2702	6.9 K2	22 10 30.786	220.08	.66	54 51 1.27	1779.9	7.0	2	58.58
19881	- 0 4322	7.8 K5	22 10 46.480	307.33	-.17	- 0 0 21.29	1780.9	9.9	2	57.25
19888	41 4420	8.3 K0	22 11 1.972	253.14	.61	41 32 29.94	1781.9	8.1	2	57.24
19902	56 2736	8.5 A2	22 11 40.203	212.24	.64	57 23 29.24	1784.5	6.7	2	58.20
19906	17 4714	8.1 K2	22 11 55.961	287.87	.21	17 46 18.61	1785.5	9.1	2	57.66
19909	79 728	8.5 K2	22 12 7.156	-29.78	-8.94	79 48 34.06	1786.3	-1.4	2	57.19
19916	35 4746	7.7 K2	22 12 34.489	263.62	.54	35 54 23.54	1788.1	8.3	3	58.30
19917	20 5106	7.8 F8	22 12 39.434	284.14	.27	21 1 47.08	1788.4	9.0	2	58.12
19918	66 1490	8.7 A0	22 12 43.254	167.45	.14	66 41 1.45	1788.7	5.1	2	57.67
19932	15 4604	8.1 F8	22 13 40.638	290.44	.17	15 46 16.74	1792.4	9.1	2	57.25
19939	31 4668	7.3 K5	22 14 15.326	269.62	.48	32 22 18.39	1794.7	8.4	2	57.58
19941	50 3637	8.2 K0	22 14 20.947	234.36	.71	50 50 9.88	1795.0	7.2	2	57.11
19949	4 4837	7.4 M0	22 14 58.547	302.27	-.05	4 53 38.56	1797.5	9.4	2	58.13
19963	49 3805	7.4 K2	22 15 51.771	238.47	.72	49 34 45.93	1800.9	7.2	2	57.67
19968	9 5019	7.8 K2	22 16 9.057	296.90	.06	10 6 15.45	1802.0	9.1	2	58.26
19969	7 4842	7.5 K2	22 16 11.590	299.51	.01	7 36 52.44	1802.2	9.2	3	58.30
19973	41 4456	7.8 K2	22 16 38.123	255.09	.65	41 53 29.51	1803.8	7.7	2	58.58
19978	14 4772	6.9 K5	22 16 57.802	291.44	.17	15 17 39.98	1805.1	8.9	2	56.70
19989	46 3661	8.1 K5	22 17 46.425	246.27	.71	46 38 55.96	1808.2	7.4	2	58.33
19992	10 4731	7.7 K0	22 17 52.864	296.36	.08	10 47 14.01	1808.6	8.9	2	57.75
20003	22 4618	7.9 K0	22 18 21.112	283.11	.32	22 48 32.42	1810.3	8.5	2	58.66
20010	72 1029	8.6 K2	22 18 43.899	122.87	-.99	72 47 19.84	1811.8	3.4	2	56.66
20023	43 4178	7.6 K2	22 19 51.244	253.68	.69	43 29 33.05	1815.9	7.4	2	58.80
20025	- 4 5663	8.1 K0	22 20 1.805	311.26	-.25	- 3 59 23.35	1816.6	9.2	2	58.61
20038	16 4724	7.2 K2	22 21 2.931	289.80	.23	17 24 10.05	1820.3	8.5	2	58.10
20045	21 4745	7.9 K2	22 21 25.484	284.98	.32	21 51 11.04	1821.7	8.3	2	58.20
20047	66 1503	8.0 K2	22 21 30.722	176.79	.35	66 54 10.94	1822.0	5.0	2	57.67
20061	34 4674	7.8 K5	22 22 13.017	268.35	.57	35 10 45.97	1824.6	7.7	2	58.13
20062	9 5040	7.5 K5	22 22 14.296	298.02	.07	9 33 20.80	1824.7	8.6	2	58.31
20064	31 4689	8.1 K2	22 22 21.871	272.56	.52	32 11 42.39	1825.1	7.8	2	58.15
20068	10 4744	8.1 G0	22 22 51.042	296.37	.10	11 16 22.49	1826.9	8.5	2	58.28

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
					1st Term	2nd Term		1st Term	2nd Term		
20072	62	2074	7.6 K0	22 23 1.876	198.17	.66	63 18 58.34	1827.5	5.5	2	57.14
20075	12	4820	8.7 F0	22 23 18.846	294.79	.14	12 54 10.60	1828.5	8.4	2	58.20
20082	53	2874	7.0 K0	22 23 49.198	233.59	.83	53 33 42.59	1830.3	6.5	2	57.12
20085	- 1	4294	8.4 K2	22 23 55.815	308.11	-.17	- 0 49 19.23	1830.7	8.7	2	57.21
20102	0	4876	8.2 F0	22 25 16.445	306.01	-.11	1 24 6.19	1835.5	8.6	2	57.70
20107	64	1665	8.2 G5	22 25 28.912	191.36	.61	65 12 39.55	1836.2	5.2	2	58.21
20109	2	4508	8.8 K0	22 25 34.578	304.99	-.09	2 29 58.86	1836.5	8.5	2	58.13
20112	24	4593	7.5 K0	22 25 51.041	282.88	.39	24 36 51.92	1837.5	7.8	2	59.06
20117	46	3711	8.4 B9	22 26 17.270	249.97	.79	47 11 38.30	1839.0	6.9	2	58.14
20120	47	3809	8.3 K0	22 26 25.173	247.81	.81	48 17 13.21	1839.5	6.8	2	58.15
20126	- 3	5452	8.4 G5	22 26 45.763	310.55	-.23	- 3 29 4.98	1840.7	8.6	2	57.21
20129	4	4860	8.4 K0	22 27 4.025	302.36	-.02	5 23 6.86	1841.7	8.3	4	58.70
20134	44	4147	8.1 A0	22 27 32.141	255.30	.77	44 45 58.23	1843.3	6.9	2	58.27
20137	45	3958	7.7 K2	22 27 45.277	254.09	.79	45 29 16.86	1844.1	6.9	2	58.35
20141	75	832	8.0 K5	22 27 57.023	98.15	-2.09	75 58 45.83	1844.8	2.4	2	59.24
20148	3	4716	7.6 K0	22 28 8.595	303.61	-.05	4 4 31.09	1845.4	8.3	2	59.25
20149	17	4758	8.0 K2	22 28 12.662	290.52	.26	17 52 55.86	1845.6	7.9	2	58.66
20152	7	4883	7.8 K0	22 28 27.049	299.87	.05	8 10 12.34	1846.5	8.1	2	59.26
20154	14	4811	8.6 K2	22 28 43.113	293.24	.20	15 12 33.53	1847.4	7.9	2	57.68
20157	38	4787	7.9 A3	22 29 3.714	265.53	.68	38 59 14.34	1848.5	7.1	3	58.30
20169	20	5180	7.7 K5	22 30 7.789	287.93	.33	20 48 19.48	1852.1	7.7	2	58.60
20170	0	4892	7.9 K0	22 30 7.952	306.57	-.12	0 50 45.62	1852.1	8.1	2	57.66
20182	65	1780	8.9 K0	22 31 9.864	195.25	.72	65 44 28.99	1855.6	5.0	2	58.15
20186	24	4608	8.5 K0	22 31 19.742	283.98	.42	24 50 43.81	1856.1	7.4	2	56.70
20192	42	4441	7.8 K5	22 31 32.842	260.05	.78	43 13 37.39	1856.8	6.7	2	57.75
20194	8	4892	8.2 F5	22 31 37.367	299.21	.08	9 10 10.09	1857.1	7.8	2	58.26
20201	12	4843	7.7 K0	22 31 57.102	295.63	.17	13 9 6.02	1858.2	7.7	2	58.66
20214	57	2562	7.1 K5	22 32 38.242	228.07	.95	57 54 16.09	1860.4	5.8	2	58.76
20217	30	4744	7.3 K2	22 32 43.060	278.02	.54	30 32 39.91	1860.7	7.2	2	57.69
20219	9	5068	7.7 K2	22 33 9.392	298.55	.10	10 4 6.29	1862.1	7.7	2	57.60
20225	4	4880	8.8 G0	22 33 28.446	302.72	.00	5 20 21.78	1863.1	7.7	2	58.22
20240	47	3856	8.3 A5	22 34 40.564	254.06	.88	47 37 26.80	1867.0	6.3	4	58.43
20241	1	4634	8.1 K5	22 34 43.635	305.91	-.09	1 39 55.38	1867.1	7.7	2	57.25
20256	43	4255	8.6 K0	22 35 23.185	260.32	.83	44 16 6.45	1869.2	6.4	2	57.59
20264	67	1454	8.5 G0	22 35 48.197	189.60	.70	67 49 18.33	1870.5	4.6	2	58.73
20270	20	5195	7.4 K2	22 36 4.184	288.99	.35	20 58 1.16	1871.4	7.1	2	58.14
20273	- 3	5482	8.4 G5	22 36 21.436	310.07	-.20	- 3 17 10.14	1872.3	7.7	2	58.59
20280	- 1	4336	8.4 F5	22 36 42.313	308.14	-.15	- 0 58 36.16	1873.3	7.6	2	57.69
20284	33	4556	8.7 F8	22 36 57.721	275.83	.62	33 37 43.79	1874.1	6.7	2	57.68
20291	30	4761	7.7 K2	22 37 22.955	279.14	.57	30 53 5.43	1875.4	6.8	2	56.70
20298	86	335	8.3 A0	22 37 50.791	-594.60	-131.00	87 1 30.58	1876.9	-15.6	2	57.67
20315	11	4859	8.0 K5	22 39 16.176	297.26	.17	12 18 45.85	1881.2	7.1	4	58.92
20316	9	5090	8.5 K2	22 39 18.626	298.99	.13	10 15 24.29	1881.3	7.1	2	56.67
20322	7	4913	7.8 G5	22 39 39.518	301.03	.07	7 48 47.20	1882.4	7.1	2	57.69
20323	0	4911	8.4 K0	22 39 50.285	306.92	-.10	0 30 30.75	1882.9	7.3	2	57.68
20333	4	4896	7.0 K2	22 40 21.044	303.58	0.00	4 42 22.79	1884.4	7.2	3	58.29
20338	15	4695	8.5 K2	22 40 49.450	294.34	.26	16 0 55.00	1885.8	6.9	2	58.21
20344	39	4916	8.7 K5	22 41 10.916	269.61	.77	39 56 1.30	1886.9	6.2	2	57.60
20356	20	5217	7.6 K0	22 41 50.516	290.46	.37	20 40 27.28	1888.8	6.7	2	58.20
20362	12	4880	8.5 K0	22 42 17.221	297.02	.20	13 3 37.36	1890.1	6.8	2	57.66

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
20369	81 788	7.6 K0	22 43 1.035	7.87	-9.14	81 38 1.41	1892.3	-.2	2	57.58
20373	- 1 4346	7.8 K0	22 43 15.484	308.24	-.14	- 1 11 46.96	1892.9	7.0	2	57.24
20376	10 4815	7.2 G5	22 43 24.343	298.86	.15	10 56 12.86	1893.4	6.7	2	58.59
20380	26 4499	8.7 A2	22 43 46.833	285.50	.50	26 34 59.12	1894.4	6.4	2	58.21
20381	37 4686	7.3 K2	22 43 49.444	272.98	.77	38 14 8.88	1894.6	6.1	3	58.30
20387	73 994	7.4 K5	22 44 20.880	153.34	-.08	74 17 26.50	1896.1	3.2	2	57.67
20389	21 4828	7.5 K5	22 44 25.341	289.46	.41	22 26 5.92	1896.3	6.4	2	58.19
20408	0 4926	8.6 K0	22 45 32.983	306.53	-.08	1 4 33.41	1899.4	6.7	2	57.68
20428	7 4932	8.8 K5	22 46 26.287	301.19	.10	8 16 41.56	1901.9	6.5	2	58.59
20438	41 4618	8.3 K5	22 47 23.032	270.12	.87	41 47 3.72	1904.5	5.7	2	57.20
20442	12 4894	8.7 G0	22 47 46.717	298.11	.20	12 32 29.28	1905.6	6.3	2	57.69
20443	19 5012	8.9 K0	22 47 54.181	292.24	.37	20 2 57.74	1905.9	6.2	2	57.67
20448	24 4673	8.2 K2	22 48 20.317	287.98	.49	25 12 21.02	1907.1	6.0	2	57.75
20462	65 1817	7.2 K2	22 49 0.432	213.78	1.20	66 28 21.69	1908.9	4.3	2	57.12
20478	39 4953	7.8 K5	22 50 3.289	273.64	.85	39 59 58.53	1911.6	5.6	2	57.20
20480	- 3 5521	7.8 G5	22 50 5.242	309.35	-.17	- 2 53 30.92	1911.7	6.4	3	57.10
20486	49 3959	6.9 M0	22 50 28.265	259.01	1.10	50 26 20.47	1912.7	5.2	2	58.22
20488	26 4524	7.4 K0	22 50 45.289	287.32	.54	26 42 41.99	1913.5	5.8	2	57.76
20495	1 4662	7.0 K5	22 51 18.873	306.24	-.05	1 34 36.90	1915.0	6.2	2	57.24
20500	- 0 4432	8.6 K5	22 51 40.641	307.23	-.09	0 8 54.78	1915.9	6.2	2	56.70
20502	- 1 4355	8.4 G5	22 51 43.872	308.23	-.12	- 1 18 55.70	1916.0	6.2	4	58.89
20504	21 4850	8.1 K5	22 51 48.899	291.39	.43	22 8 7.23	1916.2	5.8	2	58.60
20509	10 4844	7.9 F2	22 52 6.926	300.01	.17	10 37 52.67	1917.0	6.0	2	57.75
20512	6 5083	7.6 K2	22 52 12.898	302.55	.09	6 59 27.65	1917.3	6.0	2	57.66
20520	84 516	7.5 M3	22 52 38.188	-116.44	-27.49	84 46 48.27	1918.3	-2.9	2	57.73
20521	78 813	7.2 K5	22 52 41.162	114.87	-1.84	78 38 6.35	1918.4	2.0	2	57.66
20529	18 5069	7.9 M0	22 53 12.831	294.40	.36	18 36 29.09	1919.8	5.8	2	58.30
20544	71 1173	8.1 K5	22 54 11.758	192.58	1.04	71 44 55.95	1922.2	3.6	2	57.20
20548	25 4848	8.7 K0	22 54 31.579	288.86	.54	26 7 13.70	1923.0	5.5	2	57.24
20550	23 4640	8.3 K0	22 54 37.116	290.26	.50	24 24 52.57	1923.2	5.5	3	58.01
20552	16 4842	8.1 K0	22 54 43.396	295.66	.33	17 15 38.80	1923.5	5.6	2	58.22
20553	31 4816	7.7 K2	22 54 53.258	283.99	.68	31 55 54.49	1923.9	5.4	2	57.67
20555	36 4970	7.7 K5	22 55 14.765	279.15	.81	37 6 15.47	1924.8	5.3	2	58.59
20556	38 4903	7.3 K2	22 55 17.961	277.05	.86	39 7 16.23	1924.9	5.2	2	58.66
20569	- 1 4364	7.3 K0	22 56 18.852	307.70	-.09	- 0 35 2.98	1927.4	5.7	2	57.68
20571	49 4003	7.8 K5	22 56 23.440	263.02	1.17	50 25 49.16	1927.6	4.8	2	58.35
20573	26 4539	7.7 K0	22 56 30.390	288.52	.58	27 13 52.77	1927.8	5.3	2	58.30
20581	40 4958	7.9 K5	22 57 3.537	276.25	.92	40 36 53.38	1929.2	5.0	3	58.30
20584	43 4359	7.5 K2	22 57 13.682	272.86	.99	43 38 44.62	1929.5	5.0	2	57.75
20585	24 4694	8.6 A5	22 57 20.659	290.22	.53	25 22 31.80	1929.8	5.3	3	58.03
20591	73 1001	8.7 K0	22 57 52.627	185.33	.96	73 39 18.14	1931.1	3.2	2	58.13
20594	34 4817	8.0 K2	22 58 3.672	281.88	.79	35 30 12.71	1931.5	5.1	2	57.68
20596	47 4007	8.1 K2	22 58 9.349	268.25	1.11	47 39 9.81	1931.7	4.8	2	57.24
20603	54 2895	8.2 G5	22 58 31.655	256.86	1.32	54 56 32.13	1932.6	4.5	2	57.67
20606	0 4955	8.2 M0	22 58 42.876	306.82	-.05	0 48 55.96	1933.0	5.5	2	58.22
20612	13 5041	8.3 K5	22 59 15.445	298.31	.28	14 27 0.80	1934.3	5.3	2	58.20
20613	44 4307	7.6 K0	22 59 17.450	272.05	1.06	45 14 28.12	1934.3	4.8	2	57.66
20615	- 3 5553	7.8 K5	22 59 20.752	309.13	-.15	- 2 57 17.80	1934.5	5.5	2	57.20
20620	75 867	7.5 G5	22 59 35.730	169.21	.54	75 51 13.66	1935.0	2.8	4	58.70
20626	28 4506	8.4 K0	22 59 49.491	288.00	.64	29 7 34.59	1935.6	5.0	2	58.22

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
20630	6 5107	7.9 K2	23 0 20.738	302.88	.11	7 21 37.95	1936.7	5.3	2	58.76
20631	63 1917	7.7 G5	23 0 22.710	237.05	1.55	63 56 28.61	1936.8	4.0	3	57.76
20635	26 4555	8.6 F2	23 0 36.926	289.56	.60	27 25 32.69	1937.4	5.0	2	58.22
20638	41 4668	8.1 M0	23 0 48.145	276.65	.98	41 57 3.27	1937.8	4.7	2	58.22
20646	52 3360	7.1 K0	23 1 15.745	262.32	1.30	53 1 58.13	1938.8	4.4	2	58.13
20657	5 5128	8.4 A0	23 2 25.952	303.69	.09	6 14 50.37	1941.4	5.1	2	57.67
20660	16 4865	7.9 K5	23 2 38.524	297.17	.35	17 3 25.75	1941.8	5.0	2	58.15
20672	8 4993	7.8 M0	23 3 20.831	302.37	.15	8 37 32.87	1943.3	5.0	2	56.70
20675	68 1353	8.9 A5	23 3 48.277	222.81	1.66	69 0 23.06	1944.3	3.5	2	57.59
20677	37 4765	7.9 K0	23 4 2.181	281.82	.89	38 17 57.42	1944.8	4.6	3	58.35
20684	17 4868	8.3 F8	23 4 35.331	297.12	.38	17 41 56.37	1946.0	4.8	4	58.70
20692	58 2547	7.4 K0	23 5 17.816	255.33	1.53	58 43 8.19	1947.4	4.0	2	57.73
20694	29 4863	6.9 K5	23 5 23.103	289.00	.69	30 10 7.30	1947.6	4.6	2	57.29
20704	40 5001	8.9 K0	23 5 52.347	280.38	.98	40 45 25.64	1948.6	4.4	2	58.25
20712	26 4569	8.2 K0	23 6 20.493	291.20	.63	27 29 15.24	1949.6	4.5	2	57.25
20717	7 4980	8.8 K0	23 6 29.049	303.17	.14	7 39 36.99	1949.9	4.7	4	57.74
20720	25 4885	8.3 A2	23 6 35.869	292.25	.59	26 2 40.32	1950.1	4.5	2	58.68
20721	17 4874	8.2 G5	23 6 38.621	297.23	.39	18 8 21.12	1950.2	4.6	3	58.67
20723	1 4687	7.6 K2	23 6 49.227	306.33	-.01	1 52 23.07	1950.6	4.7	2	58.15
20725	62 2173	7.1 K2	23 6 54.055	248.28	1.68	62 32 40.09	1950.7	3.7	2	58.18
20729	23 4683	8.6 A3	23 7 7.030	293.73	.54	23 59 19.62	1951.1	4.5	2	58.22
20746	20 5285	8.9 K2	23 8 10.116	295.88	.47	20 54 42.97	1953.2	4.4	2	57.22
20748	44 4342	8.1 K0	23 8 14.426	277.59	1.12	44 49 40.09	1953.4	4.1	2	57.22
20751	16 4884	8.6 G0	23 8 27.404	298.48	.36	16 32 5.21	1953.8	4.4	4	58.70
20757	- 3 5584	8.4 K2	23 9 2.541	309.06	-.13	- 3 22 21.49	1954.9	4.6	2	57.25
20764	31 4867	7.3 K0	23 9 30.607	288.80	.77	32 23 39.38	1955.8	4.2	2	57.75
20767	5 5146	8.2 K2	23 9 39.073	304.09	.11	6 20 1.14	1956.1	4.4	5	59.10
20773	- 0 4483	7.7 G5	23 10 26.516	307.45	-.05	- 0 14 28.54	1957.6	4.4	2	57.22
20777	1 4695	7.2 G5	23 10 50.608	306.13	.02	2 24 10.27	1958.3	4.3	2	58.13
20778	0 4978	7.5 F0	23 10 54.874	307.00	-.02	0 39 30.70	1958.5	4.3	2	57.73
20780	52 3391	8.1 K2	23 10 59.332	269.90	1.42	52 50 54.73	1958.6	3.8	2	57.24
20781	66 1596	7.5 M0	23 11 0.840	241.18	1.91	66 48 14.30	1958.6	3.3	2	58.29
20795	71 1190	8.2 K5	23 12 4.551	223.77	1.99	71 38 11.29	1960.6	3.0	3	58.72
20801	- 1 4409	8.8 G5	23 12 20.826	307.97	-.07	- 1 19 43.03	1961.1	4.2	2	58.35
20829	38 4965	8.3 K2	23 13 59.718	285.99	.97	38 41 9.72	1964.0	3.7	2	57.22
20831	49 4078	6.9 K5	23 14 7.582	275.22	1.37	50 23 54.35	1964.2	3.6	2	57.13
20840	- 0 4984	8.6 K0	23 14 33.113	306.89	-.01	0 57 30.06	1965.0	4.0	3	57.39
20844	3 4847	8.8 G0	23 14 45.881	305.41	.07	4 10 41.50	1965.3	3.9	2	58.68
20857	8 5039	7.7 K0	23 15 28.153	303.13	.20	9 13 48.05	1966.5	3.8	2	57.24
20867	58 2572	8.7 A5	23 16 11.676	264.74	1.76	59 12 16.55	1967.8	3.3	2	58.15
20868	32 4621	8.1 F0	23 16 12.625	290.99	.82	32 46 40.66	1967.8	3.6	2	58.27
20899	13 5096	8.2 K2	23 18 26.822	301.30	.33	14 2 25.59	1971.4	3.5	2	57.22
20902	1 4714	7.8 K0	23 18 37.942	306.52	.03	1 55 24.40	1971.7	3.6	2	57.23
20903	37 4820	7.3 K0	23 18 52.850	288.49	1.01	38 18 29.98	1972.1	3.3	2	57.68
20908	12 4974	8.1 A0	23 19 7.693	301.89	.31	12 54 47.17	1972.5	3.5	2	58.14
20923	74 1018	7.8 K0	23 20 3.059	217.63	2.37	75 30 49.91	1973.9	2.3	2	57.19
20930	50 4025	7.1 K2	23 20 27.280	279.23	1.46	50 46 24.21	1974.5	3.1	2	58.15
20935	- 4 5879	8.5 K2	23 20 48.683	308.71	-.11	- 3 29 22.87	1975.0	3.4	2	57.20
20937	51 3598	7.6 K0	23 20 59.739	278.54	1.51	51 49 41.09	1975.3	3.0	3	57.40
20954	18 5147	8.2 K2	23 21 48.262	299.82	.46	18 42 27.73	1976.5	3.2	2	57.70

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
20955	34 4916	7.5 K0	23 21 48.449	291.78	.92	35 3 21.96	1976.5	3.1	2	58.75
20964	22 4829	8.0 K2	23 22 17.258	297.94	.59	23 12 18.75	1977.2	3.2	2	57.68
20965	6 5153	8.4 K2	23 22 27.350	304.74	.16	6 45 28.15	1977.4	3.2	2	58.20
20966	55 2956	7.6 K0	23 22 37.525	275.37	1.71	55 49 53.29	1977.7	2.8	2	57.28
20968	14 4990	8.3 A3	23 22 54.278	301.39	.38	15 24 49.65	1978.1	3.1	2	58.72
20973	25 4934	8.2 K0	23 23 5.201	296.92	.66	25 54 42.20	1978.3	3.0	2	58.22
20981	52 3446	6.8 K5	23 24 0.226	279.70	1.60	52 53 31.48	1979.6	2.8	3	58.31
20984	8 5061	8.4 G5	23 24 7.556	303.85	.23	9 28 28.48	1979.8	3.0	2	58.32
20991	54 2975	8.2 K5	23 24 31.883	278.24	1.69	54 41 56.16	1980.3	2.7	2	58.21
20996	79 781	8.4 K0	23 24 44.264	192.44	2.11	79 53 36.09	1980.6	1.7	2	58.68
21001	43 4462	8.1 K5	23 24 55.183	287.94	1.23	43 35 18.36	1980.8	2.8	2	57.67
21002	29 4930	8.0 K5	23 24 55.697	295.75	.77	29 36 58.55	1980.8	2.9	2	58.24
21003	36 5069	8.7 K0	23 25 4.089	292.16	.99	36 46 23.68	1981.0	2.8	2	58.86
21013	− 3 5644	8.4 K5	23 25 52.882	308.34	−.08	− 2 55 43.83	1982.1	2.9	2	58.74
21015	5 5176	8.3 K0	23 25 55.733	305.41	.14	5 31 55.74	1982.2	2.9	2	57.74
21031	22 4846	8.6 K0	23 27 8.910	299.27	.59	22 52 24.47	1983.7	2.7	2	58.15
21038	23 4752	7.0 K0	23 27 24.782	298.70	.64	24 29 48.38	1984.0	2.7	2	58.22
21039	34 4938	7.5 K5	23 27 25.312	294.20	.94	34 44 17.80	1984.0	2.6	2	58.15
21041	44 4430	8.8 A0	23 27 31.894	288.32	1.31	45 12 41.78	1984.2	2.5	2	57.68
21056	8 5072	8.0 K2	23 28 48.481	304.30	.25	9 29 7.86	1985.7	2.6	2	56.76
21062	48 4082	7.3 K0	23 29 1.774	286.45	1.50	49 13 54.90	1986.0	2.4	2	57.22
21063	58 2607	7.0 K5	23 29 4.491	277.19	2.01	59 11 10.48	1986.0	2.3	2	58.23
21099	− 1 4456	8.8 K2	23 31 33.426	307.53	.00	− 0 42 0.65	1988.8	2.4	3	58.15
21116	66 1619	7.2 K0	23 32 53.539	269.79	2.69	67 12 55.09	1990.3	1.9	3	58.07
21126	46 4089	9.0 K0	23 33 25.098	290.66	1.45	47 9 2.17	1990.8	2.0	4	58.76
21130	6 5174	7.7 K0	23 33 42.163	305.56	.19	6 35 3.19	1991.1	2.1	2	57.70
21138	20 5357	7.8 K0	23 34 25.532	301.48	.58	21 26 46.78	1991.8	2.0	4	58.48
21141	34 4966	7.9 K2	23 34 34.104	296.76	1.01	35 31 21.12	1991.9	2.0	2	58.28
21142	37 4872	8.2 K2	23 34 34.989	295.58	1.11	38 27 42.31	1991.9	2.0	2	57.68
21147	55 2990	7.2 K5	23 34 48.683	285.92	1.89	55 36 59.84	1992.2	1.9	2	57.75
21150	18 5180	8.9 K0	23 34 56.090	302.16	.53	19 30 15.44	1992.3	2.0	2	58.69
21151	36 5087	8.7 K5	23 34 56.857	296.16	1.08	37 27 45.96	1992.3	1.9	2	58.85
21154	68 1384	8.0 K2	23 35 22.053	270.38	2.94	68 47 51.41	1992.7	1.7	3	58.72
21163	64 1835	8.0 K0	23 35 42.401	276.79	2.60	65 9 25.51	1993.0	1.7	2	58.74
21171	7 5066	8.4 F5	23 36 19.506	305.38	.23	8 2 10.48	1993.6	1.9	2	58.68
21174	53 3207	7.3 K0	23 36 27.396	288.35	1.83	54 9 56.29	1993.7	1.7	2	58.22
21175	16 4959	8.1 K2	23 36 28.478	303.21	.46	16 44 14.06	1993.7	1.8	2	58.35
21177	60 2598	7.3 K5	23 36 38.574	282.78	2.29	61 1 28.79	1993.9	1.7	2	58.30
21188	4 5036	8.0 K5	23 37 44.837	306.30	.15	4 31 44.57	1994.8	1.8	2	57.74
21190	17 4957	8.5 G5	23 37 50.962	303.05	.51	18 21 58.18	1994.9	1.7	2	58.69
21195	2 4701	8.8 A0	23 38 17.493	306.59	.12	3 20 59.71	1995.3	1.7	4	58.76
21200	− 3 5688	8.8 K0	23 38 39.454	308.01	−.05	− 3 8 11.14	1995.6	1.7	2	58.21
21217	11 5044	8.4 A3	23 39 27.816	304.68	.36	12 27 59.46	1996.2	1.6	2	57.70
21223	37 4881	8.9 A5	23 39 51.226	298.27	1.12	37 40 15.24	1996.5	1.5	3	57.76
21240	84 536	7.7 K0	23 40 50.816	174.82	2.49	85 11 28.91	1997.3	.6	2	57.22
21243	59 2762	7.9 M0	23 41 9.183	288.56	2.28	59 40 27.94	1997.5	1.3	2	57.70
21244	21 4977	7.9 M0	23 41 10.540	302.97	.62	21 39 46.12	1997.5	1.4	2	58.79
21247	41 4853	7.4 K0	23 41 36.340	297.62	1.31	42 11 9.09	1997.8	1.3	2	58.30
21248	61 2510	8.4 K0	23 41 38.173	286.82	2.52	62 27 7.53	1997.8	1.2	2	57.68
21254	28 4630	8.4 K0	23 42 2.383	301.41	.85	29 29 36.16	1998.1	1.3	3	57.08

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T′ (P. M.).

T in centuries from 1900. 0, T′ in centuries from epoch.

No.	B.D. No.		M + Sp.	R.A. 1950	Precession 1st Term	Precession 2nd Term	Decl. 1950	Precession 1st Term	Precession 2nd Term	No. Obs.	Epoch 1900+
21255	15	4880	8.4 K0	23 42 5.674	304.30	.47	16 12 16.05	1998.1	1.3	2	58.69
21256	6	5197	7.1 K0	23 42 15.722	306.08	.22	6 54 51.34	1998.3	1.3	2	57.28
21267	31	4965	8.7 G0	23 42 51.581	301.11	.94	31 54 50.00	1998.7	1.2	2	57.28
21276	18	5209	8.5 A5	23 43 27.551	303.96	.56	19 16 15.52	1999.0	1.2	2	57.75
21278	− 0	4566	7.3 G5	23 44 0.970	307.28	.06	0 15 9.47	1999.4	1.2	2	57.68
21280	36	5117	7.6 K5	23 44 13.276	300.34	1.12	37 13 50.31	1999.5	1.1	2	58.28
21282	16	4983	7.7 K5	23 44 19.887	304.49	.50	17 15 5.44	1999.6	1.1	3	58.71
21283	27	4619	7.0 M0	23 44 20.902	302.45	.82	28 8 31.74	1999.6	1.1	2	57.76
21291	− 4	5955	8.6 F2	23 44 49.487	307.97	−.06	− 4 10 52.11	1999.9	1.1	2	58.15
21294	45	4325	7.8 K2	23 45 5.773	298.42	1.50	45 44 25.04	2000.0	1.0	2	59.80
21296	− 1	4489	7.1 K0	23 45 8.231	307.48	.02	− 1 2 23.21	2000.0	1.0	2	58.35
21298	3	4895	8.2 K0	23 45 11.373	306.73	.16	3 57 7.99	2000.1	1.0	2	59.34
21301	7	5086	8.1 K2	23 45 45.272	306.17	.26	7 54 38.41	2000.4	1.0	2	57.75
21303	14	5058	8.0 F8	23 45 52.486	305.15	.44	14 47 36.93	2000.4	.9	2	57.29
21306	29	5002	7.9 M2	23 45 58.824	302.56	.90	30 14 58.97	2000.5	.9	2	57.76
21307	41	4869	8.0 K2	23 46 3.165	300.03	1.32	41 54 56.73	2000.6	.9	2	59.34
21315	20	5375	8.2 K0	23 46 30.669	304.33	.61	20 50 29.49	2000.8	.9	4	59.23
21317	9	5283	8.7 A0	23 46 35.722	305.96	.31	9 56 8.03	2000.8	.9	4	59.79
21319	67	1564	8.4 M0	23 46 44.281	287.82	3.34	68 23 26.10	2000.9	.8	2	58.22
21328	12	5027	8.7 K0	23 47 37.885	305.66	.40	13 2 15.73	2001.3	.8	2	58.35
21330	66	1648	8.4 K0	23 47 55.866	290.53	3.24	67 17 29.21	2001.5	.7	2	57.22
21331	62	2310	7.0 K2	23 47 57.137	293.27	2.77	63 27 56.60	2001.5	.7	2	58.30
21335	40	5161	7.7 K2	23 48 26.823	301.50	1.30	40 53 8.36	2001.7	.7	2	57.24
21340	22	4914	9.1 M0	23 48 49.755	304.56	.68	23 1 7.79	2001.9	.7	2	57.76
21341	58	2660	8.0 G0	23 48 50.429	296.57	2.36	58 50 24.67	2001.9	.6	2	58.22
21343	− 4	5965	8.2 K5	23 48 54.905	307.74	−.03	− 3 40 55.37	2001.9	.7	2	58.15
21344	26	4707	8.2 K0	23 48 55.470	304.03	.81	27 3 28.71	2001.9	.6	2	58.85
21355	19	5164	8.7 A5	23 49 47.114	305.21	.59	19 34 36.39	2002.3	.6	2	58.21
21357	28	4655	8.5 A0	23 50 1.084	304.15	.86	28 40 27.14	2002.4	.5	4	59.09
21376	− 0	4581	7.8 M0	23 51 18.358	307.30	.08	0 19 5.20	2002.8	.4	2	57.68
21380	11	5072	7.8 K5	23 51 22.761	306.28	.38	11 43 21.79	2002.9	.4	3	58.08
21389	54	3066	8.2 K0	23 52 3.529	300.75	2.10	54 51 7.41	2003.1	.3	2	57.76
21390	− 2	6059	7.5 K5	23 52 4.897	307.51	.01	− 2 13 27.61	2003.1	.3	2	58.24
21391	17	5002	7.3 K0	23 52 14.355	305.82	.56	18 28 6.68	2003.1	.3	2	58.24
21400	37	4903	8.4 A0	23 52 31.403	303.95	1.20	37 47 30.59	2003.2	.3	2	58.75
21420	45	4367	8.0 K2	23 53 52.818	303.67	1.57	45 43 33.58	2003.5	.2	2	58.22
21422	− 1	4504	8.8 K0	23 53 53.917	307.40	.04	− 1 12 38.30	2003.5	.2	2	57.24
21423	1	4804	8.8 G5	23 53 56.879	307.23	.12	1 38 26.51	2003.6	.2	3	58.74
21434	17	5013	7.7 K0	23 54 58.287	306.38	.56	17 58 17.69	2003.8	.1	2	57.79
21435	19	5176	8.0 G5	23 55 3.159	306.27	.62	20 3 7.36	2003.8	.1	2	57.76
21439	31	5007	7.9 F0	23 55 29.757	305.70	.99	31 45 6.35	2003.9	.0	2	58.23
21445	38	5103	8.0 K2	23 55 49.874	305.38	1.26	38 41 6.93	2003.9	.0	2	57.23
21450	30	5066	8.1 K2	23 56 14.305	306.03	.96	30 32 33.10	2004.0	−.1	2	58.15
21454	15	4916	8.6 K0	23 56 18.927	306.73	.50	15 33 31.45	2004.0	−.1	2	58.25
21457	3	4912	8.0 K5	23 56 22.484	307.18	.19	3 59 42.85	2004.0	−.1	2	58.87
21462	40	5202	8.2 K2	23 56 46.003	305.70	1.36	40 51 2.74	2004.1	−.1	2	58.74
21467	62	2343	8.0 K2	23 57 11.327	304.15	2.92	62 42 48.51	2004.1	−.2	2	58.27
21469	10	5018	7.2 K2	23 57 17.599	307.01	.39	11 23 43.23	2004.1	−.2	2	58.86
21472	35	5149	8.8 G5	23 57 34.939	306.29	1.17	36 18 26.80	2004.1	−.2	3	58.08
21475	1	4814	7.8 K2	23 57 49.780	307.27	.15	2 23 49.24	2004.2	−.2	2	57.24

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

No.	B.D. No.	M + Sp.	R.A. 1950	Precession		Decl. 1950	Precession		No. Obs.	Epoch 1900+
				1st Term	2nd Term		1st Term	2nd Term		
21480	- 0 4603	8.2 K0	23 58 5.174	307.33	.09	- 0 3 19.82	2004.2	-.2	2	57.22
21489	71 1246	7.5 K0	23 59 2.253	305.61	4.62	71 57 30.02	2004.2	-.3	2	57.22
21495	20 5419	8.3 K5	23 59 18.042	307.17	.66	20 44 52.67	2004.2	-.4	2	58.22

Position 1950 + T = Position 1950 + T (1st term) + T^2 (2nd term) + T' (P. M.).

T in centuries from 1900. 0, T' in centuries from epoch.

Part II

CORRECTIONS TO THE 3753 AGK3 REFERENCE STARS

The corrections are in the form observed minus AGK2.

No proper motion has been applied. The mean epoch and the number of observations are given.

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.	Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.
15	9	39	5213	-.032	.71	57.67	2	15	220	33	24	.019	-.17	58.22	2
15	10	31	5024	.057	.36	57.69	2	13	224	18	27	-.019	.79	58.28	2
17	14	58	2691	.006	.13	57.27	2	14	227	20	22	-.008	-.54	59.35	2
12	21	12	5059	.046	.03	57.25	2	15	229	35	46	-.011	-.24	58.31	2
14	24	21	5019	.038	-.78	58.22	2	17	232	51	40	-.068	.39	57.69	2
17	26	64	1893	-.034	.25	58.23	2	11	239	0	42	-.031	.09	58.22	2
11	32	0	5084	-.024	.08	58.85	2	12	241	8	31	.016	.11	57.75	2
17	35	50	4233	-.111	-.04	57.21	2	17	246	49	49	-.020	-.97	59.35	2
17	39	67	1599	-.048	-.31	58.76	2	17	248	54	37	.019	.38	59.77	4
11	45	-4	6019	-.067	-.21	58.86	2	15	250	38	31	-.021	.39	57.82	3
17	47	52	3598	.015	-.25	57.77	2	11	259	2	37	.019	-.64	58.43	2
8	48	87	220	-.847	1.11	58.24	2	11	261	3	34	.016	.70	59.53	4
14	51	23	4853	.054	.88	57.69	2	12	266	10	31	-.035	.15	58.86	2
13	52	15	4937	.050	.67	57.28	2	11	271	-1	31	.038	.18	59.91	2
12	54	8	5172	.094	.34	58.36	2	18	276	77	6	-.143	.78	58.15	2
11	55	0	4619	.062	.25	58.38	3	12	288	6	30	.020	-1.20	57.43	3
11	57	-2	6099	-.025	.04	59.32	2	15	291	32	53	.001	.01	57.68	2
6	58	42	4834	-.008	-.31	59.99	4	12	303	11	51	-.005	.13	57.27	2
17	59	69	1383	-.044	.64	58.75	2	15	307	36	47	.064	-.52	57.70	2
15	60	32	4771	.084	-.11	57.75	2	11	312	2	44	-.029	.14	57.28	2
14	64	22	4955	.017	-.61	59.34	2	13	319	15	56	.040	.34	57.07	3
16	69	45	4418	-.016	-.13	59.75	4	13	321	19	57	-.041	.31	58.30	4
14	71	19	5210	.038	-.16	58.78	2	15	327	34	51	.032	.42	57.76	2
13	74	16	1	.026	.71	58.43	3	12	328	8	45	.022	.36	57.75	2
16	80	41	2	.009	.28	59.75	3	17	337	54	59	-.041	-.47	57.75	2
12	86	13	3	.061	-.38	57.23	2	17	343	50	72	-.011	.42	58.21	2
11	90	0	6	-.006	.28	58.30	2	11	344	0	54	-.023	.22	58.27	2
17	105	59	4	-.033	-.31	57.74	2	15	345	31	52	-.003	-.80	58.88	2
12	111	11	10	.037	-1.17	57.79	2	16	350	46	78	-.050	.45	58.11	3
15	117	31	8	-.063	-.80	57.29	2	12	352	9	44	-.012	-.59	58.24	2
12	122	9	12	.037	.38	57.69	2	15	357	37	68	.020	.01	57.75	2
11	130	-1	9	.009	.70	58.75	2	15	359	30	60	.052	.52	57.29	2
14	136	21	10	.071	-.41	58.34	2	11	360	2	54	.028	.19	57.79	2
17	142	56	19	-.026	.10	58.30	2	12	363	13	52	.018	-.55	57.67	2
15	146	28	19	.011	-2.06	57.75	2	14	364	21	46	.052	-.11	58.89	2
15	149	36	13	.004	.78	57.83	2	11	367	3	48	-.010	.49	58.43	2
14	153	20	12	-.007	-.03	58.15	2	16	370	41	67	.093	-.07	58.24	2
16	157	42	30	.090	.78	57.79	2	12	373	6	54	.077	.03	57.74	2
11	166	-4	12	.090	.34	58.22	2	15	374	32	69	.104	.66	58.23	2
18	170	75	5	.048	.36	58.21	2	16	376	47	113	.026	-.32	58.88	2
11	175	-3	18	.059	-1.06	58.34	2	12	379	10	54	.073	.39	58.27	2
15	182	32	26	-.027	.71	57.22	2	16	392	44	101	.179	-1.13	58.29	2
15	195	37		-.044	.67	58.22	2	13	403	17	61	.004	.47	57.20	2
18	199	80	3	.049	-.19	58.74	2	16	408	49	108	.021	.85	58.00	4
13	200	15	30	.072	.73	57.69	2	13	418	18	67	.056	.68	57.40	3
16	204	45	48	-.017	.53	57.24	2	15	436	36	82	.033	.31	57.67	2
6	207	47	49	.130	.80	58.25	2	11	437	-4	59	-.067	.59	57.79	2
15	208	30	31	-.028	-.25	57.75	2	11	447	-3	64	.010	.31	57.67	2
12	209	9	23	.011	.14	59.76	3	11	453	2	67	.010	.06	57.28	2
16	217	43	45	.058	.08	57.83	3	17	458	68	34	.006	1.11	58.15	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.	Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.
11	460	0	77	.006	.42	57.75	2	13	718	15	126	.022	.56	57.10	3
14	464	22	86	-.017	.74	58.24	2	18	721	84	14	-.689	.70	58.40	3
17	469	61	125	.010	-.03	57.30	2	15	729	29	145	.030	.18	57.30	2
17	471	67	56	-.069	.04	57.47	3	15	733	36	145	-.048	-.43	58.81	2
18	475	71	25	-.153	-.10	58.74	2	11	747	1	158	-.013	.13	57.52	4
15	478	28	96	-.205	-2.10	57.67	2	12	751	10	105	.029	-.30	57.79	2
12	482	6	75	.031	-.01	58.78	4	16	761	41	163	.034	-.10	57.23	2
15	483	37	98	.017	.12	58.28	2	12	763	12	108	.034	.04	57.40	2
17	484	56	91	-.025	-.30	58.30	2	11	765	0	142	.005	-.12	58.24	2
11	503	-4	64	.005	.30	57.24	2	15	767	35	167	-.017	-.02	58.28	2
16	509	44	128	-.098	.88	57.22	2	11	775	3	127	-.013	-.14	57.48	3
14	516	21	77	-.027	.58	57.74	2	18	776	69	54	-.051	-.01	58.82	2
11	517	1	108	.033	.30	57.76	2	17	778	58	136	-.065	.43	57.79	2
12	518	5	81	-.014	-.44	57.68	2	17	784	59	145	-.067	.38	57.28	2
11	519	-1	75	.012	.53	57.69	2	12	790	13	130	.053	-.41	58.24	2
15	528	33	89	-.072	-.20	57.24	2	13	791	16	90	-.023	-.09	58.84	4
12	531	7	86	.027	1.37	57.76	2	12	792	9	109	-.018	.26	57.75	2
15	537	31	89	.047	.05	57.69	2	12	802	11	120	.012	.46	57.68	2
13	543	15	100	-.004	.63	58.15	2	17	803	52	213	-.045	.44	58.03	4
11	549	3	86	.031	-.11	57.69	2	12	808	5	129	.008	-.12	58.85	2
14	550	20	90	.084	.50	58.07	3	15	817	26	161	.124	.69	57.79	2
13	556	18	93	-.026	.29	58.20	2	14	820	21	126	.016	-.70	58.27	2
12	567	11	86	.000	-.98	57.76	2	13	821	15	144	.054	.56	58.81	2
17	568	57	130	.010	.21	57.24	2	18	823	73	47	-.090	.30	58.21	2
16	570	43	135	-.025	-.59	58.30	2	16	833	40	199	-.047	-.15	57.68	2
14	575	22	106	-.089	1.04	57.69	2	11	840	1	185	-.012	.62	57.29	2
15	589	34	108	-.036	-.09	57.68	2	11	851	-1	131	.026	-.41	60.35	2
14	597	24	104	.008	.52	57.28	2	12	858	7	146	-.062	-.41	58.32	2
16	601	48	219	-.061	1.22	58.27	2	12	860	10	115	.019	-.03	57.22	2
13	605	17	93	-.003	-.11	59.06	4	15	872	29	168	.016	.38	58.21	2
16	612	41	123	-.116	.08	57.31	2	15	880	32	177	.002	.24	57.78	2
12	619	14	105	-.072	.34	57.24	2	12	883	12	126	.048	-1.32	57.67	2
12	623	7	104	.003	.02	57.22	2	17	892	52	248	-.047	-.20	59.48	4
15	632	30	114	-.079	-.37	58.37	3	15	894	36	187	.031	-.69	59.80	4
15	635	38	108	.036	.86	57.76	2	15	896	37	199	-.005	1.25	58.29	2
16	637	45	199	-.049	.82	57.29	2	11	902	0	163	.024	-.33	58.31	2
17	644	50	141	-.027	-.83	58.27	2	12	905	8	166	.014	.87	57.41	3
12	646	10	89	.006	.18	57.79	2	12	918	5	144	-.004	-.35	57.21	2
11	649	-3	99	-.016	.47	58.39	2	11	946	4	182	.083	.49	58.22	2
14	654	20	106	-.049	-.01	58.87	2	15	947	33	169	.019	-.03	57.46	3
17	656	60	107	-.032	.18	58.24	2	17	956	59	188	.170	.69	58.31	2
13	659	18	106	-.047	.41	59.36	2	5	964	25	170	-.049	.78	57.73	2
11	660	-4	95	.011	.46	59.37	2	12	967	9	132	.027	-.41	58.31	2
17	669	57	151	-.009	.61	58.24	2	16	978	39	268	-.007	.78	57.78	2
12	676	12	95	.011	.42	59.27	2	15	989	30	177	-.101	1.23	58.22	2
12	685	5	109	-.017	.37	57.79	3	16	997	48	355	.021	-.80	58.23	2
13	691	14	121	-.024	.25	57.74	2	12	999	5	150	-.045	-.07	59.00	2
12	694	9	97	.015	.28	58.85	4	12	1007	13	175	-.021	-.22	58.43	2
16	711	48	257	.013	.50	57.22	2	14	1008	20	171	.027	-.91	58.87	2
18	713	70	57	.017	-.56	57.23	2	11	1015	-1	156	-.033	.65	58.90	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.	Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.
17	1020	52	279	-.032	-.23	58.29	2	12	1317	12	189	.012	.69	57.77	3
17	1022	56	221	-.058	.12	59.00	2	17	1321	54	315	.038	-.04	58.31	2
17	1025	62	224	-.035	.28	58.78	2	11	1325	0	247	.031	.42	58.84	4
14	1039	24	190	-.041	-.29	59.31	2	16	1327	41	300	-.026	.49	58.88	2
12	1047	8	187	.018	-1.18	58.22	2	15	1335	29	260	-.002	.00	57.37	2
18	1049	70	87	-.027	-.22	57.75	2	11	1341	-2	242	-.015	-.31	58.48	3
11	1056	-2	184	.047	.18	58.82	2	13	1342	16	172	.055	-.04	59.07	4
13	1059	18	163	.020	.07	57.75	2	13	1344	18	207	-.025	-.25	57.88	2
17	1065	59	220	.081	-.72	58.94	2	11	1349	3	216	-.005	.25	58.80	2
12	1075	6	185	-.029	1.51	57.79	2	12	1361	13	238	-.023	.36	57.73	4
16	1077	49	335	.010	.09	57.67	2	12	1363	7	234	.099	.01	57.35	2
18	1079	80	34	-.175	.14	58.22	2	17	1367	51	338	.074	.58	58.30	2
12	1083	12	155	-.007	-.11	58.81	2	12	1375	9	189	.038	-.47	57.22	2
16	1103	43	262	-.031	.63	58.83	2	16	1380	46	397	-.040	.02	57.28	2
18	1111	76	39	-.490	0.00	57.41	2	16	1384	47	462	.153	-.51	57.90	2
11	1114	0	215	.007	.79	57.84	2	14	1386	23	211	-.061	.40	58.12	3
15	1122	39	301	-.025	-.36	58.89	2	15	1390	32	280	.014	.57	57.79	2
14	1125	21	173	.034	-.33	58.22	2	12	1412	9	194	.014	-.28	57.53	4
12	1130	6	195	-.066	1.49	57.24	2	15	1416	28	273	-.019	-.45	58.33	2
15	1131	33	205	.025	.34	58.76	2	11	1440	2	244	.030	.98	57.54	4
12	1139	11	167	.053	.27	58.23	2	11	1453	-2	270	.046	-.36	58.43	2
17	1144	64	150	-.049	.05	57.75	2	14	1458	22	257	-.022	-1.26	58.86	2
15	1145	36	224	.057	.11	57.42	2	13	1464	17	247	.001	-.21	57.75	2
13	1156	14	204	.027	.26	57.21	2	16	1466	44	352	-.088	-.11	57.83	2
17	1158	68	94	.046	-.89	57.28	2	11	1478	3	230	-.001	-.05	59.34	2
11	1165	-4	189	-.095	-.17	57.76	2	13	1483	15	251	.031	-.16	57.78	2
12	1172	13	204	.000	.78	57.15	3	15	1487	24	250	.067	.11	57.79	2
15	1176	25	228	.065	-.52	58.58	4	12	1493	10	225	.043	-.19	58.76	2
15	1182	32	245	-.024	-.06	58.76	2	12	1503	13	266	.010	-.08	57.44	3
16	1185	47	398	-.053	-.47	58.78	2	12	1504	5	232	.034	-.20	58.30	2
14	1187	22	221	.080	.53	58.31	2	11	1513	0	264	.072	-.81	59.99	5
12	1189	7	204	.025	-2.09	58.34	2	11	1525	1	313	.076	-.08	57.76	2
17	1191	58	230	.025	-.02	58.32	2	15	1527	26	290	-.108	-1.08	58.35	2
17	1193	56	264	-.006	-.21	58.24	2	16	1535	40	362	.254	-1.61	57.78	2
11	1210	-1	182	-.010	.98	57.78	2	11	1537	-4	269	-.018	-.78	58.84	4
15	1214	34	243	.009	.88	58.31	2	11	1560	0	289	.059	-.60	58.30	2
11	1230	-2	213	-.036	.12	58.76	2	12	1561	12	231	.066	.16	58.34	2
13	1232	17	206	.006	-.38	58.54	4	11	1563	0	274	-.019	-.27	58.30	2
15	1241	24	212	.036	-.88	57.28	2	16	1577	41	353	-.077	-.68	57.75	2
17	1244	51	308	.027	.61	58.79	2	15	1578	34	311	.021	-.29	58.77	2
11	1245	1	262	-.023	-.05	58.89	2	17	1583	61	334	-.039	.24	57.16	3
16	1267	48	448	-.005	.44	58.29	2	15	1586	32	323	-.094	.68	57.29	2
12	1269	8	238	.034	-1.35	57.28	2	15	1589	26	303	-.039	-1.40	57.78	2
17	1273	65	173	.147	.26	58.22	2	16	1606	42	388	-.036	-1.35	57.79	2
17	1275	59	261	.020	-.42	57.89	3	13	1619	17	273	-.001	.28	57.37	2
18	1278	72	75	.012	.61	57.79	2	13	1621	15	273	-.010	.11	57.85	2
11	1289	-1	199	.040	-.32	59.34	2	16	1630	46	467	-.062	-.78	58.79	2
17	1295	57	308	-.089	-.02	58.83	2	11	1638	0	302	.068	.55	58.31	2
12	1296	5	196	.072	-.61	58.78	2	11	1641	3	257	.017	-.12	58.31	2
17	1309	50	299	-.089	.19	57.89	2	12	1655	6	296	-.011	.35	58.55	4

OBSERVED - AGK2							
Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
4	1657	23	254	-.053	-.28	58.34	2
16	1658	40	400	-.011	-.42	58.79	2
17	1662	53	419	.007	.34	57.86	2
12	1671	13	296	.040	-.53	58.78	2
17	1674	69	123	.022	-.23	57.27	2
17	1694	51	444	.006	-.54	57.30	2
15	1696	34	338	-.022	-.11	57.29	2
17	1736	62	332	-.026	-.15	57.29	2
13	1738	15	286	-.025	.62	57.31	2
15	1739	28	335	.060	-1.27	57.33	2
17	1744	55	466	-.007	-.01	57.85	2
16	1749	40	415	-.277	-.05	57.27	2
18	1752	81	67	.017	.05	57.44	3
15	1758	39	450	-.041	1.19	57.29	2
12	1759	6	314	-.024	-.06	58.55	4
16	1768	47	544	.008	.89	57.76	2
12	1769	12	264	.003	.03	58.30	2
12	1773	4	340	.050	-.35	59.32	2
11	1776	-1	276	-.017	-.15	58.44	2
15	1777	31	354	-.012	-.16	58.30	2
16	1778	44	406	.037	.32	57.37	2
11	1780	0	335	.107	.56	59.12	4
16	1784	42	430	.076	.04	57.24	2
15	1785	36	394	.049	.06	57.29	2
13	1787	18	261	.018	-.31	58.34	2
13	1790	14	328	.015	-.34	59.36	2
12	1792	8	316	.065	-.08	59.92	2
17	1796	63	277	-.058	.60	58.31	2
15	1798	35	396	.046	.37	58.80	2
13	1807	17	306	.059	-.21	58.60	4
14	1808	22	298	.001	-.46	58.30	2
17	1814	56	416	.036	-.03	57.77	2
17	1827	59	403	-.018	-.04	57.30	2
12	1829	9	266	-.008	.19	58.89	2
12	1836	4	348	.026	-.15	57.30	2
12	1842	12	282	.024	-.63	57.29	2
17	1846	69	136	-.007	.17	58.30	2
11	1848	3	284	.030	-.75	58.36	2
17	1849	51	500	-.068	.54	58.31	2
11	1851	0	352	.030	.62	57.75	2
12	1862	5	285	.079	-1.24	58.28	2
13	1863	15	305	.035	.43	57.44	3
12	1866	10	292	.033	.23	57.86	2
11	1870	-1	296	.048	.56	59.33	2
11	1878	-3	320	-.021	-.01	57.88	2
17	1885	53	459	-.015	-.06	57.89	2
15	1886	31	370	.057	-.04	59.88	2
14	1888	21	291	-.008	.17	58.30	2
14	1889	22	309	-.001	-.38	58.79	2
12	1900	11	288	.010	-.19	57.82	3

OBSERVED - AGK2							
Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
16	1901	45	557	.044	.03	58.34	2
17	1905	65	234	-.101	-.62	57.75	2
15	1908	35	416	-.001	.48	58.43	2
16	1920	47	583	-.045	-.36	57.81	3
12	1924	9	280	-.010	-.19	57.81	2
17	1925	58	399	.059	-.30	57.79	2
12	1927	13	351	.077	.11	58.29	2
13	1928	19	332	-.008	.43	58.43	2
11	1929	-2	379	.024	-.47	58.86	2
16	1941	46	538	.047	.07	58.92	2
15	1942	25	368	-.076	-.88	58.86	2
3	1950	18	284	-.001	-.19	57.29	2
17	1951	49	602	-.097	-.07	57.77	2
14	1956	20	358	-.041	1.52	58.77	2
16	1966	41	430	-.033	.48	58.79	2
18	1968	77	78	.066	.50	57.27	2
12	1971	10	306	-.003	-.55	57.81	2
16	1973	48	642	.110	-.40	57.22	2
5	1983	29	385	.017	-.42	58.31	2
11	1984	1	403	.031	.14	58.89	4
12	1987	9	294	.012	.34	59.30	2
11	1990	-3	345	.032	1.26	58.90	2
13	1991	16	266	-.012	-.42	58.29	2
15	1996	33	399	.061	.07	59.47	2
16	2001	44	456	-.005	.56	57.89	2
11	2006	-2	389	.000	.29	58.86	2
15	2011	36	458	-.042	.64	58.79	2
12	2015	7	362	-.054	-.34	57.31	2
15	2031	31	403	.019	.57	57.89	2
17	2036	54	525	-.042	.28	58.31	2
17	2038	58	450	.006	.39	57.75	2
15	2045	30	379	.038	.22	57.31	2
12	2046	9	306	.014	.24	57.82	2
14	2049	22	331	.013	-.15	57.30	2
12	2055	11	326	.049	.44	58.35	2
11	2057	0	391	.060	-.37	58.46	2
15	2060	37	538	.072	-.01	59.52	4
11	2072	0	357	.010	-.28	58.42	2
18	2073	78	82	.056	.30	57.77	2
12	2079	7	375	.054	-.39	57.24	2
15	2083	35	465	-.036	.45	57.29	2
12	2084	10	318	.049	.03	57.84	2
17	2090	55	609	-.010	-.12	58.43	2
16	2092	46	565	-.030	.08	58.41	2
17	2095	59	483	-.049	.30	57.76	2
15	2096	28	409	.003	.89	59.18	4
18	2100	73	136	-.052	.20	57.84	2
15	2109	31	418	.023	.31	57.30	2
11	2114	-3	375	.007	-.37	59.21	2
12	2121	6	360	.067	.26	58.65	4

OBSERVED - AGK2							
Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.
13	2129	16	291	-.006	-.59	57.79	2
14	2131	22	347	-.063	1.28	57.85	2
11	2142	-1	338	.014	.69	58.32	2
14	2155	23	330	.001	-.33	57.76	2
17	2162	52	587	-.033	-.20	58.88	2
15	2165	30	399	-.104	-.51	58.43	2
16	2168	43	504	-.036	1.07	58.30	2
12	2171	5	343	.066	-.36	58.30	2
16	2176	47	640	.008	.06	58.35	2
13	2185	18	315	.052	.28	57.86	2
11	2213	-4	412	.024	.20	57.94	2
14	2217	20	416	-.022	.25	58.46	2
12	2221	6	380	-.003	.24	58.30	2
11	2222	-1	352	.071	.01	57.94	2
12	2224	14	418	-.012	-.35	59.34	2
18	2226	80	80	.303	.52	57.79	2
15	2228	29	434	.032	-.32	58.35	2
12	2235	5	356	.014	.40	57.29	2
11	2254	2	400	.033	.16	58.32	2
11	2260	0	387	.007	.26	58.35	2
15	2261	30	414	-.060	.02	57.37	2
17	2266	62	426	-.012	.01	57.84	2
15	2268	38	510	.053	.30	57.78	2
15	2270	28	437	.021	-.83	59.31	2
13	2272	15	354	.004	1.24	58.30	2
18	2273	74	112	-.139	.32	57.84	2
12	2275	13	410	.031	.31	58.34	2
12	2276	9	339	.038	-.14	59.35	2
15	2278	26	432	.029	.16	58.78	2
18	2283	72	141	-.191	.30	58.34	2
15	2286	36	524	.020	-.27	60.03	2
13	2289	17	403	-.021	-.43	59.93	2
12	2298	11	365	.003	-.29	57.28	2
13	2308	19	394	-.024	.11	57.51	3
12	2325	7	408	-.015	-1.30	57.89	2
18	2328	70	198	-.083	.63	57.74	2
15	2333	35	531	.047	-.37	58.30	2
12	2338	12	370	-.022	-.61	58.34	2
13	2339	17	414	-.047	1.11	58.32	2
14	2340	20	444	-.043	1.37	58.32	2
17	2343	67	222	.001	.71	59.31	2
11	2346	-2	469	.026	1.21	58.42	2
15	2350	24	381	.026	-.31	58.99	2
16	2351	40	568	.078	-.43	59.36	2
16	2355	44	560	.041	-.17	57.38	2
14	2357	21	366	.076	1.14	57.78	2
11	2384	1	474	.052	.20	57.28	2
14	2385	23	362	.038	.29	57.79	2
17	2393	54	602	.014	.20	57.90	2
16	2394	44	569	.026	.53	58.31	2
12	2399	8	416	-.004	-.38	58.77	2
15	2403	28	456	.031	-2.42	58.32	2
12	2409	13	446	-.014	.66	58.27	2
15	2411	33	503	-.023	-.17	60.77	3
13	2413	16	342	.025	.50	57.94	2
17	2420	64	346	.038	-.28	58.81	3
15	2422	38	551	.147	.01	58.90	2
16	2428	42	628	-.092	-.68	58.43	2
14	2431	21	374	-.028	.05	57.89	2
13	2442	17	438	-.050	.56	57.90	2
13	2454	19	424	.027	.77	56.96	2
15	2465	32	507	-.018	.56	57.75	2
4	2468	20	467	-.121	.20	59.30	2
11	2470	-4	476	-.004	.29	57.78	2
16	2496	44	591	.060	.18	58.53	2
17	2499	51	640	.077	-.64	58.43	2
12	2511	6	436	.009	.11	59.31	2
13	2513	15	397	-.038	-.19	57.78	2
18	2517	75	109	-.204	-.76	59.34	2
15	2523	28	473	-.054	-1.08	58.92	2
12	2534	14	484	.042	.38	58.00	2
13	2536	18	370	.025	1.29	58.39	2
12	2549	10	388	.098	-.16	57.78	2
16	2554	46	656	-.002	.16	58.32	2
15	2557	37	660	.023	.02	57.90	2
11	2562	-3	459	.054	-.50	58.90	2
4	2567	22	405	.031	-.32	58.34	2
18	2580	85	50	-.208	.41	59.35	2
18	2585	72	153	.145	-1.05	59.45	2
12	2586	5	420	-.012	-.41	59.44	2
13	2608	17	461	.039	.09	57.78	2
15	2627	26	496	.076	-.39	57.40	2
11	2635	0	471	.069	.23	58.35	2
18	2637	74	128	.010	-.51	58.30	2
14	2638	22	416	-.049	-.17	57.90	2
12	2642	12	422	.035	.10	59.40	4
15	2643	35	607	.025	.20	58.43	2
16	2650	42	681	-.053	.13	58.84	2
16	2668	40	653	-.062	.16	57.94	2
5	2669	37	688	-.078	.16	57.87	2
14	2677	19	449	.001	.56	57.83	2
12	2682	10	405	.034	-.64	58.89	2
12	2686	13	494	.003	-.77	58.42	2
17	2688	50	691	-.050	.29	58.34	2
16	2692	45	700	-.058	-.25	58.31	2
11	2694	-4	520	.004	.03	58.43	2
12	2703	8	461	.064	.25	58.46	2
15	2711	25	484	-.105	.73	57.93	2
15	2712	27	477	.200	-1.19	59.35	2
14	2715	22	431	-.041	.26	57.94	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
13	2718	17	489	-.025	-.03	58.30	2	17	3011	65	345	.022	-.11	57.42	2
17	2720	58	556	-.037	-.97	58.88	2	17	3012	55	785	-.074	.47	58.88	2
12	2726	11	434	.013	.15	58.46	2	12	3014	6	527	.093	-.64	58.90	2
11	2730	3	431	.045	.95	58.31	2	11	3042	0	546	.102	.26	57.38	2
17	2731	53	616	.073	.45	57.40	2	14	3047	23	456	-.029	-.18	56.95	2
11	2743	4	496	.012	.69	57.85	2	15	3050	32	629	-.012	-.20	58.77	2
11	2752	0	522	.055	.63	56.95	2	15	3052	39	789	-.011	-1.18	58.99	2
12	2754	12	441	.046	.49	58.42	2	13	3054	16	444	.117	-.39	57.84	2
11	2781	-3	502	-.044	.69	57.83	2	13	3069	15	493	.044	-.83	57.84	2
12	2800	6	492	-.022	1.03	57.93	2	16	3073	44	717	-.027	.19	57.40	2
18	2807	73	171	-.024	-.30	57.85	2	17	3075	57	727	-.019	-.26	58.30	2
15	2809	29	534	-.102	.61	57.81	2	12	3082	9	447	.019	.23	58.86	2
12	2813	7	481	.069	.27	57.87	2	12	3091	7	514	.044	.09	57.88	2
15	2823	30	505	.094	.68	57.96	2	12	3094	6	540	-.029	-.54	57.94	2
15	2825	24	451	.004	-.77	58.34	2	13	3108	18	494	.033	.21	58.76	2
17	2840	63	404	.034	.25	59.00	2	15	3111	29	571	.034	-.34	58.88	2
15	2842	32	585	-.047	-.23	57.81	2	15	3117	27	519	-.006	-.90	58.43	2
12	2850	8	480	.023	-.86	58.30	2	12	3131	13	568	-.031	.16	57.39	2
12	2851	12	453	-.032	-.83	58.42	2	17	3136	62	581	.051	.18	58.42	2
11	2859	-2	581	-.005	.40	59.33	2	12	3137	14	575	-.011	-.15	57.27	2
17	2861	59	616	-.053	.45	57.96	2	18	3141	73	188	-.049	.01	57.85	2
11	2862	3	447	.029	.13	59.46	4	12	3142	9	453	.001	-.26	58.83	3
13	2863	15	453	.004	-.64	58.45	2	11	3161	2	563	.004	.19	58.40	2
16	2873	41	641	-.063	-.88	57.94	2	12	3162	10	460	-.004	-.87	58.31	2
11	2880	-1	466	.029	-.40	59.37	2	16	3167	46	774	-.099	.62	57.94	2
17	2883	61	546	-.034	.34	58.34	2	17	3171	52	703	-.031	.57	58.42	2
11	2893	2	510	.072	-.14	58.30	2	18	3172	79	106	.209	-.31	57.99	2
17	2896	53	639	-.007	-.14	57.41	2	7	3173	65	352	.019	.22	58.90	2
18	2902	81	107	-.145	-.24	57.28	2	12	3181	8	537	.052	.44	58.87	2
16	2917	42	738	-.018	-.01	57.37	2	15	3190	30	557	-.051	.12	58.30	2
17	2922	67	256	-.018	-.58	57.86	2	15	3199	36	732	-.027	.04	58.46	2
16	2923	47	802	-.152	-2.42	57.94	2	11	3202	0	622	.059	.50	57.86	2
15	2924	36	676	-.014	-.57	57.97	2	17	3206	60	720	-.007	-.61	57.84	2
16	2932	45	740	.008	-.01	57.97	2	13	3232	15	516	.002	.03	57.39	2
17	2933	57	715	-.007	-.31	59.32	2	15	3234	26	596	-.060	-.76	57.39	2
14	2934	19	507	.067	.24	59.62	4	18	3249	77	131	-.131	.48	57.29	2
11	2937	0	565	.041	.91	58.86	2	15	3252	34	712	-.061	.37	58.76	2
14	2939	24	471	-.044	.04	58.31	2	13	3257	18	521	-.015	-.01	57.83	2
12	2943	5	479	.057	-.56	59.53	3	15	3259	38	788	.002	.18	58.46	2
15	2945	26	542	.003	-.16	58.90	2	14	3275	20	616	-.103	1.69	57.88	2
18	2946	82	82	-.296	.34	58.41	2	12	3280	11	510	.002	.76	57.39	2
11	2953	-4	570	-.072	-.13	59.35	2	16	3285	44	782	.037	-.06	57.38	2
12	2956	7	500	-.031	-.35	58.99	4	16	3300	48	987	-.006	.44	57.87	2
12	2958	10	432	-.041	-.08	57.85	2	11	3301	-2	707	.063	-.42	58.31	2
16	2980	48	904	.023	-.06	56.95	2	11	3307	1	656	.047	.42	58.88	2
13	2989	16	436	.000	-.09	57.87	2	15	3309	31	644	.000	.69	58.88	2
13	2991	19	523	-.020	.62	57.39	2	12	3310	6	581	-.020	.33	57.86	2
12	3000	14	559	.009	-.34	58.36	2	11	3318	2	603	.027	.19	57.89	2
17	3007	62	566	.097	.37	59.26	3	15	3323	36	749	-.106	.44	58.39	2
11	3009	1	590	.040	.07	57.82	2	12	3326	10	479	-.013	.70	58.99	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
16	3327	46	795	.045	.20	59.03	2	18	3618	76	149	.075	1.48	58.28	2
17	3332	49	1024	-.050	-.48	58.88	2	11	3629	0	642	.050	.38	58.42	2
18	3333	84	66	-.090	1.35	58.28	2	14	3631	21	591	-.028	-1.43	58.86	2
11	3335	4	588	-.018	-.41	59.34	2	12	3646	7	597	-.002	.18	58.43	2
12	3339	12	508	.004	-.34	57.90	2	11	3661	3	563	.005	.14	57.97	2
17	3343	66	290	-.003	-.32	57.87	2	15	3668	25	678	.032	.06	57.85	2
17	3346	55	827	-.076	-.07	57.94	2	12	3672	9	543	-.053	-.17	57.99	2
15	3349	26	617	-.314	-.82	58.89	2	17	3691	55	852	.014	-.33	56.94	2
5	3354	30	576	.014	-1.12	58.91	2	12	3705	13	651	-.041	-1.25	57.82	2
12	3368	8	573	-.010	-.18	58.45	2	14	3708	21	603	-.059	-.01	58.34	2
13	3378	15	537	.093	.38	57.94	2	11	3710	1	713	-.024	-.40	58.43	2
17	3387	65	373	-.043	.47	59.14	4	15	3715	36	844	.063	-1.10	58.86	2
16	3399	43	832	-.021	.12	57.42	2	17	3721	69	243	.051	.02	58.32	2
12	3401	11	530	.063	-.39	57.89	2	16	3728	47	953	-.026	-.36	59.02	2
18	3403	75	151	-.009	.90	57.98	2	13	3729	17	694	-.001	.63	59.34	2
16	3405	47	904	-.058	.37	58.90	2	15	3732	33	811	.037	-1.18	58.99	2
11	3409	2	618	.026	.28	59.35	2	12	3737	10	548	-.043	-1.21	58.90	2
11	3417	-3	625	-.028	1.45	59.32	2	15	3742	28	632	-.073	.51	57.95	2
14	3425	22	588	.022	.47	59.02	2	15	3743	39	956	.056	.06	59.34	2
16	3427	45	836	.097	-.89	57.96	2	16	3746	44	881	.049	-1.00	58.44	2
16	3434	49	1057	-.012	-.03	58.94	2	12	3758	14	672	.008	.18	58.34	2
13	3435	14	624	.072	.69	58.40	2	12	3766	7	620	.042	-.10	57.89	2
16	3437	40	855	.088	.15	59.47	2	12	3772	8	656	.042	-.42	57.81	2
17	3440	62	622	.096	1.24	59.40	4	17	3784	61	690	.028	-.24	57.51	2
15	3443	25	642	.030	.45	58.99	2	15	3788	25	690	.031	-.31	57.86	2
13	3445	16	528	.050	.22	58.30	2	18	3796	74	197	.100	-.63	58.30	2
11	3453	4	602	.021	.72	59.33	2	17	3806	52	806	-.014	.31	57.83	2
12	3462	10	502	.011	.57	58.92	2	11	3807	2	673	-.024	-.06	57.99	2
15	3470	33	747	.004	-.32	57.29	2	13	3809	19	692	.040	.54	58.34	2
13	3477	19	625	.041	-.71	57.39	2	14	3812	21	617	-.005	-.15	57.99	2
11	3478	2	628	.064	.52	58.30	2	13	3814	17	702	-.006	.12	58.86	2
17	3495	51	817	.081	-.48	57.96	2	12	3827	5	622	-.041	.37	57.39	2
13	3496	15	557	-.037	-.08	59.10	4	15	3832	30	651	-.101	-.70	58.32	2
12	3508	8	605	.004	-.37	59.16	4	12	3844	12	577	.003	-.13	57.53	2
17	3517	66	301	.079	.61	58.28	2	17	3848	63	494	-.054	-.63	58.00	2
16	3520	45	858	-.005	.13	57.42	2	7	3857	68	319	.046	.03	58.34	2
17	3533	63	470	.040	.41	59.14	4	15	3860	27	656	-.011	.32	57.99	2
12	3541	9	525	-.010	-.39	58.30	2	11	3864	0	734	.011	.32	58.86	2
12	3542	13	627	.004	-.57	57.85	2	11	3866	-4	806	-.018	.22	57.99	2
16	3543	47	927	-.071	.09	57.96	2	15	3881	32	778	-.046	-.30	56.96	2
15	3548	38	832	.031	.49	57.53	2	11	3885	0	690	.021	-.16	57.41	2
12	3565	6	617	.048	.09	57.42	2	11	3889	-2	883	-.075	-.22	59.02	2
13	3576	18	574	.014	-.37	57.84	2	12	3900	7	637	-.002	.60	58.44	2
12	3577	14	643	.030	.56	58.31	2	16	3912	44	942	-.016	.77	56.96	2
12	3578	8	625	.068	.67	58.89	2	15	3920	25	710	.098	-.56	57.85	2
11	3583	2	641	.058	1.27	57.96	2	16	3922	46	882	-.011	.52	58.34	2
11	3605	-3	676	-.016	-.25	57.96	2	15	3925	29	712	.093	-1.72	56.98	2
16	3606	39	921	-.026	-.01	57.85	2	12	3929	5	649	.006	-.05	58.15	4
15	3612	31	700	-.031	-.73	57.88	2	17	3933	51	924	-.008	-.29	58.87	2
14	3613	22	629	-.092	-.24	57.99	2	11	3938	0	754	.018	-.68	57.99	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.	Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.
17	3940	55	882	.035	.34	58.88	2	13	4180	17	774	.023	.41	57.90	2
16	3943	47	993	.012	.27	58.43	2	17	4191	61	727	.021	-.59	58.86	2
11	3944	0	702	-.039	-.03	57.99	2	11	4203	-4	928	.009	.50	58.95	2
14	3963	23	698	.003	-.20	57.95	2	14	4204	21	692	-.027	.41	56.95	2
12	3965	11	616	.058	-.60	57.27	2	11	4205	-3	869	.008	.16	59.33	2
18	3978	75	182	-.174	.30	57.83	2	17	4212	55	922	-.047	.33	58.90	2
15	3991	35	875	-.075	-.15	58.34	2	18	4226	70	320	-.015	-.76	59.91	2
13	3993	15	635	-.007	.65	58.32	2	13	4236	19	777	.015	1.32	58.92	2
11	3994	-4	851	-.075	.89	58.43	2	12	4237	6	752	.022	.20	59.00	2
16	3997	41	884	.069	-1.21	59.01	2	17	4241	59	831	-.040	-.47	58.99	2
12	3999	-8	702	.055	.17	59.02	2	18	4244	72	238	-.066	-.56	58.00	2
18	4007	82	118	-.149	.24	57.85	2	11	4246	0	845	.054	-1.26	58.30	2
11	4008	2	726	.066	-.74	58.43	2	12	4253	12	649	.014	.32	58.38	2
17	4022	52	843	.006	.49	57.39	2	17	4262	53	817	.045	.27	57.53	2
17	4023	59	811	.001	.12	57.95	2	11	4266	0	774	.053	-.62	58.43	2
12	4034	12	606	.021	.46	57.97	4	17	4269	56	975	-.034	-.26	58.90	2
15	4040	34	891	-.165	-.48	58.34	2	11	4274	-2	1021	-.037	.35	58.95	2
11	4047	-4	865	-.030	.14	58.39	2	12	4277	7	725	-.009	1.35	58.31	2
11	4049	1	768	.023	-.11	58.43	2	15	4281	28	698	-.082	.42	59.92	2
14	4054	20	776	-.055	-1.75	59.94	4	12	4284	11	655	.004	.05	59.90	2
12	4055	7	667	.058	-.13	59.33	2	11	4288	3	684	.039	.60	58.34	2
18	4065	76	165	-.230	-.23	57.83	2	17	4291	50	1070	-.055	.27	58.98	2
15	4066	37	941	.000	.34	56.97	2	12	4293	13	720	.013	-.13	57.40	2
16	4068	44	991	.066	.50	59.01	2	11	4325	4	768	.051	-.26	56.98	2
11	4072	0	724	.029	-.38	58.42	2	17	4329	60	843	-.020	.22	57.99	2
15	4073	32	815	-.008	-1.32	58.42	2	12	4333	8	789	-.006	-.33	58.87	2
14	4076	21	668	.045	-.64	57.40	2	15	4340	36	958	.017	.37	57.90	2
15	4090	25	720	.076	.10	59.32	2	13	4341	18	747	-.042	.45	58.39	2
17	4091	58	761	.043	-.50	58.30	2	16	4343	45	999	-.028	.40	58.90	2
12	4093	10	598	-.026	.05	57.86	2	16	4353	43	1124	.030	-.38	57.53	2
16	4096	45	969	.078	.61	56.97	2	16	4361	41	1003	.017	-.23	56.96	2
17	4101	66	336	.039	-.95	59.89	4	18	4367	71	280	-.078	.60	57.99	2
17	4102	56	954	-.046	.21	58.42	2	11	4374	0	802	.026	-.20	57.51	2
16	4105	42	1015	-.014	.35	57.53	2	16	4375	47	1076	-.028	-1.09	58.43	2
12	4112	8	728	-.030	-.81	58.47	2	12	4377	13	737	.020	-.06	58.87	2
13	4114	18	666	-.018	.31	59.01	2	12	4378	7	756	.049	-.13	58.42	2
17	4118	52	866	-.043	.26	57.93	2	15	4384	33	926	.003	-.09	58.48	2
12	4121	6	730	.024	.67	58.29	2	11	4385	-4	978	-.008	.29	58.57	2
12	4123	11	636	-.025	.42	58.44	2	5	4387	37	996	-.054	-.28	58.34	2
17	4126	50	1028	-.066	.62	57.83	2	12	4394	5	773	.034	.67	57.93	2
15	4132	39	1042	.015	.41	57.53	2	15	4403	34	930	.018	-.54	57.41	2
13	4139	17	762	-.019	.90	58.58	2	11	4407	-4	987	.017	-.02	58.31	2
17	4141	64	470	-.008	.52	58.42	2	3	4409	18	765	.002	-.06	57.95	2
18	4142	80	147	-.086	.04	57.99	2	17	4415	57	849	.049	-.64	57.99	2
15	4147	36	924	-.026	-1.10	57.90	2	17	4426	61	746	-.049	-.28	58.34	2
18	4150	87	33	-.845	.76	57.97	2	17	4438	65	449	-.083	-.17	56.99	3
11	4155	-2	982	-.017	-1.02	58.30	2	18	4455	82	132	-.053	-.02	57.99	2
18	4156	78	162	.376	.70	58.89	2	13	4457	15	719	-.007	-.03	58.87	2
5	4162	26	735	-.075	.28	59.95	4	17	4462	53	842	.027	-.13	58.81	3
15	4178	25	725	-.010	-1.17	58.65	2	18	4473	77	179	.094	-.72	59.08	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	**Star**	**B.D. No.**		**Δα**	**Δδ**	**Epoch**	**No.**	**Zone**	**Star**	**B.D. No.**		**Δα**	**Δδ**	**Epoch**	**No.**
18	4475	86	65	-.063	-.17	57.95	2	7	4808	55	991	.029	-.82	57.95	2
18	4482	73	269	.031	.27	59.63	4	16	4817	45	1115	-.028	.25	57.99	2
16	4485	47	1089	.026	-.28	59.00	2	12	4822	9	823	-.036	.47	57.52	2
17	4488	59	847	.106	-.66	58.45	2	18	4826	80	168	.177	.43	58.43	2
12	4498	6	819	.038	-.94	57.40	2	16	4827	46	1015	.024	-1.19	58.34	2
18	4507	83	129	.037	.63	57.97	2	14	4831	21	839	.000	-.24	59.02	2
17	4515	55	956	.024	-.54	58.55	2	12	4834	9	830	.021	.31	57.98	2
17	4529	51	1027	-.024	-.06	57.64	2	12	4838	5	916	.013	-.95	58.87	2
17	4530	58	807	.042	.33	57.99	2	17	4840	65	474	.048	.21	59.01	2
15	4531	35	976	.051	.16	58.99	2	14	4842	24	831	-.012	-1.10	58.65	2
12	4533	5	805	.021	-.14	58.87	2	16	4851	48	1274	.022	-.52	57.99	2
11	4534	3	767	.062	.32	59.02	2	11	4852	1	1015	-.003	.62	57.90	2
11	4537	-1	800	.047	-.23	59.30	2	14	4873	20	961	-.054	-.82	57.49	2
15	4541	26	787	.027	-.17	58.45	2	15	4875	35	1133	-.019	.15	57.64	2
11	4546	0	945	.059	.12	59.08	2	14	4877	21	857	.041	-.45	57.53	2
15	4548	32	892	.063	-1.29	59.07	2	11	4881	1	1028	.058	.26	58.30	2
13	4561	15	749	.034	.62	57.95	2	12	4883	13	908	-.012	-.68	58.99	2
13	4577	18	783	.010	-1.09	57.39	2	16	4886	40	1310	-.013	-.95	58.17	2
12	4585	14	840	-.028	.30	57.99	2	14	4889	23	922	.025	-.30	57.98	2
17	4586	65	459	-.005	-.46	57.97	2	17	4895	53	917	-.051	.77	58.39	2
17	4593	52	930	.040	-.02	58.87	2	17	4905	50	1184	-.099	.34	59.00	2
15	4605	39	1198	.059	.62	57.93	2	17	4922	52	967	-.010	.12	58.00	2
14	4626	24	782	-.070	-1.17	57.97	2	17	4933	56	1034	.051	-.30	58.47	2
15	4633	33	973	.019	-.35	57.82	2	3	4942	17	950	-.049	.21	57.51	2
7	4648	61	771	-.014	.25	57.85	2	12	4956	14	948	.012	.08	59.00	2
11	4653	3	812	-.031	1.19	57.99	2	11	4958	2	1003	.002	.20	57.95	2
16	4662	41	1124	-.060	-.65	57.94	2	16	4962	47	1174	.033	-.44	58.60	2
12	4686	8	904	.000	-.01	58.44	4	12	4969	6	962	.000	-.47	58.95	4
12	4702	12	758	.009	-.98	57.40	2	13	4983	18	887	-.004	-.05	58.14	2
16	4705	45	1084	-.017	-.14	57.50	2	17	4993	56	1041	-.086	.30	57.51	2
11	4711	-2	1201	-.028	.15	57.99	2	13	5005	15	866	.021	.84	57.64	2
17	4713	57	873	.112	-1.23	58.44	2	12	5013	7	951	.003	-.33	59.26	4
16	4716	47	1124	.028	-.29	58.87	2	15	5019	39	1367	-.004	.09	57.99	2
15	4729	39	1251	-.037	.38	58.39	2	17	5027	51	1096	-.022	1.10	57.99	2
11	4730	0	1003	.000	.17	59.41	2	14	5035	23	982	-.050	-.15	58.07	2
12	4733	14	873	-.057	-1.09	58.47	2	16	5040	43	1325	-.031	-1.02	58.15	2
13	4742	15	787	.005	-.38	58.32	2	12	5042	11	898	.021	-.16	56.98	2
11	4746	-4	1102	-.026	-.32	57.97	2	18	5044	72	283	-.021	-1.24	57.08	2
11	4749	-1	860	.008	.21	59.23	4	12	5045	14	978	-.005	.61	57.99	2
15	4758	34	1004	.047	-.11	57.98	2	15	5052	34	1135	-.035	.19	57.71	3
17	4759	67	380	.011	-.03	58.43	2	6	5093	46	1041	-.003	.64	56.97	2
11	4772	4	905	.011	-.15	59.88	4	12	5094	8	1044	-.008	.07	58.64	3
18	4775	73	285	.030	-.59	58.99	2	13	5096	18	920	-.005	.21	58.15	2
4	4780	22	884	-.121	-.43	59.02	2	11	5103	0	1059	.006	-.05	57.99	2
11	4783	3	864	-.019	-.40	57.90	2	17	5110	57	910	.062	-.25	59.44	3
17	4798	52	955	-.033	-.29	58.08	2	11	5117	3	1018	.000	.03	57.96	2
12	4800	6	915	.014	.32	57.31	2	15	5125	38	1277	.017	-.37	57.64	2
11	4801	1	992	.058	-.22	58.54	2	11	5131	-2	1358	-.047	-.40	58.60	2
13	4804	18	839	.027	-1.05	59.11	2	18	5145	83	149	.228	-.60	57.97	2
11	4807	-1	879	-.037	.52	58.96	2	17	5157	50	1225	.017	.10	56.97	2

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Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
17	5172	61	826	.033	.28	57.96	2	12	5510	8	1210	.008	-.22	57.99	2
11	5175	2	1063	.015	-.46	58.59	2	17	5516	62	819	.069	.07	58.08	2
11	5187	0	1086	-.010	-.25	58.60	2	16	5525	43	1474	-.005	-.95	56.65	2
18	5200	75	237	-.082	-.28	59.10	2	13	5531	15	1097	.022	.11	56.97	2
15	5201	32	1098	.100	-.47	58.88	2	16	5536	45	1259	.003	-.02	57.97	2
11	5208	-4	1251	.018	-.55	58.99	2	17	5544	55	1062	.036	.19	58.95	4
16	5209	46	1054	-.108	-.03	59.13	2	17	5548	59	952	.021	-.15	58.57	2
17	5214	66	410	-.033	.60	58.49	2	15	5549	35	1362	.004	-.10	58.12	2
15	5218	31	1119	-.014	-.46	58.79	3	11	5550	-3	1339	-.051	.96	58.16	2
18	5221	77	217	.058	-.04	59.35	2	15	5552	33	1275	-.012	-.95	57.56	2
18	5225	81	194	.015	-.44	59.00	2	11	5554	-1	1147	-.021	.58	57.16	2
17	5226	56	1073	-.077	-.05	58.67	2	17	5564	50	1285	-.210	-.70	56.62	2
11	5239	-2	1391	.022	-.07	58.99	2	18	5579	87	41	.174	-.20	58.98	2
17	5247	52	1006	.004	-1.02	59.11	2	17	5581	52	1049	.006	.35	57.90	2
16	5255	40	1446	.023	-.94	58.18	2	15	5586	25	1180	.038	-1.29	58.95	2
15	5258	36	1282	-.017	.23	57.64	2	17	5587	64	575	.003	-.29	58.54	2
15	5261	25	1020	-.018	.93	57.60	2	11	5602	-2	1530	-.069	-.21	59.35	2
16	5263	42	1433	.020	-.67	58.09	2	15	5610	26	1156	-.137	.05	58.11	2
12	5264	9	995	-.039	-.22	58.14	2	15	5615	39	1575	-.068	.31	58.09	2
16	5271	45	1194	-.012	.17	58.44	2	12	5619	5	1164	-.021	.06	58.90	2
11	5279	-1	1059	.018	.54	59.14	3	16	5625	48	1369	-.014	-.10	57.96	2
12	5282	5	1043	-.040	-.81	58.99	2	12	5627	13	1187	-.011	-.37	58.61	2
17	5283	64	555	.014	-.13	57.53	2	14	5637	21	1190	.048	-.52	58.12	2
13	5284	17	1051	.007	.62	58.17	2	16	5646	46	1129	-.009	.06	58.17	2
11	5289	0	1211	-.003	-.43	58.06	3	11	5650	-3	1386	.016	-1.18	57.97	2
15	5296	35	1283	-.080	-.89	57.97	2	16	5651	42	1533	.041	-.38	58.16	2
17	5315	68	417	-.089	-.10	57.14	2	18	5657	75	253	.102	1.04	58.90	2
14	5329	24	1045	-.032	-.27	57.90	2	15	5661	25	1223	.056	-.39	57.56	2
12	5335	7	1072	.041	.17	58.12	2	16	5663	45	1288	-.025	-.33	57.60	2
17	5351	62	801	.007	-.49	58.61	2	13	5680	19	1313	.021	.09	58.49	2
12	5353	11	986	-.001	-.26	58.42	2	12	5682	6	1208	.074	-.46	58.45	2
17	5358	66	420	.012	-.28	57.97	2	17	5686	50	1296	-.023	-.75	58.17	2
12	5359	9	1040	.014	-.52	58.45	2	11	5692	-1	1212	.146	.35	58.97	4
11	5361	0	1242	.019	-.79	59.07	3	17	5696	53	1013	-.091	-.31	56.65	2
15	5366	32	1155	.027	-.01	58.92	2	15	5699	34	1331	-.019	-.57	58.14	2
18	5375	82	155	-.273	.03	57.14	2	16	5705	40	1583	-.032	.48	58.17	2
5	5388	37	1389	-.042	.36	56.64	2	16	5713	41	1431	.051	.04	58.44	2
13	5403	17	1101	-.044	-.80	56.63	2	13	5714	18	1203	-.010	.31	58.09	2
12	5431	8	1173	.024	-.03	58.12	2	17	5721	62	840	.050	-1.08	59.00	2
11	5446	0	1270	.074	.83	56.65	2	11	5722	-4	1490	-.005	.59	58.92	2
11	5455	3	1123	.042	-.11	57.64	2	18	5723	78	225	-.087	-.46	59.14	3
15	5459	33	1244	.026	-.46	58.09	2	12	5725	13	1229	-.011	.28	59.63	2
16	5461	41	1356	-.030	-.14	58.17	2	18	5726	77	239	-.037	-.52	58.45	2
13	5463	19	1212	-.002	-.22	58.42	2	17	5733	55	1077	.012	1.17	58.17	2
12	5464	6	1116	.077	-.55	58.49	2	17	5736	58	925	-.009	-1.43	58.61	2
15	5469	35	1341	-.002	-.11	56.98	2	11	5758	0	1418	-.054	.14	57.99	2
18	5482	74	275	.104	-.25	58.44	2	12	5765	6	1246	.022	.40	57.16	2
15	5490	25	1128	-.028	-.65	56.66	2	11	5797	-2	1624	.015	.04	57.08	2
16	5494	49	1459	-.035	-.52	57.16	2	12	5804	7	1306	.047	-.38	57.16	2
15	5498	27	1006	-.025	-.24	57.97	2	17	5808	61	890	.027	.11	58.46	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
16	5810	43	1548	-.043	-.08	59.08	4	11	6186	-1	1447	.032	-.23	57.11	2
15	5819	25	1302	-.004	-.04	58.44	2	12	6187	14	1486	-.003	.15	57.59	2
15	5823	32	1316	-.081	.78	59.02	2	11	6195	-2	1829	-.038	-.05	58.65	2
5	5826	37	1525	-.004	.33	57.99	2	15	6196	36	1528	-.045	-.49	58.90	2
13	5844	16	1183	-.047	.28	57.42	2	12	6198	7	1520	-.010	-.29	59.58	4
15	5847	29	1263	-.021	.40	57.61	2	18	6204	85	98	-.024	.11	58.65	2
11	5856	-1	1271	.036	.08	59.01	4	16	6214	47	1373	.012	-.59	57.62	2
12	5867	7	1343	-.100	-.62	58.44	2	16	6226	41	1557	-.164	.63	57.11	2
17	5879	54	1050	-.012	-.18	58.60	2	17	6229	57	1021	-.006	-.10	59.01	4
14	5887	25	1326	.007	.07	58.09	2	13	6247	17	1461	-.028	-.19	57.60	2
18	5889	72	324	.045	-.90	58.63	2	13	6255	16	1346	-.025	.06	57.18	2
11	5896	0	1489	.019	-.15	56.97	2	11	6268	1	1622	.032	.04	57.10	2
13	5902	17	1306	-.037	.70	57.60	2	15	6288	29	1430	-.035	-.33	58.60	2
17	5906	67	440	.007	-.11	57.49	2	16	6292	50	1381	-.034	.04	57.17	2
17	5909	60	985	-.047	.36	57.99	2	17	6293	61	928	-.016	-.45	58.00	2
14	5929	23	1428	.022	.07	58.09	2	18	6295	73	360	-.092	-.15	57.64	2
15	5938	39	1689	-.040	1.09	57.99	2	6	6312	43	1639	-.054	.06	57.60	2
18	5946	75	262	-.174	-.41	57.61	2	11	6331	-4	1793	.032	-.69	57.62	2
15	5954	36	1471	-.021	-1.40	58.12	2	13	6333	16	1372	-.013	.09	56.61	2
17	5956	68	447	-.110	.13	57.51	2	17	6346	63	686	-.055	.16	56.63	2
15	5971	35	1464	-.121	-.54	57.15	2	17	6350	64	616	-.040	-.21	57.99	2
11	5978	-4	1610	-.060	.06	58.31	4	11	6388	-4	1820	-.037	.09	57.60	2
18	5981	80	217	.090	-.56	56.65	2	17	6400	68	464	-.051	.32	57.18	2
14	5987	20	1531	.022	-.20	57.90	2	11	6403	-3	1750	-.041	.05	58.14	2
14	6037	22	1453	.008	-.76	57.16	2	18	6407	82	194	.081	-.49	58.00	2
14	6046	24	1386	-.127	1.09	57.51	2	15	6420	30	1431	-.002	.28	57.96	2
15	6047	37	1578	-.005	-.49	58.09	2	16	6423	47	1404	-.003	.06	57.08	2
15	6059	29	1342	.009	.29	58.43	2	11	6425	2	1576	.026	-.42	59.13	3
15	6062	36	1501	-.005	-.23	57.10	2	17	6427	54	1111	.041	-.75	58.61	2
17	6075	55	1125	.010	-.41	57.53	2	12	6428	13	1570	.028	.42	58.10	2
12	6080	5	1406	-.005	.62	57.51	2	14	6429	22	1596	.029	-.28	59.63	2
17	6082	67	452	-.031	.38	59.47	2	17	6431	59	1053	.005	.38	57.63	2
16	6083	41	1513	-.049	-.35	58.63	2	16	6436	50	1399	-.018	.27	57.69	2
14	6085	22	1475	-.071	-1.51	59.07	2	16	6437	45	1394	-.010	-.38	57.65	2
17	6090	66	467	.011	1.05	58.94	2	14	6451	24	1549	-.022	-.56	59.10	2
11	6097	-1	1387	-.049	-.05	59.01	4	11	6459	0	1635	-.063	.79	58.09	2
11	6102	-3	1600	-.042	-1.27	58.12	2	16	6460	40	1807	.008	-.63	57.61	2
15	6113	32	1416	.037	-.63	57.61	2	12	6469	10	1453	-.149	.87	57.05	2
18	6115	74	303	.020	.59	58.65	2	16	6481	42	1678	-.148	.04	57.53	2
11	6118	3	1414	.045	-.14	58.63	2	11	6489	4	1627	.042	-.55	57.59	2
15	6120	39	1756	.023	.24	59.01	2	4	6503	23	1648	-.073	-.54	57.17	2
13	6124	17	1409	.059	-.23	58.44	2	18	6504	78	243	.051	-.69	57.61	2
12	6126	12	1310	.014	-.09	58.85	3	11	6507	-1	1613	-.009	-.61	57.16	2
14	6133	20	1589	.007	-.48	58.63	2	14	6510	22	1620	-.003	-.06	57.19	2
16	6147	49	1556	-.064	-.28	58.57	2	12	6517	14	1615	-.016	.91	57.99	2
11	6153	1	1565	.034	-.33	57.59	2	15	6523	37	1694	-.012	-.42	57.59	2
15	6159	38	1637	-.034	.46	57.99	2	16	6537	41	1628	.034	-1.69	56.70	2
12	6174	10	1315	.005	-.29	58.13	2	11	6549	-4	1885	-.018	.55	57.16	2
11	6176	-4	1714	-.004	.60	57.62	2	17	6563	59	1070	-.014	-.19	57.17	2
13	6179	17	1441	-.078	-.26	58.43	2	16	6564	49	1615	-.031	-.12	57.99	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
13	6593	18	1577	.032	.78	56.17	2	17	6933	58	1057	.006	.11	58.54	2
14	6594	23	1681	-.121	-.19	56.72	2	11	6938	-3	2019	-.056	.96	58.60	2
12	6595	15	1544	-.011	.02	57.97	2	11	6941	-2	2251	-.024	.15	57.18	2
15	6619	30	1489	-.034	.05	57.17	2	16	6946	45	1476	-.029	-.65	57.10	2
12	6631	14	1649	-.024	.60	57.18	2	11	6953	-1	1816	.008	-.16	58.17	2
15	6644	28	1377	-.064	-1.59	56.64	2	15	6961	27	1464	-.010	.05	57.71	2
13	6648	16	1466	-.036	.01	57.60	2	15	6964	32	1615	-.006	.06	57.63	2
15	6655	33	1520	-.017	-.68	57.61	2	16	6967	41	1717	-.051	.39	57.72	2
17	6656	56	1208	-.097	-.42	58.18	2	16	6978	44	1670	-.034	-.51	57.19	2
12	6677	13	1663	-.023	.77	57.63	2	16	6980	43	1733	-.022	-.84	59.64	2
11	6679	5	1652	-.015	1.42	57.99	2	15	6982	26	1638	.029	.88	58.09	2
16	6685	44	1627	-.063	-1.08	56.61	2	15	6988	38	1815	-.067	.02	56.69	2
14	6694	24	1659	-.124	-.09	57.17	2	13	6989	16	1551	-.030	.11	58.14	2
11	6700	-4	1950	-.019	.73	57.60	2	16	6992	47	1484	-.057	.86	57.61	2
16	6705	48	1535	.021	.57	57.19	2	11	7008	1	1905	-.023	.62	58.17	2
11	6708	1	1811	.030	-.43	58.18	2	15	7024	31	1668	-.035	.95	56.65	2
12	6735	6	1690	.026	-.37	58.13	2	11	7032	0	1828	-.026	-.34	56.69	2
18	6737	84	152	-.428	.51	56.71	2	13	7034	20	1913	.034	-.70	56.17	2
15	6744	25	1689	-.110	-1.01	57.60	2	17	7049	55	1226	.030	-.48	56.17	2
17	6749	51	1324	-.030	-.70	58.17	2	18	7057	73	387	-.201	-.92	56.20	2
17	6760	62	935	-.025	.41	57.53	2	17	7069	57	1110	-.064	.05	56.70	2
14	6763	24	1683	-.033	-.59	56.18	2	12	7071	14	1769	.006	-.18	56.64	2
17	6764	58	1045	-.063	-.70	57.18	2	15	7077	33	1608	.040	-.47	56.70	2
16	6772	46	1277	-.058	-.14	56.19	2	14	7087	20	1933	-.128	-1.17	57.17	2
14	6784	22	1717	-.005	.44	56.68	2	13	7090	15	1689	-.006	-.19	58.20	2
16	6793	41	1680	-.048	-.71	56.61	2	13	7092	17	1696	.004	.21	57.06	2
17	6805	60	1063	.015	-.42	56.66	2	16	7094	50	1485	-.090	.01	57.07	2
12	6812	14	1699	-.025	.43	56.70	2	12	7097	5	1824	-.011	-.07	56.63	2
11	6815	-1	1765	-.047	1.00	57.90	4	13	7118	18	1778	.023	.92	56.72	2
17	6817	65	579	-.096	-.30	57.94	4	15	7124	27	1501	-.003	-.04	56.71	2
18	6822	79	243	-.078	-.04	57.17	2	15	7127	36	1712	.040	.23	56.16	2
16	6826	49	1645	-.063	-1.35	58.17	2	12	7128	9	1813	-.035	-.21	56.72	2
12	6830	6	1720	.049	.24	57.62	2	14	7133	25	1794	-.035	.41	56.73	2
13	6845	16	1524	-.022	.45	58.37	4	17	7139	64	661	-.021	-.21	56.19	2
12	6858	10	1579	-.004	-.05	57.07	2	15	7141	37	1804	-.081	-.17	56.63	2
12	6863	5	1726	-.037	.36	57.18	2	12	7152	14	1790	-.020	.12	56.70	2
11	6867	-1	1779	.055	.08	57.60	2	12	7155	7	1873	-.004	-.28	56.72	2
15	6870	33	1560	.008	.80	58.17	2	16	7157	46	1335	-.090	-.26	57.60	2
15	6872	31	1634	-.113	-1.17	58.17	2	15	7161	33	1623	-.007	-.67	57.19	2
16	6880	44	1653	-.005	.57	59.14	3	18	7170	75	321	-.083	-.16	57.18	2
5	6887	36	1659	-.210	-1.34	57.64	2	15	7183	35	1722	.026	.41	56.69	2
11	6890	0	2029	.001	.56	58.63	4	18	7185	74	340	.101	.58	57.61	2
11	6891	-4	2031	-.025	.50	57.18	3	13	7189	15	1722	-.023	.03	57.18	2
12	6899	8	1841	-.093	.87	56.69	2	16	7205	40	1978	.006	.72	57.62	4
18	6900	83	191	-.093	.06	57.62	2	18	7211	76	302	.109	.20	57.06	2
12	6903	11	1641	-.035	.13	58.15	2	12	7225	14	1808	-.066	.36	58.14	2
17	6909	51	1342	.036	-1.15	58.92	4	15	7230	27	1524	-.002	-.49	56.70	2
18	6914	76	292	.005	-.71	57.20	2	17	7235	68	517	-.074	.54	58.96	4
11	6924	0	2041	-.019	-.58	58.20	2	12	7241	6	1858	.007	-.25	59.16	4
16	6931	48	1563	.015	-.56	57.61	2	12	7251	10	1710	-.018	.32	57.70	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.	Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.
17	7257	55	1243	.032	-.73	56.71	2	17	7556	62	996	-.009	-.02	57.10	2
15	7267	34	1735	-.109	-.02	56.70	2	16	7558	47	1572	-.039	-.30	58.16	2
17	7271	62	976	-.026	-.67	57.17	2	15	7562	36	1808	-.011	-1.39	56.71	2
12	7279	12	1762	.016	.04	56.61	2	12	7567	7	1971	.020	-.75	57.65	2
15	7282	31	1726	-.197	-.33	58.17	2	15	7568	31	1806	-.093	.44	57.18	2
13	7284	18	1839	-.040	-.21	59.09	3	17	7575	56	1295	.012	.63	56.68	2
12	7285	5	1869	.043	1.00	58.09	2	15	7587	30	1706	-.049	-.51	57.18	2
12	7287	13	1832	-.045	.26	58.53	3	14	7589	24	1921	-.075	.13	58.21	2
13	7293	19	1925	.005	-.01	56.70	2	11	7600	-3	2341	-.016	-.21	56.72	2
18	7296	81	263	-.255	.43	57.88	3	12	7605	10	1798	.015	.20	56.68	2
17	7297	50	1508	-.047	-.48	57.64	2	17	7614	66	553	.023	-.38	56.72	2
15	7311	40	1995	-.046	-.15	57.17	2	17	7616	61	1052	.071	.74	56.70	2
16	7317	48	1612	.005	.09	58.16	2	5	7617	27	1613	-.111	-1.21	58.14	2
17	7324	69	455	-.168	-.39	57.18	2	3	7636	17	1852	-.066	-.01	58.13	4
17	7354	59	1144	-.036	-.05	57.20	2	18	7644	71	459	-.166	-.35	56.68	2
11	7358	-4	2235	.003	1.34	58.48	4	18	7649	76	326	.012	1.62	57.72	2
13	7361	17	1776	-.032	.42	56.72	2	13	7667	19	2021	-.022	-.01	57.71	2
15	7377	31	1753	-.100	-.21	58.16	2	15	7673	38	1916	-.001	-.03	58.16	2
14	7381	23	1905	-.203	-.33	57.61	2	12	7685	7	1988	-.015	.76	57.71	2
15	7394	25	1872	-.029	-.73	57.08	2	17	7688	63	784	-.082	.06	57.64	2
16	7402	40	2010	-.189	-.47	56.69	2	15	7694	29	1772	-.058	.46	58.18	2
12	7403	11	1784	.000	-.08	57.72	2	16	7697	42	1886	.025	-.85	58.18	2
18	7406	74	350	-.012	-.20	56.71	2	12	7698	13	1936	-.001	-.32	59.73	2
13	7410	17	1797	.003	.27	57.18	2	15	7712	31	1833	-.010	-.69	58.69	4
15	7412	38	1881	-.045	.08	58.20	2	15	7719	27	1627	-.013	-.26	58.54	3
14	7413	22	1886	.009	-.22	57.64	2	11	7726	-2	2613	.113	-.25	58.26	2
11	7420	1	2035	-.018	.33	58.50	3	13	7732	18	1978	-.029	.15	57.71	2
18	7435	70	502	-.074	-.12	56.71	2	17	7733	52	1322	-.089	.10	57.17	2
6	7437	44	1728	.010	-.07	58.15	2	16	7753	49	1750	.042	-.52	56.68	2
11	7441	0	2232	-.024	1.44	57.17	2	18	7754	79	277	.173	.64	57.23	2
5	7442	30	1677	-.048	-.11	57.71	2	15	7757	29	1785	.019	-.48	57.18	2
12	7455	9	1915	.039	1.22	57.71	2	13	7769	19	2049	-.042	-.09	57.62	2
11	7477	-1	2001	-.018	-.42	57.18	2	17	7777	54	1247	-.029	-.57	59.15	4
12	7490	6	1924	.029	-.28	59.47	4	13	7786	17	1896	-.035	.49	58.19	2
17	7493	67	534	-.034	.28	57.73	2	12	7787	12	1881	-.025	-.06	58.72	2
16	7495	45	1561	-.006	-.34	58.72	2	11	7798	2	2034	-.022	-.59	57.62	2
17	7501	57	1131	.002	-.54	57.64	2	16	7799	41	1864	-.011	.25	58.73	2
15	7506	31	1784	-.028	.18	58.65	2	11	7806	-4	2410	-.020	-.12	57.69	2
17	7508	51	1409	.007	.41	58.72	2	15	7815	38	1940	-.084	-.02	57.71	2
11	7512	0	1962	.043	-.34	58.79	3	17	7826	63	789	.140	-.38	57.18	2
13	7513	19	1979	-.003	.12	57.11	2	17	7830	57	1162	-.052	-.67	57.18	2
15	7515	38	1897	.000	-.86	58.65	2	17	7845	61	1070	-.055	-.70	56.68	2
17	7519	59	1161	-.064	-1.20	59.68	4	13	7862	18	2022	-.020	-.01	56.17	2
18	7521	78	284	-.042	.06	57.71	2	13	7871	17	1919	-.001	.22	56.71	2
14	7526	22	1914	-.020	-.91	57.70	2	12	7879	9	2038	-.035	-.34	56.72	2
11	7533	-3	2314	-.023	-.46	57.74	2	11	7882	3	2041	-.012	.29	57.16	2
12	7537	13	1899	-.047	.32	58.22	2	16	7883	44	1783	-.076	-1.58	56.68	2
16	7538	49	1729	-.033	-.02	56.68	2	17	7896	54	1253	-.055	-.53	58.16	2
12	7541	14	1878	-.095	.53	57.18	2	15	7898	38	1953	-.069	-.03	56.70	2
12	7550	11	1824	-.060	.37	57.72	2	12	7910	10	1867	.033	-.71	58.17	2

OBSERVED - AGK2							
Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
12	7914	5	2050	-.007	.54	57.16	2
18	7921	72	429	-.064	.20	57.25	2
17	7924	54	1254	-.051	-.36	56.70	2
15	7927	36	1870	-.048	-.39	58.18	2
12	7932	9	2053	-.016	-1.27	59.13	3
4	7935	23	1999	-.008	-.97	57.71	2
17	7936	63	798	-.071	-.27	58.62	2
17	7942	56	1336	-.054	-.78	57.17	2
16	7947	43	1858	.038	.01	57.19	2
15	7949	31	1884	-.105	.95	58.19	2
18	7955	89	13	-.897	-1.17	57.73	2
12	7957	13	1995	-.097	-.39	59.68	2
11	7962	-4	2461	-.055	-.02	57.73	2
18	7963	70	536	.036	-.31	58.72	2
15	7971	26	1848	.009	-1.17	58.82	3
16	7983	46	1446	-.032	-.80	56.69	2
13	7985	18	2059	.015	.12	58.16	2
13	7988	16	1833	-.060	-.26	58.65	2
15	7993	35	1883	-.018	-.54	59.21	3
13	8001	19	2113	-.040	-.11	57.23	2
15	8003	25	2003	.067	-.23	57.20	2
16	8014	42	1940	.010	-.31	56.16	2
17	8015	57	1178	-.040	-.10	57.71	2
12	8018	10	1897	-.013	.12	57.71	2
17	8019	62	1028	.049	-.28	58.61	2
12	8021	8	2136	.024	-.09	57.74	2
11	8023	2	2084	-.027	-.58	58.18	2
17	8025	69	490	-.010	-.43	59.73	2
17	8027	53	1290	-.042	-.12	56.71	2
15	8028	30	1792	-.073	-.70	57.25	2
15	8029	27	1685	-.014	-1.28	57.65	2
13	8030	20	2234	.032	-.93	59.68	4
11	8032	0	2087	-.035	-.32	58.74	2
11	8044	-4	2491	-.076	-.47	58.72	2
17	8046	60	1157	.006	-.03	57.70	2
17	8049	65	672	-.117	.30	56.73	2
13	8060	18	2082	-.029	-.19	58.17	2
14	8062	23	2015	-.034	-.80	57.23	2
15	8063	39	2174	-.013	-.27	57.20	2
16	8069	41	1889	-.018	.53	57.72	2
13	8076	16	1862	-.001	.46	56.18	2
14	8077	21	1946	-.026	.13	58.24	2
17	8078	67	569	.027	-.79	57.74	2
17	8082	56	1351	-.063	-.74	58.61	2
16	8083	47	1625	-.008	-1.05	59.11	3
18	8084	75	355	.068	.06	57.72	2
16	8089	48	1705	-.413	-1.90	58.55	3
11	8098	2	2114	.026	-.68	58.23	2
15	8125	29	1851	.020	-.06	57.17	2
11	8126	-1	2174	.052	-1.25	57.65	2
17	8130	54	1270	-.092	-.41	57.71	2
17	8132	59	1212	-.083	-.52	57.62	2
15	8136	37	1938	-.048	-.85	57.18	2
17	8139	63	815	-.025	.71	56.18	2
18	8146	83	236	.000	.16	57.26	2
15	8157	31	1923	.036	-.96	58.18	2
14	8159	22	2039	.027	.33	58.24	2
12	8161	9	2112	-.023	-.92	59.21	3
17	8164	57	1189	.003	-.56	57.63	2
15	8168	27	1708	-.007	-.96	58.65	2
16	8180	44	1817	.035	-.55	57.17	2
16	8181	40	2146	-.031	.02	56.70	2
12	8193	13	2036	-.030	-1.17	59.20	3
11	8196	-4	2533	-.017	.12	58.71	2
11	8197	1	2231	.006	-.18	57.64	2
13	8204	17	2004	-.054	-.55	57.73	2
16	8206	46	1472	-.106	-.43	58.67	2
17	8207	61	1101	-.053	-.54	57.73	2
13	8209	15	1977	-.054	-.05	56.68	2
17	8210	52	1362	-.034	-.54	58.19	2
14	8212	24	2040	-.003	.08	58.65	2
17	8221	69	506	.028	.12	57.24	2
16	8226	47	1642	-.074	.48	57.73	2
17	8229	55	1315	-.154	.14	58.74	2
16	8233	41	1922	-.084	-.18	58.17	2
12	8234	14	2033	.035	-.33	58.65	2
13	8240	17	2018	-.045	1.03	58.19	2
11	8243	4	2126	.005	.31	59.19	2
12	8246	8	2172	-.042	-.46	59.26	2
12	8247	6	2109	-.012	-.04	57.73	2
15	8254	32	1845	-.073	-.52	57.71	2
16	8256	43	1885	-.036	-.90	59.78	5
14	8261	23	2055	-.017	-.75	57.72	2
15	8264	38	2006	-.094	-.92	56.71	2
11	8268	1	2247	.027	.39	57.96	4
16	8276	45	1688	-.120	-.67	57.77	2
17	8278	59	1225	-.043	.15	56.72	2
15	8282	29	1879	-.011	.71	56.71	2
11	8286	-2	2808	.076	.20	57.70	2
12	8299	12	1991	-.028	.41	58.18	2
14	8302	24	2054	-.045	-.53	57.62	2
12	8307	8	2186	-.016	-.33	57.19	2
15	8315	30	1834	-.087	-.24	58.92	4
15	8319	28	1718	-.179	.40	56.73	2
12	8321	12	1997	-.006	.04	57.72	2
14	8322	23	2062	.003	-1.11	58.23	2
15	8324	37	1956	-.022	.07	57.18	2
17	8332	51	1492	-.041	-.77	57.19	2
14	8344	20	2293	-.032	-.44	57.17	2
16	8354	43	1901	-.009	.02	57.91	4

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
18	8355	78	303	-.060	.06	56.69	2	12	8676	11	2067	.005	-.29	57.26	2
15	8363	31	1961	-.071	-1.03	56.24	2	17	8685	59	1249	-.082	.84	57.09	2
17	8368	61	1111	-.007	-.28	56.73	2	14	8695	22	2112	-.027	.92	58.21	2
13	8369	17	2053	.032	.40	56.72	2	12	8704	15	2091	-.010	.77	57.72	2
17	8381	52	1380	.060	-.28	57.18	2	11	8712	-2	2948	.024	-.33	57.70	2
16	8382	42	1994	.046	-.38	56.65	2	11	8716	3	2249	-.036	-.84	58.53	3
17	8397	60	1181	.041	-.04	58.17	2	15	8723	32	1912	.004	.05	57.09	2
12	8398	10	1972	.017	-.14	56.18	2	13	8743	16	2010	-.077	.47	56.71	2
12	8427	12	2024	-.063	-.45	57.10	2	16	8745	48	1796	.000	-.01	56.25	2
17	8431	67	586	-.105	-.58	56.72	2	15	8754	37	2016	-.093	.08	56.61	2
14	8439	22	2082	.154	-1.51	56.72	2	12	8770	12	2082	.034	-.20	56.18	2
16	8445	46	1494	.060	-.85	57.15	2	11	8772	1	2352	-.017	-.20	56.71	2
11	8446	-2	2863	-.009	-1.34	58.17	2	14	8774	22	2124	-.023	.08	57.23	2
17	8448	63	838	-.017	.56	57.71	2	15	8776	39	2275	-.055	-.28	57.63	2
18	8452	81	295	.063	-.37	57.19	2	15	8778	35	2046	-.010	-.67	57.18	2
17	8457	55	1331	-.031	.99	56.72	2	11	8785	2	2243	-.060	.62	57.25	2
18	8461	71	503	-.102	-.34	57.17	2	13	8787	17	2125	.012	-.06	57.20	2
11	8473	-4	2608	.044	-1.54	56.19	2	18	8808	85	150	-.031	-.45	56.71	2
16	8482	44	1861	-.011	-.11	56.71	2	15	8809	33	1907	.040	-.71	56.69	2
12	8489	6	2173	.036	-.77	57.62	2	16	8817	49	1880	-.011	-.12	57.17	2
13	8508	17	2084	-.013	-.15	56.65	2	12	8820	11	2102	-.008	-.28	57.73	2
11	8512	-1	2260	.009	-.48	56.74	2	12	8822	6	2211	-.013	1.28	57.26	2
15	8513	29	1903	-.017	.42	56.72	2	17	8830	55	1349	-.055	.90	56.73	2
16	8522	49	1841	-.020	-.62	56.64	2	16	8838	47	1707	-.086	-.07	56.73	2
15	8528	28	1761	.027	.68	57.15	2	13	8843	18	2274	-.061	.26	57.17	2
12	8531	10	2002	-.048	-.13	57.24	2	14	8844	25	2157	-.048	-.14	57.72	2
17	8532	50	1644	-.052	-.84	56.19	2	11	8848	-4	2728	-.002	.47	56.71	2
17	8539	52	1395	-.026	-.33	57.64	2	17	8850	52	1424	.049	-.84	57.20	2
16	8541	41	1968	-.059	-.86	56.72	2	15	8853	26	2013	-.082	.03	57.17	2
11	8543	0	2522	-.005	.05	57.71	2	18	8859	75	396	.141	-.48	58.71	2
13	8545	18	2207	-.043	.83	57.18	2	16	8861	42	2051	-.086	-.15	57.23	2
14	8555	25	2105	-.015	-.62	59.14	3	11	8864	2	2255	-.037	-.19	57.18	2
17	8559	59	1238	-.070	.16	58.25	2	18	8868	80	302	.003	.46	57.71	2
13	8573	16	1984	-.008	.32	56.70	2	11	8871	1	2370	.016	.33	57.26	2
16	8575	42	2018	.009	-.50	57.65	2	13	8872	16	2039	-.046	.43	58.65	2
12	8580	9	2195	-.032	-.75	59.20	3	14	8882	20	2387	-.068	-.44	57.26	2
16	8581	48	1779	-.123	-.46	58.19	2	15	8888	36	2006	-.028	-1.22	57.70	2
15	8583	37	1995	-.084	-.97	58.74	2	16	8889	41	2021	.045	-.61	57.16	2
14	8589	20	2335	-.044	-1.23	57.26	2	14	8894	23	2156	.012	.00	57.23	2
12	8590	7	2147	-.022	.31	59.17	2	17	8895	65	741	-.131	-.89	57.72	2
17	8591	63	848	.011	-.74	59.22	2	17	8896	58	1219	-.063	-1.73	57.71	2
15	8593	31	2000	-.132	-.11	59.24	2	12	8900	11	2117	.011	-.21	57.73	2
17	8601	61	1131	.005	.40	57.69	2	12	8904	15	2127	.015	1.32	56.63	2
12	8623	8	2243	.072	.02	56.61	2	12	8913	5	2248	-.040	.00	56.71	2
17	8636	65	723	.025	-.10	56.73	2	16	8919	45	1774	.050	-.38	57.20	2
15	8646	34	2010	-.075	.08	57.11	2	11	8924	-1	2319	.023	-.69	57.25	2
11	8648	5	2204	-.061	-.03	56.70	2	16	8929	49	1896	.058	.43	56.68	2
13	8650	17	2108	.028	.78	56.70	2	17	8950	64	762	-.042	-.30	57.18	2
17	8668	69	526	-.091	-.34	57.72	2	16	8953	47	1724	-.020	-.25	56.70	2
16	8674	48	1789	-.082	-.55	57.25	2	11	8954	0	2588	.004	.34	57.17	2

OBSERVED - AGK2							OBSERVED - AGK2						
Zone	Star	B.D. No.	$\Delta \alpha$	$\Delta \delta$	Epoch	No.	Zone	Star	B.D. No.	$\Delta \alpha$	$\Delta \delta$	Epoch	No.
14	8959	24 2156	-.129	1.06	56.70	2	17	9184	52 1461	.005	-.75	58.16	2
13	8962	19 2284	-.009	.98	56.70	2	12	9185	7 2259	-.040	-.32	57.71	2
13	8965	17 2156	-.024	-.21	57.75	2	14	9192	23 2190	-.017	.52	57.18	2
15	8966	35 2086	.003	-.56	58.17	2	12	9198	9 2317	.003	-.24	57.26	2
15	8982	30 1940	.006	-.23	57.18	2	11	9199	0 2308	.020	.42	56.71	2
18	8983	76 371	-.164	.50	58.25	2	11	9201	1 2414	-.023	.01	56.73	2
17	8989	57 1240	-.060	-.21	56.84	3	16	9206	45 1811	-.048	.25	57.24	2
15	8999	26 2031	-.159	-.37	56.74	2	12	9208	11 2190	-.006	.32	57.27	2
11	9011	-4 2775	-.023	.43	57.26	2	11	9212	-3 2873	.026	-.44	56.70	2
17	9021	69 551	-.165	.42	57.17	2	13	9217	16 2098	.040	-.07	57.23	2
12	9028	7 2219	.010	.62	56.69	2	12	9218	6 2276	-.017	-.54	56.68	2
11	9036	-1 2338	-.010	.88	56.70	2	15	9235	34 2105	-.073	-.02	57.74	2
7	9038	58 1230	-.085	.20	57.72	2	11	9239	4 2306	-.030	-.49	56.81	2
16	9045	46 1574	-.012	1.88	56.63	2	11	9249	2 2310	-.051	.15	56.71	2
15	9054	34 2073	-.085	-.56	56.68	2	12	9250	8 2336	-.022	-.48	57.74	2
11	9058	4 2283	.036	.90	56.18	2	17	9267	54 1362	-.045	-.98	57.72	2
17	9064	56 1428	-.008	.58	56.80	2	12	9273	14 2230	-.003	.34	58.28	2
15	9066	28 1835	-.042	-.85	57.19	2	15	9274	40 2313	.014	-.58	58.81	2
17	9071	51 1572	-.032	-.55	56.72	2	6	9276	49 1939	-.158	.02	56.70	2
12	9072	5 2280	-.010	-.61	56.61	2	18	9278	70 607	-.129	.10	58.29	2
13	9081	20 2430	-.019	-.51	57.80	2	17	9279	55 1384	-.039	-.56	57.25	2
13	9082	17 2169	-.045	-.06	58.24	2	12	9287	10 2139	.074	-.79	56.28	2
11	9084	-2 3052	.028	.18	57.17	2	14	9288	23 2213	.045	-.31	58.16	2
15	9087	35 2102	.036	.28	56.73	2	13	9289	16 2110	-.097	.44	58.73	2
17	9091	67 634	-.080	-.36	57.74	2	11	9291	0 2641	.086	-.61	58.77	2
15	9092	31 2097	-.029	-.65	57.17	2	14	9293	21 2175	-.026	-.20	57.71	2
17	9099	61 1165	-.043	.30	57.73	2	15	9297	26 2072	-.009	.29	57.26	2
16	9101	42 2086	-.071	-.59	56.73	2	12	9298	12 2193	.005	-.37	57.17	2
12	9111	11 2166	-.059	.13	56.64	2	11	9300	4 2313	.006	-.65	56.69	2
12	9113	14 2202	-.044	-.03	57.18	2	16	9303	46 1619	-.047	-.30	56.69	2
16	9120	43 1990	-.012	.31	56.71	2	17	9305	69 569	-.059	.08	57.74	2
15	9130	27 1852	-.019	.58	57.26	2	18	9313	71 536	.022	-.28	58.19	2
17	9136	56 1434	-.040	.13	57.25	2	17	9315	62 1121	-.040	-.59	58.29	2
18	9139	83 280	.323	-1.56	56.74	2	7	9317	58 1252	.106	.01	57.25	2
16	9141	49 1923	-.137	-.62	56.71	2	16	9327	40 2321	-.070	-.65	58.71	2
15	9142	27 1853	-.174	.20	57.24	2	15	9331	31 2133	-.060	.07	57.26	2
12	9147	10 2116	.014	.14	57.72	2	12	9341	14 2237	.019	.11	56.68	2
11	9148	-3 2860	-.056	-.06	58.19	2	11	9344	3 2357	.010	.51	57.71	2
11	9150	3 2323	-.072	-.12	57.71	2	17	9350	66 665	-.051	-.60	57.26	2
17	9152	62 1110	.034	-.27	58.69	2	11	9351	-4 2861	.048	.09	58.19	2
17	9153	59 1291	.024	-.16	58.45	5	12	9359	10 2147	.004	-.54	58.69	2
17	9156	65 756	-.032	.66	57.34	2	17	9368	59 1309	-.057	-.50	57.73	2
11	9164	-1 2356	-.060	-.02	56.71	2	16	9369	41 2089	-.012	1.14	56.69	2
17	9167	67 637	.059	.43	58.28	2	4	9372	23 2221	-.191	-.24	57.19	2
15	9169	30 1974	.073	-.17	56.73	2	14	9376	25 2249	.054	-.49	57.52	3
12	9170	12 2162	-.021	.36	57.16	2	15	9382	29 2046	-.203	-.45	58.28	2
16	9172	44 1958	-.005	-.09	57.73	2	11	9387	0 2655	.023	-.72	58.29	2
17	9176	54 1354	.001	.43	59.21	4	14	9392	22 2217	-.061	.69	56.71	2
14	9180	20 2447	.067	.06	57.48	4	17	9398	63 901	-.112	1.06	58.26	2
15	9183	25 2212	.012	-1.22	57.28	2	16	9401	43 2019	.041	-.16	57.19	2

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Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.
11	9402	0 2344	-.044	.30	58.71	2	17	9634	50 1760	-.058	.87	56.81	2
13	9404	19 2345	-.122	.39	58.79	2	17	9638	53 1432	-.010	-.15	58.26	2
15	9412	27 1897	.015	-1.00	57.73	2	16	9642	49 1986	.004	.26	57.70	2
17	9419	60 1265	.022	-.01	57.79	2	18	9645	73 504	-.006	-.46	57.26	2
17	9422	55 1394	-.066	-.08	57.97	4	15	9652	32 2072	-.138	1.11	57.81	2
13	9427	17 2233	-.009	.48	58.28	2	14	9653	24 2265	.015	.05	56.68	2
15	9435	38 2147	-.007	-.21	57.71	2	11	9655	1 2477	.004	.05	57.28	2
17	9436	64 790	-.094	-1.05	58.71	2	12	9657	8 2409	.033	.03	57.71	2
18	9441	78 349	-.047	.36	58.73	2	7	9658	59 1325	-.017	-.24	57.72	2
16	9448	50 1744	-.008	.01	58.80	2	12	9660	10 2199	.035	-1.06	58.71	2
14	9454	22 2230	-.021	-.20	58.81	2	12	9662	6 2347	.045	-1.08	58.34	2
15	9459	31 2148	-.039	-1.01	58.82	2	15	9667	26 2128	.081	-1.67	57.71	2
11	9462	-2 3165	-.078	-.02	58.77	2	15	9672	35 2181	-.022	-.33	58.79	2
13	9463	18 2372	-.004	-.26	58.28	2	16	9677	43 2045	-.021	.37	57.34	2
16	9464	48 1873	.012	-.34	57.24	2	15	9678	34 2158	-.013	-.55	57.77	2
17	9469	54 1379	.044	-.32	58.23	2	13	9690	19 2373	-.219	-.85	56.68	2
11	9470	5 2347	.003	.46	58.71	2	16	9693	45 1866	-.058	-.59	57.15	2
12	9472	15 2218	-.036	.06	59.27	2	12	9695	14 2299	-.078	-.03	57.81	2
18	9476	77 404	-.159	.57	58.25	2	11	9701	-2 3221	.007	.56	57.26	2
15	9477	25 2263	.039	.04	58.29	2	15	9706	27 1938	-.013	-.71	57.16	2
16	9488	44 1998	-.021	.37	58.20	2	13	9709	16 2170	-.015	-.61	58.28	2
5	9493	34 2141	-.095	.23	57.76	2	17	9716	61 1204	.039	-.95	56.72	2
11	9495	4 2351	.000	-.49	57.79	2	12	9731	7 2374	-.047	-.01	57.71	2
17	9507	69 579	.169	.37	58.23	2	5	9734	36 2129	.017	-.66	58.26	2
15	9517	31 2164	-.173	.26	57.70	2	6	9737	43 2052	-.022	-.75	58.71	2
13	9523	19 2355	-.002	-.65	57.28	2	14	9738	24 2281	.014	-.90	57.26	2
8	9527	71 542	.030	-.47	57.80	2	11	9744	1 2492	.009	-.34	56.71	2
13	9530	16 2139	.008	.24	58.71	2	13	9764	15 2257	-.006	-.26	57.49	4
15	9535	37 2102	-.111	.23	57.25	2	17	9767	59 1333	-.022	-.61	56.73	2
7	9538	51 1615	-.043	.18	57.80	2	15	9772	26 2145	.057	-1.25	56.68	2
7	9539	58 1268	-.058	-.24	56.70	2	18	9773	71 552	.060	.55	58.26	2
14	9541	24 2251	.028	-.77	58.18	2	12	9783	13 2322	-.045	-.49	56.81	2
16	9556	49 1977	-.074	.35	59.46	4	15	9785	32 2085	-.069	.20	57.71	2
12	9557	7 2339	-.023	-.74	57.72	2	17	9786	54 1404	-.075	-.69	57.72	2
13	9559	20 2509	-.089	.37	57.16	2	6	9788	44 2028	-.064	.51	57.81	2
16	9563	45 1850	-.051	.77	58.24	2	17	9790	63 930	.006	-.18	58.71	2
15	9574	29 2073	-.045	-.60	57.80	2	14	9791	21 2262	-.189	-.26	58.77	2
15	9577	40 2354	-.041	-.10	56.71	2	12	9794	6 2368	-.030	-.22	56.80	2
11	9587	5 2374	-.042	.20	57.80	2	11	9796	-2 3247	-.029	.82	57.71	2
16	9590	42 2140	.065	-.32	56.71	2	17	9799	69 592	-.083	.50	56.73	2
11	9598	-3 2976	.024	-.69	57.26	2	16	9803	46 1675	-.039	-.02	57.16	2
12	9603	14 2281	-.015	.29	57.72	2	15	9808	34 2183	-.031	.05	57.81	2
11	9606	0 2694	-.043	-.86	57.73	2	16	9814	40 2385	-.059	-1.88	57.72	2
15	9615	37 2112	-.056	-.07	57.80	2	15	9820	35 2196	.007	-.47	56.80	2
11	9617	3 2403	-.002	-.27	58.26	2	5	9827	38 2197	-.029	-1.03	57.74	2
17	9619	56 1472	-.075	.37	57.28	2	7	9836	68 624	.039	-.45	58.71	2
17	9624	62 1142	.119	.23	58.73	2	14	9837	25 2319	-.088	-.97	57.34	2
13	9626	17 2265	.004	.66	58.71	2	11	9841	-2 3259	.016	.13	58.77	2
11	9631	-3 2980	.031	1.02	58.69	2	12	9842	14 2324	-.037	1.87	58.22	2
16	9633	43 2040	-.106	-.09	57.18	2	17	9843	62 1156	-.067	-.01	57.73	2

OBSERVED - AGK2							OBSERVED - AGK2						
Zone	Star	B.D. No.	$\Delta\alpha$	$\Delta\delta$	Epoch	No.	Zone	Star	B.D. No.	$\Delta\alpha$	$\Delta\delta$	Epoch	No.
15	9848	34 2188	-.005	-.77	58.24	2	11	10080	1 2539	-.024	.44	58.34	2
11	9852	-3 3024	.001	.12	58.81	2	11	10081	-1 2499	-.035	.41	58.84	3
13	9854	18 2429	-.031	.15	57.34	2	18	10084	74 456	-1.347	1.46	59.55	3
11	9859	5 2425	-.035	-.08	58.79	2	13	10097	15 2311	-.019	-.01	57.26	2
15	9871	29 2110	-.036	-.02	57.72	2	18	10101	80 350	-.098	-.15	56.18	2
17	9876	67 677	-.002	-.27	56.27	2	17	10105	65 823	.027	.14	57.70	2
12	9879	6 2387	-.037	-.12	58.72	6	16	10110	41 2172	-.104	-.46	57.79	2
16	9884	50 1788	-.040	-.05	57.79	2	13	10127	17 2337	-.034	.58	56.68	2
15	9887	38 2205	-.065	-.08	57.69	2	14	10128	23 2329	-.133	-.24	56.72	2
16	9893	46 1685	-.073	.03	57.70	2	15	10131	25 2362	.074	-.15	56.26	2
16	9912	41 2155	-.057	.41	57.19	2	17	10133	64 840	.032	.43	57.34	2
15	9919	33 2072	.019	-.35	57.28	2	18	10142	76 423	-.044	-.85	56.80	2
12	9924	8 2452	-.087	-.71	56.78	2	12	10145	10 2274	-.027	-.44	57.73	2
15	9925	39 2410	.006	-.49	56.77	2	18	10151	71 568	-.210	.18	57.31	2
12	9928	10 2240	-.005	-.21	57.18	2	13	10157	19 2438	.047	1.00	56.16	2
13	9930	17 2309	.005	-.92	57.79	2	15	10164	30 2137	.089	.35	56.70	2
12	9933	15 2282	.014	.09	56.69	2	11	10175	3 2488	-.032	2.02	57.25	2
16	9953	45 1892	-.078	.23	57.33	2	12	10177	12 2328	.016	-.29	56.73	2
17	9954	54 1414	-.080	-.66	56.70	2	15	10186	36 2180	-.039	-1.37	57.74	2
17	9956	66 697	.001	.13	59.45	4	16	10196	41 2183	-.088	-.24	56.71	2
12	9958	12 2300	.030	-.92	57.23	2	11	10198	0 2777	-.001	.13	56.76	2
14	9966	25 2338	-.060	.52	57.25	2	12	10211	15 2326	.038	-.04	56.72	2
11	9967	1 2519	-.012	-.15	57.26	2	17	10212	63 957	-.084	.67	57.28	2
17	9970	56 1498	.023	-.26	56.71	2	16	10225	49 2050	.034	.25	57.70	2
14	9977	21 2282	-.041	-.11	58.97	4	13	10226	18 2488	-.029	.63	57.31	2
16	9986	49 2020	.002	-.22	56.80	2	17	10229	60 1326	-.043	-.34	56.71	2
14	9992	23 2308	.025	-.75	57.73	2	15	10232	32 2146	-.084	-.35	56.73	2
12	9995	9 2452	.009	-.05	57.79	2	13	10241	20 2600	.022	-.17	57.26	2
12	9996	7 2417	-.053	-1.07	58.26	2	12	10242	6 2448	-.051	.17	57.25	2
11	9999	-3 3053	-.030	-.64	58.25	2	7	10249	59 1377	.041	.28	57.72	2
15	10000	36 2157	-.058	-.50	57.35	2	15	10263	29 2160	.005	-.16	56.17	2
5	10003	34 2200	.009	.44	57.80	2	17	10270	69 608	-.116	-.25	59.49	4
17	10004	59 1351	-.071	-.23	57.78	2	14	10271	24 2357	-.095	.32	56.70	2
11	10005	0 2750	-.017	.24	57.81	2	18	10276	70 661	-.134	1.11	57.81	2
17	10009	58 1303	.113	-.82	57.74	2	11	10284	-1 2528	.008	.48	59.47	4
15	10012	28 1971	.044	.24	56.71	2	17	10294	51 1668	-.003	.34	57.74	2
15	10035	26 2181	-.007	.26	56.79	2	12	10300	7 2452	-.010	.67	56.32	2
15	10037	38 2215	-.109	.61	57.80	2	12	10301	6 2454	-.008	-.56	57.79	2
15	10045	33 2088	-.074	-.86	57.17	2	11	10305	0 2444	-.056	-.86	58.34	2
14	10048	22 2329	-.012	-.51	57.81	2	13	10310	17 2363	-.032	.03	56.68	2
12	10051	13 2369	-.039	-.03	58.29	2	17	10327	57 1327	-.010	-.26	56.24	2
17	10056	69 603	-.010	-1.14	57.73	2	16	10334	40 2436	.051	-.19	56.79	2
13	10059	16 2230	.016	.45	58.80	2	15	10339	31 2274	-.071	-.01	57.24	2
12	10060	10 2260	-.021	-.35	58.25	2	14	10340	25 2388	-.005	.68	56.16	2
17	10068	53 1476	-.047	-.18	58.23	2	17	10357	61 1247	.122	.31	56.79	2
15	10069	30 2123	.045	.75	57.85	2	15	10358	34 2230	.056	.25	56.66	2
17	10072	63 947	.082	-.93	57.77	2	13	10359	20 2616	-.006	-.12	57.23	2
11	10074	4 2439	-.053	.28	58.82	2	11	10368	4 2492	-.042	-.40	57.71	2
14	10077	24 2332	-.047	.16	58.75	2	5	10369	26 2231	-.015	-1.20	57.29	3
14	10079	20 2573	.021	.15	57.74	2	12	10371	8 2520	-.004	-.35	58.25	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.	Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.
12	10377	14	2404	-.032	.21	56.76	2	12	10636	7	2489	.010	-.52	57.74	2
16	10379	49	2066	.101	-.38	57.25	2	7	10638	68	664	.000	.04	57.79	2
16	10394	44	2107	.080	-.49	57.34	2	17	10655	63	981	-.080	.58	57.79	2
12	10405	10	2310	.064	-.10	57.23	2	12	10656	14	2445	.022	.85	56.87	2
13	10406	18	2510	.011	.36	56.73	2	18	10658	74	475	-.195	.15	57.27	2
11	10409	1	2586	-.066	-.03	58.04	4	11	10661	-3	3197	.004	-.03	58.23	2
18	10417	75	450	-.230	.68	57.73	2	12	10668	11	2409	.014	-.65	57.26	2
17	10421	57	1332	-.034	-.23	58.28	2	17	10669	60	1360	-.030	-.46	57.74	2
12	10422	11	2379	-.022	.42	57.80	2	14	10672	21	2373	.045	.06	58.28	2
17	10428	62	1190	.018	.13	57.77	2	12	10676	5	2555	-.046	.24	58.26	2
11	10429	0	2811	.012	-.57	58.34	2	13	10679	18	2539	.006	-.79	57.24	2
17	10443	59	1394	.043	.13	57.74	2	11	10684	4	2541	.005	-.40	57.74	2
14	10446	20	2631	-.102	.21	58.23	2	11	10689	-1	2587	.037	-.80	57.20	2
5	10450	30	2180	.095	1.49	57.27	2	11	10691	0	2858	-.077	-.64	58.34	2
14	10453	24	2374	-.037	.76	56.68	2	11	10692	2	2493	.004	.35	57.84	2
15	10455	39	2460	.000	.28	57.77	2	17	10694	56	1554	.117	-.04	58.26	2
12	10456	8	2533	.034	.39	58.03	4	15	10716	33	2172	-.106	-.30	56.81	2
18	10461	73	531	-.083	.55	57.34	2	12	10717	6	2529	-.009	-.48	56.26	2
13	10463	17	2382	.026	.83	56.17	2	17	10718	53	1516	.066	.14	57.26	2
15	10469	26	2243	.150	-1.05	56.79	2	16	10722	41	2252	.009	.22	56.72	2
15	10470	37	2205	-.040	-1.04	57.73	2	15	10723	27	2071	.067	-.52	57.79	2
16	10491	45	1955	.025	-.75	56.78	2	16	10726	45	1977	.009	.88	58.80	2
15	10494	35	2272	-.091	.36	56.70	2	14	10727	23	2408	-.029	-.74	58.28	2
13	10500	19	2491	-.007	.43	56.79	2	17	10743	55	1500	-.038	-.32	57.20	2
17	10506	56	1540	-.019	-.29	56.66	2	15	10745	38	2294	-.042	.16	57.79	2
17	10514	67	717	.082	-.33	56.69	2	13	10747	16	2323	-.006	.27	57.82	2
14	10520	24	2386	-.072	.66	56.17	2	11	10755	-3	3217	-.036	-.49	57.34	2
16	10528	49	2079	-.050	.32	56.24	2	17	10761	52	1601	-.057	.03	57.32	2
14	10529	22	2396	.011	-.40	58.60	3	13	10766	17	2422	-.006	.43	56.80	2
17	10532	54	1459	-.080	.22	57.72	2	12	10776	8	2559	.012	-.13	56.80	2
11	10533	0	2479	.004	.11	57.74	2	14	10781	25	2448	-.037	.34	58.55	4
13	10545	17	2394	-.007	-.32	57.79	2	17	10783	66	742	-.047	-.34	56.18	2
13	10546	16	2289	-.044	.64	56.79	2	11	10785	0	2878	.056	1.59	57.33	2
14	10551	20	2645	-.009	.15	56.71	2	17	10793	56	1558	.060	.28	57.73	2
12	10553	7	2477	-.054	-.03	56.73	2	11	10795	1	2641	.020	.15	58.23	2
15	10562	40	2461	-.063	-1.28	57.26	2	12	10797	12	2416	.039	-.44	58.06	4
11	10574	4	2526	-.051	-.60	57.26	2	18	10799	78	404	-.105	-.53	57.81	2
12	10576	5	2539	-.003	1.35	58.25	4	16	10801	41	2265	-.121	.11	56.20	2
14	10581	25	2418	-.037	.74	56.73	2	16	10802	47	1923	.042	-.36	56.73	2
15	10588	33	2156	-.025	-.33	56.73	2	15	10806	29	2251	.038	-.13	57.34	2
15	10589	28	2046	-.096	.50	56.26	2	17	10812	62	1214	.024	-.22	56.86	2
12	10605	12	2381	-.030	-.11	57.71	2	16	10818	45	1991	-.120	.95	58.28	2
15	10609	30	2194	.031	1.21	56.72	2	12	10819	8	2566	-.030	-.21	57.86	2
15	10618	35	2285	.055	-1.19	56.17	2	17	10820	64	877	.028	-.51	58.35	2
11	10619	-1	2576	-.040	.65	56.80	2	12	10821	5	2580	.038	-.58	58.74	2
16	10620	44	2132	.085	.83	56.73	2	15	10823	36	2235	-.086	-.50	58.26	2
17	10621	62	1199	-.007	-.04	57.27	2	13	10824	17	2430	.049	-1.09	58.82	2
18	10627	71	588	-.088	-.43	57.26	2	15	10827	33	2189	-.067	-.66	58.34	2
14	10629	23	2396	-.131	.44	57.80	2	14	10830	21	2388	-.111	-.20	56.73	2
17	10634	58	1340	-.022	.51	58.28	2	13	10836	15	2408	-.077	.18	57.27	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D.	No.	Δα	Δδ	Epoch	No.	Zone	Star	B.D.	No.	Δα	Δδ	Epoch	No.
5	10844	27	2092	-.101	.29	58.25	2	18	11064	80	383	-.054	.35	57.88	2
11	10862	0	2894	-.046	-.03	56.19	2	15	11068	32	2234	-.017	-.95	57.34	2
17	10863	69	645	.005	.31	57.26	2	11	11069	4	2606	-.020	-.41	57.79	2
13	10867	20	2683	-.024	-.75	56.78	2	15	11070	35	2333	.045	.18	57.73	2
11	10868	5	2587	.002	.97	57.26	2	11	11074	0	2932	.030	-1.12	56.86	2
12	10870	14	2474	-.042	.32	57.32	2	15	11080	28	2109	-.031	-.44	58.28	2
16	10871	42	2274	-.119	1.24	58.25	2	15	11082	33	2225	-.072	-.29	56.33	2
11	10874	-2	3466	.019	-1.09	57.98	3	14	11090	20	2713	-.008	-.65	56.82	2
18	10875	72	558	.090	-.35	58.31	3	15	11092	40	2529	-.053	.31	57.26	2
12	10878	6	2555	-.119	.63	57.82	2	7	11093	50	1915	-.046	.44	58.26	2
11	10880	-3	3239	-.070	-.06	57.82	2	17	11094	60	1396	-.074	.19	57.73	2
15	10881	31	2332	.014	.48	57.73	2	18	11102	71	613	-.102	.33	56.80	2
15	10885	38	2304	-.073	.38	57.26	2	17	11114	58	1373	-.049	-.02	57.76	4
16	10886	49	2116	-.082	.27	57.36	2	11	11118	5	2623	.025	.59	56.85	2
13	10909	17	2444	-.044	-.38	57.73	2	15	11124	26	2347	-.111	-.80	57.81	2
16	10911	49	2118	-.011	-.60	57.26	2	15	11125	38	2331	-.198	.15	57.81	2
15	10913	29	2263	-.073	-.67	57.33	2	12	11131	10	2421	-.010	-.83	57.78	2
16	10914	45	2001	.055	-1.79	56.81	2	17	11141	55	1531	-.013	-.10	57.34	2
12	10917	15	2422	.023	.72	56.82	2	18	11144	76	449	-.238	.13	57.71	2
11	10929	0	2907	-.068	.93	56.81	2	12	11145	14	2502	.001	-.92	58.56	4
17	10942	65	874	-.084	-.01	57.32	2	16	11146	49	2139	-.174	.23	57.80	2
18	10944	87	104	-.717	.26	57.25	2	11	11148	-2	3520	-.018	.80	58.72	2
18	10951	74	489	-.198	-.01	58.35	2	15	11156	28	2116	.110	-.38	56.28	2
14	10955	22	2450	-.118	-.74	56.73	2	11	11159	5	2630	.016	-.03	56.80	2
17	10959	61	1283	-.018	-1.04	57.81	2	12	11160	6	2615	.031	-.26	56.87	2
12	10960	12	2435	.084	.06	56.80	2	12	11162	9	2629	.001	.07	57.26	2
17	10961	67	735	-.014	.17	58.28	2	13	11166	16	2377	.014	.54	57.74	2
15	10973	27	2105	-.044	.02	57.28	2	18	11171	79	393	-.091	-.06	57.81	2
15	10979	40	2513	-.088	.17	56.81	2	11	11172	-3	3302	.026	-1.09	57.73	2
15	10983	34	2301	-.006	-.56	57.34	2	11	11179	-1	2674	.002	-.51	56.78	2
17	10988	59	1431	-.034	-.14	57.31	2	7	11180	54	1530	-.159	-.62	56.86	2
13	10990	17	2454	-.036	-.19	56.28	2	16	11181	43	2227	-.036	.80	57.82	2
17	10994	53	1535	-.011	-.42	57.37	2	11	11185	0	2583	.001	.12	58.72	2
12	10998	7	2526	-.006	.03	57.28	2	12	11190	15	2469	-.045	.17	58.31	2
11	10999	-3	3257	-.067	-.36	58.28	2	17	11196	63	1017	-.211	-.30	57.88	2
11	11002	-1	2639	-.009	.50	58.71	2	15	11204	34	2319	.018	-1.77	58.27	2
11	11007	1	2676	-.051	-.25	58.34	2	15	11209	32	2252	.036	.03	57.80	2
5	11011	36	2257	-.002	-.37	56.34	2	18	11220	77	475	-.325	-.08	57.71	2
11	11023	3	2626	-.046	.15	57.80	2	13	11229	18	2622	-.007	.23	57.82	2
12	11027	8	2586	-.038	.18	56.81	2	14	11231	21	2428	.033	-.08	56.78	2
11	11028	-2	3494	-.042	.16	57.82	2	12	11248	8	2618	.038	.63	57.73	2
16	11029	41	2287	-.041	.52	58.27	2	14	11249	25	2522	-.008	-.27	57.25	2
13	11033	18	2587	.006	.92	58.28	2	11	11251	5	2643	-.056	.34	57.79	2
17	11039	66	754	-.073	.26	57.73	2	15	11252	28	2133	-.081	.35	57.87	2
16	11040	47	1949	-.054	.24	56.81	2	16	11260	42	2322	-.084	-.20	57.73	2
17	11041	53	1537	-.059	.07	57.79	2	17	11266	59	1448	-.042	-.15	57.28	2
17	11049	63	1009	-.008	.06	58.80	2	16	11269	47	1970	-.032	-.26	57.31	2
16	11052	48	2017	-.003	-.01	58.77	2	15	11270	28	2134	-.023	.07	58.28	2
16	11054	44	2180	-.055	-.51	57.25	2	3	11284	17	2500	-.031	-.08	58.74	2
18	11062	84	274	.029	.12	57.79	2	16	11288	46	1797	-.034	.10	57.25	2

OBSERVED - AGK2							OBSERVED - AGK2						
Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.
11	11295	1 2724	-.001	.20	57.28	2	16	11539	47 1998	-.026	-.41	56.88	2
14	11299	21 2434	-.122	1.18	56.89	2	17	11540	60 1425	.025	-.04	57.81	2
12	11300	15 2483	.058	-.53	57.86	2	11	11541	5 2690	.022	-.68	57.77	2
12	11308	13 2561	.009	.05	56.81	2	14	11548	25 2571	-.058	-.06	57.39	2
13	11312	19 2590	.013	.43	56.74	2	17	11549	63 1038	.051	-.58	58.28	4
11	11325	-3 3329	-.048	.69	57.49	4	15	11550	27 2189	.017	.30	56.82	2
17	11333	61 1307	-.051	-.17	56.27	2	15	11554	37 2334	.024	-.37	57.82	2
15	11343	37 2306	.026	-.73	56.79	2	15	11561	40 2590	-.027	.44	57.36	2
6	11345	43 2249	.043	-.88	57.33	2	11	11562	2 2599	-.029	-.32	58.74	2
5	11346	25 2544	-.013	.26	57.72	2	15	11570	33 2284	-.055	-.27	58.69	2
15	11349	34 2341	-.082	.96	57.77	4	12	11572	13 2607	.043	.61	56.79	2
12	11350	8 2626	-.008	.11	59.27	4	17	11575	64 923	-.078	.01	57.79	2
18	11352	75 479	-.015	.24	57.36	2	17	11585	53 1577	-.023	.23	56.81	2
11	11376	-4 3331	-.036	.06	57.32	2	4	11588	24 2508	-.008	.31	57.73	2
12	11380	9 2661	.045	.53	57.73	2	5	11590	30 2345	-.085	-1.20	57.28	2
15	11381	33 2261	.036	-.23	57.80	2	18	11591	79 407	.098	-.73	57.82	2
11	11383	0 2972	-.003	.28	56.28	2	12	11596	11 2515	.019	.34	57.36	2
17	11390	57 1388	-.026	-.08	56.72	2	7	11597	51 1797	-.023	.50	58.34	2
5	11399	40 2566	.001	-.04	57.34	2	15	11608	26 2409	-.021	-.29	57.39	2
12	11405	11 2487	-.039	.24	57.26	2	13	11612	18 2681	-.018	.60	56.34	2
11	11412	1 2746	-.007	.40	56.87	2	6	11613	49 2175	.279	-.32	58.74	2
13	11417	18 2655	-.040	-.24	56.89	2	11	11614	0 2637	-.040	.82	57.70	2
15	11423	28 2148	-.008	.27	57.27	2	17	11624	59 1475	.021	.03	56.82	2
11	11440	0 2608	-.035	-.79	56.79	2	17	11628	62 1268	-.090	.19	56.28	2
13	11441	17 2532	-.065	.41	57.36	2	11	11633	-4 3390	-.010	.10	57.84	2
5	11444	37 2324	-.076	-.37	57.70	2	11	11645	3 2719	.011	.06	57.26	2
16	11445	48 2055	-.039	-.01	58.37	3	11	11650	4 2683	-.041	.88	56.81	2
16	11446	43 2258	.058	.48	57.83	2	7	11653	55 1571	-.045	-.43	56.82	2
15	11450	33 2269	.006	-1.34	58.39	2	18	11655	88 76	.150	-.06	57.87	2
12	11451	7 2575	.000	-.42	58.28	2	15	11657	39 2589	-.039	.43	56.72	2
11	11452	-3 3360	-.071	.14	58.72	2	16	11661	46 1836	-.053	-.29	56.81	2
17	11453	53 1568	-.092	-1.17	57.31	2	15	11665	26 2416	-.027	-1.17	57.80	2
14	11460	24 2495	-.009	-.39	56.81	2	11	11666	2 2614	-.058	.17	56.80	2
14	11464	21 2458	.001	-.61	57.34	2	14	11668	22 2537	-.016	-.90	56.25	2
17	11472	61 1319	.091	.18	58.73	2	13	11672	19 2628	.009	.70	56.79	2
13	11475	16 2427	.031	.23	56.82	2	16	11683	46 1839	-.010	-.19	56.72	2
15	11483	34 2358	-.123	-.58	57.83	2	17	11687	51 1802	.015	.05	56.87	2
17	11484	55 1555	-.057	-.31	57.73	2	15	11699	31 2445	-.034	-1.12	56.78	2
15	11486	36 2309	.035	-.57	57.27	2	12	11713	10 2509	-.003	-.89	57.81	2
15	11491	39 2568	.010	.09	57.83	4	7	11714	66 787	.104	.42	58.32	4
14	11494	22 2517	.003	-.69	57.38	2	17	11717	54 1566	-.114	.32	57.80	2
16	11504	46 1824	-.003	-.50	56.28	2	5	11719	36 2336	-.136	-.37	57.94	3
17	11505	59 1468	-.033	.09	57.79	2	15	11731	27 2212	-.132	-.49	57.86	2
13	11511	15 2512	-.039	.02	57.36	2	15	11742	34 2389	-.050	-.15	57.81	2
16	11512	50 1954	-.065	-.81	56.73	2	15	11748	29 2369	-.055	.78	57.32	2
17	11515	58 1397	.031	-.09	56.89	2	17	11749	60 1445	-.007	-.44	58.25	2
15	11520	26 2399	-.074	-.50	57.41	2	11	11753	2 2626	.012	.03	57.89	2
11	11523	0 2622	.025	-.47	58.25	2	16	11760	43 2300	-.064	-.02	57.33	2
17	11529	51 1792	-.026	-.14	56.82	2	18	11762	72 600	-.069	-.03	57.36	2
5	11530	34 2365	-.020	-.16	58.27	2	17	11766	63 1053	.075	-.29	57.87	2

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Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
14	11768	23	2541	.076	-.08	57.33	2	15	12044	27	2255	-.091	-.36	57.33	2
13	11774	19	2642	.011	1.19	57.35	2	11	12056	-3	3476	-.005	-.22	58.34	2
15	11775	31	2456	.006	.09	56.26	2	15	12061	34	2426	-.016	.97	57.32	2
16	11776	50	1982	-.011	.70	56.81	2	14	12066	20	2837	-.015	.59	57.36	2
12	11780	6	2700	-.057	-.11	57.34	2	11	12075	2	2685	-.031	-.34	58.55	4
13	11784	17	2596	-.009	.10	58.28	2	17	12077	53	1624	-.098	.28	58.73	2
13	11790	16	2470	.049	.10	58.72	2	17	12079	67	786	-.185	-.28	57.90	2
11	11795	0	3030	-.012	-.07	57.36	2	17	12083	50	2006	-.045	.84	57.82	2
15	11806	27	2224	-.072	-.45	57.34	2	17	12091	61	1359	.093	-.36	58.66	3
14	11808	20	2806	.035	-.20	57.36	2	18	12097	75	507	-.204	.20	57.79	2
16	11809	41	2364	-.056	.66	57.81	2	14	12098	22	2589	-.011	.24	57.40	2
15	11810	35	2419	.022	-1.71	57.87	2	13	12104	17	2641	-.039	-.17	58.77	2
16	11811	47	2027	-.050	.22	58.35	2	15	12107	27	2264	-.201	-1.62	56.87	2
12	11812	13	2643	-.034	-.11	57.36	2	12	12109	10	2556	-.009	-.29	57.79	2
12	11815	11	2543	.033	-.48	58.86	4	15	12114	40	2663	-.005	.62	58.51	4
7	11816	56	1645	.042	-.15	57.33	2	17	12119	65	943	.018	.61	56.91	2
12	11823	9	2727	.009	.14	57.27	2	17	12120	57	1446	-.052	-.14	57.33	2
12	11848	10	2523	.064	.84	56.72	2	11	12121	1	2826	.012	-.17	57.81	2
16	11852	45	2096	-.011	-.65	56.33	2	11	12128	3	2792	.035	-.16	57.33	2
14	11854	23	2551	.007	-.50	56.88	2	13	12129	17	2645	-.026	-.14	57.31	3
7	11855	61	1344	-.083	-.27	56.89	2	13	12137	19	2688	.002	-.29	57.36	2
17	11868	51	1824	-.105	-.69	57.26	2	12	12140	14	2636	.056	-.03	59.28	4
13	11877	18	2708	-.007	.41	56.78	2	18	12141	73	595	-.101	.05	57.32	2
17	11878	54	1584	-.043	-1.22	56.87	2	16	12145	47	2069	-.041	-.20	57.40	2
15	11893	29	2386	-.064	-.19	56.81	2	15	12161	35	2466	.033	-.93	57.73	2
11	11922	3	2755	.036	-1.12	56.87	2	11	12165	0	3079	.030	-.17	58.93	5
15	11926	34	2411	-.066	-.03	57.25	2	14	12168	24	2604	-.124	-.29	56.91	2
15	11934	37	2396	-.108	.68	56.90	2	14	12170	20	2848	-.023	-1.60	57.36	2
12	11940	9	2744	-.017	-.56	57.31	2	17	12186	60	1476	.035	-.75	56.90	2
17	11947	65	927	.025	.28	56.82	2	15	12191	34	2435	.039	-.67	57.34	2
14	11952	24	2570	-.097	-.05	57.27	2	16	12194	42	2424	-.019	-.20	56.87	2
11	11958	3	2761	-.026	-.33	57.34	2	6	12197	44	2289	-.015	-.60	57.34	2
15	11962	31	2474	-.141	.16	57.26	2	17	12202	51	1858	-.002	.52	56.91	2
11	11972	0	3049	.021	.77	56.90	2	12	12203	10	2573	-.002	-.02	56.88	2
16	11978	45	2106	.030	.30	56.87	2	11	12204	-1	2847	-.027	.10	58.71	2
17	11982	52	1698	-.014	.65	56.80	2	17	12205	55	1624	-.014	.49	57.78	2
16	11986	46	1865	-.003	-.13	57.40	2	15	12208	39	2665	-.022	-.40	57.36	2
7	11987	51	1837	-.152	-.90	57.35	3	17	12218	58	1459	-.031	-.27	58.25	2
13	11990	19	2667	.005	.24	58.25	2	18	12221	78	464	-.177	-.08	57.26	2
11	11991	-4	3470	.036	1.04	57.34	2	15	12222	26	2481	.032	.08	56.41	2
11	11992	-1	2815	.001	1.76	57.82	2	11	12223	-4	3533	-.064	.78	57.81	2
15	11994	35	2445	.010	-1.17	57.42	2	15	12224	29	2446	-.046	.53	57.36	2
11	11999	5	2742	.050	.56	57.80	2	7	12227	62	1308	.023	-.08	57.91	2
17	12005	55	1602	-.116	.01	58.07	4	16	12229	45	2124	-.025	-.24	56.87	2
12	12006	11	2563	.029	-.06	57.77	2	16	12232	40	2677	-.018	-1.43	57.80	2
17	12007	66	807	.026	-.17	58.34	2	12	12235	9	2796	-.047	.23	57.28	2
13	12008	17	2626	-.036	.12	57.74	2	13	12237	16	2539	.027	-.02	57.88	2
15	12009	26	2460	.092	-.63	56.79	2	18	12239	70	753	-.075	.08	57.88	2
11	12013	-2	3684	.011	.57	57.36	3	17	12247	64	961	.120	.44	58.67	3
8	12028	84	310	.161	.49	57.99	3	11	12248	2	2710	-.001	.59	56.87	2

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Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
13	12257	15	2609	-.002	.13	56.81	2	12	12532	6	2819	.026	-.96	57.80	2
11	12263	0	2727	.022	-.55	57.87	2	5	12533	31	2574	-.098	-.13	57.74	2
15	12275	36	2406	.043	.26	58.29	4	15	12540	29	2483	-.132	-1.30	57.32	2
18	12281	80	421	-.186	.65	57.34	2	17	12547	50	2041	-.036	-.21	57.34	2
17	12287	56	1682	.012	.18	57.80	2	18	12552	71	673	-.069	.08	57.37	2
17	12289	60	1486	-.001	.21	57.82	2	16	12554	44	2319	-.065	.14	57.42	2
16	12299	41	2422	-.080	.40	56.88	2	11	12559	-1	2897	.000	.30	56.90	2
13	12301	16	2551	.004	.11	57.87	2	13	12560	18	2815	-.016	.09	57.26	2
15	12302	35	2480	-.076	-.16	57.86	2	12	12563	14	2692	-.033	.38	57.77	2
16	12304	43	2350	-.034	1.04	57.35	2	15	12570	33	2402	-.021	.66	57.39	2
11	12310	1	2847	.036	-.97	57.80	2	17	12573	55	1650	.043	-.19	57.36	2
17	12319	52	1739	-.077	.00	58.86	2	12	12578	13	2742	-.020	-.53	56.82	2
12	12321	11	2601	.062	.36	57.79	2	11	12582	3	2847	.006	-.01	57.34	2
16	12323	48	2152	-.130	-.13	57.87	2	17	12583	59	1553	.036	-.68	57.78	2
11	12326	4	2783	-.013	-.63	58.72	2	15	12584	37	2490	.002	-.18	57.42	2
11	12343	2	2727	.002	-.25	58.42	2	14	12586	22	2659	-.001	-.04	56.82	2
14	12344	24	2641	.011	-.47	57.79	2	13	12599	17	2699	-.032	-.50	58.74	2
17	12360	63	1094	-.087	.33	58.36	2	11	12603	2	2771	.011	.04	56.82	2
8	12364	74	554	.038	.57	56.82	2	11	12608	-3	3580	.044	-.18	57.36	2
11	12372	3	2819	-.033	-.36	56.82	2	14	12610	24	2685	-.063	-.30	57.42	2
17	12377	55	1637	-.089	-.84	57.34	2	15	12612	28	2292	-.096	.50	56.90	2
18	12378	85	234	.150	-.42	57.34	2	12	12627	6	2839	-.004	-.60	57.28	2
15	12383	36	2414	.008	.00	57.38	2	11	12630	0	3135	-.017	.44	56.82	2
16	12384	46	1906	-.038	-.25	58.26	2	13	12636	16	2612	.002	.07	57.79	2
12	12397	6	2802	.027	-.15	57.80	2	17	12650	52	1776	.060	-.16	56.90	2
17	12403	51	1874	.017	.55	57.88	2	15	12651	32	2435	.019	-.56	56.82	2
11	12404	1	2857	-.037	.63	57.34	2	11	12653	3	2859	-.077	.60	57.26	2
13	12405	17	2676	-.006	.82	58.31	2	18	12658	82	411	-.020	-.01	59.33	4
12	12413	9	2820	.001	-.87	57.34	2	12	12661	15	2670	-.014	.66	57.34	2
17	12422	58	1474	-.007	-.28	57.89	2	11	12672	-4	3633	-.043	-.37	56.82	2
17	12428	64	970	-.125	-.81	58.59	3	16	12673	41	2471	.045	1.22	57.80	2
13	12435	16	2577	.028	.36	58.34	2	11	12683	2	2782	.001	.54	56.90	2
12	12437	8	2786	-.011	.23	57.80	2	17	12692	63	1120	-.072	.27	58.36	2
11	12442	-3	3549	.033	.72	58.54	5	16	12701	43	2392	-.081	-.91	57.80	2
13	12446	20	2897	-.117	.49	57.26	2	12	12704	8	2827	-.025	.68	57.33	2
7	12450	50	2034	-.077	-.66	58.79	4	12	12708	10	2649	.005	-.30	57.40	2
17	12452	61	1387	.102	.62	58.85	2	13	12713	17	2717	-.007	-.09	57.41	2
12	12453	14	2681	-.013	.48	57.88	2	17	12715	51	1898	-.201	1.03	59.33	4
15	12464	32	2412	-.079	-.39	57.72	2	12	12720	7	2760	.012	-1.43	57.35	2
18	12468	70	762	-.042	.10	58.29	4	11	12732	-4	3645	-.043	.61	57.34	2
18	12469	76	504	.251	.11	58.25	2	16	12752	45	2165	-.082	.87	57.87	2
16	12477	44	2312	-.066	.91	57.42	2	12	12757	13	2771	.043	-.16	56.88	2
15	12483	38	2494	-.079	.18	57.81	2	14	12766	23	2671	.006	-.53	57.34	2
11	12499	3	2836	.002	.19	58.36	2	15	12772	38	2538	-.017	.58	57.26	2
15	12500	33	2390	-.036	-.27	57.26	2	18	12774	74	573	-.069	.10	56.80	2
16	12506	47	2108	-.167	1.00	56.34	2	12	12782	12	2677	-.105	.42	57.87	2
16	12523	42	2455	.018	.40	57.39	2	12	12787	14	2722	-.024	-.15	57.42	2
17	12525	56	1700	.039	-.55	57.36	2	11	12792	4	2847	-.120	-.13	58.34	2
15	12526	35	2516	-.066	.66	57.80	2	13	12802	18	2861	-.089	.69	57.36	2
11	12527	-1	2888	-.057	.45	58.34	2	14	12803	20	2957	-.029	-.66	57.79	2

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Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
11	12809	0	3162	.020	-.19	56.34	2	12	13018	8	2883	.011	-.19	57.79	2
17	12810	54	1661	-.080	-.77	57.34	2	4	13019	22	2718	-.231	-.49	56.34	2
13	12815	15	2695	-.001	.04	57.87	2	15	13020	39	2778	-.137	1.13	57.87	2
18	12817	79	443	-.086	-.35	58.35	2	18	13022	75	539	.061	-2.40	58.35	2
18	12821	84	322	-.117	.19	57.82	2	11	13024	0	2845	-.024	.24	57.40	2
4	12827	25	2759	-.216	.31	57.79	2	12	13026	6	2912	.013	.23	58.77	2
18	12830	76	520	-.078	-.91	57.33	2	13	13036	19	2824	-.027	.48	57.86	2
13	12835	19	2796	.004	.36	56.86	2	6	13043	41	2513	-.049	-.40	58.35	2
5	12844	34	2522	.054	.33	58.69	2	11	13045	0	3207	.019	1.60	58.88	2
12	12847	7	2774	.008	.19	56.88	2	15	13047	35	2581	-.010	-.13	59.27	2
15	12852	36	2478	.110	.42	57.81	2	5	13053	27	2396	-.027	-.79	57.80	2
13	12857	18	2870	.028	.06	57.33	2	16	13058	48	2220	-.098	.56	58.59	4
14	12861	24	2728	-.015	.69	57.90	2	14	13059	24	2745	-.015	-1.44	56.82	2
16	12864	46	1960	-.098	-.66	56.88	2	12	13067	15	2732	.035	.21	58.39	2
17	12871	64	997	.014	-.36	56.33	2	16	13069	50	2098	-.033	-.09	58.07	4
16	12872	44	2350	-.001	.43	58.36	2	15	13070	28	2349	-.025	-.36	57.88	2
16	12875	50	2070	-.006	-.10	58.67	3	17	13079	55	1699	-.074	.37	58.76	5
11	12879	-1	2951	.014	1.01	57.38	2	15	13093	30	2541	.031	.18	57.33	2
12	12888	6	2878	-.058	-.35	57.97	2	17	13095	69	761	.069	-.39	58.95	2
13	12889	20	2975	-.014	-.15	58.33	2	14	13102	22	2727	-.185	-.23	58.28	2
13	12891	18	2877	-.008	-.06	56.79	2	12	13104	10	2720	.007	-.02	57.26	2
18	12894	77	541	-.126	.74	57.82	2	15	13107	38	2578	-.045	-.02	56.89	2
18	12908	83	415	.213	.95	57.82	2	12	13108	9	2928	-.019	-.67	57.86	2
15	12914	28	2325	-.154	-.77	56.86	2	12	13115	12	2725	.004	.14	57.91	2
17	12919	53	1711	-.072	.31	56.82	2	17	13118	67	847	.027	.37	57.79	2
16	12920	48	2202	-.080	.38	57.87	2	11	13122	0	3223	.042	-1.60	57.34	2
12	12923	15	2714	.022	.22	56.89	2	11	13124	0	2855	.055	-.59	57.86	2
15	12924	35	2561	-.173	.22	57.79	2	18	13130	70	799	.012	.75	58.35	2
17	12925	51	1921	.076	-1.24	57.36	2	11	13142	-4	3736	-.021	.39	57.89	2
17	12936	63	1132	-.098	.44	57.42	2	11	13144	2	2854	.003	-.27	58.87	2
15	12938	29	2538	.061	.31	56.90	2	14	13150	21	2677	-.033	-.03	58.41	2
12	12941	6	2891	-.001	.85	58.33	2	18	13155	80	451	.001	.00	57.88	2
15	12943	38	2557	-.055	.43	59.01	3	16	13156	49	2319	-.023	-.40	57.86	2
11	12950	1	2939	-.004	-.46	58.34	2	14	13172	23	2729	-.006	.35	57.33	2
12	12958	11	2684	.036	-.31	58.81	2	17	13176	66	867	-.014	-.05	57.87	2
15	12961	40	2785	.067	1.21	57.88	2	17	13177	51	1945	-.161	1.63	56.89	2
13	12968	20	2981	-.057	1.26	57.79	2	11	13180	4	2909	-.001	.18	57.34	2
11	12971	-2	3855	.020	-.59	56.34	2	15	13184	32	2511	.021	-1.13	57.36	2
15	12973	25	2786	-.022	-.16	56.90	2	5	13191	39	2797	.062	.21	58.72	2
17	12974	69	751	-.152	.05	57.42	2	15	13192	34	2559	.029	-.40	58.40	2
17	12975	56	1742	.052	.03	57.35	2	17	13194	61	1456	-.139	.80	57.42	2
16	12979	43	2414	.035	-.53	58.39	2	17	13197	56	1757	.012	.11	58.86	2
16	12984	46	1966	-.168	.25	57.86	2	13	13200	17	2783	-.053	.28	57.34	2
18	12985	72	645	.007	.24	57.87	2	15	13209	26	2598	.040	-.13	57.36	2
11	12988	-1	2963	.026	.56	57.97	2	16	13214	44	2391	-.078	.30	57.33	2
15	12991	31	2627	-.048	-.01	57.87	2	16	13230	48	2240	-.043	.57	56.85	2
14	12993	22	2714	-.070	-.21	57.80	2	15	13236	38	2591	-.035	-.20	56.89	2
5	13000	33	2471	-.064	-1.77	58.72	2	17	13242	53	1737	-.069	-.30	56.42	2
16	13007	41	2510	-.084	.04	57.34	2	14	13246	21	2692	.077	.11	57.86	2
11	13016	2	2836	-.030	-.21	57.79	2	11	13250	2	2869	-.049	.78	57.33	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
11	13251	4	2924	-.064	-.29	57.87	2	16	13565	45	2262	-.039	-.15	56.96	2
17	13253	64	1031	-.011	.25	57.87	2	12	13567	7	2909	-.031	.10	57.43	2
17	13255	54	1708	-.051	.53	58.72	2	17	13582	55	1736	-.066	.89	57.65	4
17	13256	50	2120	.078	.75	58.35	2	11	13589	0	3318	-.013	.50	56.40	2
15	13271	31	2668	-.015	-.19	57.87	2	17	13591	59	1632	.001	.74	56.88	2
12	13276	14	2796	-.044	.99	57.33	2	11	13595	-4	3832	-.004	.42	56.87	2
17	13281	66	873	-.032	.34	56.90	2	8	13603	89	28	1.283	-.79	59.39	4
16	13295	44	2399	-.233	.37	56.87	2	17	13607	53	1771	.028	.30	57.34	2
17	13333	60	1572	-.002	.99	56.90	2	12	13609	5	2981	-.005	-1.10	57.43	2
12	13335	7	2865	.006	.82	57.39	2	16	13610	49	2363	-.055	1.20	58.30	4
11	13337	1	3002	.079	.11	57.77	2	13	13614	16	2752	.005	.75	57.43	2
5	13338	28	2381	.005	.21	56.87	2	12	13617	12	2809	.010	.25	58.40	2
15	13343	33	2510	.015	-.63	59.11	4	18	13629	73	664	-.104	.18	58.42	2
15	13349	40	2827	.017	.51	58.14	4	15	13641	34	2617	-.037	.46	56.89	2
18	13350	87	143	-.379	.06	58.41	2	18	13646	76	557	-.170	1.26	56.88	2
11	13358	-4	3779	.032	1.14	58.80	2	15	13652	27	2469	-.089	-.22	57.43	2
13	13360	17	2803	-.018	.19	57.96	2	13	13655	19	2945	.074	-.55	56.36	2
11	13363	4	2939	.017	-.30	58.82	2	14	13658	24	2838	-.105	.64	58.36	2
16	13365	48	2248	-.129	.63	59.88	2	15	13660	39	2858	-.079	.27	59.65	4
17	13374	67	858	-.068	.42	56.33	2	12	13661	14	2856	-.060	.94	58.95	2
17	13375	57	1544	.036	.87	56.87	2	5	13665	29	2646	.015	-.41	57.87	2
11	13384	0	3286	.014	.00	57.87	2	14	13666	21	2751	-.101	-1.14	58.88	2
15	13391	25	2856	-.067	.61	56.89	2	15	13667	25	2891	-.017	-1.15	57.82	2
5	13395	35	2634	-.035	.00	57.80	2	11	13669	0	2948	-.006	-.25	58.41	2
14	13400	20	3051	.066	.56	57.79	2	11	13671	4	2993	.022	.29	56.87	2
15	13402	30	2596	-.070	-1.35	58.34	2	12	13684	7	2937	-.005	-.41	56.81	2
12	13407	8	2955	-.086	.52	58.86	2	17	13687	52	1865	.019	-.09	56.88	2
17	13411	61	1473	.071	-.02	57.87	4	3	13688	15	2842	.027	.52	57.91	4
11	13418	2	2900	.002	.27	56.40	2	16	13689	45	2277	-.135	1.05	57.36	2
18	13430	77	565	.086	.15	56.96	2	15	13698	30	2643	-.013	-.32	57.41	2
6	13434	46	2017	-.089	.94	57.87	2	17	13700	60	1603	.008	-.06	58.82	2
13	13437	15	2808	.005	.46	57.41	2	17	13709	61	1495	-.058	-.52	56.92	2
16	13442	42	2559	-.010	.27	57.78	2	11	13711	0	3348	.021	-.50	58.33	2
4	13452	24	2814	.037	-.79	56.89	2	14	13718	23	2804	-.025	.27	56.87	2
12	13454	5	2962	.024	-.21	56.96	2	17	13719	68	828	.085	.61	56.91	2
13	13456	18	2972	.024	-.09	57.49	2	13	13721	18	3008	-.063	.20	58.34	2
16	13463	48	2258	-.231	-.49	57.84	2	6	13722	48	2284	-.013	.12	56.89	2
12	13471	11	2762	.015	.18	57.93	2	16	13726	40	2874	.084	.73	58.48	2
18	13473	84	339	.173	-.05	58.91	2	14	13727	22	2824	.037	-.05	57.34	2
12	13488	12	2785	-.012	-.03	56.40	2	18	13728	78	510	-.102	-.62	58.42	2
11	13500	-1	3020	-.011	.38	56.94	2	16	13733	43	2491	-.029	.99	56.89	2
11	13508	0	3304	.008	.70	58.60	4	11	13742	-2	3985	.013	.11	57.88	2
12	13514	6	3000	.033	-.30	59.11	4	15	13746	28	2425	.015	-.82	58.33	2
3	13527	18	2977	.020	.60	56.87	2	17	13750	56	1798	-.103	.53	57.86	2
15	13533	27	2457	.002	.11	57.86	2	12	13758	9	3031	.016	-.60	57.87	2
17	13544	58	1552	.004	.34	56.44	2	15	13759	25	2908	.037	.16	58.34	2
11	13549	4	2971	.009	.91	56.33	2	17	13763	65	1052	.089	.08	57.83	2
17	13555	61	1484	.030	.07	56.34	2	17	13766	63	1194	-.045	.52	59.39	2
15	13560	27	2461	-.008	.12	57.34	2	13	13767	17	2859	-.052	.35	58.87	2
18	13562	70	826	.065	.70	56.92	2	12	13770	8	3026	-.027	-.87	58.91	4

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.	Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.
15	13777	29	2663	-.050	-.18	57.42	2	11	14041	2	2987	.057	-.27	57.35	2
17	13796	59	1655	-.096	-.36	56.92	2	17	14044	55	1773	.002	.78	57.36	2
16	13797	44	2464	.050	.05	57.87	2	12	14047	13	2993	-.012	.66	56.44	2
11	13799	-3	3784	-.077	-.63	58.88	2	11	14049	-2	4040	.035	.12	58.34	2
11	13803	-1	3057	-.009	.47	57.94	2	16	14052	48	2322	-.091	.00	56.92	2
11	13807	1	3080	.003	.15	59.35	2	17	14068	67	915	-.064	1.27	56.34	2
5	13811	37	2644	.028	.49	56.89	2	4	14070	24	2919	-.052	.80	57.82	2
11	13812	0	2971	-.005	-.84	58.35	2	12	14075	6	3096	.037	-.76	57.87	2
18	13816	73	678	-.034	-.14	57.80	2	11	14077	-3	3824	-.032	-.19	58.39	2
12	13824	7	2968	.002	-.37	57.36	2	17	14078	53	1807	-.020	.25	57.40	2
11	13827	3	3039	-.056	.09	58.94	2	17	14085	55	1775	-.016	.77	58.49	4
11	13832	2	2968	.066	1.19	57.37	2	11	14091	-4	3975	-.073	.79	58.90	2
13	13835	16	2790	-.103	.51	56.88	2	15	14098	27	2538	-.068	.66	58.42	2
13	13843	19	2973	-.061	.01	56.87	2	13	14100	19	3018	-.038	.26	59.00	2
15	13844	33	2594	-.065	.02	57.93	2	5	14108	35	2731	-.046	-.45	57.85	2
11	13852	-3	3793	.004	.96	58.28	2	18	14114	74	630	-.024	.43	58.90	2
16	13853	46	2074	-.013	.37	59.03	3	12	14127	10	2911	-.043	.39	56.88	2
12	13865	14	2889	-.019	.18	58.34	2	12	14128	7	3037	-.001	-.32	57.88	2
6	13868	49	2398	-.106	.70	57.37	2	15	14130	25	2973	-.060	.01	57.80	2
15	13874	40	2896	.004	1.09	58.86	4	6	14131	49	2428	.065	-.23	57.40	2
12	13879	10	2871	-.035	.62	56.96	2	18	14139	81	531	-.206	.38	58.42	2
14	13882	21	2783	-.009	.56	57.79	2	14	14141	21	2827	.023	-.03	58.42	2
7	13884	64	1075	-.046	.14	58.42	2	16	14142	47	2272	.058	-.20	57.95	2
12	13891	13	2960	.016	.17	57.35	2	17	14145	63	1228	-.003	.40	58.42	2
17	13896	69	801	-.004	-.11	57.87	2	15	14147	39	2922	-.083	-.18	58.82	2
17	13907	53	1790	-.006	-.19	56.91	2	13	14149	16	2835	-.047	.89	57.38	2
11	13909	0	3375	.026	-.72	57.93	2	15	14151	38	2708	-.108	.73	57.86	2
13	13910	18	3040	-.023	.90	58.41	2	17	14152	61	1543	-.043	.25	59.12	4
11	13926	-2	4021	-.028	.54	56.82	2	17	14154	59	1682	-.053	-.21	58.90	2
5	13927	35	2705	-.135	-1.58	58.12	4	13	14158	19	3024	.009	.49	58.47	2
16	13928	50	2195	-.074	.96	56.82	2	16	14174	44	2516	-.031	-.29	56.87	2
15	13931	28	2447	.007	-.17	56.95	2	4	14176	20	3163	-.072	-.47	57.36	2
16	13933	45	2307	.025	-.86	57.87	2	15	14185	28	2487	-.140	-1.85	57.82	2
11	13951	0	2990	.014	.00	56.91	2	11	14187	0	3423	-.029	-.58	57.41	2
18	13967	79	470	-.089	.57	57.93	2	12	14194	13	3027	.024	.66	58.90	2
12	13968	7	2996	-.014	-.66	57.80	2	11	14196	2	3020	.022	-.22	57.95	2
12	13975	6	3076	-.058	.22	57.40	2	15	14202	32	2642	-.019	.83	56.35	2
17	13983	63	1216	-.102	.14	58.42	2	12	14220	8	3108	.057	1.15	56.87	2
5	13984	39	2895	-.062	.02	58.34	2	12	14224	10	2927	.004	-.24	57.42	2
12	13987	9	3080	.048	-.18	57.88	2	17	14228	54	1780	-.057	.91	57.82	2
5	13989	33	2611	.060	-.27	57.90	2	14	14230	21	2851	-.048	-.36	57.89	2
17	13994	52	1890	-.104	-.16	57.43	2	15	14231	31	2799	-.013	.11	56.95	2
17	13995	57	1598	.169	-.58	58.46	2	17	14235	56	1844	-.075	.26	58.39	2
15	14004	34	2674	-.023	.21	56.34	2	11	14236	-2	4077	-.033	.16	58.41	2
13	14011	19	3002	.007	-.33	57.33	2	11	14237	0	3040	.001	-.74	58.41	2
16	14012	41	2622	-.019	.90	57.82	2	17	14241	57	1620	-.140	.30	57.88	2
17	14014	65	1069	-.043	-.48	57.42	2	13	14243	17	2938	-.007	.97	57.42	2
11	14017	0	3001	.030	.09	56.88	2	13	14248	19	3042	-.106	.04	57.39	2
18	14032	75	574	-.050	.48	57.85	2	12	14253	13	3037	.003	.12	57.88	2
15	14033	27	2528	.044	-.19	57.40	2	18	14255	72	703	-.190	.22	57.86	2

OBSERVED - AGK2							OBSERVED - AGK2						
Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.
16	14257	48 2346	-.039	-.29	57.82	2	12	14553	12 2993	-.008	-.68	56.88	2
15	14261	34 2716	-.030	-.16	56.41	2	11	14564	-2 4160	-.035	.40	57.36	2
11	14274	1 3154	-.051	.52	58.64	3	17	14565	62 1470	-.075	-.77	57.96	2
16	14286	41 2655	-.106	.54	56.37	2	11	14569	-4 4095	-.018	.18	57.48	2
17	14287	53 1832	.056	.56	57.40	2	17	14576	55 1830	-.038	-.63	57.35	2
17	14291	66 927	-.075	.58	56.87	2	11	14581	0 3503	.042	-.56	57.95	2
15	14298	29 2752	.063	1.04	56.42	2	16	14583	40 3006	-.057	.39	56.98	2
11	14314	-2 4094	-.030	-.25	56.90	2	17	14589	52 1961	-.062	-.25	58.42	2
15	14326	35 2762	-.048	-.48	56.41	2	15	14590	29 2816	.084	-.04	57.87	2
16	14329	47 2292	-.021	.92	56.89	2	6	14595	47 2333	-.003	.27	58.25	4
12	14340	6 3149	.016	-1.22	56.94	2	11	14598	3 3173	-.011	.38	58.41	2
17	14345	60 1649	.039	-.07	56.95	2	12	14604	10 2992	.061	.35	57.96	2
12	14349	13 3062	-.055	-.57	56.95	2	8	14608	79 493	-.258	-.20	58.44	2
16	14362	42 2671	-.201	-2.56	57.36	2	8	14619	73 717	-.083	.30	58.44	2
11	14366	0 3455	-.042	.18	58.42	2	15	14621	32 2717	-.068	-.35	56.89	2
16	14369	44 2541	-.089	-.12	57.52	2	15	14649	28 2564	-.020	.03	56.95	2
15	14371	36 2689	-.006	1.77	56.98	2	14	14656	24 3003	-.110	-.65	57.96	2
16	14375	45 2370	-.096	-1.03	58.41	2	14	14672	23 2934	-.029	-.16	56.96	2
11	14376	-2 4111	-.037	.29	57.41	2	12	14673	5 3203	-.002	.13	58.40	2
11	14378	-3 3875	-.038	.21	58.11	3	18	14674	76 606	-.195	.88	57.97	2
17	14379	58 1615	-.119	-.28	58.41	2	17	14675	60 1676	.004	.64	58.41	2
17	14381	62 1452	-.091	-.57	57.43	2	15	14687	34 2787	-.025	-.15	57.42	2
11	14385	3 3128	.007	-.89	57.94	2	15	14698	33 2733	.009	.18	56.96	2
13	14388	16 2885	.034	-.57	58.04	2	13	14700	15 3008	.024	.91	57.35	2
18	14397	83 468	-.342	1.05	57.80	2	17	14710	54 1814	-.085	.03	56.89	2
12	14400	5 3147	-.021	-.13	58.69	4	5	14714	40 3020	-.067	.21	56.96	2
12	14403	7 3102	-.035	.02	58.41	2	11	14716	4 3191	.015	-.45	57.43	2
15	14408	34 2741	-.130	-.23	59.12	3	15	14721	35 2822	-.003	-.49	58.48	2
12	14423	11 2926	.007	-.22	58.90	2	17	14728	56 1892	.009	-.64	58.41	2
15	14431	25 3039	-.161	.40	57.34	2	14	14734	20 3284	-.104	-.99	57.43	2
17	14432	53 1848	-.028	.26	57.40	2	11	14740	1 3246	-.023	-.12	56.95	2
16	14446	48 2369	-.065	.96	57.36	2	15	14745	37 2762	.055	-.91	57.83	2
14	14450	21 2882	-.001	.41	56.40	2	13	14751	17 3041	-.005	1.24	56.96	2
14	14451	24 2977	-.039	-1.39	57.97	2	16	14759	42 2719	-.022	.10	57.71	4
17	14452	67 928	-.031	-.86	57.90	2	15	14767	28 2581	-.066	.50	56.89	2
13	14460	18 3138	-.002	1.11	57.41	2	14	14773	23 2951	-.048	1.15	56.98	2
16	14477	46 2156	-.040	.47	56.95	2	11	14776	-4 4128	-.034	.43	56.96	2
11	14485	4 3140	.021	.10	56.82	2	11	14777	-3 3964	-.048	.58	58.66	4
13	14486	16 2908	-.004	1.25	57.39	2	12	14786	7 3207	-.051	.13	57.49	2
12	14488	9 3169	.033	-.60	57.43	2	7	14792	54 1819	.015	-.41	57.97	2
11	14492	0 3477	-.012	.25	57.94	2	17	14793	51 2115	.027	.38	58.05	2
11	14494	-1 3159	-.040	.57	58.04	2	17	14794	59 1734	.028	-.06	58.49	2
14	14498	22 2946	-.006	.63	56.41	2	13	14799	19 3127	.075	.17	56.98	2
16	14512	48 2380	.012	-.36	57.89	2	15	14802	32 2750	.042	.19	57.49	2
18	14514	81 543	.254	.31	58.88	2	17	14806	66 959	.005	-.31	57.95	2
17	14519	66 944	-.133	.09	57.51	2	15	14814	30 2843	.007	-.53	57.90	2
13	14523	20 3236	.008	-.87	56.36	2	11	14816	2 3140	-.024	.31	57.95	2
15	14528	38 2747	-.039	.58	56.40	2	15	14831	36 2756	-.168	.45	57.43	2
17	14534	61 1577	-.101	.27	57.43	2	13	14841	19 3135	-.016	1.39	56.89	2
17	14541	64 1117	-.027	.15	57.95	4	11	14851	0 3155	-.027	-.17	57.48	2

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Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
11	14859	3	3240	-.004	.78	56.96	2
16	14862	46	2199	-.058	.31	56.89	2
15	14876	35	2848	-.035	-1.07	56.89	2
16	14885	44	2598	-.055	.10	56.50	2
12	14894	12	3064	-.019	.37	58.48	2
17	14898	56	1911	.009	-.17	57.05	2
16	14903	41	2740	-.223	.72	56.49	2
11	14907	0	3569	.042	.43	57.88	2
18	14908	79	510	.125	-.20	57.90	2
11	14910	-3	3982	.012	.65	56.95	2
17	14911	53	1883	-.012	.71	58.05	2
12	14912	11	3028	-.033	.18	58.04	2
13	14914	15	3040	.021	-.27	57.42	2
12	14920	6	3282	-.058	1.33	57.03	2
11	14924	4	3242	-.017	.32	59.14	4
12	14925	7	3228	-.004	.67	59.00	2
12	14930	9	3259	.009	-.91	58.50	2
15	14938	32	2775	.027	-.29	57.96	2
12	14940	10	3058	-.021	-.27	57.93	2
13	14941	17	3081	.038	-.07	58.93	2
17	14944	52	1994	-.105	-.41	57.42	2
16	14950	48	2433	-.102	-.11	57.94	2
15	14956	27	2681	-.049	.13	58.44	2
17	14965	65	1141	-.004	-.14	58.05	2
16	14969	46	2211	.003	-.48	56.96	2
13	14972	18	3237	-.015	.41	57.93	2
17	14973	58	1669	-.008	.09	58.07	2
15	14975	29	2881	.031	1.07	58.96	2
11	14979	1	3306	-.033	.03	58.02	2
14	14981	20	3332	-.074	.11	58.93	2
12	14982	9	3273	.016	.04	59.45	3
15	14988	31	2908	.020	-.82	58.41	2
12	14996	6	3296	.006	.82	57.94	2
4	15002	24	3060	-.072	-.01	57.42	2
12	15005	5	3276	.089	.33	56.44	2
13	15022	19	3175	-.007	.67	56.88	2
12	15034	12	3097	-.034	-.08	58.97	2
13	15035	18	3256	.011	1.00	57.72	4
16	15039	48	2445	-.014	-.35	56.44	2
15	15040	38	2848	-.002	1.71	58.02	2
17	15041	51	2141	-.080	.04	57.03	2
15	15048	35	2878	-.031	-.20	57.98	2
14	15050	21	2997	-.085	-.80	58.03	2
11	15051	3	3298	.017	-.07	57.97	2
11	15076	-3	4023	-.051	.91	56.96	2
18	15081	71	812	-.149	.56	57.97	2
11	15087	0	3597	.029	.23	57.96	2
15	15089	32	2810	-.074	.09	58.46	3
11	15090	-2	4275	-.046	-.16	58.76	4
16	15093	40	3072	.018	.30	57.95	2
15	15094	37	2821	-.075	-.27	58.99	2
11	15095	0	3203	-.017	.37	58.48	2
4	15099	23	3020	.009	-.25	58.42	2
13	15101	17	3125	.014	.51	59.40	4
15	15103	40	3074	-.042	.36	57.97	2
14	15109	22	3035	.016	-.34	58.01	2
12	15115	13	3264	-.022	-.04	57.95	2
12	15120	10	3102	.006	.56	56.95	2
17	15125	65	1156	-.024	.40	56.49	2
15	15128	32	2820	-.022	-.36	57.06	2
17	15134	55	1890	-.002	-.14	57.96	2
12	15135	9	3299	.034	-.19	56.89	2
16	15137	43	2668	.027	-.14	57.97	2
7	15140	57	1718	-.051	-.83	57.44	2
15	15148	33	2805	.054	.98	56.49	2
15	15150	30	2911	-.030	-.77	57.51	2
12	15159	8	3322	-.021	-.21	56.96	2
11	15160	-3	4040	-.047	.61	56.98	2
18	15169	78	573	-.137	.46	57.49	2
16	15177	47	2419	-.061	.52	56.49	2
17	15197	54	1856	-.036	.17	57.43	2
16	15202	41	2784	-.101	-.94	56.49	2
15	15206	29	2927	-.015	-.35	58.68	4
11	15212	-2	4294	.021	-.80	57.49	2
17	15213	51	2161	-.125	-.27	57.42	2
18	15214	73	754	-.040	.62	57.43	2
13	15217	16	3091	-.032	-.14	56.95	2
15	15222	32	2844	-.021	-.10	58.50	2
16	15227	45	2487	.023	-.42	58.07	2
15	15228	36	2823	-.072	.34	57.59	2
12	15231	14	3185	.012	.12	58.49	2
17	15232	53	1915	-.029	.20	57.99	2
11	15234	3	3339	-.014	.36	57.94	2
17	15237	67	984	-.153	.57	59.03	2
15	15242	25	3197	-.023	-.28	58.89	2
12	15244	5	3323	.026	-.43	57.51	2
18	15246	71	823	-.086	-.39	57.91	2
12	15258	7	3304	-.035	-.94	58.03	2
11	15271	-4	4233	-.022	.72	58.43	4
17	15274	60	1735	-.029	.35	57.03	2
17	15275	65	1168	-.054	.01	58.43	4
6	15281	42	2800	-.031	.20	57.05	2
16	15284	44	2659	-.032	-.23	57.49	2
12	15286	12	3159	.001	-.04	57.94	2
11	15292	0	3646	-.012	-.39	57.97	2
16	15296	47	2435	-.001	.05	58.50	2
15	15308	29	2951	.011	.74	56.89	2
15	15319	39	3083	-.033	.74	56.94	2
12	15322	6	3365	.002	.00	57.03	2
11	15326	2	3266	.120	.21	59.42	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.	Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.
16	15333	48	2489	-.080	-.50	57.97	2	18	15683	71	847	-.179	1.02	58.05	2
17	15350	61	1645	-.045	1.08	56.89	2	11	15694	1	3467	-.003	.15	57.49	2
11	15355	5	3353	.017	-.01	56.50	2	17	15697	66	1034	.005	.13	57.48	2
12	15363	14	3205	.020	-.30	57.56	2	15	15699	38	2966	-.027	1.02	57.45	2
13	15374	17	3201	-.060	.82	57.52	2	12	15707	11	3210	-.041	.20	56.50	2
12	15377	15	3141	.014	-.14	56.97	2	12	15710	14	3289	.028	.84	56.96	2
15	15381	30	2956	-.014	.85	56.96	2	13	15712	19	3381	-.021	.16	57.99	2
15	15416	37	2863	.085	-.35	58.12	3	15	15720	31	3062	-.004	.01	56.95	2
16	15420	49	2614	-.007	-.36	56.96	2	17	15724	69	929	-.024	-.06	58.44	4
11	15431	-4	4262	-.034	.21	56.98	2	12	15730	12	3267	.009	-.32	57.43	2
15	15433	27	2787	-.058	-1.02	56.96	2	15	15742	26	3053	.002	-.43	57.97	2
11	15437	-2	4332	.005	-.27	59.84	3	17	15743	68	945	-.031	-.07	57.49	2
11	15448	0	3265	-.029	-.98	58.91	2	12	15753	7	3434	-.023	-.12	56.51	2
14	15449	22	3120	-.018	.23	56.99	2	12	15760	6	3490	-.026	.60	57.40	2
11	15455	4	3396	-.014	.27	57.49	2	15	15764	34	3019	-.090	-.60	57.06	2
13	15462	17	3225	-.018	.15	56.96	2	15	15771	35	3040	-.031	.38	57.13	2
17	15464	61	1652	.004	-.49	57.52	2	15	15773	28	2803	-.009	-.98	56.98	2
17	15472	62	1540	.012	.06	57.49	2	4	15777	21	3189	-.003	.49	57.97	2
12	15479	9	3372	-.001	-.26	56.93	2	18	15784	70	949	-.041	-.33	57.01	2
17	15484	59	1804	-.007	.45	56.74	3	14	15786	23	3162	-.051	-1.48	57.42	2
15	15521	37	2881	-.085	.29	56.46	3	17	15789	50	2449	-.014	.12	56.98	2
16	15540	45	2531	-.006	1.32	57.42	2	12	15793	10	3272	-.027	.49	58.49	2
5	15559	25	3264	.016	-.60	56.98	2	13	15800	18	3445	-.045	.22	56.47	2
11	15561	0	3285	-.014	.06	57.51	2	15	15805	27	2877	-.106	.52	57.06	2
14	15562	24	3184	-.077	.00	57.57	2	11	15806	4	3493	.008	.21	57.43	2
11	15565	-2	4357	-.010	.48	58.04	2	11	15815	-1	3386	.027	.43	57.98	2
11	15570	-3	4105	-.052	.13	57.96	2	14	15830	22	3205	-.030	-.63	57.49	2
18	15574	73	772	.023	.01	57.49	2	16	15831	49	2685	-.154	-.83	57.50	2
12	15583	13	3382	.037	-.06	57.52	2	15	15833	30	3052	-.021	-.45	58.49	2
12	15589	9	3399	-.022	.01	57.95	2	16	15834	42	2909	-.041	-.93	57.49	2
11	15594	1	3440	.024	.92	56.49	2	15	15835	39	3215	-.004	.50	58.57	2
12	15599	11	3188	.065	.65	58.98	2	11	15840	-3	4172	-.038	.37	59.02	2
16	15601	41	2839	-.063	.48	57.42	2	18	15843	75	640	-.167	.82	58.07	2
12	15603	10	3219	-.034	-.23	57.06	2	13	15846	17	3332	-.028	.36	57.57	2
14	15611	22	3157	-.002	.50	56.93	2	11	15865	0	3361	.035	.37	57.49	2
18	15612	77	661	-.167	.30	56.98	2	18	15871	80	555	-.136	.16	57.44	2
15	15613	29	3033	-.011	1.37	57.95	2	15	15873	32	2987	-.069	-.26	57.49	2
16	15619	45	2540	.016	.14	57.49	2	17	15875	67	1036	-.040	-.37	58.50	2
17	15628	59	1823	.046	-1.56	57.58	2	17	15909	56	2024	-.038	.20	57.05	2
11	15629	2	3340	.050	-.25	58.91	2	17	15917	54	1917	-.002	-.18	57.56	2
16	15637	40	3162	.037	.69	57.52	2	15	15918	38	3011	.005	-.03	57.44	2
4	15649	23	3131	-.044	.43	56.95	2	11	15939	-2	4480	-.034	.79	57.42	2
12	15657	7	3400	-.007	-.94	56.50	2	12	15954	14	3360	.013	-.03	58.04	2
15	15658	32	2941	-.076	.23	57.05	2	12	15960	9	3505	.007	-.17	57.81	3
17	15660	52	2067	-.052	-.06	57.58	2	14	15963	23	3207	-.111	-.78	57.10	2
17	15661	64	1204	-.040	.21	57.97	2	17	15976	52	2110	-.002	.06	57.96	2
14	15665	21	3153	-.019	-1.26	57.98	2	16	15977	42	2951	-.014	.55	59.03	2
11	15674	4	3448	.065	.62	58.94	2	12	15980	12	3324	.009	.86	58.06	2
12	15676	10	3246	.025	-.06	58.05	2	17	15986	66	1057	-.027	-.43	58.06	2
16	15682	43	2763	-.106	.45	57.49	2	16	15989	45	2620	.097	.66	57.50	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
12	15995	6	3576	.015	-.05	57.12	2	12	16251	13	3564	-.013	.57	57.58	2
15	15999	32	3010	-.030	-.39	56.88	2	16	16253	40	3314	-.011	-.11	58.03	2
18	16004	85	294	-.279	.19	58.05	2	12	16259	5	3656	.010	.62	57.42	2
16	16021	47	2563	-.073	.53	58.91	2	16	16261	45	2679	.049	.66	58.14	2
11	16028	0	3393	.010	.05	57.14	2	16	16263	42	3030	-.022	.48	57.59	2
12	16030	14	3375	-.006	.40	57.96	2	17	16267	63	1415	.002	-.36	57.58	2
15	16032	38	3045	-.044	.30	57.51	2	15	16271	36	3064	-.003	-1.37	57.57	2
17	16037	54	1925	-.058	-.73	58.05	2	18	16273	74	757	.026	-.18	58.02	2
16	16038	40	3254	-.016	-.78	58.07	2	13	16274	15	3415	-.001	.14	57.85	4
16	16053	49	2716	-.069	.00	57.52	2	15	16277	25	3475	-.043	-.15	57.53	2
17	16059	56	2044	-.023	.26	57.89	2	15	16305	36	3079	-.013	-.37	57.96	2
17	16066	63	1396	.089	-.10	57.01	2	16	16307	48	2668	.033	-.10	57.48	2
11	16070	0	3837	.040	-.84	57.51	2	12	16309	8	3636	.009	-.01	57.49	2
16	16072	41	2955	-.001	-1.21	57.06	2	11	16324	-4	4438	-.055	.50	57.52	2
15	16076	30	3106	-.054	-.10	57.56	2	17	16334	69	973	-.078	.34	57.56	2
15	16077	39	3300	-.030	.59	57.43	2	16	16337	40	3340	.012	1.16	57.06	2
14	16079	20	3642	-.043	-.85	57.52	2	15	16342	31	3239	.065	.88	57.61	2
18	16086	71	864	.041	.93	57.42	2	15	16346	39	3385	-.049	-.45	58.06	2
14	16087	24	3311	.033	-.73	57.12	2	17	16348	52	2184	-.002	-.45	58.59	2
13	16097	17	3418	.014	-.45	58.05	2	12	16350	10	3479	-.009	.93	57.53	2
4	16118	21	3292	.023	-.13	56.96	2	17	16351	55	2054	.080	-.25	59.00	2
12	16120	5	3599	-.046	.56	57.07	2	18	16361	80	577	-.139	-.36	58.02	2
18	16121	82	537	-.058	.14	57.13	2	16	16365	46	2464	-.241	1.92	57.98	2
16	16128	42	2996	-.071	.67	57.52	2	17	16368	61	1741	-.003	.26	58.76	4
15	16129	29	3180	-.036	-1.22	57.06	2	17	16370	66	1100	-.078	-.11	57.60	2
13	16131	15	3354	.005	.04	57.06	2	17	16376	64	1263	-.025	.05	59.04	2
15	16132	37	3008	-.075	-.25	58.49	2	16	16380	42	3065	-.070	1.29	57.04	2
18	16136	79	569	-.226	.14	57.48	2	12	16381	12	3499	-.002	.39	56.50	2
17	16139	64	1242	-.067	.15	58.12	2	16	16390	43	2962	-.024	.43	56.47	2
12	16141	13	3514	.003	.18	57.98	2	5	16392	25	3510	.021	-.77	57.50	2
12	16143	10	3385	.018	-.62	58.54	2	15	16396	38	3157	.007	-1.41	58.06	2
17	16157	54	1940	.037	-.77	58.56	2	13	16398	17	3565	.008	.60	58.04	2
17	16161	62	1596	-.059	-.18	56.49	2	11	16403	-3	4279	-.037	-.05	57.97	2
16	16164	48	2639	-.131	-1.05	58.05	2	12	16407	13	3632	-.009	.89	57.03	2
11	16169	3	3597	-.015	.11	57.06	2	12	16413	9	3699	-.017	-.12	57.50	2
11	16181	-4	4405	-.021	.47	57.52	2	18	16420	75	667	-.043	.36	58.02	2
11	16183	0	3859	-.011	-.28	57.51	2	16	16427	41	3051	-.020	-.08	57.53	2
16	16198	47	2589	-.083	-1.58	56.40	2	15	16432	33	3099	-.006	.19	57.58	2
12	16205	7	3578	.009	.87	57.07	2	15	16433	26	3253	-.018	-.81	57.51	2
15	16211	29	3195	-.024	-.06	56.98	2	13	16434	19	3643	-.025	.55	57.48	2
13	16219	18	3586	-.045	.32	57.51	2	14	16439	24	3416	.013	.39	58.05	2
15	16224	27	2975	-.033	.20	56.50	2	15	16446	30	3206	-.069	.34	57.03	2
18	16225	72	829	.013	.08	58.02	2	17	16459	59	1898	-.050	-.13	58.48	4
18	16227	77	681	-.083	.71	56.96	2	18	16464	70	998	-.022	-.08	57.48	2
17	16231	61	1728	-.105	-.26	57.11	2	12	16469	14	3546	.007	.33	57.52	2
18	16234	86	275	-.873	.47	57.97	2	18	16470	77	696	.034	1.19	58.02	2
11	16240	4	3652	.022	.43	58.12	2	15	16473	39	3428	-.012	.49	57.03	2
15	16244	37	3043	-.066	-.51	56.47	2	15	16478	37	3130	.030	-.29	57.97	2
17	16249	52	2159	-.031	.37	57.51	2	17	16486	57	1874	-.022	.32	57.05	2
11	16250	0	3883	.021	.60	57.06	2	13	16498	15	3483	-.087	.38	58.51	4

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
14	16501	21	3459	-.036	.22	58.06	2	15	16857	33	3246	-.068	.67	57.03	2
12	16509	13	3667	.000	.24	59.03	2	12	16861	12	3711	-.042	-.10	57.06	2
15	16513	25	3551	-.013	.31	56.94	2	12	16872	7	3894	.027	-.05	57.10	2
16	16528	40	3403	.011	-.10	56.57	2	11	16878	-3	4413	-.004	.29	58.03	2
11	16530	0	3960	.058	.10	57.51	2	15	16883	26	3394	-.036	.48	58.04	2
11	16537	1	3711	.008	.04	58.76	4	16	16898	49	2898	-.058	.46	56.96	2
12	16541	8	3743	.044	-.20	58.15	3	12	16899	5	3987	.024	.28	57.11	2
11	16547	4	3791	.041	.07	57.48	2	13	16901	16	3677	.014	.17	57.52	2
18	16553	76	694	-.018	-.15	58.10	2	17	16908	56	2164	.023	.23	58.12	2
13	16567	15	3511	.011	.59	56.57	2	16	16909	47	2720	-.073	.13	57.56	2
15	16584	27	3053	-.025	.25	58.49	2	15	16911	38	3362	-.014	-.18	58.04	2
15	16587	25	3581	.038	-.72	58.04	2	15	16925	25	3683	-.007	.05	58.03	2
15	16597	36	3202	-.034	.26	57.56	2	11	16930	-1	3613	.013	-.28	57.03	2
13	16600	18	3747	.023	.72	58.03	2	11	16937	2	3751	.010	.88	57.05	2
16	16605	43	3025	.023	.24	58.58	2	17	16947	62	1670	.004	.68	57.53	2
15	16608	33	3156	-.108	-.33	58.04	2	11	16950	1	3851	.003	.68	56.61	2
18	16610	72	852	-.039	-.18	58.05	2	18	16954	88	114	-1.657	.11	58.63	2
12	16611	14	3596	-.097	.32	58.03	2	17	16960	58	1851	-.031	.14	57.57	2
16	16630	46	2519	-.046	-.38	57.01	2	12	16980	8	3950	-.024	-.55	57.10	2
17	16634	59	1908	-.011	.16	56.97	2	18	16984	70	1039	-.108	.06	57.58	2
17	16641	57	1890	-.015	.85	57.04	2	15	16986	37	3315	-.043	.69	56.96	2
12	16646	7	3799	-.001	.21	57.52	2	18	17017	80	604	-.057	-.12	58.54	2
14	16647	24	3489	.048	-.03	58.05	2	16	17019	39	3630	-.052	-.39	57.14	2
17	16661	53	2113	.008	.08	57.08	2	17	17024	54	2080	-.020	-.34	57.06	2
11	16663	0	3993	.013	.00	57.49	2	17	17040	52	2336	.060	.17	58.04	2
18	16674	74	789	-.062	.61	57.50	2	16	17080	46	2627	-.025	.14	57.08	2
14	16681	20	3905	.008	-.36	57.43	2	11	17095	2	3801	.035	-.31	56.67	2
11	16686	-1	3551	.015	.74	59.73	4	16	17097	48	2837	-.012	.89	57.58	2
15	16690	29	3326	-.008	-.47	58.58	2	15	17100	32	3335	-.032	.21	57.05	2
15	16694	31	3344	-.050	.50	58.03	2	17	17102	64	1330	.017	-.24	56.96	2
12	16695	5	3934	.044	-.04	58.50	2	14	17112	22	3613	.046	-.02	57.57	2
16	16709	49	2849	.001	-1.11	57.58	2	16	17113	40	3613	.035	-.58	57.08	2
11	16713	1	3764	.028	-.42	59.03	2	17	17122	58	1873	-.007	-.09	59.02	2
12	16737	11	3599	-.008	.32	57.03	2	12	17124	7	3988	-.018	.15	57.58	2
12	16742	9	3866	-.028	.67	58.70	4	15	17132	29	3506	-.049	.46	58.56	2
8	16744	75	680	.020	-.24	57.06	2	11	17133	-4	4719	.075	.16	58.54	4
15	16745	30	3294	.025	.44	57.03	2	14	17145	21	3695	.016	.40	58.56	2
16	16749	43	3072	.004	.65	58.06	2	17	17147	66	1172	.079	.07	57.11	2
12	16758	6	3943	.011	.21	57.59	2	11	17153	0	3679	.043	.15	57.58	2
15	16760	28	3086	-.132	.31	59.53	3	12	17154	8	4007	.001	-.21	57.12	2
17	16763	65	1293	.050	-.18	58.04	2	15	17158	34	3468	.038	1.16	58.14	2
14	16772	20	3941	-.006	-.31	59.75	4	16	17169	41	3271	.031	.08	57.61	2
15	16775	32	3220	.047	.06	56.94	2	17	17172	69	1036	-.029	1.06	58.57	2
6	16797	45	2779	-.036	-.65	57.50	2	16	17183	49	2965	-.013	-.09	57.87	4
17	16804	58	1837	-.021	.39	58.56	2	15	17184	36	3466	-.023	.26	58.56	2
16	16811	42	3174	.005	1.91	57.03	2	17	17189	52	2376	.002	.56	58.60	2
11	16814	-1	3582	.034	.27	59.68	5	18	17190	73	854	.044	.64	58.05	2
17	16821	51	2438	-.023	.57	58.05	2	13	17192	14	3849	.019	.37	57.59	2
15	16850	35	3388	-.005	-.41	56.97	2	7	17202	67	1132	-.036	.72	57.11	2
12	16853	9	3911	.015	.34	59.03	2	17	17204	65	1334	-.014	.26	58.14	2

OBSERVED - AGK2								OBSERVED - AGK2							
Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.	Zone	Star	B.D. No.		$\Delta\alpha$	$\Delta\delta$	Epoch	No.
12	17207	12	3867	-.004	.33	57.59	2	17	17628	64	1377	-.138	.25	57.07	2
14	17209	20	4095	.047	.04	58.12	2	11	17632	-3	4696	.010	1.37	57.15	2
11	17221	-1	3702	.037	-1.09	57.60	2	8	17633	70	1085	.025	.08	58.05	2
17	17223	63	1504	.032	.35	58.14	2	17	17650	68	1078	-.090	-.50	58.56	2
15	17233	33	3403	.033	-.44	59.47	2	17	17656	55	2257	.038	.39	57.66	2
17	17240	58	1891	-.018	.91	57.56	2	15	17659	24	3872	.025	.10	57.51	2
18	17242	84	437	-.705	.05	58.02	2	15	17660	35	3791	-.011	-.54	57.06	2
17	17248	49	2976	-.030	.27	57.12	2	15	17665	37	3600	.043	.18	57.12	2
12	17254	5	4115	.057	-.08	58.12	2	16	17669	45	2971	-.080	-.74	58.06	2
16	17268	43	3215	-.064	.54	57.06	2	17	17681	58	1981	.025	-.17	58.06	2
11	17287	3	3990	.009	.17	57.61	2	15	17686	28	3478	-.005	-.54	58.59	2
15	17289	39	3740	-.051	.49	57.66	2	12	17688	9	4264	.008	.98	58.13	2
17	17304	62	1704	.017	-.67	57.56	2	11	17701	-4	4926	-.032	1.38	57.15	2
16	17307	48	2890	-.031	.32	57.11	2	13	17708	14	4053	.009	.26	57.61	2
13	17308	15	3796	.011	1.20	58.06	2	12	17711	6	4323	.025	.64	57.66	2
12	17310	11	3826	.092	.69	58.49	2	17	17713	61	1912	.053	-.01	59.02	2
17	17313	56	2238	.055	.36	58.57	2	18	17714	72	911	-.013	.24	57.06	2
15	17324	28	3319	-.159	-1.30	58.60	2	15	17718	32	3587	.033	.70	58.06	2
16	17338	43	3231	-.036	-.98	57.61	2	16	17727	44	3265	-.032	-.07	57.11	2
17	17339	60	1943	-.109	.55	59.02	2	16	17731	48	2959	.003	.06	57.97	2
15	17350	35	3614	-.034	-.02	58.05	2	11	17743	-2	5136	.017	.15	57.69	2
18	17357	72	891	-.067	.04	58.04	2	17	17751	50	2904	-.060	1.16	58.04	2
11	17369	1	4004	.018	-.35	58.12	2	15	17752	25	4006	.035	-.11	57.60	2
18	17374	77	730	-.167	-.60	58.06	2	17	17757	68	1084	.031	.33	58.80	4
15	17378	32	3441	.010	.07	57.15	2	17	17762	65	1409	-.008	-.71	58.56	2
17	17383	52	2431	-.018	-.71	59.03	2	12	17769	11	4035	-.017	.50	59.03	2
16	17389	47	2837	-.056	.68	58.55	2	15	17773	35	3850	.002	.03	58.15	2
18	17405	79	629	-.191	.16	58.58	2	16	17787	48	2979	-.002	-.37	57.15	2
14	17416	20	4167	-.004	.01	57.67	2	13	17793	15	3985	-.018	.70	58.14	2
15	17422	31	3631	.018	-.07	57.65	2	18	17801	78	694	-.097	.13	58.13	2
12	17433	13	4039	.027	.44	58.06	2	17	17808	60	2046	-.034	.51	57.06	2
17	17453	63	1534	-.036	-.34	58.04	2	18	17812	82	598	-.068	-.19	58.06	2
17	17461	69	1052	-.288	.35	57.15	2	17	17815	62	1769	-.021	.07	57.59	2
14	17474	24	3780	.038	-.51	57.52	2	11	17816	-1	3864	-.031	.41	58.94	2
18	17480	74	828	.137	.35	57.58	2	13	17818	16	4073	.069	.44	57.61	2
13	17486	19	4066	.049	.72	57.67	2	17	17831	53	2328	-.025	-.11	57.67	2
12	17487	14	3965	-.030	1.00	59.03	2	14	17832	21	3987	-.053	-.15	58.58	2
17	17491	62	1730	.066	.94	57.59	2	11	17839	-3	4757	.078	-.24	58.14	2
16	17498	44	3179	.035	-.57	57.60	2	15	17850	36	3794	.014	-.19	58.14	2
11	17505	-4	4855	-.005	.35	57.60	2	17	17851	55	2291	-.096	-.71	58.05	2
15	17524	27	3446	.028	.45	57.60	2	6	17853	45	3022	-.060	.10	58.05	2
12	17529	12	3995	.019	.06	58.07	2	15	17855	25	4050	-.005	-1.72	57.03	2
11	17540	0	4266	.034	-.22	58.50	2	15	17877	34	3832	.001	.02	57.59	2
16	17542	42	3403	.005	-.05	57.12	2	18	17888	69	1085	.034	1.45	57.58	2
11	17545	2	3950	.028	-.08	58.06	2	15	17891	29	3857	-.017	-.93	58.05	2
12	17552	10	4006	.017	.36	57.66	2	16	17895	43	3453	-.032	-.83	56.57	2
17	17554	58	1948	-.031	-.43	57.11	2	16	17897	42	3563	-.025	.17	58.55	4
15	17570	34	3655	.032	-.96	57.06	2	13	17900	17	4197	.069	-.06	58.15	2
17	17593	50	2844	-.048	-.05	57.11	2	11	17902	-3	4771	-.019	-.54	57.70	2
11	17627	4	4210	.005	1.51	57.11	2	14	17903	20	4389	-.023	-.14	58.14	2

OBSERVED - AGK2							OBSERVED - AGK2						
Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.
15	17906	34 3846	-.013	1.30	57.73	2	14	18333	24 4145	.040	-.61	57.16	2
11	17907	-1 3885	-.031	.07	58.15	2	17	18336	67 1252	-.099	.89	58.04	2
18	17909	71 991	-.069	-.15	58.06	2	11	18338	-1 3988	.042	-.23	58.04	2
17	17911	61 1961	.017	.28	59.04	2	16	18358	40 4211	.006	.80	57.67	2
13	17915	18 4366	-.059	.59	58.59	2	13	18365	15 4185	.025	.39	58.84	4
15	17926	37 3744	-.029	2.12	57.56	2	11	18368	1 4309	.077	.92	58.14	2
5	17945	25 4093	-.031	-.08	57.61	2	12	18383	9 4570	.031	-.09	57.95	3
18	17967	85 340	-.500	.57	58.59	2	11	18390	0 4536	.085	.42	59.57	4
18	17972	87 187	1.641	.17	58.18	2	12	18398	14 4343	-.012	.81	58.50	2
13	17973	16 4145	-.037	-.65	56.57	2	15	18402	38 4149	.040	-.67	58.64	4
18	17990	73 898	-.129	-.19	57.58	2	12	18409	10 4325	.051	-.40	58.22	2
4	17991	22 3936	.039	.31	57.61	2	4	18410	24 4165	-.010	-.33	58.25	3
12	17996	9 4414	.010	.23	57.11	2	12	18416	6 4580	.018	.24	57.56	2
16	18009	45 3066	-.038	-1.78	57.10	2	16	18417	49 3317	-.005	.34	57.60	2
6	18025	42 3613	.018	-.06	57.95	3	11	18429	1 4327	.017	1.16	58.06	2
12	18040	8 4369	.031	-.10	57.60	2	11	18436	-1 4015	-.008	.27	58.05	2
12	18043	5 4441	.011	.55	58.34	4	14	18437	21 4285	-.019	-.78	57.69	2
16	18059	46 2870	.003	.83	57.67	2	15	18448	39 4254	-.043	.00	58.12	2
12	18060	10 4205	-.035	-.28	58.12	2	15	18453	34 4098	.057	.26	58.05	2
13	18064	14 4223	.023	.69	58.13	2	15	18459	25 4308	-.027	-.26	58.14	2
13	18065	19 4322	-.011	.51	57.68	2	15	18460	32 3886	-.029	-.73	58.89	4
13	18074	17 4257	-.034	.18	58.59	2	17	18462	63 1640	.060	.24	57.59	2
15	18075	27 3652	-.028	.21	58.15	2	15	18480	27 3820	-.042	-1.02	57.10	2
11	18079	0 3949	.018	-.08	58.14	2	17	18482	60 2145	-.026	.10	58.89	3
14	18089	20 4488	.011	-.17	58.10	2	17	18505	58 2156	.083	-.09	57.12	2
11	18091	2 4121	.090	.34	58.14	2	12	18514	11 4355	.013	.64	57.21	2
16	18113	43 3541	-.014	.32	57.67	2	15	18519	37 4026	.030	-.41	57.14	2
17	18120	56 2382	-.063	.78	58.59	2	12	18520	9 4616	.013	-.50	57.59	2
18	18126	74 853	-.050	.11	58.13	2	6	18539	43 3695	.039	-.10	57.60	2
18	18140	72 945	-.032	.23	57.67	2	18	18541	72 962	-.039	-.02	57.09	2
12	18149	9 4476	.025	.67	57.57	2	15	18550	26 3970	.038	-1.60	58.58	2
17	18163	61 1996	-.087	.53	57.14	2	15	18552	32 3913	.013	.66	57.05	2
11	18167	-4 5090	-.038	.12	57.66	2	15	18570	31 4210	.022	-1.21	57.24	2
18	18182	77 770	-.173	-.42	57.12	2	14	18575	22 4176	.007	-.02	57.61	2
15	18197	33 3864	.008	-.95	58.05	2	15	18578	30 4169	.010	-.66	56.61	2
14	18201	21 4167	.070	.93	57.06	2	13	18593	15 4256	.007	-.07	58.14	2
17	18214	51 2848	-.028	.30	57.58	3	17	18609	59 2285	.019	.18	58.60	2
4	18218	21 4179	.071	-.55	57.05	2	15	18610	28 3888	.032	-2.13	57.60	2
11	18237	-1 3971	.072	-.30	58.05	2	11	18613	0 4589	.011	.36	57.22	2
15	18240	33 3885	-.078	-.33	57.59	2	11	18621	4 4552	.048	-.26	58.21	2
11	18247	-1 3976	.041	-1.27	58.13	2	16	18624	41 3897	-.054	-.03	57.66	2
15	18255	25 4226	-.020	-.65	57.56	2	11	18636	1 4374	.061	.55	57.61	2
12	18271	14 4293	.221	.96	57.56	2	12	18641	11 4397	.010	.00	57.14	2
18	18277	75 739	-.047	.51	57.63	3	17	18646	50 3209	-.028	.06	57.20	2
17	18278	60 2125	-.022	.26	58.04	2	14	18669	22 4223	.050	-.62	57.59	2
11	18280	1 4289	.076	.08	57.59	2	11	18683	0 4121	.005	.38	58.13	2
17	18291	53 2405	.043	-.21	57.10	2	11	18690	0 4610	.062	.43	57.60	2
12	18319	9 4546	.080	.22	57.59	2	12	18702	10 4403	.007	-.10	57.05	2
14	18321	21 4225	.050	-1.28	58.58	2	17	18714	53 2514	-.077	.00	58.87	4
11	18328	-4 5153	-.028	.19	57.66	2	14	18719	19 4564	-.042	-1.20	57.12	2

OBSERVED - AGK2							OBSERVED - AGK2						
Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.
11	18720	2 4275	.028	.48	57.14	2	12	19032	10 4500	.003	-.42	57.59	2
17	18731	69 1136	-.013	.95	57.12	2	12	19044	11 4528	.020	.20	57.67	2
17	18738	59 2296	.019	-.35	56.65	2	11	19047	-4 5404	.056	-.18	57.70	2
11	18752	-3 5076	-.060	-.48	58.58	2	18	19058	74 912	-.132	.25	57.20	2
14	18754	22 4248	-.044	-.97	58.88	4	13	19062	17 4546	-.045	-.24	57.23	2
15	18762	32 3999	-.021	-.62	57.20	2	13	19067	15 4388	.034	-.11	57.68	2
12	18769	5 4659	-.005	.17	58.91	4	17	19078	67 1303	-.092	.29	57.67	2
17	18774	50 3236	.014	.13	58.60	2	12	19085	12 4600	.075	.50	58.58	2
16	18776	40 4373	-.011	.36	58.13	2	16	19087	49 3501	-.007	-.09	58.21	2
11	18782	-2 5421	.002	-1.97	57.59	2	11	19088	-2 5507	-.014	.69	57.61	2
17	18785	67 1279	-.037	-.32	57.09	2	12	19089	5 4759	.034	1.08	58.22	2
14	18802	24 4299	.007	.24	57.66	2	15	19097	36 4520	-.032	-.09	57.67	2
11	18803	-3 5092	.005	-.34	58.05	2	14	19109	20 4894	-.169	.54	58.15	2
18	18809	85 359	-.110	.40	57.59	2	18	19115	81 735	-.613	.10	57.57	2
11	18816	0 4148	.052	-.21	57.15	2	6	19116	41 4109	-.028	-.09	57.14	2
17	18819	51 2982	.000	-.37	58.05	2	4	19122	23 4296	.030	-1.13	57.16	2
18	18821	73 922	-.051	1.52	57.56	2	17	19124	58 2255	-.078	-.25	57.68	2
15	18823	36 4375	.026	.60	56.69	2	13	19126	19 4692	.005	.44	57.20	2
13	18825	17 4492	-.006	.11	58.07	3	12	19128	7 4671	-.015	-.13	58.14	2
16	18828	49 3440	.120	.96	58.57	2	17	19134	63 1720	-.032	.17	58.12	2
15	18840	28 3970	.060	.05	58.60	2	15	19139	38 4472	.070	.26	58.93	3
11	18859	2 4296	.055	.53	56.70	2	12	19148	13 4694	.010	-.78	58.13	2
18	18864	70 1158	.055	.19	57.66	2	12	19164	9 4805	.009	1.25	57.64	3
11	18869	-4 5355	.066	-.53	57.60	2	16	19171	45 3531	-.024	.12	57.24	2
16	18870	41 3993	-.028	1.15	58.13	2	17	19172	54 2536	-.159	.84	57.60	2
13	18877	16 4454	-.003	.43	58.13	2	16	19185	42 4098	.019	-.93	57.24	2
16	18886	46 3174	-.084	.46	58.15	2	18	19190	75 788	-.048	.34	57.08	2
15	18890	27 3970	-.150	-.78	57.69	2	17	19192	55 2587	.010	-.19	58.07	2
15	18892	25 4463	.077	-.36	56.61	2	14	19202	23 4317	-.005	.41	57.66	2
12	18903	8 4616	.023	-.02	58.93	4	16	19217	41 4153	-.048	.41	59.19	2
17	18914	54 2476	.006	-.91	58.13	2	15	19232	38 4509	-.048	-.17	57.66	2
12	18917	12 4553	.029	.16	57.60	2	11	19240	-2 5551	.025	.05	57.20	2
15	18934	38 4362	-.026	.18	57.15	2	15	19247	29 4426	.021	.00	58.11	2
15	18951	36 4447	-.103	-.41	58.15	2	14	19258	22 4411	-.078	.03	57.61	2
15	18953	25 4477	.034	.27	57.67	2	18	19260	77 823	.044	.78	58.13	2
12	18962	8 4627	.031	-.52	57.15	2	16	19270	49 3544	.030	-.14	57.68	2
14	18964	22 4331	-.043	.43	58.05	2	18	19276	72 991	.010	.02	58.20	2
15	18971	35 4431	.047	.04	57.15	2	17	19285	56 2590	-.109	-.16	57.12	2
15	18974	39 4479	-.047	-1.04	57.59	2	11	19294	0 4238	.007	.61	58.39	4
15	18976	32 4088	-.083	.47	58.22	2	15	19295	26 4197	.032	-.24	57.65	2
11	18980	-1 4123	-.001	.37	57.68	2	15	19313	38 4539	-.034	.39	58.13	2
17	18981	63 1703	-.071	-.57	57.17	2	15	19323	30 4479	.018	-.60	57.60	2
15	18986	27 4007	-.014	-1.28	59.19	2	12	19325	5 4824	.048	-.06	57.15	2
12	18989	5 4733	.011	.61	58.14	2	12	19348	14 4647	.114	.02	58.13	2
11	18993	-3 5155	-.020	.83	58.21	2	14	19349	21 4587	.014	-.09	57.60	2
11	19002	4 4631	.052	.09	57.15	2	17	19351	50 3382	.103	-.54	57.24	2
12	19008	13 4647	-.007	-.01	58.65	2	11	19361	-4 5503	-.076	-.06	58.65	2
14	19009	21 4501	-.002	.22	57.66	2	12	19362	13 4751	-.025	-.19	57.73	2
12	19014	7 4650	.045	-.08	57.68	2	15	19364	27 4122	.012	.10	58.92	4
11	19019	0 4189	.064	.26	57.60	2	15	19373	35 4600	-.046	.02	57.21	2

OBSERVED - AGK2							OBSERVED - AGK2						
Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.
16	19374	44 3892	-.027	.21	57.58	2	17	19699	64 1613	.013	.26	56.69	2
11	19376	1 4518	.080	.41	58.89	4	11	19717	-1 4236	.035	-1.12	56.66	2
17	19381	63 1759	.000	-.04	57.24	2	18	19750	73 957	-.060	1.58	57.11	2
13	19388	16 4575	.025	1.26	58.15	2	15	19754	29 4573	-.009	-.07	56.69	2
13	19402	18 4837	.052	.96	57.66	2	15	19756	31 4617	-.036	.10	56.63	2
16	19406	46 3407	.035	.48	57.09	2	14	19757	20 5074	-.082	.01	57.66	2
15	19410	31 4529	-.016	.42	57.21	2	11	19761	-2 5689	-.012	-.06	57.23	2
14	19412	20 4991	.012	-1.20	58.13	2	17	19765	61 2243	-.016	.68	57.67	2
18	19414	70 1192	-.066	-.04	58.12	2	12	19770	5 4947	.053	.35	57.23	2
15	19415	32 4232	-.125	-.32	57.70	2	12	19771	6 4957	.092	.99	57.98	3
12	19417	8 4720	.016	-.40	57.24	2	11	19774	-3 5375	-.062	-.50	58.19	2
12	19434	10 4608	-.078	-.10	57.66	3	14	19800	24 4537	.075	-.83	56.69	2
14	19439	23 4381	-.068	-.53	57.58	2	15	19804	38 4689	-.037	.85	57.21	2
17	19443	68 1244	.019	-.35	58.57	2	11	19806	3 4665	-.003	-.41	57.90	4
16	19449	42 4195	.041	.09	57.59	2	11	19810	0 4310	.050	.54	58.20	2
11	19453	-3 5296	-.005	-.21	57.70	2	11	19823	0 4829	.012	.26	59.00	3
11	19455	0 4776	.061	.37	57.21	2	17	19825	67 1405	.030	.51	57.11	2
14	19467	21 4614	.030	.66	57.73	2	14	19832	20 5090	.018	1.25	56.69	2
11	19477	3 4613	.017	-.04	58.65	2	17	19849	59 2477	.016	.19	57.20	2
13	19483	18 4861	-.013	.26	57.75	2	17	19875	54 2702	-.034	.47	58.58	2
18	19487	73 945	-.136	.74	58.62	3	11	19881	0 4322	.090	.21	57.25	2
7	19496	69 1197	-.131	.00	58.15	2	16	19888	41 4420	.062	.84	57.24	2
16	19498	45 3680	-.054	.74	57.08	2	17	19902	56 2736	.023	.14	58.20	2
18	19501	75 801	-.054	.27	58.59	2	13	19906	17 4714	.041	.61	57.66	2
17	19507	57 2402	.108	-.36	59.09	2	18	19909	79 728	-.134	-.24	57.19	2
13	19508	16 4607	.042	-.61	58.65	2	15	19916	35 4746	-.051	.34	58.30	3
16	19510	41 4277	.043	.30	58.67	2	14	19917	20 5106	-.036	-.52	58.12	2
18	19513	80 706	-.061	.04	58.60	2	17	19918	66 1490	.014	.85	57.67	2
12	19514	7 4752	-.005	-.42	58.65	2	13	19932	15 4604	-.022	.14	57.25	2
11	19516	4 4753	-.020	1.13	58.14	2	15	19939	31 4668	-.014	.29	57.58	2
14	19542	22 4493	.020	-.34	57.17	2	17	19941	50 3637	-.053	-.02	57.11	2
11	19547	-1 4212	.043	.72	59.14	4	11	19949	4 4837	.037	.76	58.13	2
15	19548	31 4562	-.105	-.91	57.73	2	16	19963	49 3805	-.229	-1.17	57.67	2
12	19550	13 4797	.022	-.14	57.24	2	12	19968	9 5019	-.033	.85	58.26	2
16	19555	47 3584	-.011	.50	58.12	2	12	19969	7 4842	-.010	-.56	58.30	3
17	19560	50 3465	.005	.61	58.60	2	16	19973	41 4456	-.047	-.39	58.58	2
12	19562	12 4705	.033	-.28	58.59	2	13	19978	14 4772	.032	-.42	56.70	2
18	19570	77 836	-.136	.04	58.20	2	16	19989	46 3661	-.065	.26	58.33	2
15	19576	35 4664	-.006	-.78	58.14	2	12	19992	10 4731	.054	.41	57.75	2
11	19586	3 4630	.072	-.06	58.13	2	14	20003	22 4618	.032	-.18	58.66	2
12	19593	8 4760	-.028	.18	58.15	2	18	20010	72 1029	.029	.14	56.66	2
11	19597	-4 5570	-.071	-.40	59.06	2	16	20023	43 4178	-.056	.05	58.80	2
17	19606	68 1258	.072	.39	57.73	2	11	20025	-4 5663	-.125	-.15	58.61	2
15	19613	30 4558	.063	.29	58.13	2	13	20038	16 4724	-.029	.25	58.10	2
17	19619	53 2740	.089	1.64	58.12	2	14	20045	21 4745	.004	.64	58.20	2
12	19631	11 4695	.037	-.39	56.69	2	17	20047	66 1503	.032	-.16	57.67	2
16	19641	45 3740	-.054	.43	57.68	2	15	20061	34 4674	-.073	-.33	58.13	2
17	19648	49 3692	.008	-.21	57.24	2	12	20062	9 5040	.016	.40	58.31	2
11	19686	0 4807	.054	-.19	58.69	3	15	20064	31 4689	.041	1.09	58.15	2
11	19689	2 4457	.103	.38	56.66	2	12	20068	10 4744	.002	-.31	58.28	2

OBSERVED - AGK2

Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
17	20072	62	2074	.106	.54	57.14	2
12	20075	12	4820	-.004	.60	58.20	2
17	20082	53	2874	-.042	.49	57.12	2
11	20085	-1	4294	.035	.27	57.21	2
11	20102	0	4876	.045	.59	57.70	2
17	20107	64	1665	.022	.05	58.21	2
11	20109	2	4508	.058	.26	58.13	2
14	20112	24	4593	-.019	-.18	59.06	2
16	20117	46	3711	-.030	-.40	58.14	2
16	20120	47	3809	.043	.11	58.15	2
11	20126	-3	5452	-.017	.02	57.21	2
12	20129	4	4860	-.005	.76	58.70	4
16	20134	44	4147	.011	.53	58.27	2
16	20137	45	3958	.017	-1.04	58.35	2
18	20141	75	832	-.097	.73	59.24	2
11	20148	3	4716	-.065	.09	59.25	2
13	20149	17	4758	.022	1.36	58.66	2
12	20152	7	4883	-.011	-.06	59.26	2
13	20154	14	4811	.003	.23	57.68	2
15	20157	38	4787	-.056	.24	58.30	3
14	20169	20	5180	-.041	.38	58.60	2
11	20170	0	4892	.002	.02	57.66	2
7	20182	65	1780	.074	.49	58.15	2
14	20186	24	4608	.002	-.09	56.70	2
16	20192	42	4441	.002	1.19	57.75	2
12	20194	8	4892	.067	-.71	58.26	2
12	20201	12	4843	.002	.32	58.66	2
17	20214	57	2562	.012	-.31	58.76	2
15	20217	30	4744	-.050	-.29	57.69	2
12	20219	9	5068	.032	.89	57.60	2
12	20225	4	4880	.016	.68	58.22	2
16	20240	47	3856	.024	1.00	58.43	4
11	20241	1	4634	-.005	-.52	57.25	2
16	20256	43	4255	.045	.55	57.59	2
17	20264	67	1454	.047	.43	58.73	2
14	20270	20	5195	-.006	1.16	58.14	2
11	20273	-3	5482	-.044	.86	58.59	2
11	20280	-1	4336	-.007	.54	57.69	2
15	20284	33	4556	.001	.09	57.68	2
15	20291	30	4761	-.025	.33	56.70	2
18	20298	86	335	-.609	-.12	57.67	2
12	20315	11	4859	-.014	.35	58.92	4
12	20316	9	5090	.016	.19	56.67	2
12	20322	7	4913	-.002	.20	57.69	2
11	20323	0	4911	.085	-.25	57.68	2
11	20333	4	4896	.034	.29	58.29	3
13	20338	15	4695	.030	-.10	58.21	2
15	20344	39	4916	-.114	.70	57.60	2
14	20356	20	5217	.026	1.38	58.20	2
12	20362	12	4880	-.009	.46	57.66	2

OBSERVED - AGK2

Zone	Star	B.D. No.		Δα	Δδ	Epoch	No.
18	20369	81	788	-.205	.41	57.58	2
11	20373	-1	4346	.054	.14	57.24	2
12	20376	10	4815	-.007	.06	58.59	2
15	20380	26	4499	-.007	.42	58.21	2
15	20381	37	4686	-.026	.98	58.30	3
18	20387	73	994	.030	.40	57.67	2
14	20389	21	4828	-.049	-.88	58.19	2
11	20408	0	4926	.063	1.41	57.68	2
12	20428	7	4932	-.003	.06	58.59	2
16	20438	41	4618	-.008	-1.18	57.20	2
12	20442	12	4894	.047	-.72	57.69	2
4	20443	19	5012	.001	.54	57.67	2
15	20448	24	4673	.047	-.28	57.75	2
17	20462	65	1817	-.018	.19	57.12	2
15	20478	39	4953	-.021	-.17	57.20	2
11	20480	-3	5521	.012	.78	57.10	3
17	20486	49	3959	-.105	-.23	58.22	2
15	20488	26	4524	-.021	-.21	57.76	2
11	20495	1	4662	.013	-.20	57.24	2
11	20500	0	4432	.001	-.52	56.70	2
11	20502	-1	4355	.042	-1.00	58.89	4
14	20504	21	4850	.029	.33	58.60	2
12	20509	10	4844	.056	-.03	57.75	2
12	20512	6	5083	-.042	-.75	57.66	2
18	20520	84	516	.388	.07	57.73	2
18	20521	78	813	-.008	-.05	57.66	2
13	20529	18	5069	.041	-.31	58.30	2
18	20544	71	1173	.008	.55	57.20	2
15	20548	25	4848	-.021	-.40	57.24	2
14	20550	23	4640	.016	-.43	58.01	3
13	20552	16	4842	.056	.60	58.22	2
15	20553	31	4816	-.002	1.09	57.67	2
15	20555	36	4970	-.055	-.33	58.59	2
15	20556	38	4903	.091	.53	58.66	2
11	20569	-1	4364	.102	.82	57.68	2
17	20571	49	4003	-.050	.06	58.35	2
15	20573	26	4539	.010	-1.23	58.30	2
16	20581	40	4958	-.033	-.52	58.30	3
16	20584	43	4359	-.008	-.08	57.75	2
15	20585	24	4694	-.061	-.90	58.03	3
18	20591	73	1001	.127	-.66	58.13	2
15	20594	34	4817	-.128	-1.29	57.68	2
16	20596	47	4007	-.021	.01	57.24	2
17	20603	54	2895	-.065	1.03	57.67	2
11	20606	0	4955	.036	-.14	58.22	2
12	20612	13	5041	-.005	.10	58.20	2
16	20613	44	4307	.070	.72	57.66	2
11	20615	-3	5553	-.038	.00	57.20	2
18	20620	75	867	.020	.16	58.70	4
15	20626	28	4506	-.009	-.31	58.22	2

OBSERVED - AGK2							OBSERVED - AGK2						
Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.	Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.
12	20630	6 5107	-.002	.65	58.76	2	15	20955	34 4916	.099	-.54	58.75	2
17	20631	63 1917	-.160	.01	57.76	3	14	20964	22 4829	.038	.65	57.68	2
15	20635	26 4555	.026	-.21	58.22	2	12	20965	6 5153	.020	-.25	58.20	2
16	20638	41 4668	.015	.37	58.22	2	17	20966	55 2956	.015	-.61	57.28	2
17	20646	52 3360	.025	.33	58.13	2	13	20968	14 4990	.048	-.15	58.72	2
12	20657	5 5128	.002	.37	57.67	2	15	20973	25 4934	-.149	.60	58.22	2
13	20660	16 4865	.004	.55	58.15	2	17	20981	52 3446	-.044	.28	58.31	3
12	20672	8 4993	-.009	-.63	56.70	2	12	20984	8 5061	-.004	.58	58.32	2
7	20675	68 1353	-.183	.26	57.59	2	17	20991	54 2975	-.027	1.26	58.21	2
15	20677	37 4765	.081	1.82	58.35	3	18	20996	79 781	.144	-.01	58.68	2
13	20684	17 4868	.041	-.93	58.70	4	16	21001	43 4462	-.057	.46	57.67	2
17	20692	58 2547	.106	-.41	57.73	2	15	21002	29 4930	-.013	-.05	58.24	2
15	20694	29 4863	-.007	-.50	57.29	2	15	21003	36 5069	-.011	-.62	58.86	2
6	20704	40 5001	-.023	.44	58.25	2	11	21013	-3 5644	-.008	-.73	58.74	2
15	20712	26 4569	.003	-1.26	57.25	2	12	21015	5 5176	.033	-.16	57.74	2
12	20717	7 4980	.059	.29	57.74	4	14	21031	22 4846	.010	.27	58.15	2
15	20720	25 4885	-.091	.12	58.68	2	14	21038	23 4752	.062	-.82	58.22	2
13	20721	17 4874	.001	-.38	58.67	3	15	21039	34 4938	.042	-.30	58.15	2
11	20723	1 4687	.087	.97	58.15	2	16	21041	44 4430	.064	-.32	57.68	2
17	20725	62 2173	-.065	-.21	58.18	2	12	21056	8 5072	.081	.16	56.76	2
14	20729	23 4683	.000	.42	58.22	2	16	21062	48 4082	-.006	-.30	57.22	2
4	20746	20 5285	.056	.57	57.22	2	17	21063	58 2607	.031	-.32	58.23	2
16	20748	44 4342	-.014	.09	57.22	2	11	21099	-1 4456	.056	-.05	58.15	3
13	20751	16 4884	-.006	-.09	58.70	4	17	21116	66 1619	.059	.19	58.07	3
11	20757	-3 5584	.021	.11	57.25	2	6	21126	46 4089	-.002	-.83	58.76	4
15	20764	31 4867	.097	.08	57.75	2	12	21130	6 5174	.003	-.51	57.70	2
12	20767	5 5146	.023	-.36	59.10	5	14	21138	20 5357	-.018	-.12	58.48	4
11	20773	0 4483	.016	.76	57.22	2	15	21141	34 4966	.024	-.08	58.28	2
11	20777	1 4695	.058	1.17	58.13	2	15	21142	37 4872	-.021	.61	57.68	2
11	20778	0 4978	-.016	.20	57.73	2	17	21147	55 2990	.003	59.44	57.75	2
17	20780	52 3391	.032	.43	57.24	2	3	21150	18 5180	.020	.24	58.69	2
17	20781	66 1596	.130	.40	58.29	2	15	21151	36 5087	.047	-.24	58.85	2
18	20795	71 1190	-.049	-.11	58.72	3	17	21154	68 1384	-.067	-.19	58.72	3
11	20801	-1 4409	.076	.17	58.35	2	17	21163	64 1835	.001	.01	58.74	2
15	20829	38 4965	-.032	.72	57.22	2	12	21171	7 5066	.026	-.12	58.68	2
17	20831	49 4078	-.038	-.05	57.13	2	17	21174	53 3207	-.054	.59	58.22	2
11	20840	0 4984	.053	-.04	57.39	3	13	21175	16 4959	-.002	.36	58.35	2
11	20844	3 4847	.051	-.20	58.68	2	17	21177	60 2598	.024	-.11	58.30	2
12	20857	8 5039	.053	-.05	57.24	2	11	21188	4 5036	.037	.27	57.74	2
17	20867	58 2572	.056	.25	58.15	2	13	21190	17 4957	-.028	.28	58.69	2
15	20868	32 4621	-.075	1.66	58.27	2	11	21195	2 4701	-.027	.11	58.76	4
12	20899	13 5096	.052	-.11	57.22	2	11	21200	-3 5688	-.006	-.34	58.21	2
11	20902	1 4714	-.008	-.20	57.23	2	12	21217	11 5044	-.014	-.04	57.70	2
15	20903	37 4820	.010	.28	57.68	2	5	21223	37 4881	-.044	-.16	57.76	3
12	20908	12 4974	-.027	.17	58.14	2	18	21240	84 536	-.624	.21	57.22	2
18	20923	74 1018	.049	.11	57.19	2	17	21243	59 2762	-.057	.24	57.70	2
17	20930	50 4025	-.030	.21	58.15	2	14	21244	21 4977	.070	.42	58.79	2
11	20935	-4 5879	.033	-.07	57.20	2	16	21247	41 4853	-.090	-.41	58.30	2
17	20937	51 3598	-.021	-.21	57.40	3	17	21248	61 2510	.073	.43	57.68	2
13	20954	18 5147	.032	.13	57.70	2	15	21254	28 4630	.023	.16	57.08	3

OBSERVED - AGK2						
Zone	Star	B.D. No.	Δα	Δδ	Epoch	No.
13	21255	15 4880	.024	.05	58.69	2
12	21256	6 5197	.072	-.46	57.28	2
15	21267	31 4965	.071	.00	57.28	2
13	21276	18 5209	.081	-.38	57.75	2
11	21278	0 4566	.030	-.13	57.68	2
15	21280	36 5117	.056	.01	58.28	2
13	21282	16 4983	-.003	.74	58.71	3
15	21283	27 4619	.022	-.56	57.76	2
11	21291	-4 5955	-.033	.89	58.15	2
16	21294	45 4325	-.057	.34	59.80	2
11	21296	-1 4489	.011	-.41	58.35	2
11	21298	3 4895	.033	.49	59.34	2
12	21301	7 5086	.052	-.39	57.75	2
12	21303	14 5058	.056	.23	57.29	2
15	21306	29 5002	-.016	.27	57.76	2
16	21307	41 4869	-.075	.03	59.34	2
14	21315	20 5375	.039	.39	59.23	4
12	21317	9 5283	.042	.83	59.79	4
17	21319	67 1564	.031	.90	58.22	2
12	21328	12 5027	.045	1.13	58.35	2
17	21330	66 1648	-.284	-.29	57.22	2
17	21331	62 2310	.017	.10	58.30	2
16	21335	40 5161	.043	.76	57.24	2
4	21340	22 4914	.035	.59	57.76	2
17	21341	58 2660	-.021	-.23	58.22	2
11	21343	-4 5965	-.025	1.03	58.15	2
15	21344	26 4707	-.010	-.99	58.85	2
13	21355	19 5164	-.056	1.39	58.21	2
15	21357	28 4655	-.036	-1.16	59.09	4
11	21376	0 4581	-.022	.40	57.68	2
12	21380	11 5072	-.039	.59	58.08	3
17	21389	54 3066	.029	.71	57.76	2
11	21390	-2 6059	.047	.39	58.24	2
13	21391	17 5002	.025	.38	58.24	2
15	21400	37 4903	-.147	-.01	58.75	2
16	21420	45 4367	.008	.48	58.22	2
11	21422	-1 4504	-.003	-.30	57.24	2
11	21423	1 4804	.049	.11	58.74	3
13	21434	17 5013	.047	.29	57.79	2
14	21435	19 5176	-.011	.36	57.76	2
15	21439	31 5007	-.033	-.65	58.23	2
15	21445	38 5103	.054	-.87	57.23	2
15	21450	30 5066	-.195	.30	58.15	2
13	21454	15 4916	-.003	.25	58.25	2
11	21457	3 4912	.024	.65	58.87	2
16	21462	40 5202	.013	-.16	58.74	2
17	21467	62 2343	.097	.11	58.27	2
12	21469	10 5018	.019	.73	58.86	2
15	21472	35 5149	-.111	.20	58.08	3
11	21475	1 4814	.010	.24	57.24	2
11	21480	0 4603	.024	-.02	57.22	2
18	21489	71 1246	-.167	.72	57.22	2
14	21495	20 5419	.052	-.43	58.22	2

Part III

CORRECTIONS TO THE 930 FK3 STARS

The differences are in the form observed minus FK3 Revised.

The mean epoch and the number of observations in each co-ordinate are given.

The observations at lower culmination are listed separately at the end.

OBSERVED - FK3R							OBSERVED - FK3R						
FK4 No.	Δ α	Epoch	No.	Δ δ	Epoch	No.	FK4 No.	Δ α	Epoch	No.	Δ δ	Epoch	No.
1002	.004	60.03	4	-.24	60.03	4	1037	.001	57.47	10	.18	57.52	9
1	-.019	59.89	4	-.04	59.89	4	46	-.032	58.24	4	-.05	58.24	4
2	.014	59.90	6	.43	59.90	6	48	.021	60.01	5	.24	60.01	5
4	-.003	57.94	6	.26	57.94	6	1039	-.004	60.59	4	-.28	60.59	4
7	-.008	59.00	6	-.01	59.00	6	1040	.003	57.67	8	.19	57.77	7
1004	.000	59.26	6	-.03	59.26	6	1042	.024	58.61	8	-.01	58.61	8
1005	-.004	58.76	5	-.18	58.76	5	50	.011	58.79	9	-.16	58.79	9
1006	-.011	59.30	5	.08	59.30	5	1045	-.026	59.02	5	-.02	59.02	5
9	.009	60.58	5	-.31	60.58	5	1046	-.003	58.48	12	.02	58.55	11
1008	-.012	57.75	5	-.12	57.75	5	51	.024	58.53	4	-.04	58.53	4
1009	-.008	59.02	7	.15	59.02	7	52	.007	59.58	4	.15	59.58	4
1010	-.009	58.96	14	-.01	58.96	14	55	.060	57.04	4	.11	57.04	4
1011	.006	59.48	6	-.25	59.41	5	56	-.011	58.86	9	.02	58.87	8
1012	.015	59.60	6	.14	59.60	6	1047	.006	58.79	6	.16	58.79	6
13	-.005	59.00	14	-.04	59.10	12	1049	-.007	58.75	6	-.18	58.75	6
16	.033	58.65	13	.11	58.65	13	57	.001	59.38	5	.12	59.05	4
17	.006	58.69	7	.17	58.69	7	60	-.001	58.49	9	.07	58.71	8
18	-.024	58.85	5	.30	58.85	5	1050	.016	58.17	6	-.10	58.17	6
19	-.008	58.34	6	.19	58.34	6	1051	.009	59.19	8	.07	59.02	9
20	-.048	59.25	7	-.08	59.32	6	907	.444	58.66	8	.33	58.65	7
21	.012	57.97	6	.32	57.97	6	1052	-.017	58.31	4	.16	58.31	4
25	-.006	58.52	5	.09	58.56	6	62	-.001	58.62	4	.05	58.88	5
24	.021	58.33	8	.04	58.33	8	64	.027	59.62	5	-.37	59.62	5
27	-.014	59.80	6	-.12	59.80	6	63	.064	58.71	6	.00	58.71	6
1019	.012	58.42	8	.21	58.42	8	65	.005	57.63	5	-.06	57.65	6
28	.000	57.76	5	-.18	57.76	5	66	-.013	59.26	5	-.25	59.26	5
1020	-.007	59.76	5	.14	59.76	5	1054	-.017	59.78	6	-.10	59.78	6
1021	-.011	58.47	4	.07	58.47	4	70	.022	58.23	5	-.12	58.23	5
30	.003	58.56	6	-.21	58.56	6	73	-.033	59.68	6	-.05	59.68	6
29	.024	60.14	6	-.02	60.40	5	74	.021	58.05	5	-.03	58.05	5
1022	-.016	58.51	13	-.24	58.44	13	75	-.001	58.61	4	-.39	58.61	4
32	.050	59.10	4	.03	59.10	4	1056	.014	59.88	5	-.35	59.88	5
33	-.026	59.74	4	.06	59.74	4	1635	-.152	58.31	9	.33	58.31	9
1023	-.010	58.36	4	.28	58.36	4	77	-.047	59.03	4	.66	59.03	4
1024	-.012	58.51	6	.19	58.51	6	1057	-.010	59.80	4	.27	59.41	3
36	.003	58.77	6	-.23	59.16	5	1058	.018	59.01	4	.18	59.01	4
37	.008	59.00	7	-.06	59.02	6	76	.113	59.90	4	-.01	59.90	4
906	-.131	59.05	10	.18	59.09	9	1059	.022	58.83	5	-.11	58.83	5
1028	.023	59.96	5	.02	59.78	4	79	-.001	59.58	4	-.19	59.58	4
1030	.039	59.17	5	-.05	59.17	5	80	-.018	59.06	6	-.12	59.06	6
40	.008	60.51	4	-.45	60.42	3	81	.014	59.39	4	-.27	59.39	4
42	.008	58.57	4	-.17	58.57	4	1061	-.007	58.63	5	-.11	58.63	5
41	.042	58.48	11	-.02	58.48	11	1063	-.026	58.46	7	-.07	58.46	7
1032	.005	59.22	5	.20	59.22	5	1068	.021	59.95	6	-.16	59.95	6
43	-.029	60.75	5	-.12	60.75	5	85	.000	58.96	12	.10	58.96	12
1033	-.001	58.82	11	-.07	59.02	10	1069	.028	57.87	5	-.01	57.87	5
1034	.018	58.35	14	.12	58.15	13	1070	-.010	59.24	5	-.28	59.24	5
45	-.003	59.04	9	-.33	59.11	7	87	.054	60.07	4	.14	60.81	3
1035	.009	58.18	8	-.29	58.03	9	1072	.022	59.22	6	.26	59.27	5
47	-.013	60.25	5	-.24	60.25	5	1073	.007	59.28	5	.33	59.28	5

OBSERVED - FK3R						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
1074	.023	59.10	4	.34	59.10	4
89	.007	59.20	6	.38	58.87	5
91	.005	59.07	13	.00	59.07	13
92	.071	58.94	5	.07	58.94	5
94	.019	59.51	4	-.21	59.51	4
93	-.015	59.79	5	.17	59.72	4
1077	-.029	59.86	4	.11	59.66	5
98	-.010	58.25	8	.23	58.45	7
99	-.006	57.75	7	.33	57.90	6
100	.001	58.98	7	-.17	58.98	7
1079	-.002	58.25	4	-.13	58.25	4
103	-.011	58.70	7	.23	58.70	7
104	.002	58.34	5	.05	58.45	4
1080	-.017	58.44	5	-.06	58.44	5
1081	.002	59.17	4	.29	59.17	4
1082	-.008	59.55	4	-.42	59.55	4
1083	.001	58.77	11	.14	58.77	11
105	.021	58.77	12	.04	59.24	11
107	-.010	60.13	5	-.17	60.13	5
108	-.029	60.11	4	-.12	60.11	4
109	-.004	60.13	5	-.23	60.13	5
111	-.017	59.23	9	.43	59.39	8
112	-.025	59.57	7	-.10	59.57	7
1088	-.006	58.08	6	-.25	58.22	7
114	.017	59.46	6	-.19	59.46	6
116	.000	58.95	12	-.07	58.95	12
1089	-.005	59.70	6	.05	59.84	5
1091	.007	58.16	5	-.24	58.31	6
115	.028	59.47	13	.18	59.47	13
1093	.012	59.86	5	.21	59.86	5
1094	.007	58.97	5	-.14	58.97	5
1636	-.363	58.75	12	.14	58.75	12
1096	.020	59.92	4	-.43	59.92	4
120	-.013	60.53	4	.13	60.53	4
121	.007	60.62	4	.05	60.62	4
123	-.015	59.59	6	-.10	59.59	6
122	-.001	58.85	5	.52	58.85	5
124	-.014	59.03	5	.11	59.03	5
125	-.006	59.67	4	-.26	59.67	4
1097	-.008	59.19	11	-.14	59.19	11
1098	.007	58.55	3	.39	58.55	3
127	-.006	60.25	8	-.04	60.25	8
1101	-.002	58.84	13	-.15	58.86	14
1103	-.003	59.33	5	-.42	59.33	5
129	.030	58.68	7	.10	58.68	7
131	.006	59.44	4	.19	59.44	4
135	.023	59.92	5	-.19	59.58	6
134	-.029	60.03	5	.47	59.86	4
136	.029	60.47	5	.09	60.47	5
137	-.005	59.63	6	-.27	59.63	6

OBSERVED - FK3R						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
1104	.014	58.89	6	-.21	58.89	6
139	-.012	59.60	4	-.15	59.60	4
138	-.045	58.94	4	-.16	58.94	4
142	.020	60.70	4	.15	60.70	4
1105	-.008	60.66	4	.23	60.32	5
1106	-.014	59.27	4	.09	59.27	4
1107	-.013	58.39	6	.19	58.73	6
144	.012	60.16	4	.15	60.16	4
147	.009	58.94	4	.27	58.94	4
148	-.001	58.77	5	-.16	58.77	5
150	-.008	59.47	4	-.09	59.47	4
1111	.001	59.54	10	-.05	59.54	10
151	.005	59.65	7	-.17	59.65	7
1112	.000	59.15	6	-.10	59.15	6
1113	.007	59.00	5	.05	59.00	5
152	-.003	59.25	6	.24	59.33	7
1115	-.001	58.72	7	-.27	58.72	7
1116	-.012	58.89	5	-.20	58.89	5
154	.015	58.95	11	-.12	59.14	10
1117	-.011	59.67	4	.07	59.67	4
1118	-.003	58.47	10	.04	58.47	10
159	-.016	59.99	5	-.20	59.99	5
158	-.012	59.48	5	.01	59.48	5
908	-.234	59.40	10	.02	59.40	10
162	-.004	59.96	4	-.02	59.96	4
1120	.007	59.03	6	-.31	59.03	6
1122	.047	59.33	5	-.32	59.33	5
164	.055	59.67	4	.50	59.67	4
1123	-.004	58.52	11	-.18	58.52	11
165	-.023	58.98	6	.22	59.39	5
1124	-.024	59.08	4	.06	59.08	4
1125	-.003	60.25	4	.10	60.25	4
168	.011	60.24	4	.61	60.24	4
169	-.019	59.14	9	-.21	59.14	9
1126	-.009	58.09	7	-.43	58.30	6
174	.003	58.69	4	.33	58.69	4
1128	-.015	57.94	4	.24	57.94	4
1131	.017	60.13	6	.00	60.13	6
173	-.037	60.07	9	.10	60.07	9
176	.003	59.57	5	.00	59.57	5
175	.008	59.30	5	-.05	59.30	5
1133	-.023	59.15	4	.37	59.15	4
1134	.007	60.60	5	.16	60.60	5
1135	.007	60.00	4	-.17	60.00	4
179	.024	59.46	4	.04	59.46	4
178	-.022	58.72	8	-.27	58.82	7
1136	.011	59.74	5	-.07	59.74	5
180	.015	59.30	5	.31	59.30	5
181	-.014	58.50	5	.14	58.50	5
183	-.011	59.68	4	.32	59.68	4

	OBSERVED - FK3R							OBSERVED - FK3R					
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
182	-.006	58.33	6	-.18	58.33	6	237	.000	58.57	6	-.03	58.57	6
1137	.000	59.76	6	.10	59.93	5	1170	-.005	58.99	19	.17	58.90	20
184	-.017	60.25	5	-.23	60.78	4	241	-.008	59.21	5	.32	59.21	5
1140	-.008	60.52	5	.38	60.52	5	244	-.018	58.74	6	-.09	58.74	6
185	-.040	58.27	5	-.10	58.27	5	242	-.003	60.44	4	.42	60.44	4
188	.003	59.43	7	-.15	59.43	7	1171	-.009	59.54	6	.17	59.26	5
1142	-.006	58.26	10	-.05	58.26	10	1172	.002	59.94	4	.17	59.94	4
1141	-.035	58.88	4	.35	58.88	4	246	-.011	58.02	13	-.15	58.02	13
190	.020	58.83	6	.17	58.83	6	1173	.010	58.91	5	.28	58.91	5
192	-.002	58.50	9	.07	58.50	9	1174	-.009	59.30	6	.04	59.30	6
194	-.007	60.26	8	-.30	60.13	8	1175	.008	58.47	5	-.14	58.37	4
193	-.036	60.40	4	-.03	60.40	4	247	.007	58.72	8	.01	58.72	8
1637	-.329	58.25	6	.33	58.10	7	251	-.006	58.72	6	.14	58.72	6
191	.028	58.75	8	-.04	58.75	8	250	-.011	58.25	6	.00	58.06	5
195	-.001	60.56	5	.16	60.56	5	248	-.020	59.02	14	-.16	59.02	14
1145	.025	60.98	4	.38	60.98	4	254	.004	57.84	9	.27	57.84	9
1147	-.008	58.91	9	.31	58.91	9	256	-.004	58.10	6	.31	58.10	6
201	.012	59.00	4	.25	59.00	4	255	-.037	58.81	5	.29	58.81	5
202	-.004	60.18	5	-.13	59.51	6	1177	-.003	59.14	15	-.02	59.14	15
1148	-.010	57.96	4	-.09	57.96	4	1176	-.008	58.37	4	-.03	58.37	4
203	.020	59.06	7	-.18	59.06	7	258	.003	58.76	8	.04	58.76	8
1150	.005	58.27	6	.15	58.27	6	1179	.004	57.61	10	-.38	57.61	10
206	.011	59.08	6	-.46	59.21	7	259	.055	58.29	6	-.02	58.29	6
1151	.000	59.17	6	.06	59.17	6	261	-.003	59.58	6	.27	59.58	6
208	.010	57.88	10	.03	57.88	10	266	-.012	58.05	11	.12	58.13	10
209	.001	59.80	4	.08	59.80	4	260	.018	59.63	13	.21	59.58	12
205	.099	58.72	8	.26	58.72	8	1181	.010	59.35	16	-.03	59.39	14
210	.009	59.72	5	-.16	59.72	5	1182	-.018	57.92	7	.39	57.92	7
211	.000	58.64	6	-.18	58.64	6	269	.003	58.95	12	.03	58.90	10
216	-.022	58.35	9	.29	58.35	9	1185	.009	58.82	16	-.01	58.80	15
218	-.006	59.30	6	-.24	59.39	5	1186	.002	58.31	11	-.09	58.31	11
220	-.010	60.73	8	.03	60.73	8	274	-.010	58.98	5	.05	58.98	5
1638	-.145	59.50	6	.11	59.50	6	1187	-.003	58.73	15	-.08	58.63	14
1155	-.004	58.29	6	-.03	58.29	6	1188	-.002	59.52	5	-.18	59.52	5
221	.002	58.78	8	-.04	58.77	7	1190	.005	58.58	7	-.21	58.51	8
1158	-.005	60.72	4	.05	60.72	4	276	.006	58.78	8	-.20	58.78	8
1157	-.004	58.81	4	.29	58.81	4	277	.002	59.61	8	-.21	59.70	7
224	.002	59.25	4	.05	59.25	4	279	.003	58.00	8	.04	58.00	8
225	.006	60.27	4	.20	60.27	4	909	-.450	58.75	9	-.21	58.75	9
227	-.006	59.79	4	-.09	59.79	4	280	.002	59.03	11	.12	58.80	9
1161	-.023	58.73	15	.18	58.89	17	1191	.008	58.45	6	.24	58.45	6
1162	-.038	58.74	4	-.04	58.74	4	282	.017	58.59	4	.58	58.59	4
1163	-.014	58.78	6	.01	58.78	6	285	.007	59.51	4	-.22	59.51	4
230	.002	58.92	21	.09	59.01	22	284	.042	58.64	4	-.12	58.64	4
232	.001	58.74	10	.05	58.74	10	286	.017	57.81	4	.32	57.81	4
233	.002	58.97	15	-.14	58.97	15	1193	-.007	58.61	19	-.16	58.61	19
1168	-.008	59.98	4	.01	59.98	4	287	.003	58.78	6	.42	59.09	5
1167	-.026	60.32	4	.30	60.32	4	1196	.005	59.51	5	-.01	59.51	5
234	.030	59.71	4	.09	59.71	4	1195	-.011	59.52	6	-.19	59.52	6
1169	-.001	57.15	10	.17	57.15	10	289	.001	58.56	18	.07	58.56	18

	OBSERVED - FK3R							OBSERVED - FK3R					
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
291	-.053	59.38	5	-.04	59.38	5	339	.009	59.95	5	.03	59.95	5
292	-.014	57.84	6	-.07	57.84	6	338	.017	59.19	6	.08	59.19	6
293	-.003	57.81	11	-.04	57.76	10	1235	.000	58.87	11	-.16	58.87	11
294	.000	57.20	7	-.10	57.20	7	341	.038	60.46	4	-.11	60.55	5
295	.014	59.42	5	-.31	59.42	5	340	.003	60.36	5	-.09	60.36	5
1200	-.021	58.01	5	-.17	58.01	5	1236	.005	58.59	8	.15	58.59	8
1199	-.012	57.77	5	.01	57.77	5	1237	.014	57.23	5	.22	57.23	5
1201	-.011	58.82	12	-.32	58.78	11	1238	.017	57.89	9	-.15	57.89	9
296	-.001	58.79	6	-.14	58.38	5	1640	.023	58.11	8	.10	58.24	7
1205	.010	59.27	27	-.12	59.26	28	1239	-.013	59.87	3	.44	59.87	3
1207	-.008	58.88	7	.14	58.82	6	1240	-.006	59.62	5	.23	59.96	4
299	.009	58.15	13	.10	58.15	13	346	-.008	58.41	13	-.21	58.41	13
1208	.004	58.65	8	-.12	58.65	8	347	-.010	59.62	10	.20	59.62	10
300	.051	59.15	9	-.13	59.13	8	350	.001	58.88	12	.15	58.88	12
1209	-.019	59.17	6	.18	59.17	6	352	-.003	58.33	8	-.36	58.33	8
304	-.006	58.28	12	.05	58.28	12	1244	.007	58.73	9	-.21	58.73	9
302	.058	58.31	7	.13	58.31	7	1245	.003	58.65	19	.05	58.65	19
1211	-.003	58.97	6	.06	58.97	6	354	.009	58.13	10	.20	58.33	9
1213	-.012	58.26	11	.02	58.17	13	355	.034	57.71	9	-.14	57.71	9
305	-.004	58.83	6	.23	58.83	6	1246	.026	56.39	6	-.11	56.39	6
307	-.009	59.89	6	.22	59.89	6	358	.013	58.97	5	-.10	58.97	5
1639	-.077	57.95	14	.05	57.95	14	357	.052	60.21	4	-.03	60.21	4
1214	.035	60.21	5	-.11	60.21	5	910	.002	59.01	14	-.25	58.98	13
1215	.046	59.68	6	-.28	59.57	5	360	.025	57.56	8	-.04	57.56	8
310	.058	58.78	19	-.14	58.65	18	1249	.003	57.79	17	.02	57.79	17
312	.000	60.17	7	-.03	60.17	7	1250	-.004	58.51	14	-.09	58.51	14
1216	-.005	58.55	11	.01	58.55	11	363	.027	57.52	7	.31	57.52	7
1218	-.005	58.32	10	.13	58.63	12	365	.000	57.39	7	-.06	57.39	7
1217	-.003	58.12	6	-.13	58.50	5	1251	.019	57.45	9	.34	57.45	9
314	-.018	58.83	11	.14	58.83	11	1252	.028	58.93	7	-.10	58.93	7
1220	.005	58.39	9	.09	58.39	9	367	.008	57.82	7	-.04	57.82	7
316	.011	58.36	11	.08	58.36	11	1253	-.003	58.07	7	-.03	58.07	7
1222	.018	58.40	6	.23	58.40	6	1255	-.007	57.97	12	.27	57.97	12
317	.021	58.88	13	-.10	58.85	12	368	.032	58.09	7	-.10	58.09	7
320	-.002	58.83	6	.12	58.83	6	370	.010	58.84	15	.10	58.84	15
321	-.004	60.01	6	-.23	60.01	6	371	-.012	59.05	6	.14	59.05	6
322	.030	58.48	8	.01	58.48	8	1257	.003	58.41	17	-.11	58.36	16
1223	.000	57.62	12	.22	57.56	11	372	.029	58.68	9	.01	58.73	10
323	-.006	59.40	5	-.42	59.96	4	374	.027	59.08	7	.16	59.08	7
1224	.005	59.87	12	-.10	59.93	11	376	.000	58.40	15	-.01	58.40	15
1225	.021	59.05	6	.37	59.05	6	378	.001	58.88	15	-.13	58.88	15
325	.005	58.53	9	.03	58.47	11	1258	-.007	57.93	8	.00	57.93	8
1228	-.010	58.30	12	.09	58.30	12	1259	.001	58.40	14	.19	58.40	14
326	.010	58.92	7	-.09	58.92	7	379	.014	58.07	7	.16	58.07	7
328	.012	57.99	4	.20	57.99	4	380	-.009	58.63	8	-.12	58.63	8
1230	-.005	58.21	9	-.06	58.21	9	381	-.011	59.84	7	-.12	59.84	7
334	-.027	60.08	8	-.15	60.08	8	384	.000	58.45	5	.28	58.45	5
337	-.018	58.03	11	.04	58.03	11	383	-.004	56.71	6	.19	56.71	6
335	-.014	60.04	6	.10	60.19	5	1262	.035	58.64	5	.03	58.64	5
1232	.004	59.42	5	-.01	59.42	5	1263	.014	57.57	6	-.06	57.81	7

OBSERVED - FK3R							OBSERVED - FK3R						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
1266	.002	57.87	13	.01	57.76	12	1299	.011	58.05	11	-.21	57.52	10
386	.001	59.66	5	-.02	59.76	4	437	.011	57.32	8	-.30	57.32	8
1267	-.029	58.64	5	-.08	58.64	5	1300	-.012	58.34	10	.11	58.34	10
387	.032	58.23	9	-.46	58.23	9	440	.052	57.78	11	-.03	57.82	10
388	.000	59.11	13	-.01	59.11	13	1302	-.004	58.16	19	-.19	58.16	19
390	-.019	58.24	6	.01	58.24	6	441	-.002	58.41	8	.17	58.41	8
911	-.075	58.37	18	.02	58.37	18	1303	.002	58.56	7	.18	58.56	7
1270	.013	57.20	5	.18	57.20	5	1304	.006	57.29	9	.03	57.29	9
1271	.003	59.50	4	.47	59.50	4	444	-.013	58.83	6	-.19	58.83	6
394	.037	59.24	4	.30	59.24	4	445	.001	59.46	6	-.13	59.46	6
1272	-.002	59.46	4	-.03	59.46	4	1306	-.017	57.25	14	-.13	57.25	14
396	.003	59.50	5	-.21	59.50	5	1307	.011	57.69	5	-.13	57.69	5
395	.058	58.23	4	.31	58.23	4	447	.013	58.17	5	-.22	58.17	5
398	-.004	59.10	7	-.05	58.91	6	1308	-.006	58.28	4	.06	58.28	4
1274	-.009	58.61	15	.11	58.46	16	1310	-.020	58.66	7	-.02	58.39	6
1275	.003	58.79	7	-.15	58.79	7	1311	-.005	57.31	16	-.01	57.31	16
404	-.001	58.65	23	-.06	58.67	22	450	.000	57.77	7	-.41	57.77	7
403	-.007	59.37	8	-.29	59.37	8	1642	-.169	57.80	8	-.02	57.80	8
1276	.012	58.27	6	-.01	58.27	6	451	-.060	58.65	8	.25	59.00	7
405	.015	58.26	5	-.19	58.26	5	1313	.010	57.18	8	-.05	57.17	7
407	.019	58.84	5	-.24	58.84	5	454	.024	58.32	14	-.07	58.31	13
1278	.009	59.11	13	.17	59.35	12	1314	.003	57.76	13	-.11	57.76	13
1279	-.004	59.20	6	-.03	59.20	6	456	.002	59.08	4	.15	58.94	5
409	-.005	58.42	16	-.20	58.42	15	458	-.004	59.14	5	.20	59.14	5
1281	.012	58.54	7	-.19	58.54	7	1315	.015	58.82	6	-.23	58.33	5
412	-.001	58.41	8	.05	58.41	8	460	-.010	57.49	5	-.42	57.49	5
413	.020	58.09	9	.19	58.09	9	1316	.004	58.59	4	.01	58.59	4
1282	-.006	58.89	6	-.14	58.89	6	1317	-.008	58.59	7	-.07	58.59	7
1284	.017	58.48	11	-.23	58.29	10	1318	-.002	58.19	9	-.04	58.19	9
416	-.020	58.89	5	.09	58.89	5	461	.001	57.92	15	.19	57.92	15
1285	.005	58.75	10	.18	58.71	9	466	.005	57.81	8	.18	57.81	8
417	-.017	59.44	6	-.26	59.60	6	467	.020	58.18	7	-.17	58.09	8
418	-.001	58.67	11	.09	58.60	10	1322	-.001	58.16	6	-.11	58.16	6
1286	-.009	58.17	8	.04	58.17	8	472	-.037	58.22	7	-.08	58.22	7
1287	-.006	58.44	11	.11	58.44	11	470	-.028	57.96	5	-.22	57.96	5
420	.005	58.17	8	.05	58.17	8	1323	.020	59.51	5	.29	59.57	4
1641	-.067	58.33	17	.19	58.33	17	473	.017	58.77	4	.19	58.77	4
422	-.007	58.89	5	.49	58.89	5	1324	.004	58.20	21	-.20	58.30	20
423	.000	59.30	4	.19	59.30	4	475	.003	58.14	15	-.05	57.91	16
424	-.024	57.43	6	.02	57.43	6	1326	-.005	58.35	18	-.22	58.35	18
1292	.004	58.95	17	.04	58.87	16	478	.021	58.18	8	.08	58.18	8
425	.000	59.12	7	-.02	59.08	6	1327	-.015	57.73	7	-.17	57.73	7
1293	-.004	57.95	12	.27	57.95	12	1328	.006	58.35	13	-.15	58.34	14
427	.004	58.76	15	.04	58.73	16	1330	-.002	57.96	12	.01	57.96	12
429	.040	57.82	12	-.18	57.69	11	1332	-.002	58.06	7	.09	58.06	7
1295	-.024	59.46	6	-.24	59.46	6	1333	.016	58.65	7	.14	58.48	8
1296	-.001	58.94	9	.00	58.94	9	1335	-.007	58.14	11	-.15	58.14	11
1297	-.008	57.93	14	.33	57.93	14	483	.006	58.14	5	.12	58.14	5
432	.009	59.04	9	.11	59.04	9	484	-.006	59.36	6	-.17	59.36	6
433	-.009	58.57	12	-.12	58.57	12	486	.042	57.84	8	.06	57.84	8

OBSERVED - FK3R							OBSERVED - FK3R						
FK4 No.	$\Delta\alpha$	Epoch	No.	$\Delta\delta$	Epoch	No.	FK4 No.	$\Delta\alpha$	Epoch	No.	$\Delta\delta$	Epoch	No.
485	-.007	58.14	4	-.19	58.14	4	1374	-.001	58.28	9	.17	58.28	9
1336	.004	58.36	17	-.08	58.36	17	1375	-.009	59.14	9	.23	59.25	8
488	.001	58.48	7	-.21	58.48	7	531	-.023	58.50	7	.03	58.50	7
1337	-.013	58.07	4	.29	58.07	4	1378	.005	58.60	5	.00	58.60	5
1338	-.019	58.91	5	.10	58.91	5	533	-.022	59.51	7	.00	59.51	7
1339	.018	58.92	5	-.14	59.33	4	1379	.002	58.28	12	.35	58.28	12
490	-.015	58.17	8	-.22	58.17	8	534	-.008	60.11	4	.17	60.11	4
491	-.002	59.33	4	-.20	59.33	4	535	-.002	60.00	5	.01	60.00	5
492	-.022	57.69	8	-.16	57.69	8	536	.006	58.21	5	.24	58.21	5
1344	-.008	58.24	20	-.14	58.24	20	1380	-.009	57.24	7	-.02	57.20	6
494	-.021	58.01	10	.05	58.05	11	1381	.018	58.62	4	.44	58.62	4
1346	-.001	57.93	22	.11	58.01	21	540	-.019	58.14	9	.17	58.14	9
497	.014	58.79	7	.25	58.79	7	1382	.002	57.82	7	-.07	57.82	7
498	-.018	59.14	5	-.15	59.14	5	545	-.037	59.90	4	.41	59.90	4
1348	-.008	58.21	7	.20	58.21	7	1383	-.004	57.20	7	.04	57.20	7
499	.048	58.57	5	.11	58.57	5	1384	-.009	58.16	4	.14	58.16	4
1349	-.005	58.95	5	.36	58.95	5	547	-.010	59.56	8	.11	59.56	8
1350	.007	59.05	7	-.12	59.05	7	1386	.004	58.31	11	-.19	58.31	11
500	-.005	57.55	11	-.21	57.55	11	549	.049	58.18	6	.18	58.18	6
1351	.005	57.57	10	-.05	57.60	9	550	.012	58.87	6	.38	58.87	6
501	-.021	59.18	6	.26	59.18	6	1388	.006	58.87	9	.03	58.67	8
502	.000	58.85	6	.08	58.85	6	1644	-.088	57.92	10	.05	57.92	10
1352	.025	58.07	7	-.41	58.07	7	551	.033	59.62	4	-.16	59.62	4
1353	-.005	58.91	5	-.10	58.91	5	1390	-.002	60.41	4	-.07	60.41	4
505	-.029	58.49	7	-.15	58.49	7	1392	.018	58.87	4	.10	58.87	4
1355	.017	59.35	7	-.20	59.51	7	1393	.001	58.68	4	-.05	58.68	4
1643	-.126	58.18	23	.30	58.18	23	554	.019	58.44	10	.25	58.56	9
1358	.015	58.31	4	.11	58.31	4	1394	-.007	58.59	7	-.14	58.59	7
507	.006	59.30	4	-.05	59.30	4	555	-.009	59.06	6	.26	59.06	6
509	-.017	59.36	4	-.10	59.36	4	557	-.010	58.19	8	.09	58.19	8
1359	-.010	57.80	11	-.06	57.80	11	1395	-.026	58.47	9	.10	58.47	9
511	-.005	58.14	6	.06	58.05	7	1397	-.011	58.64	9	-.15	58.64	9
513	-.016	59.18	5	-.13	59.18	5	1396	-.005	58.23	8	.21	57.89	6
1360	.011	57.87	6	-.18	57.87	6	562	.007	58.32	12	-.11	58.33	11
1362	.001	58.66	10	-.07	58.66	10	563	-.001	58.42	4	.01	58.42	5
517	.016	59.06	4	-.04	59.06	4	565	.077	59.01	5	.25	59.01	5
516	.004	58.17	10	.02	58.17	10	564	-.016	59.78	5	.06	59.78	5
521	-.008	58.65	7	.00	58.65	7	1400	-.010	58.67	4	-.17	58.67	4
1366	-.005	57.96	11	-.03	57.96	11	1401	-.004	58.10	9	-.05	58.10	9
1367	.002	57.92	7	.02	57.92	7	569	-.017	58.27	6	.02	58.27	6
1368	-.003	57.65	7	-.27	57.65	7	1406	-.009	58.59	7	-.24	58.59	7
522	.026	57.79	5	.02	57.79	5	568	.001	59.14	4	.41	59.14	4
524	.025	58.05	11	.30	58.22	10	570	.005	59.33	4	-.28	59.33	4
523	-.015	57.74	5	.02	57.74	5	571	-.018	58.17	7	.12	58.17	7
526	-.010	58.17	5	-.31	58.17	5	572	-.008	58.02	9	.04	58.02	9
525	.005	58.02	10	-.22	58.02	10	1408	-.005	58.26	15	-.21	58.26	15
528	-.008	58.59	7	.06	58.59	7	573	-.005	59.11	6	-.07	59.11	6
527	-.011	59.06	7	-.01	59.18	6	576	-.002	57.98	7	-.17	57.98	7
1370	.019	57.81	7	-.15	57.81	7	1409	-.008	58.51	15	.19	58.51	15
1372	-.013	58.50	9	.15	58.50	9	578	-.011	58.77	6	.17	58.77	6

OBSERVED - FK3R							OBSERVED - FK3R						
FK4 No.	$\Delta\alpha$	Epoch	No.	$\Delta\delta$	Epoch	No.	FK4 No.	$\Delta\alpha$	Epoch	No.	$\Delta\delta$	Epoch	No.
580	-.001	57.76	9	-.18	57.76	9	633	.001	58.88	11	-.19	58.84	10
1412	-.044	57.49	10	-.20	57.49	10	634	.008	58.76	6	-.12	58.65	5
582	.002	57.99	13	-.11	57.99	13	1445	.004	58.68	24	-.07	58.64	24
583	-.013	58.05	6	-.29	58.05	6	1446	.004	59.64	5	-.27	59.64	5
590	.012	58.54	8	.23	58.27	7	635	.008	58.78	7	-.22	58.48	8
587	.016	58.40	4	.50	58.40	4	1448	-.013	59.09	7	-.11	59.09	7
584	.001	60.18	4	-.03	60.18	4	636	-.006	58.30	9	-.10	58.30	9
585	-.009	60.04	5	-.19	60.04	5	1450	-.014	58.68	12	.07	58.62	11
588	-.011	58.78	6	.07	58.78	6	639	-.020	58.85	8	-.04	58.85	8
1645	-.113	57.72	7	-.12	57.72	7	1451	-.003	58.47	23	-.08	58.39	24
1414	-.005	58.13	7	.11	58.13	7	641	.011	59.00	4	-.13	59.00	4
1416	-.004	58.16	11	.01	58.05	10	643	-.022	59.83	6	-.02	59.83	6
591	-.007	58.49	8	-.17	58.49	8	1453	.006	59.01	8	-.04	59.01	8
593	.004	58.62	8	-.06	58.62	8	1454	-.006	59.04	8	-.04	59.04	8
595	-.005	57.65	9	-.06	57.65	9	1456	-.001	59.47	9	-.16	59.47	9
1420	-.014	57.99	20	.09	57.92	19	1458	.002	58.02	12	-.06	58.02	12
598	.015	58.29	13	.00	58.29	13	647	-.003	58.72	9	.04	58.51	8
1421	.027	58.88	6	.01	58.88	6	1459	.000	58.89	10	.03	59.08	9
1422	-.020	57.76	14	-.05	57.78	13	650	-.002	57.46	6	.15	57.46	6
1423	-.014	58.85	5	.41	58.67	4	1460	.017	58.65	7	-.14	58.65	7
601	-.010	59.17	7	.22	59.17	7	653	-.002	57.93	8	-.12	57.93	8
603	.008	58.73	8	.12	58.73	8	655	-.013	59.54	5	.41	59.54	5
606	.020	58.80	25	-.04	58.80	25	657	-.036	59.13	6	.13	59.13	6
1425	-.004	58.11	10	-.25	58.11	10	1462	-.019	59.47	5	.24	59.47	5
605	.011	58.94	9	.19	59.00	10	1461	.005	58.79	7	.17	58.49	6
608	-.022	58.68	5	.28	58.68	5	659	.023	57.92	5	-.23	57.92	5
612	-.033	59.00	13	.44	59.00	13	656	.011	60.23	4	-.09	60.08	5
1427	-.005	58.01	5	-.08	58.01	5	664	.007	58.85	16	-.02	58.85	16
609	-.008	58.66	4	-.27	58.66	4	663	-.016	58.53	8	.18	58.53	8
1428	.017	59.85	5	-.16	59.85	5	665	.011	59.87	14	-.11	59.87	14
1429	-.011	58.50	10	-.21	58.72	9	670	-.003	58.90	7	-.36	58.90	7
613	.005	58.93	4	.22	58.93	4	667	-.035	60.13	6	-.56	60.27	5
614	-.017	59.19	5	.10	59.19	5	668	.002	60.17	6	.14	60.17	6
618	-.003	58.72	8	.05	58.63	7	1465	.013	58.86	5	-.16	58.86	5
619	.009	58.82	13	.26	58.76	12	1466	.010	58.21	11	-.01	58.40	12
1432	.002	58.09	9	-.11	58.09	9	913	-.092	57.96	11	-.14	57.96	11
621	-.026	58.80	6	-.12	58.80	6	675	-.026	58.72	13	.03	58.48	11
623	-.042	59.00	8	-.16	59.17	9	1467	-.015	58.48	13	.07	58.48	13
1433	.003	58.54	13	.15	58.54	13	671	.050	59.28	5	.16	59.28	5
622	-.004	59.26	6	-.23	59.30	7	1468	.003	59.22	6	-.11	59.22	6
1434	-.006	57.81	13	-.06	57.81	13	672	-.009	57.71	7	-.33	57.71	7
626	-.025	58.31	6	-.22	58.19	7	676	.012	59.05	8	-.06	59.05	8
627	-.035	58.05	5	.15	57.95	6	674	-.022	59.36	6	.41	59.36	6
1436	.017	57.60	12	-.16	57.60	12	673	-.027	59.64	9	.42	59.64	9
1438	-.003	58.02	19	.08	58.02	19	1469	-.005	58.39	6	-.09	58.39	6
1440	.008	59.23	5	-.47	58.76	6	677	.007	59.56	16	.10	59.56	16
629	-.001	58.50	4	-.05	58.50	4	680	-.008	58.76	11	-.14	58.76	11
912	.014	58.63	8	.29	58.53	7	681	.010	59.27	7	-.20	59.04	8
1441	.008	59.46	4	-.47	59.46	4	685	.014	58.94	5	.12	58.94	5
1442	.005	58.63	15	.00	58.63	16	684	-.030	59.22	4	.53	59.22	4

	OBSERVED - FK3R							OBSERVED - FK3R					
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
1475	.010	57.75	17	.01	57.64	16	1508	.024	59.05	6	.00	59.05	6
1477	.007	59.26	5	.01	59.26	5	1509	-.001	58.14	15	-.09	58.14	15
1476	.000	58.47	18	-.03	58.59	17	733	.009	59.01	7	.33	59.01	7
688	-.002	59.19	8	.01	59.13	7	732	-.005	59.44	7	.23	59.44	7
690	-.013	58.36	7	.17	58.36	7	1510	.014	58.45	7	-.27	58.45	7
914	-.037	58.61	9	.38	58.79	7	1511	.004	58.66	23	.17	58.66	23
695	-.014	58.28	12	.15	58.07	11	737	.007	58.77	13	-.03	58.80	11
1478	.009	59.06	18	-.08	59.10	17	738	-.014	58.36	8	.21	58.36	8
1479	.003	59.27	8	-.13	59.27	8	1513	.011	57.82	16	.23	57.82	16
1480	.005	58.62	14	.03	58.77	14	1515	-.002	58.19	10	-.14	58.19	10
1481	.008	58.47	7	-.06	58.60	8	740	.005	58.88	11	-.02	58.88	11
1646	-.021	58.49	12	.16	58.49	12	741	.001	58.78	11	-.25	58.78	11
700	-.085	58.55	6	-.14	58.55	6	743	.004	59.10	11	-.25	59.10	11
1483	.004	59.04	4	.09	58.89	3	744	-.004	57.98	12	.16	57.98	12
1482	.022	58.47	9	.01	58.47	9	745	.005	58.80	5	.00	58.80	5
1484	.016	57.98	12	.10	57.98	12	746	.031	59.09	6	.21	58.79	5
699	.005	59.53	5	.48	59.53	5	1519	.001	57.93	10	.12	57.93	10
701	-.051	58.36	5	-.16	58.07	6	749	.022	59.46	7	.10	59.46	7
1486	-.020	58.45	11	.15	58.45	11	1521	-.014	59.10	6	-.03	59.10	6
702	-.009	58.14	11	.02	58.14	11	752	-.001	59.25	7	-.05	59.25	7
703	.009	59.07	6	-.21	59.07	6	1523	.014	58.95	8	-.39	58.95	8
1488	-.008	59.23	6	-.38	59.23	6	1524	.014	58.84	17	-.04	58.84	17
1489	.005	57.70	8	.18	57.70	8	1647	-.069	58.15	14	-.16	58.26	13
1491	-.005	59.40	5	.03	59.40	5	1525	.004	59.86	4	.15	59.86	4
1492	-.021	59.06	6	.11	59.06	6	756	.028	58.65	5	-.14	58.65	5
1494	-.002	58.46	9	.10	58.46	9	759	-.035	57.84	8	.02	57.46	7
705	.003	57.89	7	-.31	57.89	7	1526	.015	59.57	4	.08	59.57	4
707	.007	58.19	10	.06	58.14	11	757	-.012	58.03	3	-.08	58.03	3
709	.006	58.40	11	-.18	58.48	10	758	-.027	58.81	5	.27	58.58	4
711	-.025	60.12	5	.26	60.12	5	760	.015	57.93	9	-.44	57.93	9
714	-.054	58.72	6	.25	58.72	6	765	-.005	58.89	7	.08	58.89	7
713	.009	58.49	8	.09	58.49	8	1531	.002	58.64	17	-.16	58.71	15
712	.001	58.91	9	.33	58.91	9	1533	.009	57.65	12	-.11	57.65	12
716	-.010	59.14	6	-.04	59.14	6	1534	.004	59.60	5	.07	59.60	5
717	.003	59.76	10	.05	59.74	11	1535	-.030	59.33	4	-.24	59.33	4
1497	-.023	57.76	17	-.14	57.76	17	767	-.016	57.86	4	.27	58.03	5
1498	.011	58.94	5	.01	58.94	5	1536	-.018	58.66	4	.06	58.64	5
719	.006	58.59	8	.03	58.48	9	1538	-.022	58.50	6	-.10	58.50	6
1500	-.001	58.34	19	.21	58.40	20	768	.002	60.40	5	-.18	60.35	4
723	.012	59.21	6	-.13	59.21	6	1537	.006	58.06	7	.06	58.29	6
724	-.002	58.73	6	-.07	58.73	6	770	-.016	58.53	8	.00	58.50	7
725	.009	58.48	14	-.24	58.48	14	1539	.004	59.10	6	-.26	59.10	6
726	-.019	58.69	6	.05	58.69	6	772	.016	57.97	19	.11	57.97	19
729	-.044	58.85	7	-.25	58.85	7	774	.019	59.43	6	.18	59.43	6
1503	.019	58.44	6	-.08	58.44	6	777	.002	58.71	9	.14	58.60	10
730	.027	60.14	5	-.25	60.14	5	778	-.007	58.75	10	.12	58.75	10
1505	.023	60.31	4	-.15	60.31	4	782	.005	59.09	4	-.16	59.09	4
1506	.009	59.40	5	-.06	59.40	5	780	.002	58.36	4	.24	58.36	4
734	.014	59.60	7	-.01	59.60	7	783	-.006	58.00	5	.09	58.00	5
1507	.013	57.60	5	.39	57.60	5	1541	.026	59.64	4	-.14	59.97	3

OBSERVED - FK3R							OBSERVED - FK3R						
FK4 No.	Δ α	Epoch	No.	Δ δ	Epoch	No.	FK4 No.	Δ α	Epoch	No.	Δ δ	Epoch	No.
1544	.028	58.08	4	.24	58.08	4	833	-.003	57.06	5	-.21	57.06	5
781	-.008	60.02	5	.17	60.02	5	834	.006	60.19	13	-.12	60.19	13
1543	.023	58.72	4	-.07	58.72	4	835	-.030	57.53	7	-.04	57.53	7
915	-.067	58.36	17	-.12	58.36	17	837	-.019	58.56	9	.06	58.30	8
1545	.028	58.46	6	-.30	58.46	6	836	.012	58.48	5	.34	58.48	5
1547	.000	58.33	17	-.07	58.34	18	1583	-.022	58.90	7	.14	58.90	7
786	.014	57.58	9	-.24	57.58	8	840	.005	58.48	10	.24	58.48	10
788	-.006	58.68	8	-.20	58.68	8	1648	-.075	59.22	18	.07	59.22	18
1549	.015	58.61	7	-.11	58.61	7	843	.001	57.69	6	-.44	57.69	6
789	.025	58.41	12	.15	58.41	12	842	.006	59.20	6	-.02	59.20	6
1551	-.016	58.14	6	.12	58.14	6	844	.012	59.56	7	.46	59.86	6
792	.002	58.31	8	.07	58.54	7	1585	.007	59.51	8	.02	59.51	8
1553	.006	58.79	7	-.20	58.79	7	1586	.018	59.44	4	-.04	59.44	4
793	.098	59.61	5	-.03	59.61	5	1588	-.017	59.54	4	-.03	59.54	4
795	-.060	58.74	8	.07	58.74	8	1589	-.001	60.14	4	-.11	60.14	4
794	-.006	58.67	7	.06	59.00	6	847	-.032	60.71	4	.36	60.71	4
1555	-.001	58.67	11	-.05	58.67	11	1590	-.018	59.99	4	-.10	59.99	4
797	.012	58.86	10	-.10	58.85	9	1591	-.009	60.52	4	-.08	60.45	3
800	-.003	58.96	16	-.10	58.79	14	848	-.002	59.71	4	.03	59.71	4
1558	-.005	58.37	5	-.02	58.37	5	1593	.067	58.95	4	-.07	58.95	4
1559	-.004	58.39	4	-.23	58.39	4	1594	-.002	58.17	9	.27	58.17	9
803	-.042	57.95	9	.10	57.95	9	850	-.005	59.78	8	.04	59.78	8
1560	-.017	59.66	7	.13	59.66	7	851	.004	59.40	6	-.30	59.40	6
804	-.005	58.10	8	.00	58.10	8	1595	.001	58.75	13	-.29	58.75	13
1564	.010	58.93	10	-.21	58.93	10	853	-.012	58.94	9	-.08	58.83	10
807	-.020	58.02	5	.27	58.02	5	852	-.014	59.42	6	.10	59.42	6
1565	.021	58.28	5	-.04	58.28	5	855	.008	60.29	8	-.12	60.29	8
809	-.038	58.65	5	.06	58.65	5	857	.012	60.23	6	.11	60.13	5
808	-.002	59.47	5	.37	59.47	5	858	-.006	59.17	5	-.02	59.17	5
1568	.003	57.22	5	-.04	57.22	5	1596	-.016	58.46	6	-.12	58.46	6
811	-.003	59.20	5	.05	59.20	5	859	-.007	59.47	7	-.07	59.58	6
1569	.014	59.09	10	.11	59.09	10	1598	-.008	58.15	19	-.10	58.15	19
1570	-.001	59.79	5	-.02	59.79	5	862	-.019	58.84	7	.05	58.84	7
813	-.003	58.88	5	.04	58.88	5	863	.020	58.10	10	.05	58.10	10
817	-.057	58.62	8	-.33	58.62	8	864	.016	60.18	11	.42	60.18	11
815	-.003	60.11	7	-.23	60.11	7	1600	-.037	59.17	4	.09	59.17	4
1571	-.021	59.06	5	-.04	59.06	5	1649	-.077	59.15	19	-.01	59.15	19
818	.006	59.07	6	.40	59.07	6	869	-.010	59.79	5	-.26	59.79	5
1572	-.025	60.26	5	.40	60.26	5	1602	.011	57.60	10	-.22	57.60	10
1574	.013	58.64	6	-.63	58.64	6	870	-.005	59.82	4	-.07	59.82	4
821	-.021	60.10	5	-.21	60.10	5	871	-.018	58.95	4	.23	58.95	4
1575	.005	60.17	7	.27	60.17	7	1603	.004	58.47	13	.10	58.41	14
823	-.007	59.42	7	.21	59.42	7	1604	-.009	57.70	6	.25	57.70	6
1578	.031	59.51	7	-.21	59.51	7	1606	-.012	59.72	8	-.07	59.72	8
1579	.003	59.16	6	.09	59.10	7	875	-.010	59.54	5	-.22	59.54	5
1580	.012	59.00	22	-.03	59.00	22	1607	.007	57.95	6	-.08	57.95	6
826	.002	58.38	12	-.34	58.38	12	1608	.010	58.22	10	.10	58.22	10
827	-.010	60.41	12	-.20	60.41	12	878	.013	59.25	7	.17	59.25	7
830	.040	58.43	5	-.09	58.43	5	1609	.001	58.41	14	.01	57.90	12
831	.001	58.94	7	-.13	58.94	7	880	-.002	60.09	7	-.12	60.09	7

OBSERVED - FK3R							OBSERVED - FK3R						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
1610	.003	58.35	7	.17	58.35	7	1620	.001	58.39	13	-.30	58.39	13
1613	-.024	59.61	6	-.31	59.75	5	1622	-.012	59.37	7	.02	59.37	7
882	-.002	59.15	8	-.09	59.15	8	1623	-.004	59.76	6	.11	59.58	5
881	.002	59.12	4	-.49	59.12	4	895	.048	57.75	7	-.10	57.75	7
884	-.005	58.79	8	.07	58.79	8	897	-.009	59.57	5	-.17	59.30	4
1614	.011	59.72	8	.11	59.84	7	898	.005	59.44	5	-.15	59.44	5
1615	.005	59.93	6	-.07	59.96	5	1625	-.037	59.28	7	-.40	59.28	7
885	-.003	58.71	11	-.21	58.91	10	899	.014	59.58	6	.03	59.58	6
1616	.002	58.76	7	-.09	58.76	7	1627	.062	58.77	7	.25	58.75	5
888	.009	58.94	10	.03	58.94	10	1650	-.150	58.32	10	-.06	58.32	10
890	.008	59.81	5	.11	59.81	5	1628	.000	58.77	5	-.25	58.77	5
891	.015	60.03	4	.48	60.03	4	1629	.000	59.95	5	.05	59.95	5
893	.011	58.48	7	.31	58.78	6	900	-.028	60.58	7	.06	60.57	6
892	.017	58.09	7	.02	58.09	7	902	.002	59.89	7	-.03	59.89	7
1619	-.011	59.37	5	.30	59.78	4	1630	.005	59.26	8	.03	59.26	8
LOWER CULMINATION													
1642	-.248	58.28	9	-.49	58.33	10	659	-.018	60.20	4	-.25	60.20	4
451	-.028	59.54	5	-.01	59.54	5	664	.022	59.10	7	.03	59.10	7
454	.007	58.92	15	-.17	58.94	14	670	-.007	59.11	5	.18	58.61	4
472	-.021	59.26	5	-.26	59.12	4	913	-.295	58.08	7	-.21	58.08	7
478	.032	59.02	5	.42	59.02	5	675	-.014	58.82	7	-.13	58.82	7
486	.041	60.33	4	.03	60.33	4	685	-.027	60.82	4	-.09	60.82	4
499	-.002	58.91	5	.26	59.44	4	914	.042	60.16	5	-.35	59.95	3
500	-.023	58.19	5	.15	58.19	5	695	.054	58.79	4	.03	58.79	4
505	-.024	58.64	4	-.04	58.91	5	1646	.007	58.41	13	-.04	58.41	13
1643	-.148	58.56	11	.22	58.54	10	700	.016	59.70	8	-.06	59.50	7
511	.042	60.01	6	.15	59.71	7	701	.041	58.32	4	.58	58.32	4
521	-.051	59.55	6	.12	59.37	4	1494	-.003	59.19	8	-.29	59.47	7
524	-.058	57.15	5	-.31	57.42	6	714	-.045	59.67	5	-.52	59.40	3
1379	.078	59.19	12	-.29	59.11	11	723	.029	58.53	6	-.08	58.39	5
536	.012	60.37	7	.61	60.79	5	729	.048	59.62	6	-.17	59.62	6
550	-.151	58.92	4	-.25	58.92	4	734	-.003	58.73	12	-.09	58.96	11
1644	.014	58.97	7	-.04	59.14	6	1647	-.172	58.39	15	-.09	58.31	16
554	.070	59.66	5	.66	60.08	4	759	-.024	58.17	10	.03	58.16	11
565	-.019	60.32	4	.03	60.32	4	767	-.011	57.74	8	.06	57.53	7
569	-.023	60.83	4	.00	60.83	4	1538	-.029	58.70	8	-.19	58.70	8
590	-.009	59.42	7	-.08	59.42	7	770	.019	58.85	8	.11	58.88	6
587	.081	60.88	4	.64	60.86	3	783	-.028	58.80	5	-.26	58.80	5
1645	-.048	58.97	5	-.35	58.97	5	915	-.098	59.19	12	-.26	59.03	13
606	-.001	60.68	10	-.44	60.71	8	795	-.008	59.70	7	-.10	60.31	5
612	-.051	59.38	9	.03	59.17	8	803	-.003	57.88	8	.32	57.93	6
619	.001	59.59	7	.41	59.52	6	809	-.060	58.73	6	.39	59.21	5
1432	.023	59.97	5	.41	60.68	4	817	.038	59.07	6	-.12	59.07	6
623	.027	58.91	9	-.29	58.91	9	1572	.024	59.70	6	.63	59.41	5
912	-.045	58.61	6	-.10	58.61	6	1578	.028	58.43	6	-.09	58.43	6
639	.023	59.18	6	.10	59.18	6	830	.000	59.09	10	.17	59.17	9

OBSERVED - FK3R							OBSERVED - FK3R						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
837	.021	59.41	7	-.34	59.42	6	182	.009	58.87	6	.61	58.73	5
1648	-.183	59.19	17	-.20	59.19	17	1637	-.202	58.21	12	.09	58.31	13
1593	.022	56.65	7	.22	56.65	7	191	-.008	58.33	14	-.12	58.33	14
1594	.064	59.37	7	-.20	59.37	7	203	-.026	58.87	6	.33	58.87	6
851	-.052	59.61	6	-.31	59.69	5	205	.022	58.76	7	.06	59.05	5
853	-.001	57.87	5	.22	57.87	5	1638	-.229	58.64	11	-.12	58.64	11
863	.010	59.77	6	-.05	59.88	5	233	.009	58.30	10	.20	58.30	10
1649	-.011	58.39	11	-.51	58.20	10	234	-.050	59.69	6	-.15	59.69	6
882	.023	58.57	8	.29	58.99	6	247	-.012	59.30	5	-.06	59.30	5
893	.042	57.78	19	.02	57.78	19	248	.021	58.58	18	-.14	58.47	17
895	-.055	58.07	4	.09	58.07	4	259	-.001	57.92	6	-.08	57.92	6
1627	.127	60.30	5	-.01	60.30	5	260	.017	58.89	10	-.42	59.10	8
1650	-.114	58.03	18	-.32	58.03	18	909	-.538	57.61	11	-.28	57.61	11
16	.001	57.68	6	.38	57.34	5	284	.050	59.30	6	-.36	59.04	5
24	.036	58.15	4	.02	58.15	4	300	.065	57.64	9	-.37	57.77	8
29	.039	57.79	5	.39	57.79	5	302	.082	58.13	5	1.05	58.13	5
32	.087	60.07	4	.80	60.07	4	1639	-.113	58.63	11	-.15	58.63	11
906	-.127	58.03	16	-.22	58.03	16	1215	-.021	59.59	4	.34	59.59	4
41	.071	58.94	10	.06	58.94	10	310	.005	58.98	13	-.38	58.86	12
46	.043	58.15	4	-.23	58.15	4	317	.030	59.01	5	.39	59.13	6
48	.001	59.35	4	-.08	59.35	4	322	.082	57.70	5	.05	57.70	5
1042	-.016	57.58	4	-.44	57.58	4	338	-.004	59.03	5	.16	58.81	6
51	-.038	58.37	6	.22	58.18	5	1640	-.077	58.31	14	.28	58.31	14
55	.002	59.59	4	.30	59.59	4	355	.015	60.59	4	.47	60.59	4
907	-.007	57.21	12	-.18	57.19	11	910	-.048	59.36	12	-.25	59.36	12
63	.016	59.35	4	.37	59.35	4	357	.022	58.84	5	.22	58.84	5
70	.020	60.10	4	-.03	60.10	4	363	.063	59.68	6	.06	59.68	6
1635	-.191	58.60	13	-.15	58.62	12	372	-.052	59.20	6	-.31	59.20	6
76	.028	59.60	5	.25	59.65	4	1262	.007	59.78	5	-.25	59.78	5
87	-.053	57.60	5	.27	57.60	5	387	.020	59.30	4	.27	59.30	4
92	-.033	60.39	4	-.11	60.39	4	911	-.096	58.09	11	-.35	58.02	10
105	.077	59.35	8	.24	59.15	6	395	.016	59.41	12	-.41	59.28	11
115	.076	58.43	6	.51	58.43	6	403	-.006	58.21	8	.19	58.12	7
1636	-.344	57.68	8	-.12	57.68	8	413	.066	58.46	9	-.06	58.46	9
1096	.002	59.44	4	.23	59.12	3	417	-.025	60.28	6	.65	60.28	6
129	-.005	58.05	7	.56	58.16	6	1641	.066	59.47	8	.10	59.34	10
138	-.067	59.95	4	.03	59.95	4	429	.012	58.93	6	.59	58.66	8
908	-.367	58.18	16	-.21	58.32	17	433	-.016	59.60	4	-.02	59.60	4
1122	-.018	57.97	6	.38	57.97	6	440	.051	59.57	5	.12	59.57	5
173	-.038	59.33	11	-.39	59.60	10	1303	.032	60.35	5	.45	60.35	5
178	-.043	59.67	5	.40	59.67	5							

July 25, 1967

Please note the list of corrections to the Ottawa catalogue (Pub. D.O. Vol. XXV, No. 9) as detected and compiled by Robert B. Hanson of the U.S. Naval Observatory.

E.G. Woolsey
Astronomy Division

LIST OF CORRECTIONS TO OTTAWA CATALOGUE (VOL. XXV, NO. 9)

PART II

The BD zone numbers for the following Ottawa Star numbers should be <u>NEGATIVE</u>:

5 12 22 52 62 80 81 87
93 108 124 132 134 155 162 182
193 203 221 226 229 236 271 278
280 286 290 291 301 311 324 332
350 352 367 374 385 390 403 406
411 417 438 442 446 459 491 502
527 549 576 599 612 631 638 640
644 662 675 680 697 701 704 719
729 793 804 825 842 875 885 911
913 930 934 974 976 994 1012 1044
1055 1066 1084 1088 1100 1116 1136

PART IV

OTTAWA NO.	BD. NO.				OTTAWA NO.	BD. NO.			
	FOR		READ			FOR		READ	
33	2°	44	2°	422	135	61°	160	61°	1591
44	31°	66	31°	642	136	2°	319	2°	3118
54	60°	84	60°	768	138	31°	292	31°	2884
90	37°	138	37°	1380	140	14°	327	14°	3207
94	22°	125	22°	1241	149	71°	97	71°	889
107	10°	122	10°	1220	151	58°	189	58°	1809
112	58°	100	58°	982	157	44°	327	44°	3234
121	6°	209	6°	2036	159	69°	107	69°	1070
123	31°	197	31°	1907	163	52°	259	52°	2572
124	67°	64	67°	577	182	14°	445	14°	4369
125	37°	201	37°	1965	183	35°	433	35°	4267
126	20°	253	20°	2467	193	59°	237	59°	2334
128	11°	242	11°	2348	194	37°	424	37°	4240
131	14°	277	14°	2770	204	24°	449	24°	4463
132	27°	248	27°	2417	246	74°	106	74°	1006
134	26°	274	26°	2722	249	30°	505	30°	4978

CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES
Observatories Branch

PUBLICATIONS
of the
DOMINION OBSERVATORY
OTTAWA

Volume XXV No. 9

RESULTS OF OBSERVATIONS MADE WITH THE OTTAWA REVERSIBLE MERIDIAN CIRCLE
1954-1962

CATALOGUE OF 2665 STARS

E. G. Woolsey

Price $1.25

ROGER DUHAMEL, F.R.S.C.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1966

Results of Observations Made with the Ottawa Reversible Meridian Circle 1954-1962

Catalogue of 2665 Stars

E. G. Woolsey

ABSTRACT: This catalogue contains the results of observations made at Ottawa with the Reversible Meridian Circle during the period January 1954 to December 1962. The program consists of 1142 FK3 (Supp.) stars, 160 Ottawa zenith stars and 255 additional stars. The additional stars include the FK3 stars omitted from the Apparent Places of Fundamental Stars, Kopff's replacement stars and stars from the Galactic Research list of Blaauw and Parenago. The published positions were determined differentially using the 1108 FK3 stars whose declinations are greater than -27°30' and whose positions are published in the APFS.

The catalogue also gives the relative corrections to the fundamental stars in the form observed minus FK3 position. The program stars were observed at least six times: the probable error of a single observation is ″.28 in right ascension and ″.34 in declination.

Résumé: Le présent catalogue renferme les résultats des observations faites à Ottawa, à l'aide du cercle méridien réversible, de janvier 1954 à décembre 1962. L'étude a porté sur 1,142 étoiles FK3 (Supp.), 160 zénithales à Ottawa et 255 autres étoiles. Ces dernières comprennent les étoiles FK3 omises de l'*Apparent Places of Fundamental Stars,* les étoiles de remplacement de Kopff et celles qui sont énumérées dans la liste du *Galactic Research* de Blaauw et Parenago. Les positions indiquées ont été déterminées de façon différentielle et on a utilisé les 1,108 étoiles FK3 dont les déclinaisons sont supérieures à -27°30' et dont les positions ont été publiées dans l'APFS. Le catalogue donne aussi les corrections relatives aux étoiles fondamentales comme elles ont été observées, moins les positions données au FK3. Les étoiles à l'étude ont été observées au moins six fois: l'erreur probable d'une observation est de ″.28 en ascension droite et de ″.34 en déclinaison.

INTRODUCTION

This is the final catalogue of observations with the Ottawa Reversible Meridian Circle. Observations on this instrument ceased in December 1962 and the instrument has been dismantled to make way for a new time-laboratory. The work on star positions at Ottawa will continue but will be done using the new Mirror Transit which is being brought into operation.

The principal program undertaken was the observation of the FK3 (Supp.) stars for the northern sky. Modern observation on these stars had been requested so that their positions and proper motions could be determined with sufficient accuracy to permit them to be included in the Fundamental Catalogue. Along with these stars, the re-observation of the Ottawa PZT stars was undertaken to check their relation to the Fundamental Catalogue and to determine any periodic errors in the meridian circle results.

In order to produce this catalogue in an easily usable form, each group of stars has been published as a unit. The first part deals with the fundamental or FK3 stars, the second with the FK3 (Supp.) stars, the third with our own PZT stars, and finally the remainder of the stars observed. The positions are not given for the FK3 stars but are given in the form observed minus FK3 along with the number and epoch of the observations.

The observers were:

E.G. Woolsey	Jan. 1954 to Dec. 1962
R.W. Tanner	Jan. 1954 to Dec. 1962
I. Halliday	Jan. 1954 to Nov. 1954
G.A. Brealey	June 1954 to Sept. 1961
M.O. Wheeler	July 1955 to Dec. 1962
R.A. Constanzo	Apr. 1959 to Sept. 1959

Assisting in the reductions were Miss O. Boshko, Mrs. B. Crawford, Mrs. B. Dell and a number of summer assistants.

Thanks are expressed to F.P. Scott and the U.S. Naval Observatory for providing the reduction to apparent place for the period 1956 to 1961.

OBSERVING PLAN

From examining the differences "Observed minus N30" against the number of observations in our previously observed programs, we found the accuracy gained by adding more observations started to decrease noticeably after six observations, and the overall accuracy increased very slightly after ten observations. For this reason it was planned to observe each program star at least six times, three with each clamp position, and the reference stars ten times, five with each clamp position. On our previous programs many of the reference stars had received too few observations, and an effort was made to observe these stars more uniformly.

The reference stars were to be all the stars published in "Apparent Places of Fundamental Stars" that lie north of -27°30'. These were divided in the following manner:

-12°30' to 12°30'	Time stars
over 80°	High azimuth stars
75 to 80°	75° azimuth stars
60 to 75°	Refraction stars
remainder	Comparison stars

The method observing and calculating is the same as that described in our publication Vol. XXV No. 8, except that the positions of the reference stars are all taken from the FK3 rather than the FK3R.

FUNDAMENTAL STARS

(Catalogue Part I)

In forming this catalogue, each night's work was corrected using night constants derived from the fundamental stars in the manner described in Pub. D.O. Vol. XXV No. 8.

Briefly, the night corrections in right ascension were derived using all the FK3 stars observed on that night; and in declination the night correction for refraction was based on all FK3 stars, but that for latitude on those FK3 stars that lie between the equator and the pole.

The observed positions for the fundamental stars were retained only in the form observed minus computed.

Tables I to III give the comparison of the positions with the FK3: the star positions are averaged for each three hours in right ascension and ten degrees in declination.

Tables IV and V show the error of a single observation. They give the average standard deviation derived for each star. The weights given are the number of stars.

A least square solution of the residuals (O-FK3) for the 311 time stars yields:

$$(\mathrm{O\text{-}FK3})_\alpha \cos\delta = {}^{\mathrm{s}}.0012\cos\alpha - {}^{\mathrm{s}}.0006\sin\alpha - {}^{\mathrm{s}}.0011\cos 2\alpha - {}^{\mathrm{s}}.0017\sin 2\alpha$$

The average difference, observed minus FK3, is tabulated for each star along with the number of observations in each co-ordinate, and the average epoch.

Since none of the program stars has been observed below the pole, the observed values for the fundamental stars obtained above and below the pole have not been combined. The values for lower culmination are given at the end of the table.

FK3 SUPP. STARS

(Catalogue Part II)

The FK3 (Supp.) stars are the 1142 stars given by Kopff in the *Supplement – Katalog des FK3 (FK3 Supp.),* Supplement to the Astronomische-Geodatischen Jahrbuch 1954, Astronomischen Rechen-Institut, Heidelberg.

The star observations were reduced in the same manner and with the same corrections that were applied to the FK3 stars. The reduction for each individual observation to mean place 1950.0 was done using GC proper motions.

The observations on each star were examined for consistency. Although six observations were considered adequate for any star, additional observations were taken if the mean error of a single observation exceeded $^{\mathrm{s}}.033$ sec δ in right ascension or $''.56$ in declination. On completion of the observing, these observations were re-examined and in any case where the difference, observation – average position, exceeded $^{\mathrm{s}}.100$ sec δ in right ascension or $1''.50$ in declination, or the range exceeded $^{\mathrm{s}}.175$ sec δ in right ascension or $2''.50$ in declination, the observation was considered a mistake and was omitted. After applying this criterion there was no star with less than six observations, three in each clamp.

In order to eliminate mistakes as much as possible, the average observed position for each star was compared with that given in the FK3 (Supp.), the GC and the AGK2. Each star was examined individually and the reductions re-checked where necessary.

The positions given have been reduced from apparent place to mean place 1950.0, using GC proper motions which are also published here for convenience. The precessional tables have been omitted since they are available elsewhere. This has made it possible to have all information pertaining to one star on one line in the catalogue and to retain the results on one punched card.

Anyone requiring precessional tables may take the values from the AGK2 or use the formulae given on page 10 of *Fourth Fundamental Catalogue (FK4)*, Veröffentlichungen des Astronomischen Rechen-Institut, Heidelberg, Nr 10.

In the calculations of apparent place no corrections have been made for parallax.

For the 108 stars of the FK3 (Supp.) whose parallax is given by A. Kopff, a calculation for parallax has been made using the formula:

$$\Delta\alpha = \pi(Yc-Xd)$$
$$\Delta\delta = \pi(Yc'-Xd')$$

as given on page 64 in the *Explanatory Supplement to the Ephemeris*, H.M. Nautical Almanac Office, 1961.

The values given in Table VI were calculated using the π as published in FK3 (Supp.), the average value of X and Y for the day taken from the Astronomical Ephemeris 1960, and 1960 values of c; d, c' and d' for each star.

These corrections are of the order of the rounding off errors. However, anyone wishing to apply them may do so by substracting them from the tabulated positions of the individual stars.

PZT STARS

(Catalogue Part III)

The Ottawa zenith stars observed are the 160 stars of the Ottawa PZT program being used in 1954.

The reductions of these observations were done in the same manner as described for the FK3 (Supp.) except that the proper motions used in the reductions were the Ottawa proper motions.

For each star the difference, observed minus catalogue, has been given. These PZT star positions, used for comparison purposes, were supplied by the Time Service. They are considered as preliminary and may require minor corrections when they are eventually published.

Five of the PZT stars, numbers 64, 69, 100, 117 and 83, are listed elsewhere in the catalogue. However, in this listing the PZT proper motions have been used. The first four appear in the FK3 (Supp.) as numbers 479, 504, 723 and 850 respectively. The last star, PZT number 83, is FK3 number 1338.

The observations on this group of stars were checked for consistency by comparing individual observations with the mean; and for mistakes by comparing the results with the PZT positions.

A comparison of observed minus catalogue for the PZT stars and the FK3 stars that lie between 40 and 50°, is given in Table VII. These are given for three-hour zones in right ascension. On the whole it indicates good agreement between the PZT positions and the FK3 stars, but there does appear to be a seasonal variation in declination for the Ottawa Meridian Circle.

ADDITIONAL STARS

(Catalogue Part IV)

The additional stars consist of two lists which have been combined because of their small number.

The first list contains the FK3 stars that were dropped from the fundamental catalogue, and A. Kopff's Ersatz or replacement stars that are listed in AN 231, No. 5537, page 310. These stars were included at the suggestion of F.P. Scott of the U.S. Naval Observatory.

The second list contains the stars marked P (stars to be given priority) in a list of Galactic Research Stars dated November 1953. This latter list was proposed at the Conference on Co-ordination of Galactic Research, held at Vosbergen, Holland, June 22 to 27, 1953 and was provided by A. Blaauw of Yerkes Observatory. A number of stars from both groups are already included in other sections of this publication and are not repeated here.

All the stars of this list were reduced to epoch 1950.0 without proper motion, except the FK3 stars which were reduced using FK3 proper motions. For these stars the apparent places for the years 1954 and 1955 were obtained from the American and Russian Ephemerides and for the remaining years the positions were calculated at the U.S. Naval Observatory. In order to bring these to the same basis as the other stars (position 1950.0 without proper motion), the star positions were adjusted by adding the product of the proper motion and difference in epoch.

A special case arises in connection with No. 129 (FK3 No. 477). The position given is for the preceding star rather than the centre of gravity of the pair.

TABLE I. Catalogue Comparison in Right Ascension (O-FK3)
Unit $^{s}.001$, Weight-Number of Stars

R.A. / Declination	0h to 3h		3h to 6h		6h to 9h		9h to 12h		12h to 15h		15h to 18h		18h to 21h		21h to 24h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
60°L to 70°L	37	9	-11	6	5	9	6	10	-3	7	4	7	4	5	5	7	7	60
70°L to 80°L	31	7	-27	5	58	5	16	4	-19	8	7	7	-24	9	-9	10	0	55
80°L to 90°L	-203	3	-249	4	-349	2	-9	4	-201	3	-140	3	-56	4	-81	3	-147	26
80° to 90°	-297	3	-276	4	-348	2	-51	4	-214	3	-66	3	46	4	-108	3	-149	26
70° to 80°	27	7	-9	5	47	5	28	4	-16	8	-22	7	-36	9	0	10	-2	55
60° to 70°	40	8	4	6	22	9	19	10	14	7	4	7	-5	5	-6	7	13	59
50° to 60°	4	11	-10	9	10	5	8	8	1	8	-2	11	-9	9	-10	8	-1	69
40° to 50°	-13	11	-19	17	-10	14	-1	12	-15	12	-18	15	-12	9	-16	12	-13	102
30° to 40°	-9	12	-5	12	0	11	-4	15	0	14	-2	13	-5	13	-6	14	-4	104
20° to 30°	4	16	-8	16	-2	19	-6	10	-1	12	-9	15	8	14	0	14	-2	116
10° to 20°	2	14	-5	15	-1	14	1	14	2	13	-7	14	9	16	-4	12	0	112
0° to 10°	4	20	0	16	-4	14	-2	16	-4	13	4	16	8	14	0	17	1	126
-10° to - 0°	-3	12	0	23	3	14	0	16	-4	16	-6	13	3	20	-3	18	-1	132
-20° to -10°	-13	16	-19	10	-6	13	-11	15	-4	18	-10	17	0	16	-5	17	-8	122
-30° to -20°	-7	10	-22	11	-10	9	-13	8	-7	13	-14	12	-4	12	-7	10	-10	85
Mean	-5	159	-22	159	-7	145	-1	150	-12	155	-10	160	-3	159	-8	162	-8	1249

TABLE II. Catalogue Comparison in Right Ascension (O-FK3) cos δ
Unit $^{s}.001$, Weight - Number of Stars

R.A. / Declination	0h to 3h		3h to 6h		6h to 9h		9h to 12h		12h to 15h		15h to 18h		18h to 21h		21h to 24h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
60°L to 70°L	-15	9	4	6	-2	9	-2	10	2	7	-2	7	-1	5	-2	7	-3	60
70°L to 80°L	-7	7	6	5	-14	5	-3	4	4	8	-1	7	5	9	3	10	0	55
80°L to 90°L	21	3	21	4	21	2	4	4	20	3	9	3	5	4	7	3	13	26
80° to 90°	-19	3	-22	4	-19	2	-6	4	-21	3	-4	3	-2	4	-8	3	-12	26
70° to 80°	6	7	-2	5	12	5	7	4	-4	8	-6	7	-10	9	-1	10	-1	55
60° to 70°	17	8	1	6	9	9	7	10	5	7	1	7	-2	5	-3	7	5	59
50° to 60°	2	11	-5	9	5	5	4	8	-0	8	-1	11	-5	9	-5	8	-1	69
40° to 50°	-8	11	-13	17	-7	14	-0	12	-10	12	-12	15	-8	9	-11	12	-9	102
30° to 40°	-7	12	-3	12	-0	11	-3	15	0	14	-1	13	-3	13	-4	14	-3	104
20° to 30°	3	16	-6	16	-2	19	-4	10	-1	12	-7	15	6	14	0	14	-1	116
10° to 20°	2	14	-4	15	-0	14	1	14	2	13	-7	14	8	16	-4	12	-0	112
0° to 10°	3	20	0	16	-4	14	-1	16	-3	13	3	16	8	14	-0	17	0	126
-10° to - 0°	-3	12	-0	23	2	14	-0	16	-3	16	-6	13	3	20	-2	18	-1	132
-20° to -10°	-12	16	-18	10	-5	13	-9	15	-4	18	-9	17	-0	16	-5	17	-7	122
-30° to -20°	-6	10	-19	11	-9	9	-11	8	-6	13	-12	12	-3	12	-6	10	-9	85
Mean	-1	159	-5	159	-1	145	-1	150	-2	155	-5	160	0	159	-3	162	-2	1249

TABLE III. Catalogue Comparison in Declination (O-FK3)
Unit $''.01$, Weight - Number of Stars

R.A. / Declination	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
60°L to 70°L	17	9	27	6	7	9	11	10	19	7	4	7	1	5	19	7	13	60
70°L to 80°L	-5	7	-2	5	-14	5	-5	4	-20	8	-9	7	-28	9	-10	10	-13	55
80°L to 90°L	-3	3	-16	4	-32	2	-8	4	-3	3	-40	3	-13	4	-44	3	-18	26
80° to 90°	26	3	14	4	7	2	11	4	18	3	5	3	19	4	-5	3	12	26
70° to 80°	2	7	13	5	5	5	12	4	12	8	17	7	-2	9	-1	10	6	55
60° to 70°	10	8	-4	6	-9	9	3	10	11	7	15	7	1	5	5	7	4	59
50° to 60°	12	11	11	9	11	5	-2	8	-3	8	9	11	28	9	19	8	11	69
40° to 50°	6	11	12	17	4	14	4	12	-4	12	1	15	5	9	2	12	4	102
30° to 40°	-6	12	5	12	-2	11	2	15	-7	14	-2	13	0	13	1	14	-1	104
20° to 30°	-8	16	-2	16	6	19	-5	10	-8	12	-7	15	-13	14	-9	14	-5	116
10° to 20°	1	14	-5	15	-4	14	-6	14	-3	13	-9	14	-1	16	-21	12	-6	112
0° to 10°	6	20	-2	16	1	14	-4	16	-5	13	-4	16	-2	14	-2	17	-1	126
-10° to - 0°	-2	12	-9	23	-7	14	-6	16	-9	16	2	13	-4	20	-3	18	-5	132
-20° to -10°	0	16	15	10	2	13	19	15	12	18	11	17	16	16	16	17	12	122
-30° to -20°	27	10	20	11	4	9	17	8	27	13	30	12	25	12	35	10	24	85
Mean	4	159	4	159	0	145	2	150	2	155	3	160	2	159	1	162	2	1249

TABLE IV. Mean Error of a Single Observation in Right Ascension, FK3 Stars
Unit $^{s}.001$, Weight - Number of Stars

R.A. / Declination	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt	Val.	Wt	Val.	Wt.	Val.	Wt	Val.	Wt	Val.	Wt.
60°L to 70°L	32	9	40	6	37	9	35	10	32	7	37	7	40	5	35	7	36	60
70°L to 80°L	30	7	32	5	36	5	28	4	31	8	31	7	29	9	31	10	31	55
80°L to 90°L	24	3	26	4	22	2	24	4	21	3	31	3	27	4	28	3	26	26
80° to 90°	26	3	24	4	25	2	25	4	25	3	23	3	24	4	23	3	24	26
70° to 80°	25	7	23	5	23	5	25	4	25	8	24	7	25	9	28	10	25	55
60° to 70°	25	8	28	6	27	9	26	10	27	7	24	7	29	5	25	7	26	59
50° to 60°	26	11	27	9	27	5	26	8	23	8	26	11	27	9	26	8	26	69
40° to 50°	25	11	27	17	23	14	24	12	21	12	29	15	31	9	25	12	25	102
30° to 40°	27	12	28	12	27	11	25	15	23	14	25	13	23	13	23	14	25	104
20° to 30°	30	16	26	16	25	19	26	10	26	12	27	15	25	14	24	14	26	116
10° to 20°	29	14	27	15	24	14	25	14	25	13	26	14	27	16	25	12	26	112
0° to 10°	25	20	27	16	25	14	24	16	24	13	27	16	28	14	25	17	26	126
-10° to - 0°	28	12	28	23	27	14	25	16	28	16	32	13	30	20	28	18	28	132
-20° to -10°	30	16	35	10	32	13	29	15	34	18	32	17	34	16	33	17	32	122
-30° to -20°	30	10	35	11	31	9	31	8	31	13	34	12	35	12	31	10	32	85
Mean	28	159	29	159	27	145	26	150	27	155	29	160	29	159	27	162	28	1249

TABLE V. Mean Error of a Single Observation in Declination, FK3 Stars

Unit ".01, Weight – Number of Stars

R.A.	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
Declination	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
60°L to 70°L	51	9	47	6	46	9	56	10	54	7	53	7	57	5	54	7	52	60
70°L to 80°L	60	7	51	5	56	5	57	4	49	8	49	7	48	9	48	10	52	55
80°L to 90°L	54	3	59	4	42	2	49	4	50	3	52	3	49	4	52	3	51	26
80° to 90°	47	3	48	4	52	2	51	4	44	3	50	3	53	4	51	3	50	26
70° to 80°	49	7	43	5	45	5	43	4	51	8	47	7	49	9	50	10	48	55
60° to 70°	50	8	46	6	42	9	51	10	46	7	41	7	49	5	50	7	47	59
50° to 60°	42	11	40	9	44	5	47	8	44	8	45	11	44	9	42	8	44	69
40° to 50°	44	11	41	17	44	14	40	12	39	12	42	15	41	9	45	12	42	102
30° to 40°	43	12	37	12	41	11	43	15	41	14	46	13	40	13	47	14	42	104
20° to 30°	44	16	42	16	41	19	50	10	45	12	42	15	44	14	49	14	44	116
10° to 20°	41	14	44	15	41	14	45	14	45	13	45	14	44	16	45	12	44	112
0° to 10°	45	20	45	16	44	14	47	16	43	13	49	16	45	14	49	17	46	126
-10° to - 0°	47	12	51	23	51	14	49	16	53	16	52	13	55	20	53	18	52	132
-20° to -10°	56	16	52	10	53	13	56	15	57	18	54	17	58	16	57	17	56	122
-30° to -20°	59	10	51	11	58	9	55	8	57	13	59	12	58	12	57	10	57	85
Mean	48	159	46	159	46	145	49	150	48	155	48	160	49	159	50	162	48	1249

TABLE VI. Parallax Corrections for FK3 (Supp.) Stars

FK4 Supp. No.	π	Δα	Δδ	FK4 Supp. No.	π	Δα	Δδ	FK4 Supp. No.	π	Δα	Δδ	FK4 Supp. No.	π	Δα	Δδ	FK4 Supp. No.	π	Δα	Δδ	FK4 Supp. No.	π	Δα	Δδ
2002	34	000	02	2249	28	001	01	2660	46	-002	02	2994	36	-001	03	3243	30	-001	02	3536	46	-005	03
2010	24	000	01	2283	29	000	00	2724	42	-001	01	3009	25	000	00	3248	46	-001	02	3544	27	-001	01
2028	33	000	01	2297	46	000	01	2730	43	-004	03	3020	21	-001	02	3254	35	000	02	3571	36	-001	03
2031	21	000	02	2326	33	000	00	2739	20	-001	00	3021	33	-001	02	3257	34	000	02	3609	31	-001	02
3941	25	000	02	2338	20	001	00	2756	20	-001	01	3025	36	-001	01	3259	43	-001	03	3613	21	000	02
2071	28	000	01	2348	23	000	01	2826	20	-001	01	3047	42	000	01	3293	40	-001	03	3654	20	000	02
2073	33	000	00	2384	21	-001	01	2844	27	-001	02	3083	30	000	02	3305	28	-003	02	3656	31	001	03
2084	25	000	00	2387	21	002	01	2846	27	-001	00	3090	31	-002	02	3324	30	000	01	3666	32	-001	02
2089	21	000	00	2457	22	-001	-01	2852	38	-002	02	3102	27	-001	02	3328	35	-001	03	3693	30	-002	02
2115	20	000	00	2477	34	000	-01	2855	29	-002	03	3103	23	-001	02	3393	31	-001	02	3711	50	-001	01
2120	36	000	01	2491	23	000	01	2866	24	-002	02	3107	24	000	00	3394	26	000	01	3716	22	000	01
2173	34	-001	-01	2558	34	-003	02	2879	25	-001	00	3124	22	000	02	3420	40	-001	01	3965	31	-005	02
2179	33	001	01	2568	21	-001	00	2918	23	-001	00	3146	32	000	03	3433	23	-001	02	3775	22	-001	02
2187	40	000	01	2604	53	-009	03	2924	38	-001	01	3160	35	000	02	3447	20	-001	02	3796	21	000	01
2194	20	000	00	2630	33	-001	00	2938	28	-001	01	3177	40	000	01	3460	23	-001	01	3828	39	-001	00
2204	35	000	00	2633	29	-002	01	2963	27	-001	02	3179	26	-001	02	3513	20	000	02	3857	25	000	01
2222	29	000	02	2649	27	-002	01	2981	23	-001	01	3185	26	-001	01	3529	39	-001	01	3863	36	-001	02
2236	21	001	01	2658	26	-001	00	2983	23	-001	01	3221	26	-001	01	3530	29	-001	01	3919	38	-001	03

TABLE VII. Comparison of PZT Stars with FK3 Stars of the Zenith Zone

R.A.	0^h to 3^h		3^h to 6^h		6^h to 9^h		9^h to 12^h		12^h to 15^h		15^h to 18^h		18^h to 21^h		21^h to 24^h		Mean	
Declination	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.	Val.	Wt.
Right Ascension **Unit ″001, Weight – Number of Stars**																		
PZT	-4	18	-8	20	-15	20	-8	20	-5	19	-5	21	-8	21	-2	21	-7	160
FK3	-8	11	-13	17	-7	14	-0	12	-10	12	-12	15	-8	9	-11	12	-9	102
Declination **Unit ″01, Weight – Number of Stars**																		
PZT	12	18	7	20	-11	20	-7	20	-10	19	12	21	7	21	9	21	2	160
FK3	6	11	12	17	4	14	4	12	-4	12	1	15	5	9	2	12	4	102

Part I

CORRECTIONS TO THE 1108 FK3 STARS

The differences are in the form observed minus FK3. The mean epoch and the number of observations in each co-ordinate are given.

The observations at lower culmination are listed separately at the end.

OBSERVED - FK3							OBSERVED - FK3						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
905	.008	61.69	11	.01	62.38	10	41	.048	58.45	36	.00	58.55	35
1002	.000	59.66	10	-.10	60.16	12	1032	-.004	60.16	11	.14	60.37	12
1003	-.003	60.99	10	.09	60.99	10	43	.003	60.73	14	-.04	61.29	14
1	-.010	58.26	14	-.04	58.45	13	1033	.009	59.44	40	.14	59.62	39
2	.009	58.50	25	.23	58.37	24	1034	.014	58.33	59	.09	58.61	54
4	-.009	57.34	16	.28	57.18	17	45	-.012	58.92	18	-.11	58.95	15
7	-.004	58.01	15	-.02	58.01	15	1035	-.019	58.33	25	-.02	58.27	26
1004	-.009	59.57	12	-.12	59.81	13	47	-.009	60.69	17	.03	60.86	17
1005	.000	57.84	19	-.23	58.03	17	1037	-.013	57.12	28	.10	57.21	26
1006	-.028	57.56	17	-.18	57.66	15	46	-.018	57.36	16	.19	57.61	16
9	.017	59.92	13	-.51	60.27	12	48	.024	59.81	14	.16	59.98	12
1007	-.065	59.12	8	-.28	59.39	12	1039	.010	60.68	13	-.18	60.68	13
1008	-.003	57.70	38	.00	57.83	36	1041	-.035	59.49	15	.46	60.01	15
1009	-.024	58.43	14	-.06	58.56	13	1040	.051	57.79	13	-.06	57.93	14
1010	-.007	58.28	47	.06	58.60	46	1043	-.025	59.81	15	.45	59.93	15
1011	-.010	57.58	35	.40	57.77	30	1042	-.018	59.34	22	.06	59.74	21
1012	.001	59.13	14	.26	59.13	14	50	.008	58.63	13	.07	58.86	14
13	-.007	58.11	54	-.23	58.46	47	1045	-.019	58.40	15	-.02	58.40	15
14	.026	59.77	12	-.01	59.66	10	1046	-.009	58.28	31	-.04	58.56	29
16	.045	58.36	31	.13	58.57	30	51	.057	59.22	11	-.09	59.22	11
17	.016	58.34	21	.35	58.45	19	52	-.015	60.75	14	.28	61.02	11
18	-.013	58.58	16	-.13	58.75	13	55	.034	57.50	16	.11	57.41	15
19	.004	58.35	13	-.04	58.65	14	56	.000	59.21	39	.14	59.46	35
20	-.034	57.26	18	.04	57.17	17	1047	.000	58.86	13	.37	59.42	11
21	.014	58.44	14	.31	58.48	13	1049	-.021	58.54	15	.04	58.81	14
22	.011	59.43	12	.19	59.34	12	57	-.010	58.97	15	.20	59.91	14
25	-.018	57.76	21	-.03	57.76	21	59	.002	59.85	11	.14	60.09	12
24	-.003	57.93	34	.22	57.98	30	60	.000	57.44	24	.08	58.05	21
27	-.007	59.10	14	-.19	58.90	13	61	.008	62.17	9	.52	61.55	11
1018	.015	60.50	12	.58	60.89	12	1050	.025	58.99	12	-.20	59.20	13
1019	.005	57.50	33	.31	57.55	28	1051	.006	59.06	37	-.01	59.26	36
28	.015	58.25	18	-.03	58.25	16	907	-.358	57.90	15	.26	58.07	13
1020	-.005	58.97	13	.16	59.23	12	1052	.029	58.14	13	-.15	58.14	13
1021	-.019	59.03	11	.18	60.03	10	62	.002	60.46	19	-.06	60.58	20
30	.004	58.41	32	-.29	58.54	26	64	.012	59.66	11	-.17	60.29	11
29	.004	60.07	11	-.03	60.42	11	63	.074	58.75	10	.25	59.11	11
1022	.000	57.95	56	-.08	58.02	55	65	-.004	58.33	22	.10	58.17	24
32	.037	60.38	12	.09	60.18	13	66	-.007	59.53	12	-.10	59.53	12
33	-.022	58.62	14	-.08	59.42	15	71	-.009	58.51	16	.20	58.88	12
1023	.009	59.40	10	.27	59.40	10	1054	-.003	58.69	18	-.01	58.69	18
1024	.001	58.41	26	-.10	58.74	24	70	.024	58.64	21	-.09	58.51	20
1025	-.036	59.08	11	-.21	59.64	13	73	-.049	59.16	12	-.03	59.16	12
36	-.006	58.25	25	.01	58.93	22	74	.014	58.25	17	-.11	58.44	17
37	.001	58.00	19	-.11	58.02	17	75	.004	59.66	13	.01	59.66	13
906	-.207	58.55	37	.13	58.75	38	1056	.014	60.29	11	-.16	60.65	13
1028	-.002	58.81	14	.03	58.46	14	1635	-.327	58.08	29	.38	58.08	29
1029	-.032	59.96	10	.45	60.91	11	77	-.027	61.28	10	.40	61.41	11
1030	.039	59.30	11	-.30	59.35	10	1057	.001	61.37	10	.28	61.64	11
40	.007	60.78	13	-.21	61.38	13	1058	.021	59.50	12	.12	59.50	12
42	-.017	59.22	11	.34	59.51	12	76	.083	61.80	10	-.05	61.64	11

	OBSERVED - FK3							OBSERVED - FK3					
FK4 No.	**Δα**	**Epoch**	**No.**	**Δδ**	**Epoch**	**No.**	**FK4 No.**	**Δα**	**Epoch**	**No.**	**Δδ**	**Epoch**	**No.**
1059	.010	59.34	13	-.36	59.34	13	1091	.007	59.57	27	-.30	59.72	26
79	.019	58.76	11	-.19	58.76	11	115	-.069	60.12	43	-.01	60.14	44
80	.005	59.30	22	.21	59.30	22	1093	.004	60.07	30	-.06	60.18	29
81	.012	61.13	13	-.14	61.13	13	1094	.006	59.59	14	.29	59.59	14
1061	.004	58.84	17	-.32	58.85	16	1636	-.401	58.19	42	.01	58.29	39
1063	-.007	58.15	14	-.33	58.15	14	1096	.035	60.14	14	-.01	60.33	15
1064	-.012	60.64	10	.02	60.06	10	120	-.027	60.58	11	.05	60.52	12
83	-.030	59.68	12	-.06	59.68	12	121	-.003	61.12	16	-.12	61.12	16
1066	-.002	61.49	33	-.10	61.50	32	123	-.007	60.93	24	-.16	60.93	24
1068	.021	58.57	19	-.12	58.57	18	122	-.022	58.99	20	.30	59.32	18
85	.006	58.68	40	.10	58.92	40	124	-.001	58.64	14	.00	58.64	14
1069	.009	58.85	11	.03	58.85	11	125	-.011	60.73	14	-.30	60.65	13
1070	.005	59.92	9	-.32	59.92	9	1097	-.006	59.48	52	-.28	59.60	51
1071	-.015	59.45	10	.26	59.75	11	1098	.001	59.52	11	-.04	59.52	11
87	.051	60.20	18	.03	60.55	15	127	.001	60.87	25	-.06	61.02	24
1072	.015	59.17	28	.36	59.45	25	1099	.009	59.05	15	.33	58.84	11
1073	-.003	60.66	24	.12	60.66	24	1100	.012	60.63	15	-.03	60.63	15
1074	.008	59.64	20	.36	59.62	18	1101	-.007	58.83	53	-.06	58.94	53
89	.022	58.60	18	.06	58.59	17	1103	-.023	58.97	13	-.25	58.97	13
91	0.000	59.78	67	-.18	59.84	69	129	-.004	58.93	25	.30	59.16	24
92	.063	59.22	13	.10	59.22	13	131	-.017	59.31	13	.19	59.60	12
94	.017	59.72	8	-.42	59.72	8	135	-.013	58.92	13	0.00	59.16	12
93	-.012	60.92	11	.18	61.30	12	134	-.041	61.52	12	.25	61.49	10
1077	-.022	60.94	11	.21	60.94	11	136	.003	60.89	10	.04	60.89	10
97	-.022	61.19	10	.17	61.00	9	137	-.003	57.77	19	-.12	58.00	17
1078	-.023	61.43	11	.13	61.99	10	1104	.007	58.49	16	-.33	58.65	15
98	.000	58.23	24	.09	58.38	23	139	-.004	59.68	11	.08	59.63	13
99	-.022	58.64	19	-.07	58.93	16	140	-.023	60.51	11	.24	60.28	10
100	-.006	58.41	14	-.15	58.35	12	138	-.036	59.32	10	.15	59.32	10
1079	-.018	60.80	11	.17	60.80	11	142	.003	61.76	10	.09	61.78	11
102	-.001	61.27	11	.34	61.82	10	1105	-.003	60.54	14	.39	60.44	15
103	-.022	59.07	14	.20	59.07	14	1106	-.010	60.37	12	-.04	60.56	13
104	-.010	58.40	14	.04	58.50	12	1107	.011	59.16	23	.05	59.62	22
1080	-.012	59.66	14	.05	59.66	14	144	-.004	61.60	11	.11	61.60	11
1081	-.002	60.84	11	.05	60.84	11	147	-.014	58.11	17	.42	58.67	16
1082	.003	60.55	11	-.27	60.43	10	149	-.019	59.99	10	-.29	60.15	11
1083	.009	59.06	47	.12	59.13	46	148	-.027	59.47	13	.06	59.50	14
105	.029	59.86	53	.03	60.12	50	150	-.020	60.89	27	.05	60.85	27
107	-.001	59.38	17	-.10	59.61	16	1111	.007	58.23	33	-.04	58.30	34
1084	-.054	60.37	9	-.43	60.54	11	151	.010	61.07	25	-.06	61.07	25
1085	-.023	58.25	10	.13	58.67	11	1112	-.012	59.69	13	-.35	59.69	13
108	-.007	59.94	13	.17	60.98	11	1113	-.020	59.48	16	.14	59.68	17
109	-.010	59.79	13	.02	59.58	14	152	-.010	59.56	16	.08	59.56	16
111	-.021	59.46	18	.16	59.54	17	1115	-.011	58.79	21	-.27	58.93	20
1087	-.052	61.21	11	-.21	61.15	10	1116	-.017	58.98	14	-.21	58.77	13
112	-.010	59.66	16	-.26	59.71	14	154	-.004	58.73	33	.02	58.99	30
1088	.003	58.28	18	-.15	58.46	18	1117	-.009	60.37	11	.31	60.37	11
114	.003	58.91	15	-.24	59.13	14	1118	-.003	58.92	31	-.11	59.15	30
116	-.014	59.68	56	-.20	59.73	54	159	-.015	59.93	10	-.03	59.93	10
1089	-.001	59.03	15	.14	59.49	12	158	-.006	59.78	10	.03	59.60	11

OBSERVED - FK3							OBSERVED - FK3						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
1119	-.034	62.83	10	-.16	62.81	8	198	-.047	62.11	12	.24	62.52	12
161	-.018	61.92	7	.18	61.76	6	1147	-.008	59.62	28	.31	59.58	27
908	-.332	59.16	32	.08	59.38	32	201	.003	61.06	25	.48	61.34	25
162	-.017	59.34	14	.01	59.40	12	202	-.022	59.39	13	-.07	59.39	13
1120	.015	59.73	28	-.07	59.66	27	1148	-.007	58.36	14	.05	58.36	14
1122	.050	60.75	16	-.18	60.68	15	203	-.003	59.68	29	-.11	59.78	30
164	.018	59.51	11	.22	59.80	12	204	-.013	58.62	14	.43	59.21	12
1123	.013	58.52	32	.13	58.62	28	1150	-.006	58.00	20	-.13	58.10	21
165	-.003	59.68	18	-.10	60.08	16	206	.003	59.68	23	-.31	59.92	21
1124	-.020	59.14	14	.32	58.99	13	1151	-.003	60.48	13	.07	60.48	13
1125	.005	61.06	13	-.13	60.90	12	207	.006	61.39	9	-.09	61.46	10
168	-.015	61.16	12	.07	61.16	12	208	.004	56.67	27	-.05	56.67	25
169	-.016	58.04	26	.01	58.31	25	209	-.008	61.36	10	-.15	61.36	10
172	-.028	60.55	11	.46	61.80	11	205	.067	58.84	13	.30	58.76	13
1127	-.040	60.12	11	.19	61.14	9	210	.013	61.17	10	-.37	61.17	10
1126	-.014	58.30	12	-.26	58.44	11	211	.003	58.31	13	-.03	58.80	11
174	-.005	60.11	11	.12	60.11	11	1153	-.035	60.70	9	.39	60.81	10
1128	-.031	59.61	11	.30	59.61	11	216	-.017	58.36	24	.23	58.45	24
1131	.028	59.30	29	.02	59.31	28	217	-.026	59.20	15	-.08	59.83	13
173	-.003	60.14	41	.24	60.56	35	218	-.002	58.92	12	-.02	58.92	11
176	.001	59.55	12	-.04	59.55	12	219	-.036	62.12	11	.53	62.13	9
175	.005	59.95	11	.08	59.95	11	220	-.006	61.00	16	.07	61.07	17
1133	-.008	58.71	13	.19	58.71	13	1638	-.075	59.24	20	.01	59.40	22
1134	-.001	60.43	15	.00	60.33	14	1155	.007	58.16	26	-.59	58.81	16
1135	.010	59.47	12	-.12	59.77	11	221	.006	58.64	16	-.06	59.00	12
179	-.006	60.84	14	-.04	60.84	14	222	-.018	61.62	12	.17	61.58	11
178	-.041	59.20	19	-.20	59.33	16	1158	-.012	60.17	14	.02	61.00	11
1136	.011	61.33	12	-.22	61.33	12	1157	.000	60.67	12	.02	60.67	12
180	.005	61.02	24	.01	61.02	24	224	-.018	60.39	18	.01	61.05	17
181	-.001	59.00	16	-.01	59.20	15	226	-.021	61.32	11	.63	61.24	10
183	-.035	60.03	16	.33	59.83	13	225	-.030	60.26	10	.13	60.26	10
182	-.011	58.78	27	-.02	59.24	25	227	-.011	60.48	10	-.10	60.63	11
1137	-.016	59.92	14	-.13	60.00	13	1161	-.004	58.22	50	.17	58.58	48
184	-.008	58.47	19	-.04	58.95	14	1162	-.008	60.88	10	-.40	60.88	10
1140	-.012	58.85	17	.24	59.02	16	1163	-.011	59.77	13	.20	59.94	14
185	-.019	60.04	19	-.05	60.21	17	230	.006	59.10	69	.21	59.27	65
186	-.005	61.18	15	-.07	61.07	13	232	.000	58.42	20	-.01	58.56	18
188	-.004	60.99	28	-.12	60.96	27	1165	-.030	58.36	13	-.03	58.98	13
1142	.005	58.89	27	-.11	59.15	25	233	-.014	59.27	49	-.30	59.25	49
1141	-.024	59.91	13	.30	59.91	13	1168	-.002	59.44	12	-.08	59.46	11
190	.000	59.16	21	.10	59.12	18	1167	-.023	60.98	11	-.27	60.95	11
192	.016	58.60	18	.18	58.60	18	234	.027	61.15	10	-.12	61.24	11
1144	-.015	60.69	13	.33	60.60	12	1169	-.002	57.73	25	.09	57.93	24
194	-.015	61.08	25	-.20	61.08	26	237	-.003	60.19	14	.26	60.19	14
193	-.034	59.38	14	.08	59.38	14	1170	-.009	58.74	63	.07	58.97	60
1637	-.295	58.16	20	.44	58.36	20	241	-.004	57.89	15	.15	58.17	13
191	-.002	59.61	27	-.02	59.73	25	243	-.015	60.60	11	.13	61.14	10
195	-.003	61.04	21	.12	61.04	21	242	-.026	61.26	12	.14	61.38	13
1145	-.011	60.57	12	.29	60.91	12	244	-.025	58.07	25	-.13	58.15	24
1146	-.005	61.83	11	.37	61.73	10	1171	-.040	58.37	15	.05	59.10	14

OBSERVED - FK3							OBSERVED - FK3						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
1172	-.020	60.09	12	.11	59.72	13	1197	-.001	60.58	10	-.05	60.77	10
246	-.002	59.15	64	-.35	59.44	58	289	.008	58.05	47	-.03	58.12	46
1173	-.015	60.13	12	.27	60.28	13	291	-.022	60.31	13	.36	60.34	15
1174	-.002	58.66	21	.05	58.79	20	292	.035	58.87	14	-.03	58.62	13
1175	.022	59.12	18	.13	59.24	18	293	-.003	57.67	28	.08	57.74	26
249	.007	62.19	10	.23	62.20	10	294	-.006	56.58	12	-.27	56.58	12
247	.006	57.51	12	.01	57.51	12	295	.001	60.30	12	-.10	60.44	13
251	-.006	58.92	12	.18	59.17	11	1200	-.018	58.98	10	-.26	58.98	10
250	.005	58.27	12	.18	58.51	10	1199	.012	59.51	11	.07	59.52	11
248	-.019	58.91	49	.06	59.06	49	1201	-.001	58.08	32	-.27	58.04	31
254	-.002	57.84	18	.20	58.12	15	1202	-.008	61.64	11	-.47	61.77	13
256	-.004	58.44	13	.31	58.44	13	296	-.036	58.73	13	-.18	58.53	13
257	-.039	61.51	12	.01	62.15	10	1204	-.010	58.50	11	-.02	58.83	10
255	-.036	59.41	15	.04	59.82	15	1205	.002	58.41	47	-.15	58.34	49
1177	.004	58.62	48	-.07	58.86	45	1207	-.011	59.72	13	-.12	59.76	12
1176	-.002	60.07	12	-.07	60.07	12	299	.017	57.91	20	-.03	57.80	19
258	.003	58.14	24	.04	58.18	24	1208	.012	57.88	15	.04	57.90	16
1179	.008	58.73	29	-.53	58.93	27	300	.046	59.05	24	-.20	59.04	23
259	.022	58.74	14	.13	59.10	14	1209	-.009	57.73	14	-.18	57.73	14
261	-.010	58.43	16	.13	58.98	13	304	.019	57.45	34	-.27	57.49	33
266	-.010	58.66	41	-.01	58.80	36	302	.107	58.18	13	-.08	58.52	14
260	.020	59.20	34	.05	59.29	32	1212	.036	61.85	10	.17	61.85	10
1181	.022	58.97	58	.39	59.15	57	1211	.015	60.50	11	.05	60.50	11
1182	-.014	58.22	13	.17	58.22	13	1213	-.024	57.84	36	.33	58.06	36
270	-.003	60.18	12	.29	60.58	10	305	.009	57.61	13	.08	57.61	13
269	.004	58.01	18	.11	57.97	15	307	.008	59.27	13	.03	59.27	13
271	-.023	59.43	10	.05	58.87	12	1639	-.079	57.35	27	.03	57.28	26
1185	.022	58.64	44	-.13	58.71	41	308	-.007	62.17	10	-.10	62.24	9
273	.007	62.23	13	-.01	62.24	12	1214	.049	60.89	11	-.77	61.00	12
1186	-.015	57.46	34	-.03	57.59	31	1215	.034	60.48	13	-.37	60.50	12
274	-.002	60.43	13	.03	60.56	14	311	.000	61.71	9	-.06	61.75	10
1187	-.003	58.13	32	-.15	58.14	29	310	.094	58.95	46	.09	58.82	44
1188	.008	58.23	18	-.17	58.36	17	312	.005	60.56	17	-.11	60.51	17
1190	-.026	58.70	16	-.21	58.82	16	1216	-.045	56.79	26	.10	56.82	25
276	.017	58.13	19	-.03	58.25	17	1218	.055	57.71	31	.23	57.78	36
277	.003	58.67	13	-.32	58.64	12	1217	.007	59.66	13	.20	60.11	13
279	-.006	57.87	15	.03	57.99	14	314	-.023	57.80	22	.21	57.80	22
909	-.616	58.25	25	.10	58.51	29	1220	.008	58.18	16	.08	57.94	17
280	.008	58.33	19	.23	58.19	16	1221	-.007	57.58	12	-.15	57.58	12
1191	-.007	57.64	16	-.07	57.74	15	316	-.002	59.87	25	-.04	59.87	25
282	.001	58.53	11	.36	58.55	10	1222	.015	58.42	14	.12	58.12	14
1192	-.005	60.69	10	-.11	61.47	10	317	.011	58.36	22	-.12	58.13	21
285	.002	59.95	14	-.15	60.09	15	320	-.004	59.34	13	.00	59.34	13
284	-.009	58.20	16	.05	58.51	14	321	-.004	59.80	10	-.05	60.01	11
286	.016	58.49	13	.13	58.49	13	322	.095	58.83	11	.24	59.11	12
1193	-.014	58.46	39	-.25	58.44	39	1223	-.004	57.18	44	.19	57.18	42
287	-.018	58.01	14	.44	58.85	10	323	.002	60.11	13	.05	60.28	11
288	.036	59.17	14	.67	59.43	9	1224	.000	60.20	17	-.02	59.85	18
1196	.005	58.26	12	-.08	57.93	11	1225	.004	59.01	12	.10	58.88	13
1195	-.008	59.33	12	.01	59.33	12	325	.007	57.35	32	.03	57.40	34

OBSERVED - FK3							OBSERVED - FK3						
FK4 No.	$\Delta\alpha$	Epoch	No.	$\Delta\delta$	Epoch	No.	FK4 No.	$\Delta\alpha$	Epoch	No.	$\Delta\delta$	Epoch	No.
1228	-.011	57.78	18	.07	57.78	18	373	-.030	60.50	14	.18	60.81	13
326	.000	58.52	14	-.09	58.68	12	1257	.014	57.73	40	.14	57.88	36
1229	-.084	60.74	11	-.56	60.69	8	372	.007	59.08	20	.17	59.23	19
328	.000	59.11	13	-.12	59.35	12	374	.012	58.53	13	.16	58.53	13
1230	.007	58.78	31	-.14	58.90	30	376	.015	58.06	38	-.05	58.08	37
334	-.008	59.98	27	-.01	60.37	25	378	.002	57.94	37	-.05	58.07	35
1231	-.029	58.91	10	.28	60.11	10	1258	-.023	58.78	12	-.24	59.03	13
337	-.014	58.11	39	-.04	57.96	36	1259	.004	57.54	30	.11	57.65	28
335	-.027	59.85	12	.34	59.90	11	1260	-.067	59.09	14	-.11	58.84	10
1232	.010	59.01	12	-.01	59.01	12	1261	-.005	60.35	11	.23	61.08	12
339	.000	58.43	16	.16	58.44	16	379	.011	59.22	12	.14	59.22	12
338	.016	58.66	20	.00	59.15	17	380	-.015	59.74	22	-.02	59.76	21
1235	.012	58.03	44	-.50	57.87	39	381	-.010	58.37	19	-.21	58.31	18
341	.008	60.57	13	.01	60.59	14	384	.009	58.61	12	.01	58.61	12
340	.038	59.66	14	-.11	59.93	13	383	-.019	59.22	11	.18	59.14	13
1236	-.025	57.94	35	-.21	58.07	32	1262	.016	59.37	14	.02	59.39	13
1237	-.008	57.59	13	.24	57.56	14	1263	.007	56.63	20	-.16	56.64	17
1238	.011	57.07	15	-.22	57.21	15	1266	.001	57.25	28	-.19	57.47	23
1640	-.103	56.87	19	.30	57.01	18	386	-.008	60.46	13	-.07	60.53	10
1239	.001	60.32	10	-.01	60.32	10	1267	-.022	59.00	14	.09	59.31	13
1240	.004	58.19	17	.67	58.85	12	387	.043	57.90	15	-.18	58.31	15
1242	-.025	56.74	15	.39	56.99	13	388	.005	58.04	33	-.03	58.06	31
346	-.004	58.11	25	-.09	58.14	22	389	-.030	60.82	12	-.33	61.33	11
347	-.011	60.22	32	.15	60.22	32	390	-.012	59.58	12	.17	59.60	11
350	-.005	58.00	24	.12	58.08	23	911	-.056	57.55	53	.08	57.54	54
352	-.007	58.74	17	-.35	58.71	16	1270	.004	57.14	15	-.26	57.28	14
1243	.001	60.10	10	.08	60.10	10	1271	-.019	60.43	10	.07	59.95	11
1244	-.011	58.95	16	-.27	58.93	15	394	.013	61.15	11	.18	61.15	11
1245	-.002	58.36	56	-.07	58.51	52	1272	-.004	59.96	12	.16	59.96	12
354	-.006	58.85	36	.10	58.98	35	396	-.010	59.82	11	-.12	59.77	10
355	.037	57.58	19	-.14	57.58	19	395	.027	57.42	17	.09	57.65	15
1246	.017	55.83	13	-.05	55.75	13	399	-.010	60.05	9	.14	59.76	8
358	-.007	59.86	10	-.15	59.86	10	398	.004	58.25	11	-.16	58.05	10
357	.035	60.07	12	.02	60.07	12	1274	.026	57.62	48	.07	57.69	47
910	-.061	58.84	44	-.27	59.14	36	1275	-.009	58.57	16	-.14	58.53	15
1247	.025	60.62	10	.29	60.75	11	404	.006	58.08	58	-.13	58.05	57
360	.008	57.40	15	-.01	57.26	14	403	-.002	58.48	17	-.01	58.48	17
1249	-.013	58.18	49	.04	58.28	49	1276	.006	58.64	12	.09	58.57	11
1250	-.010	57.42	35	-.17	57.60	32	405	-.013	57.23	20	-.21	57.43	20
364	.007	60.30	10	.29	60.30	10	407	.011	57.68	14	-.26	57.68	14
363	.052	58.57	15	.08	58.47	13	1278	.003	57.92	50	.04	58.06	42
365	.004	58.40	13	-.24	58.08	12	1279	.023	59.13	12	.06	59.39	11
1251	.025	57.39	13	.43	56.79	14	1280	-.028	61.48	11	.43	61.53	12
1252	.028	58.21	13	-.36	58.12	12	409	-.002	57.44	44	-.29	57.56	40
367	.003	58.10	16	-.05	58.55	13	410	-.030	61.54	12	.11	61.48	11
1253	-.010	58.21	13	-.13	58.60	12	1281	.001	58.53	15	-.08	58.61	14
1255	-.006	57.40	31	.09	57.39	28	412	-.012	58.29	20	.07	58.23	16
368	.006	57.77	15	-.15	57.77	15	413	.042	57.39	19	.20	57.65	17
370	.006	58.42	44	.02	58.33	41	1282	-.013	59.46	12	.12	59.21	13
371	.003	57.58	16	-.09	57.67	15	1283	-.015	62.15	11	.32	62.15	11

OBSERVED - FK3							OBSERVED - FK3						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
1284	.011	57.06	24	-.24	57.09	21	454	.060	58.43	29	.02	58.65	25
416	-.004	58.03	13	.25	58.19	12	1314	.000	57.00	19	-.18	56.73	19
1285	-.009	57.54	35	.31	57.72	31	456	.019	58.33	12	-.01	58.69	11
417	.002	57.68	12	.28	57.76	12	457	-.028	60.82	9	.28	60.57	10
418	.001	57.83	29	-.05	57.94	26	458	-.024	58.68	11	.19	59.11	10
419	.005	61.06	11	.05	60.94	10	1315	.004	58.41	23	-.20	58.28	22
1286	-.014	57.02	15	.84	56.92	14	460	-.008	58.63	24	-.18	58.82	23
1287	-.008	56.97	24	-.08	57.09	23	1316	-.045	59.15	13	-.18	59.15	13
420	-.012	57.94	14	-.21	57.94	14	1317	-.002	57.92	21	.10	58.24	17
1641	.015	57.87	47	.31	57.82	46	1318	-.010	57.88	32	-.23	57.86	30
421	-.020	56.54	15	.05	56.70	14	1319	-.002	56.51	15	.61	56.32	10
422	.005	58.89	13	.35	58.89	13	461	-.008	58.35	31	.31	58.32	30
423	-.003	59.51	12	.11	59.51	12	466	.008	56.72	24	-.16	56.78	23
424	.014	57.16	10	-.10	57.16	10	465	-.013	57.96	14	.19	57.86	13
1292	.009	57.66	32	.01	57.58	31	467	.018	57.50	21	-.07	57.49	22
425	.003	57.92	20	-.02	57.76	18	1321	.010	59.81	9	-.15	59.62	11
1293	-.011	57.84	25	.32	57.84	25	1322	-.005	57.71	12	-.04	57.71	12
426	-.009	58.83	11	.18	58.78	10	472	-.054	57.68	19	.17	57.89	19
427	.007	57.42	49	-.15	57.63	42	470	-.020	58.39	12	-.16	58.39	12
429	.023	58.15	19	.06	58.01	19	471	-.027	59.97	12	.30	61.04	8
431	-.007	58.01	12	.14	57.89	11	1323	.028	58.45	16	.42	58.32	14
1295	-.035	58.82	11	-.33	58.82	11	473	.000	59.30	13	-.12	59.30	12
1296	-.014	57.15	29	.04	57.29	27	1324	.007	57.68	66	-.17	57.70	64
1297	-.014	57.90	36	.09	57.80	35	475	-.005	58.06	41	.17	58.05	39
432	.010	58.75	17	.14	59.01	15	1326	-.012	58.55	58	-.17	58.50	57
433	-.016	58.35	32	-.07	58.39	30	478	.025	58.38	21	.16	58.39	20
1299	.005	57.45	33	-.25	57.36	30	1327	-.030	57.25	16	-.02	57.18	15
437	.005	56.74	16	-.24	56.74	16	1328	.003	58.36	51	-.13	58.50	48
1300	.002	57.53	23	.04	57.50	22	1329	.005	59.89	10	.45	59.89	10
440	.036	57.66	25	.04	57.66	25	1330	.002	58.41	42	-.04	58.41	42
1301	-.025	58.41	15	.13	58.04	13	1332	.004	57.09	23	.11	57.09	23
1302	-.005	57.93	51	-.08	57.88	47	1333	.034	58.14	17	.12	58.14	17
441	.000	58.34	14	.21	58.19	13	1334	.024	60.04	11	.17	60.04	11
1303	-.002	58.66	16	.17	58.66	16	1335	-.010	57.66	34	-.20	57.92	31
1304	.002	57.48	15	.08	57.73	16	483	-.018	59.38	12	-.09	59.38	12
1305	-.011	59.82	11	.42	59.47	11	484	-.006	59.81	15	-.10	59.81	15
444	-.021	58.30	11	-.17	58.30	11	486	.026	58.24	17	.09	58.24	17
445	.008	59.75	24	-.04	59.93	22	485	-.003	57.86	12	-.03	57.86	12
1306	-.014	57.11	49	-.01	57.11	49	1336	-.001	58.37	54	-.31	58.30	51
1307	.015	58.11	16	-.15	58.03	15	488	.001	58.96	22	-.27	58.94	21
447	.010	57.67	12	-.13	57.67	12	1337	-.014	57.03	15	-.06	57.37	16
1308	-.019	60.27	12	.03	60.27	12	1338	.002	58.78	13	.03	58.78	13
1309	.005	62.27	11	-.11	62.27	10	1339	.022	58.85	11	-.17	59.00	10
1310	-.016	58.68	19	.15	58.38	16	490	.000	57.29	28	-.37	57.22	27
1311	.001	57.57	38	.01	57.52	37	491	-.016	60.48	11	-.17	60.48	11
1642	-.284	57.17	34	.03	57.10	33	1341	-.043	58.18	10	.59	58.51	8
450	-.002	57.61	20	-.32	57.70	18	492	-.010	57.25	15	-.03	57.25	15
451	-.045	59.46	41	.26	59.66	36	1344	-.007	57.50	51	-.19	57.53	49
453	-.002	59.88	14	-.03	59.92	13	494	-.029	57.85	15	-.12	57.85	15
1313	.014	57.29	14	-.07	57.54	12	1345	.009	60.21	11	.35	60.42	9

OBSERVED - FK3							OBSERVED - FK3						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
495	-.037	60.62	9	.00	60.70	10	1375	.007	57.98	31	.04	58.05	28
1346	-.004	57.31	45	.11	57.31	43	1376	.028	61.23	9	.40	61.25	10
497	-.011	57.82	23	.10	57.82	21	531	-.029	57.28	20	.04	57.28	20
498	-.009	59.10	12	-.23	59.08	11	1378	.008	58.39	11	-.06	58.39	11
1348	.010	57.54	25	.02	57.67	24	533	-.016	57.44	34	-.06	57.63	32
499	.012	57.29	16	.13	57.24	16	1379	-.005	57.98	38	.20	58.15	36
1349	.006	57.79	11	.08	57.79	11	534	-.012	59.73	11	-.19	59.73	11
1350	.002	57.62	13	-.12	57.62	13	535	-.022	59.08	13	-.05	59.08	13
500	-.013	57.70	21	-.16	57.94	21	536	.012	58.07	16	.18	58.32	17
1351	-.004	57.10	51	.02	57.34	49	1380	-.025	56.52	15	-.19	56.45	14
501	-.020	59.10	12	-.02	59.10	12	1381	-.015	57.07	26	.11	56.98	24
502	.010	58.65	10	-.08	58.65	10	540	-.008	57.89	28	-.05	57.83	27
1352	.001	57.71	16	.23	57.61	15	1382	.003	56.98	33	.11	56.98	33
1353	.019	59.32	9	-.06	59.61	10	545	-.019	59.82	14	.22	59.94	13
505	-.016	57.68	32	-.35	57.84	30	1383	-.022	57.06	21	-.25	57.06	21
1354	.005	60.31	10	-.06	60.31	10	1384	-.003	57.52	17	.11	57.52	17
1355	.012	57.56	29	-.05	57.60	29	547	-.022	59.34	22	.12	59.67	21
1357	-.008	60.75	11	.41	60.60	10	1385	-.009	56.11	15	-.03	56.16	13
1643	-.242	57.23	59	.26	57.25	58	1386	.012	57.57	20	-.20	57.51	22
1358	-.002	57.78	16	.01	58.01	15	1387	-.015	59.49	13	.45	59.31	10
507	.008	59.80	11	.00	59.80	11	548	-.022	58.45	13	.29	58.56	11
509	-.023	60.95	10	.07	60.95	10	549	.044	58.28	14	.20	58.28	13
510	-.019	61.48	10	.26	61.39	9	550	-.074	57.88	18	.32	58.40	17
1359	-.024	57.15	30	.26	57.41	30	1388	.016	57.78	26	-.24	57.67	25
511	.020	57.77	14	.25	57.64	14	1644	-.115	56.87	37	.26	57.07	36
513	-.009	58.36	12	0.00	58.36	12	551	.002	59.08	10	-.14	59.08	10
1360	.048	57.10	20	-.08	57.10	20	1390	.009	57.40	14	-.22	57.40	14
515	-.018	58.11	14	.24	58.40	13	1391	-.009	62.22	10	.42	62.21	9
1361	.021	60.24	10	.42	60.01	9	1392	-.034	60.95	10	-.15	60.95	10
1362	0.000	57.59	43	.30	57.43	43	1393	-.008	58.39	13	-.17	59.14	11
517	.007	59.76	11	-.06	59.76	11	554	.022	57.27	17	.13	57.26	15
516	-.001	57.36	38	-.03	57.41	37	1394	.001	58.02	26	-.01	58.08	25
1365	-.004	56.82	11	.20	56.82	11	555	-.008	58.57	11	.24	58.99	10
521	.005	57.97	13	.15	57.71	14	556	-.011	60.18	13	.18	60.25	9
519	-.008	59.63	13	.19	59.91	12	557	-.009	57.11	17	.06	57.28	15
1366	-.019	57.26	52	-.21	57.31	52	1395	-.027	57.70	27	.03	57.74	26
1367	-.003	58.10	12	-.17	58.10	12	1397	.000	58.49	23	.01	58.49	23
1368	-.006	56.88	16	-.28	56.88	16	1396	-.011	57.38	22	.43	57.29	18
522	.017	57.75	11	-.26	57.75	11	559	-.020	55.80	16	.19	55.93	16
524	-.002	58.25	30	.18	58.36	29	562	.007	57.34	35	.06	57.25	33
523	-.005	56.66	20	-.07	56.79	19	563	.006	57.45	12	.02	57.45	12
526	-.027	58.04	13	-.21	58.19	11	565	.022	59.45	13	.01	59.80	12
525	.012	56.95	38	-.59	56.79	37	564	-.021	58.04	11	-.05	57.75	12
528	-.014	57.68	15	-.22	57.68	15	1400	-.016	58.54	13	-.18	58.39	11
527	-.011	58.12	13	.01	58.10	12	1401	.010	57.16	35	-.11	57.35	35
1369	.013	58.92	11	-.05	58.92	11	1404	-.020	60.44	10	.83	60.36	6
1370	.015	57.48	19	-.21	57.49	18	1405	.005	61.26	8	.67	61.26	8
1371	-.008	59.19	11	.24	59.19	11	569	-.039	58.59	10	.17	58.59	10
1372	.001	58.39	15	.29	58.39	15	1406	-.009	57.34	16	-.31	57.86	13
1374	-.003	57.19	37	-.03	57.24	35	568	-.016	58.68	11	.09	58.68	11

OBSERVED - FK3						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
570	.003	59.04	12	.04	59.04	12
571	-.004	57.50	15	.00	57.13	12
1407	.001	57.44	11	.17	57.84	12
572	-.014	57.29	19	.05	57.45	18
1408	-.012	57.95	66	-.11	57.94	64
573	-.019	58.42	14	-.22	58.42	14
576	.002	57.99	14	.10	57.99	14
1409	.001	57.24	51	.04	57.45	49
578	-.015	58.41	12	.03	58.41	12
577	-.001	60.07	11	.32	60.07	11
580	-.014	56.44	24	-.13	56.31	22
1412	-.002	57.22	21	-.34	57.51	19
1413	-.029	56.99	13	.17	57.37	11
582	-.007	57.45	22	-.10	57.60	21
583	-.019	56.90	16	-.02	57.06	15
590	-.039	57.49	41	.11	57.90	35
587	.034	56.88	15	.42	56.72	13
584	-.001	59.32	12	.17	59.49	11
585	-.015	60.63	10	-.19	60.53	11
588	.003	58.79	22	.04	58.95	23
1645	-.060	57.44	22	.13	57.76	22
1414	-.014	57.04	19	.04	57.02	18
1415	-.011	59.42	11	.39	59.91	10
1416	.007	57.73	21	-.04	57.82	19
591	-.034	56.92	22	.03	57.06	22
1417	-.001	56.98	12	.32	57.39	11
593	-.001	57.61	18	-.11	57.71	16
592	.000	58.83	10	.02	58.83	10
595	.036	57.03	19	.06	57.16	17
594	-.012	60.87	11	.20	60.86	11
1419	-.013	61.15	11	.15	60.98	9
1420	-.010	56.95	49	.08	57.06	46
598	.008	58.18	21	.14	58.31	19
597	-.048	56.63	17	.00	56.85	15
1421	.008	57.59	11	.17	57.59	11
1422	-.025	57.92	61	-.57	58.31	53
1423	.002	59.05	12	.40	59.00	11
601	-.019	58.01	11	.24	58.18	11
603	.001	58.54	23	.17	58.49	22
606	-.004	58.97	60	-.03	59.06	59
1425	-.007	56.78	26	-.17	56.99	23
605	.014	59.36	27	.03	59.74	26
607	-.019	60.03	10	.34	59.94	10
608	-.051	59.21	12	.12	59.21	12
612	-.005	58.55	24	.30	58.79	22
1427	.004	57.43	25	.08	57.71	23
609	-.001	58.72	11	-.54	58.95	10
1428	.031	60.09	11	-.19	60.09	11
1429	.001	57.34	41	-.28	57.47	40
613	.001	58.30	12	-.06	58.30	12

OBSERVED - FK3						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
614	-.035	60.22	11	.46	60.00	10
616	-.028	58.58	12	.19	59.09	9
1430	.008	59.46	11	-.36	59.97	10
618	-.005	58.55	13	-.16	58.12	11
619	-.002	57.36	29	.29	57.92	24
1432	.003	58.03	24	.23	58.35	21
621	-.030	57.75	18	.03	57.85	19
623	.016	58.91	22	.28	59.38	20
1433	-.002	57.36	48	.08	57.60	43
622	-.006	60.50	19	-.35	60.40	19
1434	-.039	56.94	27	-.26	57.06	23
624	-.014	59.41	16	.00	59.85	13
626	-.017	57.96	13	-.22	58.18	13
627	-.011	58.90	11	-.20	58.78	12
1436	.032	56.84	27	-.23	56.88	24
1437	-.008	60.76	13	.58	60.02	9
1438	-.015	57.22	50	.01	57.54	43
1440	-.013	58.99	11	-.68	58.44	11
629	-.003	60.03	11	-.06	60.66	11
912	.034	56.61	25	.07	57.21	22
1441	.011	60.16	13	.03	60.31	12
1442	-.016	57.75	39	.08	57.97	36
633	-.012	58.94	36	-.24	59.44	29
634	.011	59.33	15	-.27	59.62	13
1445	.018	57.32	62	.19	57.80	50
1446	.009	58.67	14	.11	59.00	13
635	-.013	56.84	20	-.30	57.37	17
1448	-.010	58.72	18	-.03	59.25	16
1447	-.010	60.66	12	.45	61.77	7
1449	-.031	56.75	16	.08	57.11	13
636	-.023	58.31	14	-.12	58.46	18
1450	-.019	57.44	55	-.52	57.88	44
639	-.050	58.53	17	.09	58.94	15
1451	.011	57.46	66	.01	57.77	59
641	-.001	59.32	11	-.01	59.32	11
643	-.027	59.50	13	-.10	59.91	12
1453	.001	58.07	29	.11	58.33	27
1454	-.013	59.45	17	-.34	59.51	14
1456	.003	58.15	20	-.19	58.61	17
644	-.001	60.34	11	-.23	60.08	11
1457	-.023	60.37	12	.18	60.76	10
1458	-.037	57.10	36	.06	57.27	32
647	-.005	57.29	18	-.26	57.64	17
1459	.006	58.23	19	.13	58.51	15
650	-.005	58.35	13	.23	58.58	12
1460	-.005	56.58	25	-.21	56.73	21
653	-.012	57.41	24	.05	57.41	24
655	.000	58.78	15	.32	59.20	13
657	-.015	60.14	12	.11	60.14	12
1462	-.001	60.84	11	.32	60.84	11

OBSERVED - FK3							OBSERVED - FK3						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
1461	.034	57.40	21	.16	57.56	17	699	.002	60.03	15	.40	60.60	12
659	.028	57.35	16	-.05	57.47	14	701	.034	58.23	15	.02	58.36	14
656	-.005	60.00	12	-.22	60.49	12	1486	-.007	57.91	37	.11	58.32	33
658	-.023	59.97	13	.49	60.25	11	702	-.005	57.06	38	.11	57.48	30
664	-.006	58.13	42	.04	58.28	40	1487	.001	57.01	16	.13	57.24	13
663	-.025	56.94	25	.03	57.45	20	703	.007	57.36	18	-.11	57.45	17
1463	-.020	56.90	15	.52	57.44	11	1488	-.015	58.70	17	-.31	58.69	15
665	.002	59.94	40	.06	60.07	40	1489	.005	56.88	54	.03	57.04	41
670	-.084	57.85	24	.03	58.11	22	1491	-.001	60.93	13	.08	60.82	14
667	-.035	58.97	12	-.61	58.98	12	1492	-.038	59.83	12	.24	60.29	11
668	-.009	60.61	24	-.13	60.71	22	1493	.007	60.02	12	.11	60.69	12
1465	.021	58.61	14	.45	58.92	13	1494	.007	57.48	52	-.06	57.71	42
1466	.042	57.29	31	.26	58.06	26	705	-.003	57.72	15	-.17	58.10	12
913	-.171	57.48	24	-.06	58.00	27	707	-.001	57.68	19	.18	57.85	19
675	-.002	58.43	40	.33	58.76	34	706	-.005	60.11	12	.19	60.54	9
1467	-.001	57.32	43	.24	57.77	38	1495	.017	61.42	12	.44	61.42	12
671	.025	58.98	11	.07	58.98	11	709	.007	57.23	21	-.26	57.73	18
1468	.003	59.19	11	.00	58.95	10	711	-.020	60.45	12	.21	60.63	11
672	-.031	56.94	20	-.14	57.20	18	710	.010	58.52	16	.03	58.85	11
676	-.016	58.12	21	-.08	58.31	20	714	-.070	58.61	14	.04	58.41	12
674	-.023	58.23	16	.06	58.84	13	713	-.011	57.34	24	.09	57.75	19
673	-.017	58.83	38	.12	59.14	35	712	.007	57.85	24	.24	57.95	22
1469	-.020	56.81	16	-.10	56.97	14	716	.001	57.29	19	.05	57.83	14
677	.014	59.24	34	.22	59.58	30	717	.009	59.74	28	-.19	59.92	27
1470	.004	60.33	14	.41	60.72	12	1497	-.045	57.24	49	-.07	57.43	51
680	-.006	58.94	48	-.12	58.98	46	1498	.007	59.63	12	-.27	59.56	10
681	-.006	57.87	19	-.12	58.37	16	719	.022	57.51	18	-.24	57.67	18
1472	.037	59.75	15	.01	60.19	14	720	-.004	56.04	13	.01	56.31	11
682	-.012	58.19	16	.36	58.02	15	1500	.002	58.19	66	.13	58.44	61
685	-.003	57.89	22	-.10	58.57	18	723	-.029	57.37	29	-.12	57.24	25
684	-.023	59.51	10	.36	59.51	10	724	-.006	57.97	20	.17	57.94	19
1475	.011	56.72	39	.16	56.88	33	722	-.011	59.36	11	.32	58.74	11
1477	.003	58.35	12	-.16	58.35	12	725	.009	58.39	39	-.34	58.65	35
1476	.006	57.31	69	.03	57.81	57	726	-.011	59.54	13	-.08	59.30	12
688	-.004	60.21	23	-.22	60.37	22	729	-.038	58.79	14	-.17	58.79	14
914	.334	57.66	15	.38	57.52	14	727	-.012	59.52	12	.35	59.32	11
690	-.012	57.67	14	-.13	57.79	15	1503	.006	57.07	27	.02	57.33	21
695	-.027	58.64	22	.10	58.49	19	730	.016	58.65	13	-.09	58.65	13
1478	.004	57.29	57	-.05	57.79	45	1505	.029	59.80	12	.28	59.80	12
1479	.065	58.76	15	-.03	59.25	14	1506	.015	59.58	13	-.11	60.01	12
692	-.006	58.55	10	.06	59.15	10	734	-.031	60.57	22	-.04	60.73	18
696	.007	58.87	13	.10	58.89	13	1507	.033	57.81	12	.39	57.73	11
1480	.007	57.31	49	-.02	57.78	35	1508	.019	57.00	18	.06	57.00	18
1481	.027	58.17	15	.17	58.73	13	1509	.011	58.31	66	-.22	58.63	58
1646	-.066	57.37	40	.30	57.46	38	733	-.018	58.00	17	.27	58.08	16
700	-.051	58.34	23	.09	58.86	20	732	.006	57.59	19	.41	57.96	16
1483	-.028	60.00	11	.06	60.05	10	1510	.012	57.80	13	-.22	57.73	12
1482	.011	58.30	21	.09	58.10	18	1511	.002	57.86	86	.04	58.24	75
1484	.014	57.14	51	.11	57.25	45	736	.007	58.88	14	.15	58.79	10
1485	-.022	60.24	10	.59	60.44	10	737	-.003	57.81	53	.26	58.10	44

OBSERVED - FK3							OBSERVED - FK3						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
738	.005	57.80	13	.43	57.80	13	780	-.009	60.85	10	-.15	60.85	10
1512	-.006	60.02	13	-.03	60.49	12	783	-.026	57.81	15	.08	57.77	12
1513	.010	57.48	22	.31	57.53	21	1541	.016	60.21	11	-.19	60.37	10
1514	.001	56.82	15	.07	57.18	9	1544	-.005	60.16	11	.57	60.61	10
1515	-.004	56.99	31	-.16	57.27	25	781	-.006	59.82	11	-.11	60.13	10
740	-.003	57.49	28	.05	57.99	24	1543	.018	56.56	16	-.26	56.62	15
1517	-.004	59.76	14	.26	59.70	11	915	-.056	57.63	47	.04	57.84	40
741	-.004	58.75	25	-.38	58.75	25	1545	.020	59.39	15	-.35	59.48	13
743	.006	57.57	26	-.29	57.65	25	1546	-.011	60.08	13	.58	59.82	10
744	-.020	56.70	41	.10	56.98	34	1547	.004	58.91	53	.01	58.89	49
745	.007	59.14	15	-.09	58.84	14	786	.016	57.11	21	-.17	57.62	17
746	.012	60.48	13	.02	60.00	14	1548	.021	60.21	16	.36	60.63	10
1519	-.001	56.57	30	.18	56.94	26	788	.008	59.03	14	-.27	59.03	14
749	.015	59.49	22	.01	59.74	20	1549	.008	57.86	19	-.27	57.99	18
1521	-.017	59.66	12	-.06	59.66	12	789	.024	58.32	53	-.06	58.62	48
1522	-.006	61.73	12	.18	61.18	13	1551	-.022	59.20	11	.02	59.20	11
752	.008	58.28	19	-.24	58.36	15	792	-.017	58.47	19	-.09	58.80	16
1523	.000	58.12	23	-.40	58.30	20	1552	-.006	60.69	10	-.30	60.98	10
1524	.013	58.28	52	-.04	58.97	41	1553	.008	58.08	17	-.49	58.30	16
1647	-.029	57.87	28	.03	57.78	25	791	.011	61.00	11	.54	61.00	11
1525	.001	59.68	12	-.06	59.27	12	793	.087	60.76	8	.09	60.63	11
756	.008	59.44	12	-.20	59.80	11	795	-.082	57.82	18	.00	58.00	17
759	.022	56.98	31	.03	56.96	27	794	-.002	58.63	20	-.01	58.92	20
1526	.007	58.67	11	.35	59.58	9	1555	-.016	58.54	33	.01	58.80	28
757	-.010	59.87	11	-.10	60.34	11	797	.008	57.91	25	.01	57.97	23
758	-.034	59.98	12	.36	60.43	10	800	-.001	59.14	67	.03	59.23	62
760	.007	58.26	17	-.32	58.43	16	1558	-.005	57.68	17	.16	57.97	17
1527	.017	59.91	14	.12	59.72	13	1559	-.009	59.02	13	.01	58.71	14
1529	.011	60.21	14	.68	60.42	8	803	-.024	58.84	31	-.01	59.11	29
761	-.020	62.18	10	-.23	62.15	9	1560	-.011	59.44	18	.29	59.40	19
762	-.012	59.40	13	.21	59.71	12	1561	-.010	58.54	12	.34	58.61	11
765	-.020	58.39	13	.20	58.04	12	804	-.003	57.08	17	-.05	57.08	17
1531	.013	58.47	70	-.03	58.78	59	1562	-.009	57.53	17	.21	57.48	13
1533	.005	57.80	37	-.13	57.96	33	806	-.022	58.51	15	.11	60.01	10
1534	-.011	59.35	11	.29	59.35	11	1564	.003	58.31	37	.48	58.58	31
1535	-.039	59.38	11	.01	59.38	11	807	-.038	58.46	10	.10	58.46	10
767	-.003	58.35	15	.16	58.90	13	1565	.020	59.66	10	-.16	59.66	10
1536	.002	57.54	29	.03	57.60	24	809	-.080	58.97	12	-.17	58.68	11
1538	-.061	58.51	17	-.17	59.33	13	808	-.001	59.77	11	.05	59.77	11
768	.005	60.41	18	-.25	60.57	17	1568	-.003	57.63	17	.08	57.63	17
1537	-.013	57.78	39	-.06	58.09	34	811	.003	58.64	16	-.20	58.64	15
770	-.077	58.61	17	.02	59.02	14	1569	.004	58.71	61	.06	58.84	55
1539	.010	58.34	16	-.01	58.59	13	1570	-.017	59.37	12	.08	59.71	11
772	.028	58.29	49	.28	58.48	46	812	-.024	60.50	12	-.05	59.76	11
773	-.015	59.32	12	.27	59.66	11	813	-.016	58.27	14	-.19	58.78	12
774	.010	59.70	10	.01	59.70	10	817	-.055	58.63	25	.00	59.02	22
777	-.010	58.20	25	.05	58.15	24	815	-.003	59.58	21	-.13	59.58	21
778	.006	57.91	27	-.01	58.08	25	1571	-.026	58.40	13	-.23	58.40	13
779	-.020	57.44	15	.12	58.12	10	818	.005	57.52	19	.08	57.55	17
782	-.014	58.56	15	.14	58.83	14	1572	-.053	59.59	13	.33	60.09	12

OBSERVED - FK3							OBSERVED - FK3						
FK4 No.	$\Delta\alpha$	Epoch	No.	$\Delta\delta$	Epoch	No.	FK4 No.	$\Delta\alpha$	Epoch	No.	$\Delta\delta$	Epoch	No.
819	-.021	61.11	13	.20	61.24	10	1597	-.009	61.34	11	.48	60.79	10
1574	-.004	57.35	34	-.12	57.60	28	1598	-.014	57.82	59	-.37	58.07	57
821	-.044	59.97	11	-.13	59.97	11	861	-.012	58.62	11	.18	58.62	12
1575	-.003	58.43	22	-.04	59.15	16	862	-.022	58.36	15	.01	58.62	13
1576	-.032	58.79	13	.31	58.79	12	863	.012	57.64	32	-.10	57.53	30
1577	-.005	57.65	16	.10	58.73	10	864	.003	60.29	24	.38	60.53	23
823	.004	57.96	19	-.15	57.91	18	866	-.006	57.45	12	.17	57.78	11
1578	-.022	58.25	23	.00	58.31	22	1600	-.043	58.60	11	-.17	58.68	12
1579	.009	58.82	14	.20	58.82	14	1649	.071	58.24	43	-.08	58.62	41
1580	.009	58.37	61	.15	58.54	60	869	-.032	58.70	15	-.14	59.01	13
826	.009	57.13	31	-.43	57.22	30	1602	.000	57.76	52	-.11	58.15	43
827	-.004	59.42	39	-.17	59.82	37	870	-.019	58.94	11	-.31	59.36	10
830	-.003	58.11	19	.02	58.04	17	871	-.025	60.98	10	.17	60.98	10
828	-.004	58.86	14	.38	59.65	11	1603	-.004	56.61	46	.09	56.81	42
831	.016	57.75	17	-.09	57.75	16	1604	-.021	59.69	10	.06	59.69	10
833	.004	56.40	22	-.32	56.56	19	873	.006	57.53	14	.35	57.74	12
834	.010	60.00	31	-.34	60.16	31	1606	-.006	58.22	42	.09	58.62	35
835	-.030	56.98	14	-.17	56.98	14	875	-.007	59.08	13	-.04	59.02	13
837	-.025	58.91	17	-.04	58.07	13	1607	.003	57.17	26	-.01	57.33	24
836	.004	59.05	14	.32	59.48	14	1608	-.016	56.93	21	.09	57.38	20
1583	-.020	57.77	22	.54	58.00	22	878	.007	60.65	23	-.10	60.74	24
1582	.024	58.19	13	.39	57.92	11	1609	-.012	57.59	49	.00	57.52	45
840	.005	58.08	32	.28	58.19	30	880	.002	59.71	12	-.22	59.71	12
1648	-.302	58.73	67	.09	58.78	65	1610	.014	58.09	18	.31	58.12	17
1584	-.034	60.55	11	.62	59.90	6	1611	.013	59.71	10	.68	59.57	7
843	.004	57.43	28	-.52	57.37	26	1612	.015	58.50	13	-.30	58.83	11
842	-.005	59.60	10	.05	59.60	10	1613	-.004	58.83	16	-.03	59.04	15
844	.011	58.86	20	.47	58.93	18	882	-.010	58.06	32	.06	58.02	32
1585	.006	57.74	43	.20	57.84	39	881	.001	57.63	15	-.06	58.05	11
1586	.028	60.09	12	-.38	60.09	12	884	.003	58.10	38	-.13	58.27	35
1588	-.010	57.10	17	-.11	57.30	15	1614	.007	58.13	27	.19	58.41	26
1589	-.011	61.52	10	-.04	61.52	10	1615	-.011	60.43	14	-.40	60.96	12
847	-.017	59.05	12	.53	59.45	11	885	-.003	58.27	34	-.54	58.68	32
1590	-.026	60.48	9	.01	60.69	10	1616	-.017	59.13	12	-.25	59.13	12
1591	-.009	58.94	14	.17	59.55	11	888	.015	58.63	37	-.25	59.00	35
848	-.030	59.46	11	.09	59.41	12	890	-.009	58.30	14	.01	58.30	14
1593	.113	58.43	23	-.12	58.72	20	891	.017	60.18	11	.23	60.31	12
1594	-.005	57.06	22	-.05	57.05	20	893	.073	58.88	53	.32	59.37	48
849	-.005	61.89	12	.40	61.85	10	892	.005	57.61	24	.04	57.65	23
850	-.006	56.98	24	.10	57.47	22	1619	-.017	59.92	12	.39	60.12	11
851	.010	58.30	11	-.21	58.30	11	1620	.005	57.24	35	-.37	57.16	32
1595	.000	57.08	36	-.20	57.52	31	894	.013	60.49	15	.25	61.00	12
853	.000	59.34	19	-.02	59.33	18	1621	-.010	58.15	15	.08	58.40	14
852	-.016	57.34	14	.17	57.56	13	1622	-.017	57.47	18	.06	57.73	15
854	.003	57.92	16	.46	58.30	12	1623	-.001	57.74	30	.08	57.78	24
855	-.010	59.41	27	-.07	59.67	26	895	.038	57.72	24	.05	57.98	22
857	.000	59.80	13	.26	60.19	11	1624	-.024	60.54	14	.36	61.31	13
858	-.015	58.05	19	-.14	58.01	18	897	-.004	58.44	30	-.01	58.40	27
1596	.017	57.35	19	-.09	57.40	19	898	-.007	58.31	14	-.26	58.50	10
859	.003	58.88	15	-.04	58.82	13	1625	-.030	58.12	28	-.05	58.28	29

OBSERVED - FK3							OBSERVED - FK3						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
899	-.011	59.98	12	.02	60.19	13	1629	.004	60.47	12	-.19	60.63	13
1627	.074	58.26	16	.14	58.32	14	900	-.027	59.10	15	-.11	59.60	12
1650	-.094	57.59	48	-.17	57.96	45	902	-.004	59.01	20	-.09	59.04	21
1628	.000	58.30	12	-.45	58.30	12	1630	-.007	58.88	26	-.20	59.02	27
1642	-.296	57.22	32	-.11	57.76	32	701	.038	61.13	14	.15	61.34	13
451	-.081	58.86	15	-.11	59.08	14	1494	.010	59.69	21	-.45	60.04	19
454	-.018	58.43	59	-.17	58.74	55	714	-.057	58.48	18	-.17	58.74	17
472	-.009	58.60	20	-.16	59.04	16	723	.014	58.23	15	-.20	58.17	14
478	.029	57.74	18	.17	58.07	14	729	.022	59.69	14	-.17	59.98	14
486	-.015	57.76	25	.12	58.16	17	734	-.102	58.06	24	-.25	58.75	21
499	-.014	59.31	19	-.03	59.72	17	1647	-.046	58.29	38	-.11	58.27	36
500	-.037	57.65	12	.13	57.82	11	759	-.030	57.62	30	-.12	57.75	30
505	-.009	58.68	12	-.30	59.25	12	767	-.033	57.18	26	.08	57.22	22
1643	-.169	59.02	51	.06	59.03	48	1538	-.042	58.70	17	-.47	58.80	14
511	-.002	58.96	14	.17	58.88	12	770	-.030	57.87	15	-.06	57.62	14
521	-.040	58.97	21	-.10	59.45	16	783	-.003	57.39	10	.00	57.64	9
524	.000	56.49	19	-.22	56.42	18	915	-.102	58.29	34	-.33	58.35	33
1379	.040	59.14	29	-.36	59.39	26	795	-.102	58.19	17	-.04	58.75	12
536	-.023	58.58	16	.41	58.51	13	803	-.010	57.11	25	.15	57.40	18
550	-.064	58.50	16	-.23	58.92	13	809	-.071	58.74	12	.34	58.93	10
1644	-.138	60.40	57	-.03	60.53	53	817	.000	59.50	20	-.11	59.89	16
554	.065	60.84	17	.40	61.00	17	1572	.008	58.87	14	.38	58.95	14
565	.024	59.51	11	-.25	59.51	11	1578	-.026	58.20	14	-.18	58.11	13
569	.057	61.42	13	-.12	61.16	14	830	.011	57.82	18	.19	58.20	16
590	.005	59.99	23	-.06	60.46	20	837	-.042	59.20	17	-.44	59.25	14
587	.055	60.91	12	.76	61.07	12	1648	-.170	58.81	32	-.29	58.83	32
1645	-.127	57.41	18	-.56	57.83	14	1593	.070	56.72	19	-.13	56.93	16
606	-.014	60.71	48	-.27	61.08	39	1594	-.004	58.24	20	-.23	58.37	16
612	-.005	59.21	16	.12	59.17	14	851	-.042	59.78	13	.09	59.78	11
619	-.020	59.73	19	-.01	60.29	16	853	-.008	57.42	14	.15	57.28	13
1432	-.002	60.28	14	.02	60.31	12	863	.002	60.24	11	.19	60.51	11
623	.054	59.08	21	-.25	59.04	19	1649	.028	57.62	37	-.52	57.74	31
912	.026	58.53	25	-.34	58.66	27	882	.030	58.26	24	.10	58.08	18
639	-.018	58.68	21	.00	58.59	20	893	.063	58.83	54	-.09	59.14	50
659	-.030	58.99	12	-.12	59.34	11	895	.005	57.42	21	.18	57.49	15
664	.019	59.34	18	-.12	59.27	19	1627	.066	58.61	13	-.21	58.73	9
670	-.046	59.53	16	-.01	60.01	13	1650	-.102	57.01	42	-.51	57.03	38
913	-.319	58.55	14	-.31	58.96	16	16	.036	58.11	27	.03	57.67	21
675	-.005	58.45	27	-.04	58.68	25	24	.033	57.96	21	-.18	58.33	17
685	.003	59.43	12	.00	59.73	11	29	.040	57.83	14	.26	58.03	13
914	-.040	61.74	12	-.13	62.15	12	32	.030	58.46	7	.66	58.75	9
695	.018	60.81	10	-.60	60.81	10	906	-.291	57.81	58	-.09	57.94	59
1646	-.037	58.47	42	.07	58.67	40	41	.087	58.87	29	.06	59.20	25
700	-.004	60.11	16	-.22	60.19	13	46	.051	57.39	13	-.08	57.57	11

OBSERVED - FK3							OBSERVED - FK3						
FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.	FK4 No.	Δα	Epoch	No.	Δδ	Epoch	No.
48	-.005	56.49	13	.24	57.10	13	259	.021	58.34	16	.15	58.59	14
1042	.028	58.27	12	-.14	58.48	10	260	.055	58.05	45	-.29	57.99	32
51	-.007	57.50	14	.03	57.27	14	909	-.552	57.45	32	-.38	57.43	29
55	.041	56.78	13	.03	56.78	13	284	.036	57.59	22	.01	57.92	17
907	.095	56.38	26	.00	56.34	22	300	.026	57.60	30	-.07	58.44	18
63	.052	59.66	13	.42	60.37	9	302	.077	58.26	22	.50	58.56	20
70	-.013	59.94	11	.00	60.31	9	1639	-.145	57.71	36	-.25	57.76	29
1635	-.414	57.96	30	.00	58.09	26	1215	-.021	59.71	11	.03	59.72	10
76	.043	59.46	11	.25	60.23	6	310	.063	58.20	37	-.17	58.44	30
87	.047	57.08	16	-.14	56.80	12	317	.009	57.69	20	.36	58.42	15
92	.044	59.55	11	-.30	59.78	12	322	.106	57.79	20	-.03	57.90	19
105	.039	56.87	31	.03	56.54	25	338	-.019	58.35	13	-.03	58.30	14
115	-.006	59.82	29	-.09	59.61	24	1640	.024	57.37	37	.17	57.61	33
1636	-.434	56.99	31	-.10	57.05	29	355	-.005	59.87	13	.28	60.75	8
1096	.003	60.42	14	-.04	59.92	10	910	-.142	59.17	55	-.34	59.41	48
129	.000	57.22	22	.52	57.39	17	357	.021	56.99	15	-.21	56.89	13
138	-.065	59.44	11	-.01	59.44	11	363	.046	58.75	23	.07	58.57	20
908	-.293	57.21	42	-.33	57.57	39	372	-.048	59.52	18	.09	59.88	16
1122	-.026	56.88	22	.13	57.15	19	1262	.023	60.48	14	-.09	60.52	10
173	-.006	58.48	48	-.10	59.25	38	387	.047	59.93	13	.14	59.69	15
178	-.059	59.49	13	.20	59.41	11	911	-.055	57.68	41	-.21	57.90	34
182	.019	59.20	12	.51	59.17	11	395	.024	58.81	26	-.22	58.53	25
1637	-.147	57.61	37	.09	57.96	33	403	-.002	57.29	26	-.19	57.70	22
191	-.044	58.07	37	.01	58.44	32	413	.067	58.02	26	.13	58.35	23
203	-.004	57.19	23	.29	57.47	16	417	-.015	58.94	17	.20	59.82	15
205	-.012	58.75	20	.07	58.64	20	1641	.138	58.56	39	.07	59.02	42
1638	-.122	57.54	25	-.30	57.68	23	429	-.026	58.31	29	.40	58.68	24
233	-.030	57.92	34	-.22	58.18	27	433	-.033	57.21	20	.07	57.56	16
234	-.016	57.63	22	-.10	58.16	16	440	.025	58.84	16	-.06	59.42	14
247	-.012	58.90	11	-.03	59.20	12	1303	-.003	58.76	15	.24	59.08	13
248	.040	58.36	61	-.15	58.69	54							

EXPLANATION OF CATALOGUE FOR PARTS II, III AND IV

The various columns give:

1. A current number within the group in order of right ascension.

2. The BD number.

3. The visual magnitude and spectral type, mostly from the Henry Draper Catalogue.

4 and 5.

The observed right ascension and declination together with their adopted centennial proper motions. In Parts II and III the observed value has been reduced to the epoch 1950.0 using the proper motions as given. These were taken from GC and the Ottawa Preliminary PZT Catalogue respectively. In Part IV the observed values have been reduced without proper motions to the epoch 1950.0.

6. The number of observations and mean epoch of observation in right ascension and declination respectively.

7 and 8.

The catalogue comparisons. The catalogue number and the value "Observed-Catalogue" in right ascension and declination respectively.

Part II

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	$100\mu'$	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	$\Delta\alpha$	$\Delta\delta$	No.	$\Delta\alpha$	$\Delta\delta$
1	33 4828	6.23 G0	0 2 16.145	6.10	34 22 48.26	10.0	8	6	56.88	56.58	44	.051	-.57	2002	-.065	-.40
2	26 4744	6.57 G5	0 2 26.545	.50	27 23 47.85	-.5	7	6	58.02	58.40	48	.037	.30	2003	-.024	-.18
3	12 5063	5.66 K0	0 3 7.752	.28	13 7 4.89	.2	8	8	59.66	60.52	75	.000	-.33	2004	.012	-.15
4	63 2107	5.49 B8	0 3 49.598	.13	63 55 4.51	.4	7	8	59.98	60.32	94	-.069	-.08	2005	.037	-.32
5	3 3	6.32 K0	0 5 38.393	.02	-2 43 32.99	-.4	8	7	57.74	57.87	124	.000	.60	2006	.003	.56
6	40 29	5.73 A5	0 10 54.523	-1.07	40 45 34.28	-14.4	11	11	58.05	58.05	244	-.021	.23	2010	.015	.52
7	32 21	6.06 A0	0 11 26.127	-.12	32 55 41.80	-2.1	8	6	56.53	56.95	256	.014	.15	2012	.005	-.70
8	7 27	6.19 G5	0 13 59.738	-.20	7 57 45.31	-1.0	8	6	56.39	56.57	315	.026	-.28	2015	.016	.11
9	47 50	5.82 B9	0 14 30.142	.08	47 40 11.16	1.7	9	7	56.44	56.63	335	-.067	-.84	2016	.003	.30
10	0 28	6.43 G5	0 15 13.510	.55	1 24 39.28	1.0	6	6	55.51	55.51	346	.043	.36	2017	.019	-.22
11	12 25	6.40 K0	0 19 50.052	.39	13 12 18.07	2.9	10	7	55.96	56.32	446	.017	-.21	2020	-.007	.35
12	3 49	6.28 K0	0 21 56.310	-.26	-2 29 43.72	-3.2	8	7	55.81	55.95	480	.054	-.37	2021	.023	-.08
13	52 61	5.72 B9	0 22 23.365	.23	52 46 11.89	-.4	8	7	57.25	57.47	488	-.011	.04	2022	.021	-.25
14	79 10	6.53 B9	0 23 51.462	.80	79 46 31.84	.5	11	11	60.01	60.10	521	-.078	-.35	2023	.062	-.37
15	24 52	6.72 F5	0 24 26.963	.90	24 45 56.36	-1.6	8	7	58.64	58.20	527	-.065	.09	2024	-.016	.07
16	43 92	5.16 A2	0 25 31.854	.86	44 7 5.48	-1.0	10	9	58.20	58.48	546	-.066	.01	2027	.014	.15
17	9 47	6.02 F2	0 25 44.785	.19	9 54 58.79	-20.5	8	9	58.97	59.28	550	.057	.58	2028	.031	-.49
18	76 10	6.35 G5	0 27 39.749	9.84	76 44 38.04	-2.2	9	6	57.09	56.60	588	-.021	-.31	2031	.103	.02
19	6 64	5.66 A0	0 29 48.840	.21	6 40 46.78	1.1	8	7	57.39	57.46	636	.024	.12	2032	.025	.46
20	19 79	5.53 G5	0 29 57.908	.91	20 1 8.92	-4.5	6	6	57.27	57.27	641	.029	-.03	2033	.001	-.24
21	70 24	6.36 A0	0 30 18.552	.76	70 42 22.41	.4	7	6	56.34	56.43	648	-.146	-.12	2034	.043	-.09
22	1 68	5.93 F8	0 32 58.705	.89	- 0 46 48.05	-5.7	7	7	56.77	56.77	701	.041	.09	2036	.011	-.06
23	14 76	5.86 B3	0 34 10.754	.01	14 57 24.54	-1.6	8	6	56.27	56.62	728	-.009	.20	2039	-.016	-.07
24	2 80	6.58 K0	0 34 55.867	.60	2 51 40.76	-5.5	7	7	56.73	56.73	744	.001	.35	2040	-.001	.01
25	81 13	6.40 F8	0 35 54.405	-5.46	82 13 5.70	9.1	8	6	59.13	59.94	760	-.106	-.01	3941	-.057	.11
26	59 92	6.74 A0	0 35 56.818	.43	59 33 5.62	-.1	7	8	58.90	59.88	762	-.121	.02	2041	.039	.65
27	38 90	5.42 G5	0 38 24.015	-.12	39 11 4.67	-.4	9	6	57.49	57.17	812	-.030	.40	2043	-.022	.38
28	23 94	5.98 A5	0 38 56.543	.73	24 21 18.68	-2.1	8	8	57.36	57.11	822	.013	.41	2044	-.007	-.29
29	65 83	5.92 G5	0 39 3.240	-.08	65 52 25.89	-.4	10	9	57.73	58.83	825	-.188	.35	2045	-.007	.03
30	49 164	4.85 B3	0 39 15.821	.11	50 14 19.60	-.5	6	6	57.77	57.77	828	.007	.61	2046	.000	.18
31	11 96	5.68 G5	0 44 24.741	.35	11 42 5.49	-2.9	8	6	57.10	57.38	935	.012	.13	2050	.004	.32
32	18 101	6.06 A5	0 44 34.794	.68	19 18 21.03	.8	7	6	56.70	56.70	938	.028	.50	2051	-.014	-.00
33	44 176	6.12 A0	0 47 30.102	.64	44 43 48.58	.5	7	7	56.62	56.62	999	-.035	.31	2055	-.002	-.06
34	82 20	5.55 A2	0 50 2.723	3.52	83 26 11.98	-1.4	9	8	57.11	57.27	1045	-.151	-.02	3942	-.087	.08
35	26 151	5.94 A2	0 53 16.767	-.15	26 56 19.44	1.0	6	6	55.80	55.80	1105	.007	.24	2059	.007	.14
36	22 153	4.62 G5	0 54 31.829	-.27	23 8 53.38	-4.0	7	7	57.47	57.47	1136	-.052	.03	2060	-.020	.02
37	33 140	6.22 K0	0 55 29.304	.37	33 40 55.20	-5.8	7	7	59.09	59.51	1159	-.093	-1.13	2061	-.005	.36
38	79 24	6.63 F2	0 56 14.632	3.55	80 16 33.52	2.6	8	7	58.07	58.24	1175	-.139	-.01	2062	-.099	.59
39	70 65	6.46 A0	0 57 7.617	1.75	70 42 50.50	.3	7	7	56.07	56.22	1190	-.127	.52	2063	.042	.51
40	51 220	6.27 K2	1 1 5.240	.10	52 14 6.06	-5.6	7	6	56.47	56.75	1275	-.049	.06	2066	-.038	.44
41	12 135	6.22 G5	1 3 55.560	.08	12 41 18.72	3.6	9	7	57.22	57.05	1336	.017	-.26	2068	.029	.27
42	56 196	6.58 K0	1 3 57.016	1.34	56 40 10.42	-12.8	8	8	58.14	58.14	1339	-.125	1.36	2069	.033	.01
43	43 234	5.16 A2	1 5 7.994	1.51	43 40 34.51	-5.7	7	8	58.08	58.54	1364	-.015	-.28	2071	-.009	.49
44	31 185	6.29 F2	1 5 14.858	1.56	31 44 45.31	-3.4	9	9	60.53	60.53	1368	-.004	.54	2072	-.003	.19
45	4 190	5.67 F0	1 5 47.450	-1.79	5 23 8.50	-17.6	9	7	58.65	58.47	1383	-.006	-.10	2073	.007	-.29
46	68 77	5.34 A0	1 7 14.600	.68	68 30 47.44	-1.8	8	7	57.93	57.80	1406	-.038	-.44	2074	.077	-.36
47	41 219	5.74 G0	1 7 27.779	-1.24	41 48 57.99	-4.0	6	6	59.11	59.11	1410	-.007	-.28	2075	-.053	.07
48	64 127	5.49 B8	1 8 24.519	.38	64 45 13.82	-1.1	9	6	58.56	58.93	1434	-.070	.87	2078	.024	.79
49	9 138	6.65 G5	1 8 51.577	.06	10 1 35.50	.9	9	8	59.10	59.64	1440	.035	-.76	2079	-.028	.08
50	23 158	4.64 K0	1 11 1.670	.09	24 19 10.18	-3.0	7	7	56.50	56.50	1474	.019	.64	2082	-.038	.01

No.	B.D. No.		M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O – G.C.			O – FK3 (Supp.)		
								α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
51	15	177	5.85 B8	1 11 27.991	-.18	15 52 9.68	-2.4	8	7	56.91	57.08	1482	-.010	.00	2083	.017	-.22
52	1	162	5.82 F5	1 12 15.858	-.11	-1 14 27.25	21.0	10	8	59.15	60.12	1501	.005	-.36	2084	-.032	-.08
53	47	357	6.50 B8	1 13 26.876	.15	47 49 7.37	-.2	11	10	56.71	56.90	1519	-.068	.27	2085	-.031	.42
54	75	59	6.45 A3	1 17 51.942	2.00	75 58 40.06	-2.4	10	7	56.51	57.11	1616	-.304	-.04	2087	-.145	.25
55	27	215	5.60 K0	1 18 21.081	.20	28 28 38.91	-6.9	9	7	55.34	55.37	1630	.007	-.58	2089	.006	-.66
56	0	223	6.48 K2	1 20 2.310	.35	1 27 57.32	-4.4	11	7	56.11	56.81	1657	.026	.34	2091	-.034	-.10
57	36	237	5.53 A0	1 20 48.444	.64	37 27 16.78	-1.6	10	8	58.37	58.88	1681	.012	.11	2093	.005	.54
58	22	226	6.07 F5	1 22 51.410	.12	23 15 7.65	-3.7	7	6	56.36	56.28	1722	.029	1.54	2096	-.014	.09
59	5	194	5.12 K2	1 27 33.730	1.95	5 53 11.96	-4.3	8	6	56.40	56.62	1819	.016	-.17	2099	.022	-.44
60	34	265	6.28 B8	1 29 16.022	-.10	34 32 35.57	-.1	11	7	56.19	56.84	1850	.001	.15	2100	.018	-.13
61	52	382	6.80 B8	1 32 14.786	.04	53 5 25.00	-.3	9	6	56.72	57.37	1910	.007	.22	2102	.031	-.15
62	1	219	7.03 G0	1 34 42.617	-.05	-0 36 13.84	-6.9	8	8	59.00	59.00	1960	-.025	-.25	2106	-.048	-.79
63	61	304	6.61 B8	1 34 47.063	-.08	62 5 52.36	1.7	8	7	57.66	57.93	1962	-.027	-.56	2107	.036	.84
64	57	349	5.74 K0	1 34 50.329	-.14	57 43 25.72	-.5	6	6	58.61	58.61	1965	.066	.34	2108	-.014	.48
65	20	264	6.86 K2	1 35 52.652	.36	21 8 40.75	-.3	7	7	59.63	59.63	1980	-.056	.37	2110	.002	-.22
66	43	343	5.17 G5	1 36 20.374	-.20	44 7 57.84	1.4	12	11	58.57	59.00	1991	-.014	.46	2112	-.030	.39
67	25	276	6.26 F5	1 38 30.655	.85	25 29 37.92	-4.5	7	6	55.54	55.66	2042	.025	-.02	2115	.006	-.65
68	45	447	6.32 F5	1 44 43.115	.09	45 58 54.12	-5.5	8	7	56.22	56.42	2176	-.015	.68	2119	.005	.64
69	31	316	5.82 F5	1 45 49.237	-1.36	32 26 15.54	30.1	8	8	58.03	58.03	2195	.018	-.10	2120	.051	-.32
70	2	270	6.00 G5	1 45 50.416	-.02	3 26 11.98	2.3	8	8	59.41	59.41	2196	-.020	.11	2121	.021	-.01
71	54	396	5.49 B3	1 48 41.278	.24	54 54 3.25	-.5	9	8	57.33	57.53	2241	-.060	.29	2122	.008	.43
72	40	394	5.63 K0	1 50 16.762	-.05	40 29 2.45	-.1	7	7	58.53	58.39	2274	-.062	.24	2124	-.002	.35
73	8	292	7.05 M0	1 51 43.542	.08	8 32 9.16	.4	9	8	58.42	58.50	2308	-.015	.55	2128	.010	.35
74	67	169	5.03 B8	1 52 4.896	.22	68 26 27.04	-.8	9	8	58.38	58.33	2313	-.019	.15	2129	.037	.00
75	22	284	5.95 K0	1 53 3.382	.06	23 19 58.87	-.6	13	11	57.59	58.63	2323	.036	-.23	2130	.018	.08
76	17	289	5.16 G5	1 54 36.834	.24	17 34 27.39	-1.9	8	8	56.10	56.10	2347	.008	.04	2132	.000	-.11
77	58	341	6.58 A0	1 54 49.318	.29	59 22 59.39	-2.0	6	6	55.55	55.55	2353	.104	.02	2133	-.002	.03
78	11	261	6.14 A2	1 56 44.997	.02	12 3 11.78	-3.4	9	7	55.94	56.26	2395	.014	.29	2136	-.005	.39
79	76	63	5.36 F0	2 0 2.304	3.73	77 2 33.91	-5.2	7	7	57.01	57.01	2459	.014	.42	2139	.044	.45
80	0	307	5.56 A5	2 0 37.623	.51	-0 6 42.21	2.2	9	9	60.17	60.03	2474	-.010	.02	2142	-.002	-.09
81	4	324	5.92 K0	2 1 9.204	.13	-4 20 31.88	-5.8	7	6	57.71	58.20	2485	-.063	.30	2143	-.016	.22
82	80	64	5.99 A0	2 3 6.834	-1.41	81 3 31.98	.8	8	7	56.81	57.10	2517	-.232	.57	3943	-.135	.24
83	37	486	4.77 A2	2 5 27.651	1.33	37 37 22.58	-3.8	10	9	58.90	59.13	2552	-.008	-.18	2145	.014	-.36
84	53	460	6.40 G5	2 6 45.437	.34	53 36 28.68	-4.7	7	7	58.29	58.45	2580	-.073	.34	2146	.020	-.07
85	30	347	6.20 A0	2 8 29.201	.30	31 17 30.53	-.9	7	7	59.99	59.99	2613	-.039	.26	2148	-.105	.71
86	73	121	6.19 G5	2 8 41.395	1.30	73 47 39.34	-3.0	8	9	61.92	61.90	2618	-.270	.02	2149	.045	.09
87	2	375	6.04 K0	2 9 3.339	-.05	-2 3 34.06	-2.9	12	8	60.57	60.56	2624	-.008	.54	2151	.013	.25
88	43	447	5.08 K0	2 10 4.441	-.21	43 59 53.33	-1.0	6	6	59.47	59.47	2645	-.026	-.34	2153	-.025	-.28
89	28	374	6.57 G5	2 11 43.677	1.23	28 27 35.78	-10.2	8	7	56.49	56.71	2689	.013	.61	2155	-.007	-.33
90	23	307	6.50 G5	2 14 20.470	-.34	23 32 14.96	-3.3	11	11	59.08	59.10	2743	.065	.02	2156	.002	.43
91	57	535	6.09 K0	2 14 26.351	.76	57 40 9.02	1.2	6	8	60.01	60.22	2746	-.049	-.26	2157	-.015	.11
92	55	598	5.22 A2	2 18 51.226	.00	55 37 4.94	.3	8	8	55.47	55.47	2836	-.010	-.41	2159	.004	-.02
93	1	322	5.62 A5	2 19 39.365	-.16	-1 6 41.54	-4.9	9	9	58.72	58.72	2850	.006	.43	2160	-.043	.46
94	40	500	5.87 F0	2 19 42.968	-.78	41 10 13.77	-10.2	7	6	58.00	58.51	2851	.057	-.03	2161	-.038	-.07
95	9	316	5.53 B5	2 22 7.971	.13	10 23 6.75	-1.0	7	7	56.17	56.17	2901	-.009	-.05	2164	-.011	-.21
96	49	656	4.86 K5	2 22 16.462	.24	50 3 13.27	-1.3	11	10	56.63	57.09	2902	-.012	.35	2165	-.015	.32
97	5	338	6.67 F2	2 23 37.919	.62	6 4 7.63	-5.0	9	8	58.61	58.73	2934	-.033	.65	2166	.016	-.19
98	45	614	6.77 G5	2 26 30.625	.32	45 48 38.57	-8.9	8	8	58.06	58.06	2978	.031	.82	2169	.015	.81
99	24	358	5.86 F5	2 27 39.399	.46	25 0 52.47	-7.8	9	9	56.85	57.06	3001	.008	.22	2171	.025	.02
100	19	365	6.14 F0	2 27 49.835	.57	19 38 4.05	-3.6	8	8	57.03	57.03	3003	-.019	.56	2172	.013	.42

No.	B.D. No.		M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ′	No.		Epoch		O − G.C.			O − FK3 (Supp.)		
								α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
101	83	56	6.82 K0	2 28 38.679	−2.16	83 36 57.37	3.1	8	9	61.71	61.83	3019	−.096	−.78	3944	−.257	.11
102	1	438	5.44 K0	2 28 54.739	.15	2 2 47.58	−.3	7	7	60.31	60.48	3029	−.001	−.17	2173	.024	.09
103	76	81	6.86 M0	2 29 3.297	2.24	76 29 58.21	−4.7	6	7	61.65	61.08	3033	−.299	.69	2174	.090	.19
104	70	183	6.73 K0	2 29 23.543	1.41	71 4 32.29	−6.0	7	7	58.82	58.95	3041	−.129	−.08	2175	.016	.27
105	14	419	6.07 F5	2 30 9.524	−.13	14 48 51.91	4.3	9	9	57.01	57.01	3055	−.035	.35	2176	.012	−.21
106	65	280	6.07 K0	2 33 29.299	.80	65 31 44.08	−.7	10	10	58.79	58.89	3125	−.108	.27	2178	.019	.28
107	11	360	5.68 F5	2 33 54.035	1.90	12 13 54.79	−8.2	8	8	60.23	60.23	3133	−.002	−.16	2179	−.002	−.22
108	4	436	5.84 K0	2 35 10.481	.27	−3 36 41.32	−3.8	9	7	57.08	57.45	3158	−.026	.25	2180	−.005	.46
109	60	548	6.99 F0	2 38 42.593	.04	61 22 53.88	2.6	10	7	57.19	57.37	3238	−.011	−3.83	2186	.007	.31
110	39	610	4.99 G0	2 39 4.956	−.12	39 59 1.75	−18.6	9	9	57.50	57.50	3245	−.043	.33	2187	−.005	.14
111	54	598	5.66 B8	2 39 27.174	.46	54 53 38.95	−2.1	8	8	57.15	57.27	3253	−.029	.43	2188	.039	.35
112	80	86	5.92 K0	2 40 25.390	.70	81 14 22.65	−6.8	8	7	60.58	60.41	3270	−.242	.09	3945	−.228	.15
113	17	426	6.47 K0	2 41 31.354	.28	17 33 12.48	−3.3	10	9	57.98	58.23	3294	−.019	−.06	2190	.002	.07
114	0	469	7.08 G5	2 47 3.417	.22	0 42 52.90	−3.3	9	8	57.87	57.60	3392	−.059	.37	2193	−.003	−.30
115	37	646	4.27 F0	2 47 25.094	1.61	38 6 50.63	−10.6	7	7	58.44	58.44	3401	.010	−.25	2194	−.026	.33
116	68	200	6.0− F5	2 47 28.799	.12	68 40 59.49	−.7	7	7	59.21	59.21	3403	−.097	.24	2195	.018	−.17
117	46	648	5.97 G5	2 48 20.145	−.28	46 38 13.68	−2.4	7	7	60.47	60.47	3418	.014	.07	2197	.017	.31
118	34	527	4.67 K5	2 48 25.464	.14	34 51 19.34	−6.4	8	7	61.57	61.54	3419	−.092	.22	2198	−.019	−.36
119	60	591	5.63 F5	2 51 57.726	2.06	61 19 7.41	3.7	7	8	59.08	59.28	3487	−.082	−.31	2201	.013	−.18
120	17	458	5.57 F5	2 53 36.465	1.94	17 49 29.90	−20.9	8	8	57.84	57.84	3532	−.024	.01	2204	−.008	−.23
121	31	509	5.18 A0	2 54 14.733	.01	31 44 3.23	−3.2	7	7	58.96	58.68	3544	−.001	.28	2205	−.010	.23
122	3	410	6.31 M0	2 54 27.196	.05	4 18 0.67	2.5	6	6	59.77	59.77	3547	.013	−.10	2206	.007	−.37
123	39	681	4.62 A2	2 55 33.232	.27	39 27 50.66	−3.9	9	9	58.78	58.78	3567	−.062	.03	2207	−.046	−.08
124	3	475	5.48 B9	2 57 9.516	−.08	−2 39 46.16	−2.0	8	9	58.32	58.82	3597	.008	.10	2209	−.011	.07
125	10	401	6.20 K5	2 58 1.160	.54	10 40 24.04	−2.9	9	8	58.59	58.56	3616	−.009	−.39	2213	.041	−.91
126	25	477	5.91 A2	2 58 56.973	−.10	26 15 56.96	.7	6	7	58.38	58.15	3629	−.030	.04	2214	.007	−.21
127	56	767	5.08 K0	3 1 45.937	−.17	56 30 40.24	7.6	7	7	57.26	57.26	3674	−.057	−.10	2217	.049	.34
128	1	534	6.05 K0	3 2 2.754	.20	1 40 10.49	.8	6	7	57.44	57.67	3683	−.019	−.35	2218	.012	−.32
129	63	390	5.82 B9	3 3 6.493	−.22	63 51 55.55	1.3	8	7	58.02	58.19	3705	.011	.13	2219	.072	.92
130	12	436	5.84 G5	3 3 38.709	.00	12 59 44.14	−5.8	9	8	60.40	60.23	3712	−.022	−.16	2220	−.026	−.32
131	80	97	5.95 A2	3 3 47.894	−2.16	81 16 50.86	−.3	9	8	59.26	59.70	3715	−.122	.29	3946	−.190	.42
132	6	606	5.56 M0	3 4 4.953	.03	−6 16 50.54	−.4	10	8	57.23	57.57	3718	−.002	.12	2221	−.025	−.18
133	73	168	4.89 A2	3 6 27.603	.52	74 12 22.19	−8.6	6	6	56.71	56.71	3759	−.160	.11	2222	−.048	.07
134	4	540	6.34 M0	3 8 48.412	−.08	−3 59 57.88	−3.3	9	8	58.51	58.85	3806	−.009	1.11	2224	.010	−.42
135	47	779	6.42 K0	3 8 58.127	.73	47 32 22.86	−7.7	10	9	60.63	60.50	3812	−.027	.06	2225	−.048	.27
136	6	496	5.84 G5	3 9 46.961	−.05	6 28 25.76	.0	6	6	59.66	60.49	3827	−.008	.06	2226	.031	.03
137	59	609	7.09 B5	3 10 7.366	.03	59 22 38.61	.4	6	6	58.20	58.20	3836	−.064	.17	2227	.027	.27
138	38	690	5.97 A0	3 14 30.759	.23	39 6 4.65	−1.4	8	8	57.93	57.92	3927	−.041	.51	2230	−.012	.51
139	69	205	6.68 A0	3 15 16.203	.42	69 33 1.68	.0	7	7	59.14	59.14	3938	−.200	.08	2231	−.060	.21
140	33	619	4.92 K0	3 15 35.739	.03	34 2 28.40	−1.2	9	7	58.19	58.86	3948	.000	.17	2232	.006	−.31
141	28	516	4.72 K5	3 17 18.430	.01	28 52 6.89	−1.4	7	8	57.45	57.37	3981	−.050	−.23	2234	−.026	−.56
142	42	750	4.98 A2	3 18 4.971	−.52	43 9 2.13	−.1	9	9	59.23	59.23	4004	−.054	.23	2236	−.071	.15
143	0	581	6.64 K0	3 21 1.834	−.04	0 44 4.78	−10.8	7	7	56.73	56.73	4046	.010	1.14	2239	.041	.76
144	24	481	5.66 K0	3 21 20.958	.10	24 32 54.41	−4.5	8	8	60.07	60.07	4051	−.009	−.03	2240	−.020	−.04
145	12	473	6.22 G5	3 21 24.807	.10	12 27 12.59	−2.1	8	8	60.80	60.80	4056	.027	−.02	2241	.002	−.28
146	18	484	6.45 A2	3 24 11.673	.34	18 34 58.15	.2	8	8	56.26	56.26	4103	−.028	−.48	2242	.005	−.47
147	5	502	6.12 G5	3 28 5.881	.20	6 1 8.28	−1.2	7	7	56.86	56.86	4183	.069	−.02	2247	.002	.27
148	45	778	5.35 F0	3 28 57.800	−.50	45 53 21.01	−6.8	8	6	59.07	59.64	4210	−.011	−.20	2249	−.015	.02
149	72	178	6.41 A0	3 29 40.730	.34	73 10 49.01	−2.0	6	6	60.68	60.68	4225	−.111	−.04	2251	−.004	.02
150	57	730	6.41 F5	3 29 42.891	−.17	57 42 2.21	−.1	6	6	58.88	58.88	4226	.138	2.55	2252	.044	.32

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
151	39 811	5.80 A0	3 30 16.743	.08	39 43 57.21	-3.9	7	7	56.72	56.71	4236	.014	-.07	2254	.004	-.45
152	31 616	6.62 F0	3 31 53.828	.44	31 51 4.90	-4.5	7	6	55.83	55.84	4264	-.030	.89	2255	-.009	.75
153	16 484	6.33 G5	3 36 35.789	.29	16 22 31.49	-3.3	8	7	56.62	56.73	4348	-.014	-.14	2257	-.005	-.23
154	2 581	5.76 G5	3 37 14.664	-.23	2 53 43.89	1.1	9	7	56.79	56.75	4365	-.026	-.28	2258	-.001	-.14
155	5 715	5.52 B8	3 38 9.639	-.01	-5 22 15.16	-.4	11	9	58.70	59.41	4395	-.025	.27	2260	-.002	.09
156	74 168	6.82 G5	3 39 15.045	.62	74 23 5.87	3.8	10	7	59.57	60.46	4423	-.234	-1.19	2262	-.044	.40
157	19 578	5.50 B8	3 39 25.627	.03	19 32 29.68	-1.2	6	6	58.25	58.25	4430	-.013	-.21	2263	-.009	-.25
158	45 804	6.09 A5	3 41 9.931	-.04	45 56 36.43	-3.7	10	11	58.54	58.38	4459	-.040	.82	2266	-.042	-.11
159	66 284	5.84 F2	3 41 15.312	1.68	67 2 49.94	-10.9	7	7	61.27	61.27	4463	-.193	-.07	2267	.033	.28
160	36 742	5.57 A2	3 41 16.806	.40	36 18 13.86	-3.5	8	7	59.10	59.42	4464	-.020	-.25	2268	-.008	-.11
161	9 494	6.95 G5	3 45 47.384	.49	9 29 35.68	1.3	8	6	58.92	59.74	4574	.012	-.22	2270	.043	-.05
162	0 602	6.10 K0	3 46 4.812	.39	0 4 32.20	-.4	6	7	60.72	60.29	4584	-.036	-.03	2273	-.046	-.14
163	52 715	6.87 B2	3 46 38.457	.07	52 19 51.11	-.6	6	6	57.22	57.22	4598	-.040	.46	2274	-.000	-.01
164	6 594	5.62 B9	3 49 20.058	.07	6 23 9.34	-.4	7	6	58.86	59.37	4662	-.017	-.33	2275	.012	-.14
165	71 222	6.39 F0	3 51 4.330	-1.02	71 40 34.00	1.0	9	9	60.51	60.51	4691	-.092	-1.07	2277	-.098	.20
166	86 51	5.84 F5	3 51 16.143	16.77	86 29 19.82	-7.5	7	7	60.69	60.55	4693	-.398	.33	3947	-.478	.38
167	47 912	5.34 B5	3 52 21.475	.19	47 43 35.26	-2.8	10	8	58.22	58.75	4721	-.011	.60	2279	-.045	.12
168	62 628	4.87 B9	3 52 59.478	.07	62 55 41.10	.6	7	6	57.49	57.56	4730	.009	.31	2281	-.023	.21
169	22 605	5.76 F0	3 53 54.496	.51	22 20 8.07	-10.8	8	6	57.10	57.68	4744	-.021	-.04	2283	-.010	-.11
170	77 138	7.04 K0	3 56 2.331	.15	78 3 48.86	-2.7	9	8	57.64	57.71	4781	-.435	.92	2285	-.142	.17
171	17 666	5.76 F0	3 57 55.668	.94	18 3 16.28	-3.3	8	7	57.20	57.52	4807	-.012	.30	2288	.030	-.04
172	58 690	5.07 F0	4 0 16.217	.01	59 1 7.93	.2	9	7	57.71	58.19	4858	-.052	.04	2290	.024	.34
173	68 303	6.14 K2	4 1 0.338	.24	68 32 40.13	1.2	7	7	59.05	59.05	4874	-.091	-.37	2291	.081	-.11
174	2 645	5.39 F5	4 1 32.835	1.00	2 41 32.80	-12.4	10	8	58.92	59.62	4892	-.005	-.01	2292	.016	.00
175	28 619	5.29 F0	4 3 54.654	-.64	28 52 4.14	.6	8	8	55.92	55.92	4944	-.024	.15	2295	.004	.01
176	42 897	6.67 B8	4 4 44.277	.07	43 3 32.66	-2.0	8	7	59.39	60.02	4958	-.003	-.11	2296	.012	-.38
177	37 882	5.59 F8	4 5 16.209	1.42	37 54 38.50	-20.0	7	8	57.34	57.27	4973	-.041	-.12	2297	-.006	.04
178	13 648	6.02 B9	4 6 13.802	.10	13 16 2.35	-.9	10	9	57.59	57.76	4994	-.010	-.09	2298	-.024	-.32
179	33 807	5.91 K0	4 7 46.068	.02	33 27 27.96	-1.6	9	9	57.57	57.57	5018	-.060	.32	2300	-.022	.33
180	5 601	5.71 F0	4 8 40.366	1.00	5 23 39.74	1.1	9	6	57.52	58.10	5042	-.035	-.19	2301	.004	-.66
181	57 785	6.09 A2	4 10 54.785	.03	57 20 6.20	-1.0	7	6	57.42	57.64	5091	-.057	.47	2304	.008	.34
182	1 600	6.34 B5	4 11 5.647	.05	-1 16 32.68	.2	7	8	58.43	58.34	5097	-.041	-.51	2305	.002	-.22
183	40 912	4.89 G0	4 11 28.683	.15	40 21 32.21	-2.5	7	7	58.51	59.09	5103	-.056	-.14	2306	-.005	.38
184	53 750	5.12 A2	4 12 48.332	-.10	53 29 18.63	-.1	10	9	58.73	58.39	5132	-.077	.28	2310	-.016	.25
185	75 173	6.63 B5	4 14 43.002	.60	75 59 11.82	-2.2	7	6	57.94	57.91	5180	-.190	.64	2312	-.047	.23
186	21 618	5.56 A5	4 15 25.400	.70	21 27 31.33	-3.5	8	6	57.33	57.75	5189	-.010	-.11	2313	.006	-.43
187	64 433	5.40 G0	4 15 56.912	-.42	65 1 16.11	-.2	11	10	57.85	57.93	5199	-.031	.12	2315	.007	.27
188	50 973	5.54 B3	4 16 23.606	.09	50 48 5.59	-.4	9	8	59.92	59.69	5207	-.062	.04	2316	-.052	.13
189	60 800	5.67 K0	4 17 25.791	.79	60 37 8.97	-10.6	7	6	58.80	59.26	5244	-.033	-.34	2317	.012	-.13
190	46 872	4.89 B3	4 17 55.691	.21	46 22 53.60	-3.9	6	6	61.91	61.91	5256	.010	.68	2319	-.017	1.02
191	5 631	5.90 G5	4 18 1.110	-.11	6 0 47.03	-4.8	7	7	60.20	60.20	5259	-.011	.23	2320	-.005	.19
192	80 133	5.58 K0	4 18 14.432	.40	80 42 35.47	-2.0	9	7	59.66	59.47	5265	.017	.46	2321	-.097	.37
193	7 798	5.72 B8	4 18 17.195	.02	-7 42 38.16	-.4	8	8	61.31	61.31	5267	-.033	.34	2322	-.007	.45
194	57 800	6.23 A0	4 22 50.993	.18	57 28 24.05	-1.8	12	10	59.74	59.89	5358	-.036	.39	2324	.062	.40
195	31 776	5.33 K0	4 22 54.969	.60	31 19 40.72	-11.8	8	7	60.70	60.98	5359	-.060	.49	2325	-.018	.73
196	22 696	4.40 A5	4 23 18.683	.78	22 42 6.80	-4.7	10	10	59.13	59.13	5370	-.018	.13	2326	-.021	-.12
197	8 687	5.99 B5	4 23 38.162	.02	8 28 41.88	-1.4	8	8	57.97	57.97	5378	-.039	.64	2327	-.013	-.17
198	12 598	5.12 A5	4 26 1.877	.76	12 56 18.46	-1.3	6	6	58.37	58.37	5443	-.064	.21	2330	-.006	.30
199	27 661	6.61 A0	4 26 14.247	.14	27 17 44.04	-2.2	6	6	58.11	58.11	5447	-.051	-.27	2331	-.003	.45
200	72 227	5.97 A5	4 27 40.853	.77	72 25 26.57	-7.9	6	6	57.30	57.30	5478	-.097	-.45	2333	.009	-.22

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
201	5 679	5.78 A0	4 31 28.550	-.13	5 27 55.38	-1.0	9	7	58.27	58.32	5570	-.027	.57	2335	-.024	.46
202	63 515	5.91 A0	4 31 41.975	-.32	64 9 35.59	-1.4	7	6	60.18	59.92	5574	-.025	.82	2336	.020	.10
203	8 887	5.45 M0	4 31 47.019	-.18	-8 20 4.74	.7	8	8	60.48	60.48	5576	.016	-.21	2337	.031	-.22
204	40 1000	4.46 K0	4 33 13.173	-.10	41 9 51.05	-1.8	7	7	58.30	58.30	5609	.019	.56	2338	-.017	.61
205	0 798	5.32 B5	4 34 38.905	-.03	0 53 54.66	-.3	7	7	59.07	59.07	5627	-.017	.02	2339	.010	.18
206	20 785	5.73 B9	4 35 18.594	-.10	20 35 9.43	-.7	6	6	58.65	58.65	5644	-.036	.10	2341	-.010	-.28
207	12 618	4.30 A3	4 35 21.524	.69	12 24 43.63	-1.2	8	8	60.75	60.98	5645	-.061	-.06	2342	-.043	.10
208	24 674	6.27 A3	4 36 19.934	.16	25 7 14.69	-.4	9	7	56.85	56.92	5663	-.044	-.45	2343	.020	-.04
209	7 681	5.55 F0	4 36 23.516	.60	7 46 23.38	.2	8	7	58.93	58.90	5665	.016	-.20	2344	.008	-.45
210	15 666	4.85 A3	4 36 24.689	.58	15 49 13.99	-1.8	7	7	61.34	61.34	5666	-.021	-.12	2345	-.004	.22
211	79 150	6.57 A0	4 36 57.891	-.45	79 33 46.22	1.5	8	7	61.09	60.55	5677	-.019	-.17	2346	-.153	-.05
212	48 1128	5.70 A0	4 37 39.838	.46	48 12 20.96	-4.4	6	6	57.34	57.34	5687	-.056	.08	2347	-.065	.09
213	37 954	5.82 F5	4 38 25.995	2.04	38 11 11.41	-9.8	12	10	58.83	59.27	5701	-.042	.27	2348	-.082	.20
214	43 1043	5.25 A0	4 39 21.068	.39	43 16 19.45	-5.1	7	6	58.81	58.80	5719	-.068	.51	2349	-.048	.43
215	11 646	5.43 A0	4 43 14.711	.49	11 36 56.91	-.5	7	7	60.72	60.72	5802	-.033	.01	2353	-.024	.07
216	70 322	6.39 B9	4 44 59.167	.32	70 51 20.55	-1.5	8	7	58.10	57.97	5835	-.188	.12	2358	.050	1.56
217	31 816	5.76 K0	4 46 0.293	.16	31 21 8.30	-10.3	9	7	56.90	57.13	5853	-.002	-.10	2359	-.007	-.53
218	48 1162	5.79 G5	4 47 23.357	-.35	48 39 24.24	-4.2	7	7	58.14	58.14	5880	-.002	.76	2361	-.010	.57
219	63 543	5.81 M0	4 47 23.564	.67	63 25 21.86	-9.6	8	9	60.08	60.17	5881	-.096	.04	2362	-.093	-.12
220	27 701	5.91 F2	4 49 39.485	.39	27 48 56.93	-3.2	7	7	57.95	57.95	5940	-.026	.60	2365	.001	1.02
221	5 1068	4.45 F0	4 50 26.134	-.12	-5 32 5.79	2.4	7	6	58.63	59.06	5954	-.028	-.39	2366	.015	-.48
222	80 155	5.32 K0	4 50 54.314	.00	81 6 59.73	2.9	10	8	61.94	61.97	5962	-.151	.16	3948	-.210	-.36
223	55 941	5.58 A0	4 50 57.320	-.10	55 10 45.01	-.8	6	6	60.50	60.50	5964	-.061	.48	2367	-.038	.38
224	11 675	5.15 A3	4 52 0.310	-.09	11 20 45.54	2.0	9	8	57.73	57.94	5983	-.022	.26	2368	-.006	.58
225	7 755	5.54 K0	4 52 5.411	-.13	7 41 59.09	-3.2	9	9	60.25	60.25	5986	-.019	.20	2369	.012	-.02
226	1 762	6.23 F2	4 54 44.808	-.27	-1 8 36.78	-3.6	8	7	56.58	56.65	6043	-.027	1.00	2373	.010	-.47
227	24 717	5.65 B9	4 55 5.577	.24	24 58 30.03	-5.1	9	7	56.90	57.44	6048	-.039	-.01	2374	.015	-.30
228	0 923	6.18 K0	4 59 15.807	.11	0 39 4.00	-3.1	7	7	58.48	58.48	6143	-.088	.76	2376	-.008	.93
229	3 998	5.98 B5	5 2 24.290	.00	-3 6 26.55	.2	8	7	56.65	56.73	6206	-.007	.06	2378	.032	.20
230	35 973	6.37 A3	5 2 40.258	-.07	35 52 10.90	.0	9	6	57.06	57.04	6216	-.035	-.25	2379	-.090	.65
231	69 302	6.58 K0	5 4 7.395	1.33	69 34 35.25	-6.5	6	7	58.13	57.55	6245	-.203	.61	2382	-.069	.32
232	20 885	5.29 A3	5 4 50.661	-.32	20 21 15.25	-3.6	7	7	56.98	56.96	6259	-.045	.29	2383	.006	.18
233	64 500	6.40 F2	5 4 52.033	.39	64 51 31.24	-16.8	8	6	58.15	58.67	6260	-.328	-.31	2384	.021	.72
234	48 1226	6.63 A3	5 5 15.673	-.22	49 3 29.80	-.5	6	6	59.71	59.71	6272	.026	.56	2386	-.055	-1.50
235	73 274	5.38 A0	5 6 2.596	.21	73 53 9.86	-3.3	9	9	61.10	61.10	6288	-.140	.76	2387	.012	.51
236	2 1165	5.93 F2	5 8 48.039	.48	-2 33 3.95	1.0	9	9	58.32	58.63	6348	-.006	-.71	2390	.000	-.44
237	15 759	5.36 K0	5 8 49.075	.08	15 59 8.13	.6	6	6	57.95	57.95	6350	-.055	.10	2391	.008	.15
238	53 872	6.16 A0	5 10 43.166	.19	53 9 25.28	.0	7	7	56.77	56.77	6383	-.130	.27	2393	.023	-.06
239	4 877	5.82 K0	5 12 4.440	-.04	5 5 59.16	.9	9	8	58.87	59.09	6407	-.032	-.29	2394	-.005	.07
240	11 756	5.50 A0	5 13 17.321	-.02	11 17 12.13	-1.0	8	9	59.98	59.74	6436	-.033	-.07	2395	.022	.03
241	71 299	6.76 G5	5 14 46.318	-.39	71 39 49.58	-1.8	8	7	58.32	58.50	6471	-.133	.30	2396	.037	-.10
242	62 742	5.88 K2	5 15 41.997	.05	62 36 11.17	.3	6	7	58.61	58.49	6496	-.054	-.07	2397	.005	.29
243	21 816	5.14 K0	5 16 16.152	.10	22 2 47.69	-8.3	6	6	58.90	58.90	6506	-.048	-.05	2398	-.039	.03
244	33 1013	5.16 A5	5 16 42.984	.01	33 54 28.14	-1.3	6	6	61.43	61.43	6515	-.001	.34	2399	.034	.23
245	41 1162	5.12 B3	5 18 15.785	.18	41 45 24.56	-3.5	9	10	59.99	59.77	6556	-.072	-.10	2400	-.057	.17
246	8 933	5.71 B2	5 19 0.103	.01	8 22 50.12	.2	8	8	58.97	58.97	6574	-.019	-.50	2401	.016	-.55
247	57 879	5.25 A0	5 19 10.567	.33	57 29 54.23	-5.7	9	9	59.73	59.73	6578	-.080	.14	2402	.085	-.03
248	77 195	6.54 A5	5 21 42.082	.36	77 56 9.98	-1.3	10	7	60.82	61.46	6647	-.089	.06	2404	.034	.65
249	1 1005	4.73 B3	5 22 8.982	.00	1 48 8.11	.0	6	7	56.86	56.89	6660	-.026	.28	2406	.008	.06
250	35 1102	6.30 K2	5 23 33.646	-.13	35 24 55.15	-1.1	11	9	59.31	60.04	6691	-.003	-.02	2408	.046	-.66

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	$\Delta\alpha$	$\Delta\delta$	No.	$\Delta\alpha$	$\Delta\delta$
251	41 1206	6.09 K0	5 27 16.435	-.14	41 25 30.08	-4.2	7	7	57.01	57.16	6797	.043	.30	2412	-.041	.24
252	14 947	5.58 B3	5 31 3.642	-.04	14 16 20.28	-.6	6	7	57.20	57.28	6886	-.021	-.15	2414	-.000	-.11
253	23 954	5.28 B3	5 32 23.751	.08	24 0 29.53	-1.6	8	8	60.39	60.39	6916	-.022	-.28	2415	.007	-.31
254	54 914	5.96 K5	5 32 28.700	.01	54 23 52.17	.2	8	8	61.97	61.99	6921	-.083	-1.09	2416	-.053	-.33
255	47 1178	6.05 F0	5 32 29.162	.12	47 41 4.43	-1.7	6	6	61.58	61.58	6922	-.030	-.19	2417	-.070	.78
256	10 828	6.10 K0	5 34 17.522	.32	11 0 20.77	-1.3	7	6	56.22	56.07	6975	-.016	.06	2420	-.005	.03
257	4 1002	4.54 B3	5 36 32.620	-.02	4 5 40.68	.1	12	11	58.58	58.72	7042	-.022	.09	2423	.016	.13
258	25 902	5.00 B3	5 36 38.111	.17	25 52 15.38	-2.3	6	6	59.11	59.11	7047	-.092	.02	2424	-.026	.13
259	31 1048	5.96 B8	5 37 21.641	.13	31 19 57.93	-.8	8	8	57.37	57.37	7066	-.121	-.49	2425	-.024	.16
260	65 485	5.78 K0	5 37 25.409	.02	65 40 25.25	-2.1	12	10	59.02	59.82	7068	-.043	.31	2426	.080	.07
261	1 1105	5.24 G5	5 39 53.376	-.36	1 27 7.13	-1.4	11	8	56.91	57.35	7136	-.029	-.04	2427	.009	.18
262	42 1396	6.41 K0	5 43 39.741	.17	42 30 37.17	-8.6	9	8	58.63	59.10	7221	-.098	.08	2431	-.049	-2.78
263	9 954	5.89 G5	5 44 7.324	-.23	9 30 20.58	-6.5	8	6	57.01	57.48	7228	-.039	.42	2432	.008	.00
264	13 979	5.20 B5	5 44 52.619	.11	13 52 59.28	-1.6	9	9	60.58	60.58	7249	-.110	.21	2433	-.035	.15
265	24 970	5.02 K0	5 45 56.718	.03	24 33 9.30	-2.8	6	6	59.56	59.56	7283	-.061	.09	2435	-.021	-.43
266	71 324	7.17 A3	5 46 26.502	.36	71 16 35.43	.4	8	8	60.65	60.65	7297	-.289	.37	2436	.062	.05
267	51 1117	6.40 G5	5 46 57.823	1.81	51 30 6.52	-4.0	6	7	59.41	59.23	7308	-.004	.72	2437	.025	.33
268	68 412	6.40 K0	5 47 32.496	.32	68 27 37.03	-4.0	8	8	61.65	61.65	7319	-.183	-.44	2438	.035	-.29
269	4 1052	6.12 K0	5 47 34.114	.12	4 24 37.92	-4.3	6	6	58.87	58.87	7320	-.123	.83	2439	-.010	.41
270	37 1336	4.99 M0	5 47 37.664	.36	37 17 35.60	-4.4	9	8	60.89	60.88	7322	-.096	-.18	2440	-.011	.12
271	7 1187	5.32 B3	5 48 57.055	.01	-7 31 47.71	.0	7	7	59.04	59.59	7354	-.027	.20	2442	-.018	.13
272	33 1179	6.38 M0	5 49 21.401	.09	33 54 23.27	.3	8	9	61.60	61.22	7369	.027	.63	2443	-.043	-.33
273	1 1151	5.01 K0	5 49 50.556	-.04	1 50 40.20	-.7	7	6	60.07	60.92	7380	-.044	-.02	2444	.002	-.13
274	59 920	5.26 A0	5 50 28.949	.05	59 52 47.29	-2.0	8	8	61.05	61.05	7402	-.057	.15	2446	-.000	.06
275	19 1126	5.89 B2	5 51 58.979	.01	19 44 30.23	-1.0	10	9	58.21	58.79	7436	-.037	.18	2447	.005	.38
276	66 413	6.59 K0	5 52 30.193	.73	66 5 25.45	-2.3	9	7	58.24	58.85	7452	-.008	.92	2448	.047	.53
277	11 975	6.08 G5	5 54 1.734	.68	11 30 58.40	-5.4	6	7	58.22	58.22	7488	-.014	-.23	2453	-.027	-.36
278	9 1285	5.10 A5	5 56 41.783	.11	-9 33 37.20	-5.2	7	7	60.66	60.66	7565	-.048	-.27	2455	.017	-.71
279	16 957	6.75 K2	5 57 31.013	-.02	16 17 52.60	-5.3	6	6	61.26	61.26	7586	.027	2.67	2456	-.001	-.12
280	3 1256	4.68 K0	5 57 33.158	.06	-3 4 28.95	-7.0	6	7	59.37	59.30	7587	-.035	-.22	2457	.005	-.38
281	48 1333	6.24 K0	5 57 52.548	-.07	48 57 33.57	-.8	8	8	58.64	58.69	7598	.028	-.22	2458	-.017	-.02
282	75 247	6.52 K5	5 58 15.491	.55	75 35 17.76	-1.6	6	6	59.01	59.01	7606	-.152	.73	2459	.001	.02
283	42 1473	6.13 G5	5 59 41.589	1.08	42 54 55.25	-14.6	12	8	55.82	55.93	7641	-.058	.12	2461	-.033	.05
284	51 1146	6.30 A5	6 0 31.130	.06	51 34 37.49	-4.6	6	7	57.54	57.63	7663	-.010	.21	2463	-.000	.41
285	38 1377	5.31 A3	6 3 8.208	.12	38 29 21.31	-5.3	8	8	57.80	57.80	7723	-.031	.00	2465	-.039	.46
286	4 1362	5.37 B3	6 4 9.900	-.06	-4 11 13.56	-.2	8	8	57.22	57.48	7750	-.034	.41	2467	-.007	.54
287	19 1253	5.70 B9	6 9 3.568	.04	19 48 12.86	-1.2	9	6	56.46	57.28	7887	-.040	.24	2471	.004	.56
288	32 1217	5.96 K2	6 9 3.560	.06	32 42 22.99	-.3	7	7	55.77	55.77	7888	-.114	-.02	2470	.038	-.09
289	13 1173	5.81 B2	6 12 18.178	.23	13 52 3.09	.7	8	7	57.90	58.17	7984	-.074	-.44	2474	-.007	-.13
290	6 1469	4.09 K0	6 12 24.933	-.03	-6 15 28.22	-1.8	7	8	58.95	58.95	7986	-.036	.39	2475	-.000	.43
291	0 1234	5.68 F5	6 13 1.610	-1.08	- 0 29 30.53	-22.2	6	6	61.01	61.01	8001	-.028	-.03	2477	-.034	-.24
292	4 1181	6.44 B3	6 13 8.278	-.12	4 18 4.23	-.2	6	6	61.17	61.17	8010	.031	-.31	2478	.012	.36
293	61 869	5.30 M0	6 13 18.212	.01	61 32 3.02	-.4	7	7	61.07	61.07	8016	-.135	-.45	2479	-.022	-.28
294	9 1173	5.29 A2	6 14 21.161	.02	9 57 44.70	-6.4	10	9	58.03	58.25	8051	-.011	.44	2480	-.009	.24
295	14 1235	5.98 A0	6 15 14.788	-.12	14 24 10.60	-.1	8	8	57.84	57.84	8073	.013	-.02	2481	.009	-.20
296	53 1008	5.41 F5	6 17 42.437	.36	53 28 38.72	-9.6	8	7	58.27	58.74	8151	-.073	.45	2484	.036	.41
297	44 1426	7.04 G5	6 18 23.107	.16	44 5 0.32	-3.7	7	7	58.88	59.19	8169	-.070	.95	2485	-.087	.27
298	35 1397	6.88 K0	6 21 18.157	.03	35 16 59.49	-2.3	9	8	60.50	60.57	8247	.017	-.43	2487	-.182	-.65
299	25 1255	6.56 K0	6 21 38.910	.06	25 4 36.79	-.9	7	7	60.83	60.83	8261	-.055	.50	2488	.004	-.14
300	56 1125	5.8- A3	6 22 12.625	-.23	56 18 51.80	1.9	8	8	61.83	61.83	8281	-.093	.41	2491	.012	.54

No.	B.D. No.		M+Sp.	R.A. 1950	100μ	Decl. 1950	$100\mu'$	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
								α	δ	α	δ	No.	$\Delta\alpha$	$\Delta\delta$	No.	$\Delta\alpha$	$\Delta\delta$
301	1	1242	5.73 A0	6 24 7.574	-.02	-1 28 34.57	-3.5	9	8	57.24	57.39	8335	-.060	.05	2493	-.038	-.28
302	16	1159	6.33 G5	6 25 35.311	-.68	16 16 18.33	-5.3	7	8	58.96	58.87	8382	.029	.15	2494	.013	-.20
303	46	1149	6.01 K0	6 26 18.867	-.02	46 43 10.98	.4	8	7	59.37	59.84	8411	-.087	.45	2496	-.047	.18
304	32	1324	5.6- A0	6 29 11.405	-.17	32 29 32.65	-2.1	9	8	57.97	58.46	8474	-.064	-.02	2500	-.024	.12
305	86	79	6.57 G5	6 30 9.039	1.57	86 44 7.54	-10.6	6	7	59.34	59.70	8505	-.512	.27	3949	-.607	.26
306	73	340	6.22 F2	6 31 36.886	-3.45	73 44 16.62	-2.6	7	7	59.10	59.10	8540	-.020	.24	2503	.119	-.20
307	28	1168	5.05 A0	6 32 3.118	.05	28 3 47.38	-1.9	7	7	59.65	59.65	8557	-.043	.10	2504	-.002	-.13
308	10	1186	6.06 K5	6 32 32.185	-.09	10 1 45.79	.1	7	7	60.38	60.38	8567	-.008	-.83	2505	-.005	.11
309	78	227	5.88 K0	6 32 44.110	.55	78 2 24.27	-.1	6	7	61.04	60.63	8574	-.076	-.57	2507	.094	-.61
310	82	177	6.39 A2	6 33 59.399	.33	82 9 49.39	-5.4	10	7	60.02	59.76	8605	.154	.61	3950	-.128	.33
311	5	1710	5.48 B9	6 34 7.590	.00	-5 10 5.75	-1.4	7	7	57.80	58.06	8609	-.013	-.58	2509	.014	-.12
312	71	359	6.07 G5	6 34 38.253	.43	71 47 39.09	.5	9	8	60.02	60.66	8630	-.301	.79	2511	.020	.11
313	2	1315	6.42 K0	6 35 3.568	-.21	2 44 55.93	-4.8	6	6	60.93	60.93	8642	-.051	.11	2512	.020	.70
314	22	1416	6.28 K0	6 36 4.805	.06	22 4 35.78	-2.9	7	6	60.34	60.87	8672	-.008	-.06	2513	-.001	-.43
315	36	1482	6.33 F5	6 38 16.377	-.32	35 58 49.80	-2.5	9	6	58.16	58.55	8724	.091	-.28	2516	-.013	-.47
316	44	1518	5.17 K5	6 39 26.725	-.38	44 34 29.16	-3.2	6	6	60.06	60.06	8751	-.052	.12	2517	-.024	.34
317	29	1327	5.54 K0	6 41 35.332	-.04	29 1 24.28	-2.8	7	7	57.10	57.54	8799	-.059	.20	2518	-.026	.12
318	57	1004	5.47 G5	6 42 33.959	.28	57 13 25.20	-4.1	6	6	57.56	57.56	8826	-.103	.18	2520	-.031	.00
319	67	454	5.04 B3	6 45 44.807	.11	67 37 48.83	.3	7	7	58.38	58.38	8902	-.073	.24	2523	-.001	.17
320	32	1414	5.76 K0	6 46 25.875	-.31	32 39 55.34	-4.3	6	7	59.07	58.95	8915	-.010	-.44	2525	-.002	.15
321	16	1298	5.69 B8	6 46 57.107	-.11	16 15 41.22	-1.4	6	7	60.95	60.99	8927	-.055	.36	2526	-.013	.10
322	41	1536	5.04 K0	6 47 13.907	-.18	41 50 31.69	-13.4	7	8	59.13	60.26	8931	-.045	-.51	2527	.001	.03
323	21	1405	5.22 A0	6 48 33.248	-.05	21 49 19.41	-3.5	10	9	56.28	56.77	8965	-.026	.31	2530	.016	.35
324	0	1487	5.33 A2	6 51 52.136	.06	-1 3 47.00	-1.1	7	6	56.10	56.10	9052	-.032	-.36	2533	-.009	-.73
325	10	1335	5.88 B8	6 53 40.728	-.18	10 1 22.51	-2.1	7	6	57.32	57.53	9100	.025	.21	2535	.009	.21
326	45	1367	4.80 A2	6 53 58.325	-.19	45 9 40.48	-.4	7	6	57.69	57.79	9113	-.035	-.14	2537	-.013	-.03
327	38	1656	6.15 K2	6 55 38.547	-.32	38 7 22.19	-12.5	6	6	57.26	57.26	9151	-.028	-.30	2538	-.015	-.52
328	52	1152	6.74 K0	6 55 46.122	-.21	52 38 31.66	-4.4	10	9	58.59	58.87	9156	.045	1.46	2539	.038	-.02
329	3	1488	6.02 K0	6 56 19.169	-.08	3 40 18.20	-.7	7	7	57.96	58.52	9175	-.018	.34	2540	.015	.32
330	63	678	6.71 K5	6 57 12.502	.19	63 44 55.80	-1.7	7	6	58.92	58.91	9198	-.122	.31	2542	.066	-.01
331	17	1479	6.20 M0	6 59 31.026	.13	17 49 41.79	4.0	8	6	58.01	58.52	9270	-.042	-.76	2543	-.007	.15
332	4	1788	4.89 B3	7 0 25.776	-.09	-4 9 54.80	.1	7	6	57.29	57.49	9293	.001	.05	2547	-.007	.21
333	44	1584	6.95 G5	7 4 30.493	.06	44 7 9.64	-1.4	10	6	57.00	57.81	9397	-.046	-.14	2548	-.047	-.11
334	34	1533	6.47 K0	7 4 56.567	-.10	33 54 45.08	-3.8	6	6	58.43	58.43	9405	-.043	.33	2549	-.007	.02
335	78	240	6.91 A5	7 5 59.497	.39	78 50 8.93	-.1	9	10	59.72	59.96	9434	-.060	1.89	2550	-.016	.72
336	72	352	6.45 K0	7 8 9.831	.42	71 54 4.67	2.0	7	7	59.61	59.20	9489	-.027	.03	2552	.034	.07
337	27	1327	5.60 A2	7 8 17.061	-.14	26 56 26.31	-4.1	6	6	61.32	61.32	9493	-.042	.53	2553	.020	.28
338	51	1295	5.69 M0	7 9 29.764	.08	51 30 50.26	.9	7	6	57.58	58.02	9526	-.031	.30	2555	.028	.21
339	59	1065	5.33 K0	7 11 33.390	-1.21	59 43 44.48	-26.0	7	6	58.42	58.64	9581	-.108	-.29	2558	.003	-.06
340	12	1469	5.84 K0	7 11 45.388	-.37	12 12 12.04	-2.0	7	6	57.53	57.96	9592	-.006	-.31	2559	.015	-.25
341	31	1529	5.98 B9	7 14 52.434	-.18	31 2 50.62	-2.0	10	8	57.69	57.52	9688	.038	-.36	2563	.079	-.41
342	2	1640	6.06 G5	7 16 45.544	-.03	2 50 1.94	-1.8	8	6	57.30	57.53	9739	-.043	.32	2564	-.009	.23
343	7	1684	5.95 F8	7 17 5.743	.55	7 14 14.17	-5.4	10	9	58.18	58.52	9752	-.120	-.09	2565	.035	.50
344	45	1422	5.64 F0	7 17 40.537	-.40	45 19 21.78	.9	6	6	57.94	57.94	9769	-.059	-.23	2567	-.027	.01
345	37	1707	5.21 K0	7 18 42.318	-.72	36 51 23.64	-2.8	9	8	58.64	59.07	9796	-.070	.24	2568	-.021	.37
346	82	201	5.11 M3	7 20 40.776	-.02	82 30 50.47	-4.1	6	6	58.15	58.15	9851	-.224	.09	3951	-.162	.23
347	66	502	6.29 B9	7 22 29.693	.09	66 25 58.09	-2.4	7	6	57.80	57.92	9894	-.179	-.34	2571	.106	.47
348	49	1623	4.45 A0	7 22 56.823	-.10	49 18 46.22	-5.0	6	6	57.33	57.33	9909	-.050	-.30	2572	.013	-.00
349	19	1743	6.79 K0	7 26 34.770	.17	19 44 14.91	.2	8	7	59.71	59.64	10008	-.078	-.60	2577	-.014	.13
350	1	1738	5.80 K2	7 26 46.998	-.12	-1 48 3.46	-1.0	7	8	59.92	60.20	10017	.035	-.18	2578	.000	-.47

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
351	62 934	6.75 G5	7 27 33.369	-.01	61 51 56.98	-10.9	6	6	58.86	58.86	10036	-.078	-.36	2581	.076	.72
352	4 1979	6.38 K0	7 28 22.998	-.07	-5 7 13.23	-.8	9	7	57.03	57.29	10053	-.021	.16	2582	-.000	.03
353	17 1596	5.64 K0	7 28 55.464	.34	17 11 38.39	-8.4	7	7	58.86	59.00	10073	-.045	.14	2585	-.017	-.28
354	2 1691	5.26 A5	7 29 30.096	-.09	2 1 18.77	-.3	7	8	56.58	56.29	10085	.011	-.19	2587	.000	-.03
355	40 1903	6.57 M0	7 33 52.663	-.03	40 8 19.62	-4.1	6	6	57.82	57.50	10193	-.113	-.71	2589	-.036	.15
356	54 1167	6.59 B9	7 35 15.078	-.14	54 0 58.61	-7.6	8	8	58.58	58.58	10234	-.019	-.19	2590	-.031	.17
357	34 1649	4.92 F0	7 35 54.276	-.23	34 42 2.67	-11.6	6	6	56.99	56.99	10257	-.057	-.39	2592	.008	-.37
358	57 1093	6.20 K0	7 36 41.917	-.17	57 11 57.02	-1.4	6	7	59.29	59.13	10279	-.059	.12	2593	-.004	-.24
359	48 1561	5.77 G5	7 37 31.144	-.44	48 15 1.08	-13.6	6	6	58.01	58.01	10305	-.062	.23	2594	.069	.37
360	23 1780	6.18 K5	7 37 58.981	-.08	23 8 8.58	-.4	7	7	57.01	57.01	10318	-.008	-.57	2595	.006	-.11
361	14 1729	5.81 M3	7 39 14.103	-.03	14 19 36.76	-1.2	6	6	59.52	59.52	10351	-.033	-.37	2597	.013	-.49
362	44 1666	7.19 G5	7 40 15.970	-.73	43 54 53.01	-2.2	6	6	57.20	57.20	10376	-.061	-.02	2598	-.051	.42
363	50 1460	5.28 A0	7 40 17.366	-.09	50 33 15.10	-3.5	8	8	58.70	58.70	10377	-.020	.41	2599	.015	.09
364	65 593	6.00 K0	7 41 54.315	.56	65 34 39.93	1.9	8	6	58.39	59.50	10420	-.099	-.16	2602	.041	-.03
365	70 474	7.14 G0	7 42 10.591	-1.86	70 19 54.28	-14.5	6	7	57.52	57.04	10433	.011	.11	2604	.070	.19
366	5 1790	6.95 K0	7 45 23.946	-.07	5 32 6.26	-3.6	9	8	56.49	56.56	10509	-.013	.12	2606	-.021	-.19
367	5 2280	5.75 F2	7 50 19.723	-.15	-5 17 52.04	-2.9	7	7	56.73	56.73	10649	-.007	-.58	2611	.003	-.59
368	77 303	6.78 A3	7 50 38.063	.29	77 42 35.19	-1.4	9	9	59.63	59.63	10657	-.151	-.20	2612	.195	.55
369	35 1705	6.11 A0	7 52 25.472	-.51	35 32 44.79	-1.6	10	9	57.73	58.90	10701	-.019	-1.08	2613	-.164	.13
370	20 1946	5.36 A0	7 52 44.929	-.12	20 1 2.96	-4.5	7	7	55.73	55.73	10707	-.007	-.19	2614	.047	-.40
371	79 265	5.33 A0	7 57 0.948	-.99	79 37 13.91	-5.2	7	7	57.27	57.27	10808	-.029	.07	2617	.201	-.11
372	17 1731	5.79 K0	7 57 55.466	-.06	17 26 50.24	-1.0	8	9	59.21	59.53	10845	-.035	.42	2618	.018	.34
373	63 749	6.04 F8	7 58 2.873	-.16	63 13 48.07	-2.2	6	6	60.95	60.95	10851	-.044	.57	2619	.042	.15
374	0 1882	4.88 K0	7 58 40.701	.39	-1 15 8.46	-7.5	8	7	59.34	58.97	10870	-.001	.26	2620	.001	.24
375	9 1843	6.11 F5	7 59 7.850	-.04	9 3 11.63	2.5	6	7	58.89	58.79	10880	-.025	-.58	2621	.002	-.31
376	2 1854	4.52 K0	7 59 39.835	-.21	2 28 23.65	10.2	6	6	59.97	59.97	10891	-.047	-.06	2623	-.028	-.01
377	13 1831	5.11 A0	8 2 17.419	-.23	13 15 43.83	-7.1	7	6	56.09	56.23	10959	-.050	.40	2625	-.008	.20
378	43 1770	6.24 A0	8 3 42.420	-.04	43 24 20.26	-3.4	7	7	57.46	57.46	10995	-.065	-.47	2627	-.032	-.21
379	22 1862	5.38 G0	8 4 49.413	.16	21 43 42.17	-7.6	7	6	57.03	57.18	11021	-.036	-.11	2630	-.001	-.70
380	25 1865	5.83 G5	8 7 26.635	-.48	25 39 38.17	-35.2	7	6	58.33	58.69	11091	-.058	-.08	2633	-.015	-.42
381	39 2065	6.47 G0	8 8 2.987	-.84	38 52 53.54	-6.6	8	9	58.52	58.92	11107	-.105	-1.04	2635	.001	.06
382	48 1621	6.75 B9	8 9 51.076	-.17	48 25 56.28	-2.4	6	6	57.72	57.72	11157	-.117	.59	2639	.036	.91
383	56 1278	5.90 K0	8 9 51.789	-.20	56 36 15.15	-3.6	8	8	59.27	59.27	11158	-.050	.23	2640	.010	.63
384	30 1664	5.59 A0	8 10 3.103	-.03	29 48 28.50	-2.4	8	7	58.93	59.87	11163	-.076	-.18	2641	-.002	.17
385	0 1938	6.51 K0	8 10 49.199	-.21	-1 0 50.89	.5	6	6	57.97	57.97	11179	-.018	.31	2643	.005	.47
386	60 1124	5.52 A5	8 13 42.026	.01	59 43 35.36	.0	7	7	57.86	57.86	11252	-.091	.02	2645	.022	-.04
387	82 235	6.17 A0	8 15 3.157	-.67	82 35 26.19	-2.9	8	8	59.45	59.45	11296	-.189	.18	3952	-.098	-.02
388	21 1817	5.93 G5	8 17 26.097	.47	20 54 25.23	-5.6	7	8	57.76	57.57	11358	-.054	.83	2646	-.002	.53
389	53 1246	5.58 A2	8 20 1.920	-.25	53 22 57.66	-10.7	8	7	55.30	55.31	11424	-.076	.51	2649	.024	.29
390	5 2512	6.07 A3	8 20 2.425	-.35	-6 1 5.48	.2	7	8	56.89	57.05	11425	-.083	-.05	2650	-.034	.30
391	35 1819	6.21 K0	8 21 53.137	-.01	35 10 28.76	-1.9	6	7	56.32	57.04	11473	-.077	.12	2652	-.032	.16
392	2 1965	5.91 K0	8 22 59.809	-.13	2 15 58.88	-2.3	8	7	55.78	55.85	11493	-.038	.77	2654	.014	.61
393	8 2053	5.23 K0	8 23 13.885	-.23	7 43 43.73	-.8	7	7	58.47	58.47	11505	-.039	-.13	2655	.000	.17
394	28 1602	5.83 K2	8 23 25.463	-.22	28 3 34.86	-12.5	8	9	59.49	59.97	11509	-.030	.25	2656	-.005	-.16
395	13 1912	5.75 M0	8 23 58.088	-.17	12 49 15.41	-10.5	7	8	58.88	58.80	11525	-.016	-.18	2658	-.004	-.05
396	78 287	7.14 G5	8 23 59.838	.04	78 23 44.61	-3.4	7	7	57.64	57.64	11526	-.217	.07	2659	.063	-.06
397	46 1398	6.33 G0	8 24 8.018	-.23	45 49 23.99	-35.7	7	7	60.29	60.29	11534	.013	.19	2660	.015	.89
398	67 545	6.01 G5	8 25 4.689	-1.01	67 27 51.16	.9	6	6	57.02	57.02	11561	-.121	.01	2662	.090	-.38
399	33 1703	6.60 A0	8 26 4.607	.22	32 51 33.92	-.5	7	6	56.57	56.80	11591	-.144	-.54	2663	-.095	.17
400	24 1940	5.73 F0	8 28 33.270	-.60	24 15 4.18	-5.1	6	7	58.02	58.05	11655	-.035	.03	2666	-.010	-.23

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
401	18 1963	5.57 M0	8 28 44.800	-.39	18 15 53.53	-6.2	7	6	55.90	56.01	11659	-.035	.35	2667	-.002	.09
402	59 1176	6.77 A0	8 29 54.788	-.07	58 46 44.48	-4.2	6	6	59.02	59.02	11688	-.160	.83	2668	.057	.41
403	1 2074	5.61 A0	8 31 29.863	-.26	-1 58 47.36	2.2	8	8	56.04	56.42	11743	-.017	-.56	2669	-.015	-.08
404	70 523	7.10 K0	8 32 14.878	-.33	69 52 23.53	-4.7	7	7	57.20	57.20	11756	.024	1.47	2670	.149	-.16
405	43 1834	6.98 A2	8 32 53.695	.18	42 45 13.15	-1.9	6	6	58.03	58.03	11772	-.058	.37	2671	.069	-.48
406	7 2540	5.61 A2	8 33 1.754	-.18	-7 48 32.42	1.7	7	7	59.39	59.39	11775	-.023	-.30	2672	-.024	.11
407	24 1955	6.84 A0	8 33 5.323	.02	24 13 29.62	-1.4	6	7	61.17	60.74	11778	-.073	.54	2673	-.021	-.22
408	10 1837	5.98 A0	8 34 23.196	-.22	9 49 50.02	-1.2	7	7	60.11	60.11	11807	-.017	.24	2675	-.006	-.29
409	64 698	4.76 K0	8 35 51.859	-.80	64 30 16.78	2.3	8	7	60.73	61.10	11850	-.121	.02	2677	.055	.16
410	82 253	6.69 A0	8 37 31.895	-.44	82 25 13.35	-2.0	7	6	59.96	60.59	11900	-.056	.17	3953	.044	.34
411	8 2452	6.48 A0	8 38 36.066	-.19	-8 52 23.82	-.3	8	7	57.51	57.72	11938	-.047	-.04	2682	.003	.31
412	13 1972	5.67 A3	8 40 27.086	-.01	12 51 41.18	-.2	7	6	56.45	56.65	11983	-.066	-.04	2686	-.015	-.03
413	3 2039	4.32 B3	8 40 36.695	-.12	3 34 46.05	-.5	8	7	56.92	57.32	11987	-.023	.42	2687	.021	.12
414	10 1864	5.58 A0	8 42 2.272	-.10	10 15 50.28	-2.2	9	9	59.20	60.07	12029	-.033	-.05	2688	.005	-.17
415	31 1876	6.14 K0	8 42 17.616	.00	30 52 48.81	-.8	6	6	57.89	57.89	12037	-.033	-.06	2690	.052	-.24
416	78 293	7.30 M3	8 44 13.470	.23	78 21 3.67	-2.4	7	7	58.18	58.18	12105	-.278	-.25	2692	.046	-.13
417	1 2130	5.22 A0	8 44 42.930	-.22	-1 42 45.75	-.2	8	8	59.13	59.02	12122	-.027	.18	2693	-.002	-.15
418	89 13	7.01 A0	8 45 53.867	-2.79	88 46 14.65	.7	6	6	57.19	57.19	12154	.159	-.13	3954	-.889	-.10
419	15 1917	6.29 G0	8 48 14.492	-.78	15 32 14.06	7.2	8	8	57.97	57.97	12211	-.006	-.32	2699	-.002	-.20
420	44 1794	5.24 G5	8 48 35.926	-.10	43 54 51.38	4.1	7	7	57.83	57.83	12221	-.058	.35	2700	-.020	-.04
421	62 1027	5.72 F0	8 49 16.494	-.11	62 9 3.90	2.0	6	6	57.32	57.32	12235	-.053	-.41	2701	.001	-.16
422	52 1343	6.99 F5	8 49 28.724	-.38	52 34 43.89	2.4	8	7	56.63	56.96	12241	-.043	.45	2702	.034	-.28
423	36 1883	6.02 A2	8 50 47.063	-.18	35 43 42.97	-2.8	6	6	56.71	56.71	12272	-.039	.21	2704	-.064	-.99
424	28 1666	5.25 G5	8 52 40.195	-.08	28 7 10.64	-3.8	9	8	56.21	56.46	12326	-.036	.01	2705	-.009	-.29
425	40 2125	5.88 F2	8 53 16.188	-.72	40 23 39.92	-5.4	6	6	56.91	56.91	12341	-.022	.90	2706	-.055	.51
426	22 2029	7.01 G5	8 54 12.026	.02	22 3 12.90	-.9	6	6	58.86	58.86	12362	-.021	.30	2708	.041	-.11
427	9 2093	6.32 K0	8 55 0.278	-.12	9 34 53.16	-.4	7	8	57.35	57.34	12389	.009	-.54	2710	.014	-.65
428	18 2090	6.56 A0	8 55 28.704	-.17	18 30 9.73	-3.3	6	6	59.18	59.18	12396	-.013	.33	2711	.021	.40
429	2 2112	6.50 A0	8 55 33.185	-.22	1 44 8.87	-1.2	8	8	60.52	61.00	12398	-.051	.34	2712	-.048	.17
430	25 2029	5.45 A0	8 59 49.067	-.01	24 39 3.20	-.9	8	10	58.27	58.65	12496	-.032	-.17	2714	.002	-.24
431	59 1217	6.19 A0	9 2 51.149	-.25	59 32 44.24	-2.5	7	7	57.37	57.37	12551	.000	.68	2716	.039	-.01
432	5 2116	5.41 K0	9 3 20.467	-.11	5 17 35.58	-1.0	8	7	56.94	56.61	12564	-.040	-.08	2717	-.014	-.01
433	2 2145	6.41 M0	9 4 24.942	-.05	1 39 52.36	-2.8	6	7	58.52	59.03	12581	-.066	.31	2718	-.013	.03
434	30 1817	5.38 G5	9 5 0.186	-.22	29 51 23.38	-.5	7	7	58.62	58.62	12593	-.043	.15	2719	.003	-.24
435	52 1365	4.54 A3	9 5 21.305	-1.44	51 48 28.91	-4.2	6	6	61.37	61.37	12604	-.039	.75	2721	.027	.51
436	34 1949	5.95 F8	9 5 47.249	-1.48	34 5 12.23	-12.6	6	6	60.00	60.00	12613	-.077	-.05	2723	-.051	-.04
437	27 1715	5.96 G5	9 5 51.084	-.92	26 50 13.88	-37.4	7	8	60.26	60.50	12615	-.040	-.17	2724	.019	.07
438	8 2588	5.50 B8	9 6 15.337	-.16	-8 23 10.70	-1.2	7	7	60.15	60.15	12626	.015	.29	2725	.006	.13
439	64 723	4.74 F5	9 6 49.055	1.50	63 43 7.57	-6.6	6	6	59.90	59.90	12646	-.092	.42	2727	-.021	-.18
440	72 444	6.46 K0	9 9 13.779	.21	71 51 46.38	-5.2	7	7	56.65	56.65	12687	-.497	.25	2729	-.015	.27
441	62 1058	5.23 F8	9 10 24.596	.03	61 37 51.34	-3.5	6	7	55.89	56.07	12713	-.063	.22	2730	.032	.01
442	0 2158	6.99 A2	9 12 19.394	-.03	-1 22 43.99	-1.3	10	10	58.48	58.48	12755	.002	.12	2732	.004	.00
443	15 2009	5.57 K0	9 12 28.339	-.27	15 8 59.93	-1.5	8	7	56.56	56.63	12758	-.031	-.07	2733	-.003	.03
444	54 1285	4.89 A5	9 12 36.218	.64	54 13 47.46	5.5	8	6	56.48	56.89	12761	-.044	.38	2734	.023	.26
445	47 1658	5.70 A0	9 14 10.426	.21	47 1 36.93	.8	8	8	57.33	57.33	12799	-.059	-.15	2738	-.012	-.02
446	5 2762	5.40 K0	9 14 12.729	.13	-6 8 37.35	.3	9	9	56.00	56.36	12800	-.015	-.64	2739	.007	-.45
447	5 2158	6.51 A5	9 17 13.521	-.24	5 25 41.89	-2.1	6	6	57.58	57.58	12863	-.072	.03	2740	.012	-.23
448	57 1214	5.98 M3	9 18 3.936	-.10	56 54 44.87	-1.3	7	7	57.10	57.10	12883	-.041	.01	2743	.015	-.16
449	37 1978	6.45 A5	9 21 17.517	-.68	36 48 10.26	-3.4	8	8	56.45	56.82	12957	.047	.40	2748	.036	.04
450	75 377	6.29 A2	9 22 39.872	-.65	75 18 55.22	2.7	7	7	57.68	57.52	12988	.113	-.82	2749	.088	.51

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O – G.C.			O – FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
451	17 2078	6.27 K0	9 22 46.429	-.60	16 48 8.21	-2.2	6	6	58.76	58.76	12990	-.036	-.53	2750	-.004	.01
452	46 1509	5.56 G5	9 25 23.859	-.09	45 49 18.50	-13.1	9	7	56.09	56.24	13051	-.016	-.20	2751	-.050	-.10
453	8 2226	5.88 K0	9 25 49.503	-.22	8 24 26.74	-3.7	9	9	56.22	56.22	13063	.005	.20	2752	.005	-.26
454	34 1999	5.98 K0	9 27 42.236	-.12	33 52 35.54	-5.1	8	8	56.48	56.48	13112	-.035	-.26	2755	.015	-.26
455	23 2107	4.48 K5	9 28 52.245	-.17	23 11 22.27	-4.4	8	9	56.59	56.89	13143	-.029	.16	2756	.011	-.12
456	2 2217	6.15 F5	9 30 6.335	-.11	2 5 11.12	-3.9	8	7	59.28	59.28	13172	-.025	-.35	2758	-.006	.00
457	29 1913	6.35 A2	9 30 22.853	-.35	28 35 25.92	-4.1	6	6	60.20	60.20	13182	.004	.16	2760	-.003	.10
458	40 2224	4.99 K0	9 31 57.067	-.20	39 50 40.37	1.0	7	8	56.37	56.60	13221	-.070	.23	2762	-.053	.48
459	5 2840	5.70 K0	9 32 2.931	.04	-5 41 27.30	-5.7	6	6	55.04	55.04	13226	-.003	-.37	2763	.020	-.07
460	31 2011	5.74 M0	9 33 45.125	.06	31 23 12.72	-4.2	8	7	56.24	56.52	13265	-.040	-.21	2765	.003	-.03
461	17 2109	5.92 K0	9 34 17.196	-.08	16 39 46.42	-1.0	9	8	57.21	57.48	13277	-.027	-.08	2766	-.001	-.06
462	7 2160	5.14 K0	9 34 34.339	-.40	7 3 39.12	-.3	7	8	57.36	57.46	13283	-.032	.04	2767	.006	.01
463	67 602	6.28 K5	9 35 20.847	-.13	67 29 56.24	-4.5	7	6	57.70	57.44	13304	-.204	.33	2769	.059	.09
464	43 1943	6.63 K0	9 36 0.576	-.38	43 22 16.94	-7.0	6	6	58.85	58.85	13318	-.017	.20	2770	-.007	.41
465	72 466	5.39 K0	9 38 23.667	-.58	72 28 52.90	-3.2	8	7	57.11	56.80	13364	-.029	-.15	2772	.083	-.23
466	40 2241	5.50 K0	9 38 54.847	-.45	39 59 12.52	-4.6	7	7	59.74	60.74	13372	-.059	-.21	2773	-.036	-.07
467	49 1868	6.34 A0	9 39 26.389	-.26	48 39 35.86	-1.9	7	7	57.50	57.95	13379	-.070	-.28	2774	-.037	-.27
468	55 1345	6.34 A2	9 39 40.227	-.47	54 35 34.93	-3.6	7	7	57.95	57.95	13386	.005	-.37	2775	.018	-.00
469	35 2042	6.03 F2	9 39 42.220	-.12	35 19 22.39	-5.5	6	6	58.42	58.42	13388	-.065	-.15	2776	.003	-.14
470	79 319	6.13 F0	9 41 28.416	-.85	79 22 5.00	-3.3	8	6	58.10	58.21	13419	-.188	.36	2780	.026	.59
471	7 2181	5.99 M0	9 43 31.827	.03	6 56 24.88	-3.4	7	8	57.38	57.48	13452	-.034	.38	2781	-.021	.10
472	2 2246	5.69 F2	9 43 48.820	-.38	2 1 3.67	-4.8	8	7	58.21	58.52	13459	-.023	.16	2782	.010	.29
473	21 2113	6.01 F0	9 47 2.359	-.32	21 24 47.71	-1.7	11	9	56.06	56.17	13528	-.025	-.24	2785	.006	-.30
474	38 2076	6.74 F0	9 49 20.184	-.45	38 8 59.72	-2.4	8	8	58.11	58.11	13573	-.019	-.38	2787	-.038	.20
475	0 2573	6.29 K0	9 49 38.204	-.26	0 18 40.83	-2.8	8	9	56.88	57.02	13583	.024	.16	2788	.001	-.17
476	61 1151	6.42 K0	9 51 25.635	.09	61 21 10.58	-.4	10	7	56.41	56.95	13613	-.022	-.14	2790	.093	-.63
477	50 1698	5.34 A2	9 52 27.768	-.06	50 3 24.70	1.6	6	6	56.44	56.44	13643	-.036	-.18	2793	-.011	-.18
478	9 2262	5.93 K0	9 53 47.014	-.60	9 10 14.94	1.1	8	8	59.36	59.36	13679	.005	-.02	2794	.012	-.50
479	46 1566	6.50 K0	9 54 48.098	.04	45 39 12.68	-3.8	6	6	57.28	57.28	13704	-.020	.02	2798	.013	.47
480	13 2183	5.18 A0	9 55 32.108	-.17	12 41 3.15	-2.2	10	7	56.81	57.40	13724	.000	.37	2800	.010	.12
481	57 1242	5.71 K5	9 56 26.093	-.37	57 3 7.51	-3.5	8	8	58.00	58.00	13735	-.043	.18	2802	-.030	.04
482	30 1946	5.86 K0	9 56 43.452	-.67	29 53 8.38	-4.3	7	6	57.13	57.61	13742	-.048	-.10	2803	-.022	-.17
483	75 399	7.09 G5	9 57 22.309	-1.42	75 0 1.66	-4.3	8	7	61.03	61.28	13749	.011	.16	2805	.069	.04
484	22 2164	5.59 B3	10 0 1.855	-.14	22 11 28.37	-1.3	10	8	56.00	56.48	13796	-.010	.26	2807	-.018	-.32
485	84 225	6.48 K0	10 0 52.011	-.30	84 9 43.73	.4	9	8	57.44	57.86	13814	-.218	.00	3955	-.224	.24
486	6 2259	6.29 G5	10 4 10.577	-.23	5 51 21.81	-2.1	9	7	56.59	56.56	13888	-.023	.18	2811	.014	.35
487	35 2110	4.47 A5	10 4 29.165	.43	35 29 20.91	-.2	8	7	58.88	58.81	13896	-.023	-.35	2812	-.020	-.54
488	0 2615	4.50 A0	10 5 22.696	-.11	- 0 7 35.38	-1.3	6	8	58.25	58.47	13916	-.044	.00	2814	-.014	-.09
489	64 770	6.75 K5	10 5 28.900	.21	64 11 51.70	-.3	6	6	60.02	60.02	13920	-.138	-.27	2815	.070	-.29
490	38 2110	6.14 K0	10 8 15.367	-.24	37 38 56.17	-3.3	8	6	55.57	55.55	13985	-.004	-.51	2817	.029	-.03
491	6 3096	6.06 A0	10 8 47.861	.06	-7 4 10.33	-.8	8	7	57.08	57.51	13995	-.024	-.41	2818	-.004	.07
492	79 328	6.72 A0	10 11 8.444	.55	79 11 44.58	-.5	8	7	56.65	56.27	14041	-.037	.27	2820	.019	.18
493	60 1246	6.1- M0	10 11 41.722	.20	60 14 3.08	-.5	7	6	55.76	56.02	14054	.006	.52	2821	.060	-.41
494	30 1981	5.35 A0	10 13 24.257	-.56	29 33 37.12	-3.0	6	7	57.25	57.25	14086	-.015	-.05	2823	.006	.01
495	14 2228	5.74 M0	10 13 59.807	-.15	13 58 42.18	-2.2	7	6	57.70	58.10	14110	-.020	.18	2824	.011	-.07
496	44 1973	6.69 G5	10 15 49.796	.55	44 18 12.07	-30.1	6	6	58.28	58.28	14143	-.011	-.15	2826	-.013	.29
497	49 1940	6.15 K0	10 16 20.980	-.97	48 38 58.07	-12.8	6	6	57.73	57.73	14154	-.078	.77	2827	-.052	.19
498	69 568	5.84 F0	10 17 16.437	-.94	68 59 59.74	-4.2	6	6	57.24	58.09	14180	-.060	.25	2828	.192	.56
499	54 1367	6.22 K0	10 17 17.840	-.43	54 28 6.77	-1.0	9	7	56.79	57.11	14181	-.005	-.23	2829	.009	-.27
500	6 2301	6.50 F2	10 20 38.863	-1.61	5 56 54.90	-7.6	10	9	56.74	57.59	14263	.009	.54	2833	.015	.25

No.	B.D. No.		M+Sp.	R.A. 1950	100μ	Decl. 1950	$100\mu'$	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
								α	δ	α	δ	No.	$\Delta\alpha$	$\Delta\delta$	No.	$\Delta\alpha$	$\Delta\delta$
501	9	2351	5.92 M0	10 22 37.140	.07	9 2 22.44	-4.2	7	8	56.66	56.60	14301	-.020	-.26	2835	.010	-.23
502	6	3146	5.85 K5	10 23 14.240	-.96	-6 48 25.21	11.8	7	6	56.94	57.42	14321	-.009	.82	2836	-.037	.20
503	20	2487	6.29 K0	10 24 17.474	-.41	19 37 10.68	-1.5	6	6	56.43	56.43	14340	-.039	-.15	2837	-.018	-.06
504	45	1832	6.49 K0	10 25 36.207	-.24	45 28 5.49	-3.0	8	7	59.56	59.89	14377	-.015	.04	2838	-.053	.20
505	64	789	6.00 A3	10 26 59.189	-.86	64 30 53.80	-5.6	7	6	57.28	57.46	14404	.024	-.24	2839	.074	.12
506	51	1605	6.70 F2	10 27 9.856	-.06	50 49 34.32	-4.7	6	6	59.09	59.09	14414	-.029	.67	2840	.056	.33
507	0	2663	4.95 B5	10 27 44.086	-.27	- 0 22 47.92	-2.5	9	9	59.44	59.75	14431	-.033	-.04	2841	.012	.03
508	25	2260	7.16 F0	10 29 32.159	-.37	24 41 59.22	.9	7	8	56.97	57.50	14469	-.063	-.77	2843	.064	-.15
509	41	2101	4.84 A5	10 30 19.272	-1.20	40 41 0.35	-.8	6	6	57.07	57.07	14491	-.028	.27	2844	-.002	-.03
510	81	343	6.56 G5	10 30 59.402	-.82	80 45 12.37	-.9	6	6	59.54	59.54	14509	-.124	.23	2845	.091	.31
511	7	2330	5.17 K0	10 32 11.536	-.71	7 12 41.78	5.6	6	6	56.05	56.05	14533	-.023	-.49	2846	-.009	-.51
512	54	1387	5.72 K0	10 36 0.295	-1.09	53 55 47.62	-8.4	9	9	57.38	57.50	14625	.022	.13	2849	.035	.14
513	16	2144	6.62 F2	10 36 13.733	.39	16 23 17.72	-2.6	8	7	56.26	56.41	14633	-.026	.01	2851	.019	.05
514	38	2166	5.83 G5	10 36 16.412	-1.86	38 10 16.60	-4.6	9	9	57.80	58.15	14634	-.061	-.05	2852	-.042	.22
515	66	678	5.12 K0	10 38 33.334	-2.69	65 58 44.09	-7.5	7	6	55.91	55.86	14688	-.051	-.07	2855	.053	-.16
516	14	2294	5.64 K0	10 43 46.477	-.87	14 27 32.91	-7.1	8	8	56.87	57.11	14814	-.018	.08	2860	-.007	-.15
517	28	1931	6.12 F5	10 47 9.069	-.04	28 14 18.15	2.7	9	7	56.13	56.38	14897	-.033	-.19	2863	.019	-.59
518	76	402	7.14 A3	10 47 28.186	-2.16	76 15 37.80	-3.2	6	8	56.89	57.22	14903	.106	-.34	2864	.105	.30
519	60	1296	5.66 K0	10 48 16.052	-.40	59 35 10.55	-5.7	7	7	58.73	58.73	14912	-.049	.77	2865	.099	.33
520	70	634	6.08 G5	10 50 7.032	-7.72	70 7 15.61	-7.7	10	6	56.64	56.74	14954	-.069	.65	2866	.066	.69
521	55	1418	5.36 K0	10 50 33.507	-.79	54 51 5.08	-1.5	7	7	55.95	55.95	14962	-.004	.10	2869	.030	-.13
522	43	2058	4.84 A0	10 51 6.476	.42	43 27 23.98	-3.0	7	8	57.41	57.51	14974	-.050	.18	2870	-.048	.09
523	23	2279	6.24 K2	10 53 35.473	-.19	22 37 7.48	.3	9	7	56.35	56.54	15035	-.069	-.13	2873	-.042	.02
524	52	1528	6.34 K0	10 56 21.244	-.11	52 9 1.75	-.4	8	7	56.63	56.85	15082	-.111	-.37	2876	-.010	-.18
525	12	2284	6.36 F5	10 57 4.391	-1.58	11 58 24.57	3.5	6	6	59.27	59.12	15102	-.013	-.15	2877	.005	-.59
526	46	1680	5.67 K2	10 57 22.855	.06	45 47 40.73	.0	8	9	59.88	60.13	15109	-.017	-.10	2878	.003	-.04
527	1	2471	4.97 M0	10 59 16.589	.10	-2 12 54.15	-3.7	7	7	56.52	56.52	15151	-.028	-.14	2879	-.013	-.19
528	20	2547	4.42 A0	10 59 39.764	-.07	20 26 54.60	3.0	8	8	57.48	57.48	15162	-.013	.61	2880	-.010	.16
529	39	2414	6.08 A2	11 1 44.782	-.63	38 30 40.17	-.3	7	8	56.21	56.34	15215	.010	.05	2882	.016	-.32
530	50	1793	7.07 F5	11 2 53.490	-1.12	50 26 33.93	-1.8	11	9	57.79	58.36	15246	.098	-.11	2886	.001	-.52
531	18	2452	6.59 K5	11 4 5.120	.16	18 0 29.36	-3.7	8	8	56.62	56.62	15273	.007	.10	2887	.026	-.08
532	72	515	6.87 F0	11 5 0.662	-.78	72 13 48.11	-1.3	9	9	58.40	58.40	15304	.040	-.36	2888	.036	.14
533	25	2344	5.63 A2	11 6 8.318	.04	24 55 46.14	-.1	8	7	56.87	56.96	15319	-.004	.09	2889	-.007	-.28
534	30	2111	7.18 G5	11 6 20.100	-.27	30 18 42.11	-2.2	7	7	57.40	57.40	15326	.044	.24	2890	.068	.12
535	37	2162	5.99 M3	11 6 34.410	-.38	36 34 50.98	-3.0	6	6	57.10	57.10	15334	-.007	-.05	2892	.035	-.43
536	8	2476	5.90 K0	11 11 25.953	.29	8 20 4.68	-11.0	7	7	55.63	55.63	15437	-.012	-.05	2895	.016	-.27
537	79	356	7.08 K0	11 12 31.583	-1.95	78 34 55.04	-2.0	7	6	56.84	57.27	15459	-.261	.39	2896	.136	.40
538	23	2322	4.87 M0	11 12 32.815	-.15	23 22 5.83	-1.2	9	8	58.76	58.69	15460	-.044	.02	2897	-.031	-.40
539	60	1318	6.66 A3	11 13 22.681	-.53	60 12 58.09	-1.9	7	7	57.38	57.38	15492	.072	1.38	2899	.020	-.04
540	2	2409	5.44 K5	11 14 42.983	.36	2 17 8.54	-14.8	9	9	57.01	57.14	15520	-.017	.00	2902	-.000	-.32
541	67	692	6.31 K0	11 17 51.472	.91	67 22 30.99	-4.9	6	6	55.38	55.38	15586	-.088	-.65	2905	.002	-.08
542	52	1558	7.18 F0	11 18 8.934	-1.92	52 2 11.81	-11.1	7	8	56.24	56.22	15594	.029	.12	2906	-.010	-.25
543	57	1316	6.32 A2	11 18 58.050	-.61	57 20 56.21	1.6	6	6	56.93	56.93	15607	-.085	-.36	2907	-.005	.33
544	44	2083	5.06 G5	11 20 5.297	-.32	43 45 26.47	-1.6	8	6	56.39	56.62	15625	-.074	.32	2908	-.054	.23
545	12	2335	5.96 K0	11 22 23.381	-.72	11 42 18.98	-1.4	9	8	55.88	55.96	15670	.014	.33	2912	.009	.23
546	17	2356	5.63 F2	11 23 0.029	-1.01	16 43 53.67	-1.4	9	8	56.30	56.55	15677	-.001	.09	2913	-.005	.24
547	62	1183	5.86 F0	11 26 13.997	-1.68	62 3 2.43	23.6	9	8	57.62	57.91	15745	-.018	.28	2915	.057	.11
548	30	2163	6.78 F0	11 27 25.607	-.77	30 14 35.26	-20.5	8	7	56.36	56.52	15772	.018	.24	2916	-.016	-.57
549	2	3360	5.07 K2	11 27 45.511	.12	-2 43 39.01	-1.9	9	10	57.94	57.59	15779	-.026	-.25	2917	-.007	-.25
550	19	2459	5.74 K0	11 27 52.578	-.59	18 41 7.23	1.0	6	6	56.63	56.63	15784	-.011	.45	2918	.002	.20

No.	B.D. No.		M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O − G.C.			O − FK3 (Supp.)		
								α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
551	81	373	6.13 A0	11 28 23.393	-6.49	81 24 9.87	3.1	7	8	57.16	57.42	15795	-.092	.04	3956	-.004	.21
552	37	2195	6.33 K0	11 31 17.050	-1.07	37 5 33.52	-6.3	8	7	55.98	55.94	15857	-.031	.47	2923	-.045	.05
553	3	2521	5.81 F5	11 31 48.368	-1.22	3 20 17.08	-10.8	6	6	55.44	55.44	15867	-.016	.27	2924	.010	.45
554	55	1473	5.76 G5	11 32 20.225	.09	55 3 42.56	-.2	8	8	56.41	56.41	15875	-.028	.52	2925	.027	.21
555	11	2377	6.45 A2	11 33 8.116	.20	11 11 17.48	-2.6	9	9	57.50	57.50	15892	-.002	.40	2927	.034	-.26
556	78	392	6.71 K5	11 34 36.517	.20	77 52 21.23	.9	9	9	58.75	58.75	15932	-.170	-.04	2928	-.056	.83
557	51	1679	5.99 K0	11 35 11.146	-.56	50 53 43.69	-4.2	7	7	56.85	56.85	15947	-.016	1.01	2929	.019	.18
558	47	1894	6.25 F2	11 35 52.837	-.40	47 6 42.18	-3.4	8	8	58.15	58.15	15970	-.007	.35	2931	.009	.11
559	8	2532	5.47 M3	11 35 52.900	-.06	8 24 40.35	.0	8	8	59.06	59.06	15971	-.013	.17	2932	-.004	.06
560	22	2391	5.43 G5	11 38 11.175	-.44	21 37 50.38	-4.8	7	7	56.53	56.53	16030	-.028	.12	2936	-.007	.22
561	32	2179	5.74 F5	11 38 58.315	-2.74	32 1 22.65	1.7	8	8	57.02	57.02	16051	-.039	.46	2938	.006	.03
562	26	2250	6.19 K5	11 41 37.088	-.13	25 29 44.73	1.3	9	7	55.70	55.83	16105	-.008	-.29	2940	.006	.09
563	56	1544	5.41 K0	11 44 15.598	.15	55 54 23.02	-3.8	9	8	56.49	56.53	16153	-.043	.20	2941	-.017	-.15
564	29	2214	7.21 F2	11 45 49.800	-.72	28 41 41.95	-1.8	7	7	56.40	56.40	16177	.002	-.15	2943	-.027	-.56
565	13	2465	6.22 A3	11 48 21.376	-.86	12 33 24.26	.7	8	7	56.13	56.25	16219	-.086	1.26	2946	.002	-.38
566	9	2560	5.62 K0	11 52 29.210	-.20	8 43 19.05	1.1	9	8	57.71	57.76	16294	-.029	-.03	2951	.010	-.18
567	26	2270	7.04 K0	11 52 50.149	-.47	25 48 1.69	-.6	8	7	58.19	58.47	16302	-.014	-.83	2952	-.044	-.62
568	57	1343	5.93 K0	11 53 22.230	.08	56 52 36.61	-.5	7	7	58.84	58.39	16315	-.039	.21	2953	.003	.14
569	41	2253	6.54 F5	11 54 40.496	-1.47	40 37 22.59	-7.1	7	7	58.31	58.31	16347	-.006	.61	2954	-.028	.47
570	18	2546	6.91 F2	11 55 8.592	-.66	17 44 45.86	-.8	8	6	56.39	56.61	16358	.019	.27	2955	.002	.02
571	4	2556	5.24 A0	11 57 23.218	-.13	3 56 1.24	-1.5	6	6	56.40	56.40	16406	.009	.39	2960	.033	.29
572	81	389	6.44 M0	11 57 44.408	-2.96	81 7 55.04	-3.8	9	8	57.87	57.82	16414	-.056	-.43	3957	-.046	-.05
573	71	598	6.69 A0	11 58 18.671	-.25	70 30 57.48	1.0	9	9	57.95	57.83	16424	.041	.08	2962	.113	.13
574	36	2230	5.62 K0	11 59 6.137	-.75	36 19 17.36	-9.1	9	8	58.72	58.66	16439	-.047	.32	2963	-.019	-.11
575	43	2179	5.07 A3	11 59 34.723	-2.95	43 19 22.55	6.7	7	7	58.00	58.00	16445	-.083	-.08	2965	-.061	-.30
576	2	3460	6.47 K0	12 3 26.072	-.22	-2 51 10.98	-2.3	8	6	56.14	56.45	16530	-.003	-.09	2967	-.012	-.16
577	2	2517	6.13 K0	12 7 7.497	.29	2 10 42.96	-18.4	6	6	55.92	55.92	16608	-.021	.21	2972	-.004	.25
578	6	2559	5.74 F0	12 7 30.446	-1.07	6 5 5.50	1.5	8	6	55.56	55.98	16616	-.031	-.15	2973	-.013	-.04
579	26	2316	5.81 K0	12 9 19.064	-.34	26 8 55.37	-3.3	6	6	56.15	56.15	16659	.005	-.05	2976	.002	-.35
580	21	2398	5.67 G5	12 9 36.782	-.13	20 49 13.28	-2.9	9	6	56.87	56.46	16667	-.013	.54	2977	.003	.14
581	11	2440	5.81 A2	12 10 53.150	-.65	10 32 25.36	-2.1	9	8	57.38	57.54	16693	.000	.35	2978	-.008	-.35
582	66	751	6.78 K0	12 11 40.692	-.61	66 23 13.44	-1.0	8	7	56.56	56.32	16711	.035	.92	2979	.070	.12
583	71	610	5.89 K0	12 12 46.304	-.50	70 28 41.48	-2.4	9	8	57.51	57.28	16733	-.077	-.27	2980	-.064	.18
584	15	2436	5.08 A2	12 13 27.855	-.58	15 10 38.20	-3.5	9	8	59.43	59.44	16747	-.015	.06	2981	-.006	.09
585	24	2443	5.06 K0	12 13 48.845	-.21	24 13 23.67	-1.4	7	6	58.43	58.83	16752	-.012	.27	2982	.018	.26
586	33	2213	5.08 K0	12 13 59.488	-.39	33 20 26.94	-12.2	7	7	58.30	58.30	16754	-.050	.54	2983	.002	-.03
587	88	71	6.28 F0	12 14 45.040	-5.96	87 58 37.75	5.2	7	6	59.13	59.10	16763	.285	.28	3958	-.155	.52
588	31	2350	6.14 F5	12 16 0.498	.70	30 31 41.50	-13.0	7	7	56.16	56.16	16789	-.077	.25	2984	-.020	-.25
589	75	470	5.41 A2	12 16 36.328	-.86	75 26 16.79	.1	9	8	57.06	57.29	16797	-.138	.27	2986	-.047	.19
590	18	2592	4.91 K0	12 18 11.484	-.79	18 4 8.01	8.1	7	7	56.59	56.59	16835	-.012	-.01	2987	.017	-.12
591	47	1955	6.52 K0	12 19 29.337	-.77	47 27 35.08	-4.1	8	7	56.24	56.27	16862	.097	1.21	2991	-.037	-.56
592	43	2218	5.98 F0	12 21 19.630	-.70	42 49 10.43	.6	6	6	55.48	55.48	16899	-.079	.61	2993	-.083	-.56
593	52	1626	4.97 K0	12 21 36.073	.12	51 50 20.53	.7	10	10	56.71	56.71	16906	-.011	.16	2994	.006	-.06
594	64	896	6.37 G5	12 22 46.995	-.29	64 4 46.33	-.2	7	6	56.97	56.58	16941	.004	.20	2996	.070	.03
595	28	2115	5.15 A5	12 23 54.127	-.11	27 32 42.11	-1.4	8	8	56.06	56.06	16955	-.043	.23	2997	-.018	-.15
596	72	565	6.44 K0	12 24 14.810	-3.37	72 12 24.30	-2.1	6	6	56.45	56.45	16960	.402	-.10	2998	-.078	.13
597	29	2288	4.56 K0	12 24 26.844	-.64	28 32 46.13	-8.8	8	7	57.52	57.73	16964	-.042	.24	2999	-.005	-.14
598	56	1598	5.84 M0	12 25 12.800	-.30	55 59 21.76	-1.6	8	8	56.21	56.21	16985	-.016	.20	3000	.027	-.06
599	3	3298	6.03 F2	12 25 17.471	-.59	-4 20 19.74	-.6	10	10	57.90	57.90	16989	-.029	.35	3001	-.003	.37
600	8	2609	6.16 K5	12 28 48.918	-.20	7 52 48.46	.3	7	7	56.10	56.10	17063	.017	.18	3002	.007	-.32

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O – G.C.			O – FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
601	11 2473	6.46 K0	12 30 30.996	-.38	10 34 16.41	-.3	7	7	56.13	56.13	17103	-.007	-.01	3004	.008	-.27
602	17 2504	5.78 K2	12 34 27.918	-.26	17 21 53.07	-2.4	9	9	57.62	57.62	17183	-.010	.17	3007	.001	.09
603	2 2560	6.02 M0	12 35 49.268	-.52	2 7 46.70	-2.6	8	7	58.78	58.70	17209	-.048	.45	3009	-.019	-.39
604	21 2439	5.51 K0	12 36 38.097	-.60	21 20 13.97	-1.7	9	9	56.28	56.28	17225	.001	.09	3012	.000	-.05
605	36 2295	6.32 A0	12 36 51.084	.20	36 13 35.11	-1.3	6	6	57.01	57.01	17231	-.030	.06	3013	-.003	-.43
606	34 2344	6.62 K0	12 39 52.847	-1.79	33 57 49.84	-11.6	8	8	56.38	56.38	17285	-.006	.05	3014	.029	-.76
607	81 402	6.26 A0	12 43 9.618	1.14	80 53 41.26	-4.6	8	8	56.37	56.37	17347	-.016	-.18	3017	.076	.15
608	50 1948	6.77 F0	12 45 31.313	-1.08	50 25 46.74	-2.2	7	7	57.89	57.89	17385	-.029	1.14	3019	-.025	.38
609	67 764	5.67 K5	12 45 32.174	.06	67 3 46.83	-.8	7	6	58.30	57.96	17387	-.044	.14	3020	.018	.48
610	25 2568	6.39 G5	12 46 20.937	-2.49	25 6 50.89	-11.6	8	8	58.67	58.67	17400	-.001	.67	3021	.042	-.10
611	14 2549	5.64 A0	12 46 23.860	.22	14 23 42.78	-3.2	9	8	58.63	58.95	17401	-.027	.46	3022	.002	.15
612	2 3593	6.15 F5	12 50 37.355	-1.73	-3 16 54.74	-.7	7	7	56.47	56.47	17487	-.047	-.34	3025	-.025	.02
613	20 2772	6.56 G5	12 51 4.293	-1.16	19 45 16.87	-19.6	9	7	57.63	57.43	17499	.047	.85	3026	.021	.63
614	34 2369	6.26 A2	12 51 49.884	-.77	33 48 17.38	2.2	6	6	57.49	57.49	17517	-.009	.01	3027	-.020	-.44
615	47 2003	6.02 M3	12 52 39.682	-.17	47 28 2.83	-1.2	7	7	57.36	57.36	17533	-.068	-.05	3030	-.002	-.44
616	0 3002	6.88 K0	12 53 4.811	-.14	0 19 33.43	-.8	7	8	56.71	56.65	17542	-.028	.20	3032	-.004	.11
617	44 2234	6.95 A0	12 54 20.314	.03	43 49 19.78	-.3	9	9	57.42	57.42	17572	-.025	.22	3034	-.020	-.32
618	9 2696	6.77 F5	12 54 42.512	-.54	8 33 49.19	2.4	6	6	56.31	56.31	17579	-.058	-1.43	3035	-.025	.13
619	18 2682	4.96 M0	12 56 27.065	-.24	17 40 42.43	2.2	7	7	55.86	55.86	17616	-.050	.30	3036	-.008	-.48
620	76 473	6.19 K0	12 57 18.601	.15	75 44 30.63	.6	12	12	58.30	58.30	17637	-.085	.17	3037	-.018	.32
621	31 2434	5.08 K0	12 57 53.000	-.16	31 3 15.03	-1.4	7	7	56.78	56.78	17647	-.009	-.28	3039	.002	-.31
622	60 1439	6.33 A0	13 0 37.423	-.32	59 59 5.01	-1.5	7	7	55.97	55.97	17702	-.045	.01	3041	.004	.13
623	28 2185	4.90 K5	13 4 46.836	.23	27 53 33.41	-7.8	6	6	56.65	56.65	17787	.006	.28	3045	.006	.17
624	6 2697	6.91 G0	13 6 18.801	.56	5 28 58.24	-68.8	7	7	56.39	56.39	17811	-.013	.65	3047	-.009	.23
625	17 2595	6.18 K0	13 7 20.325	-.47	17 6 53.30	-1.9	8	8	57.31	57.31	17825	-.020	.30	3049	.000	.02
626	63 1056	6.49 A0	13 7 54.347	-.42	62 29 42.54	-1.4	8	8	57.72	57.72	17837	-.086	.51	3050	-.005	.56
627	25 2610	6.46 K0	13 9 43.920	-.13	24 31 25.56	-3.6	7	6	56.15	56.14	17877	-.028	-.22	3052	-.037	-.16
628	12 2565	5.82 K5	13 10 3.572	-.36	11 49 17.04	-3.0	7	7	56.66	56.66	17884	-.006	-.59	3053	-.004	-.69
629	81 416	6.32 G5	13 11 56.890	-.36	80 44 8.79	.8	10	10	57.63	57.63	17932	-.016	.18	3056	.021	.20
630	73 587	6.43 A0	13 12 6.019	.49	73 3 49.12	-3.1	6	6	55.50	55.50	17934	-.083	.48	3057	.039	.42
631	0 2674	6.49 F0	13 13 51.367	-.36	-1 7 36.04	-1.8	7	7	56.22	56.22	17960	.076	-.87	3058	-.009	-.48
632	20 2814	6.29 A3	13 14 6.705	-.84	20 2 53.79	1.7	9	8	57.55	57.33	17970	.024	-.04	3059	-.001	-.39
633	69 694	6.11 B9	13 14 49.980	-.27	68 40 16.02	1.1	7	6	57.40	57.63	17991	-.157	.25	3060	-.040	.60
634	50 1994	5.13 A0	13 16 7.026	-.31	49 56 40.17	1.1	7	7	57.46	57.46	18009	-.091	.03	3063	-.043	-.25
635	35 2435	5.96 A5	13 16 46.358	-.24	35 23 24.25	.5	6	6	57.15	57.15	18023	-.020	.45	3064	.019	-.08
636	44 2265	6.58 F2	13 18 40.012	-1.35	44 15 5.31	1.5	9	9	56.64	56.64	18063	-.029	.59	3066	.003	-.30
637	2 2664	5.68 A0	13 19 8.964	-.42	2 20 57.82	-6.0	7	7	56.19	56.08	18079	-.014	.26	3067	.025	.11
638	4 3469	5.94 K0	13 20 43.226	-.13	-4 39 48.63	-2.1	7	7	55.71	55.71	18109	-.019	-.17	3069	-.020	.06
639	24 2578	5.75 A2	13 22 43.619	-.06	24 6 51.85	-1.5	7	6	56.42	56.48	18147	-.002	.18	3072	.008	-.28
640	0 2686	6.01 A3	13 23 37.559	-.75	- 0 55 59.02	-.1	6	6	56.77	56.77	18163	-.030	.13	3074	-.018	-.06
641	79 422	5.94 G5	13 26 29.710	-4.70	78 54 7.47	2.6	10	7	57.21	57.90	18223	-.319	.57	3075	.014	.18
642	11 2575	5.78 K0	13 26 44.285	-.42	11 4 36.62	-4.6	7	7	57.49	57.22	18234	-.019	.21	3076	-.004	-.28
643	7 2655	6.29 K5	13 27 29.536	.05	7 26 11.83	-.4	7	8	55.93	56.36	18249	-.028	.56	3077	-.019	.30
644	5 3714	4.83 M0	13 29 21.697	-.68	-5 59 53.80	-4.8	7	8	55.91	55.72	18288	-.037	.15	3079	-.014	.22
645	49 2227	4.63 A3	13 32 24.748	-1.28	49 16 15.83	1.9	6	6	56.30	56.30	18356	-.063	.28	3083	-.018	-.17
646	25 2652	5.90 M0	13 34 37.899	-.20	24 52 3.81	-1.0	6	6	54.99	54.99	18399	-.029	.27	3085	-.011	.06
647	55 1625	4.75 M0	13 38 50.572	-.26	54 56 2.82	-1.4	6	6	56.66	56.66	18504	-.029	.04	3087	.012	-.04
648	65 953	5.70 A0	13 39 56.500	.83	65 4 28.48	-1.9	8	8	57.97	57.98	18527	-.021	.91	3088	.018	.65
649	35 2474	5.98 K0	13 40 29.734	.15	35 14 24.83	.4	10	10	59.26	59.26	18539	-.078	.17	3089	.008	-.45
650	78 466	6.11 K0	13 42 24.665	-2.25	78 18 52.95	4.0	8	9	58.83	58.66	18583	-.050	.51	3090	.011	-.04

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ′	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
651	39 2680	5.57 K0	13 44 50.418	-1.17	38 47 31.67	-2.5	6	6	58.84	58.84	18636	-.024	.15	3094	.016	-.03
652	42 2440	6.78 K2	13 45 58.473	.25	42 17 48.36	-6.6	7	7	58.34	58.34	18651	-.063	.34	3095	.078	.54
653	31 2547	5.81 K0	13 46 23.367	-.13	31 26 16.36	3.4	7	7	58.83	58.83	18662	.015	-.09	3096	-.019	-.44
654	21 2578	5.06 K0	13 47 20.907	.12	21 30 41.61	1.0	7	7	57.35	57.35	18683	-.002	.14	3098	-.007	-.01
655	6 2800	6.25 K0	13 47 53.886	.15	5 44 40.46	-1.6	6	6	59.18	59.18	18698	-.074	.53	3100	.020	-.16
656	62 1318	6.05 K0	13 48 7.839	.95	61 44 17.39	-10.4	6	6	59.72	59.72	18704	-.068	.52	3101	.014	.64
657	35 2496	4.96 M0	13 49 35.164	-.18	34 41 28.28	-3.8	6	6	56.21	56.21	18741	-.018	.12	3102	.008	.01
658	69 724	6.44 K0	13 49 45.249	-3.45	68 33 45.97	-7.0	7	7	56.93	56.93	18744	.030	1.00	3103	.032	-.20
659	12 2635	5.99 A2	13 49 51.321	.16	12 24 41.69	-1.4	6	6	56.29	56.29	18746	-.014	.45	3104	-.002	.05
660	79 431	6.63 G5	13 50 9.142	-1.67	79 14 32.88	.2	8	7	59.72	59.15	18752	-.273	-.16	3105	.091	.02
661	29 2464	5.84 A5	13 50 54.201	-.93	28 53 36.43	2.1	7	7	57.93	57.93	18769	-.039	.19	3106	-.020	.22
662	0 2758	5.30 K0	13 52 7.901	-.55	-1 15 28.33	-3.1	6	6	56.30	56.30	18800	-.036	.36	3107	-.006	.11
663	14 2680	6.15 F5	13 53 25.334	-2.01	14 18 2.37	-.5	9	9	56.46	56.46	18830	-.008	.65	3109	.020	-.22
664	22 2650	5.42 A0	13 56 18.293	-.08	21 56 21.62	-5.2	9	8	56.62	56.69	18900	-.018	.12	3113	-.011	-.36
665	9 2835	5.88 A2	13 58 51.850	.23	9 8 9.02	.4	6	6	56.16	56.16	18941	-.019	-.84	3114	.017	-.65
666	46 1922	6.46 K5	14 0 13.022	.15	45 59 41.06	-7.9	9	7	58.25	58.36	18969	.023	-.43	3115	-.033	-.51
667	5 2836	6.28 F2	14 1 25.028	-.12	5 8 25.35	-.7	7	6	56.08	56.04	18993	.020	-.09	3118	.015	-.39
668	50 2047	5.44 M0	14 6 25.210	-.66	49 41 37.65	5.5	7	6	56.72	56.83	19095	-.017	.26	3124	-.009	-.00
669	75 529	6.34 A3	14 6 31.644	-1.51	74 49 49.53	1.1	8	8	58.12	58.12	19097	.004	.22	3125	-.003	.30
670	60 1516	6.50 K0	14 7 13.031	-1.59	59 34 26.34	-2.8	7	7	57.96	57.96	19109	-.115	.45	3126	-.039	.38
671	3 2867	4.90 A0	14 9 43.777	-.34	2 38 38.22	-3.4	7	6	56.55	56.64	19157	.016	.45	3127	.010	-.03
672	70 778	5.36 M0	14 11 7.724	-.48	69 40 1.15	-5.0	7	7	58.38	58.38	19189	-.160	.32	3128	-.053	.59
673	22 2678	6.40 A2	14 12 21.884	.28	22 6 21.34	-1.0	6	6	56.39	56.39	19224	-.025	.21	3130	-.016	.16
674	10 2654	5.36 G5	14 12 23.795	-.19	10 20 6.72	-16.0	9	8	57.85	58.08	19226	-.041	-.13	3131	.011	-.53
675	1 2938	5.24 K0	14 16 57.686	-.80	-2 2 7.21	-7.4	7	7	56.86	56.86	19323	-.012	-.13	3134	.004	-.41
676	16 2637	4.97 K0	14 17 23.148	-1.01	16 32 6.50	5.2	8	8	56.39	56.39	19334	-.009	.61	3135	-.007	.20
677	31 2605	6.34 A2	14 17 57.420	-.12	30 39 27.93	-.7	8	7	55.41	55.54	19345	.006	-.32	3136	.014	-.40
678	25 2770	6.15 F2	14 20 52.100	-1.22	25 33 49.83	6.4	7	7	56.74	56.74	19400	.031	.07	3139	.012	-.74
679	39 2764	6.32 K0	14 23 26.674	-.07	38 37 5.05	-2.2	7	7	55.79	55.79	19464	.021	-.33	3142	-.016	-.27
680	6 4009	5.74 K5	14 26 3.262	-.14	-6 40 37.00	-6.1	9	8	57.00	57.13	19516	.015	.44	3143	.008	.26
681	36 2495	6.19 K0	14 26 12.147	-.24	36 25 10.88	-1.0	6	6	57.00	57.00	19519	-.037	.08	3144	.005	-.28
682	1 2941	5.80 A3	14 27 17.372	.00	1 3 2.75	.1	8	8	57.63	57.63	19542	.031	.42	3145	.042	-.50
683	42 2508	6.45 G0	14 27 38.527	1.38	42 1 15.16	-22.5	8	8	57.49	57.49	19550	-.009	.48	3146	.001	.34
684	5 2886	6.13 K2	14 28 15.091	-.01	4 59 37.03	-2.1	6	6	56.37	56.37	19572	.026	.45	3149	.015	-1.35
685	63 1136	6.04 F5	14 29 34.524	-2.67	63 24 22.95	.3	10	9	57.96	58.23	19595	-.046	.73	3150	.065	.23
686	22 2715	5.96 F0	14 30 16.097	-.93	22 28 45.53	2.9	7	7	56.53	56.53	19611	-.023	.58	3151	.006	-.05
687	33 2474	6.28 F2	14 32 4.022	.91	32 45 9.98	-.3	7	6	56.41	56.57	19650	-.081	.01	3153	.049	-.55
688	57 1519	6.25 F5	14 32 45.096	2.64	57 17 12.21	-24.0	7	7	56.93	56.93	19666	-.060	.51	3154	-.016	.48
689	50 2095	5.90 K5	14 32 54.687	-.48	49 35 7.88	4.4	9	9	59.28	59.28	19668	-.018	.01	3155	.009	-.13
690	23 2710	6.48 K0	14 33 51.192	-.11	23 28 1.22	1.5	7	7	58.40	58.40	19687	-.017	.32	3157	-.019	-.48
691	80 448	6.35 K0	14 34 57.100	-3.64	79 52 36.91	8.3	8	9	58.23	58.35	19705	-.246	.39	3159	-.062	.13
692	18 2906	5.98 K0	14 35 54.405	-.23	18 30 53.26	-8.1	9	9	57.70	57.70	19726	-.002	.68	3160	.030	-.02
693	54 1693	5.52 A0	14 36 39.969	.15	54 14 18.91	-2.4	8	8	56.01	56.01	19742	-.003	-.36	3161	.019	-.51
694	8 2903	5.03 G5	14 39 11.258	-.04	8 22 28.68	-.4	7	7	57.10	57.10	19789	-.037	.30	3163	-.014	-.00
695	41 2523	5.79 K0	14 41 48.005	-.10	40 40 11.76	2.1	8	7	56.75	56.93	19841	-.040	-.23	3166	.013	-.06
696	15 2758	6.10 M3	14 43 44.465	-.58	15 20 27.58	.9	7	7	55.81	55.81	19885	-.016	.96	3168	-.011	.05
697	0 2886	6.06 A0	14 46 19.779	-.06	- 0 38 27.09	1.3	7	6	55.50	55.50	19932	-.012	-.39	3169	.001	-.82
698	10 2748	6.77 K0	14 47 0.604	-.34	10 15 7.24	-8.8	8	9	56.64	56.94	19946	-.012	.11	3170	.021	-.28
699	29 2581	5.66 A2	14 47 49.175	.16	28 49 18.99	-.5	7	6	55.70	55.91	19966	-.021	.28	3171	.011	-.39
700	24 2786	5.81 G0	14 48 1.526	1.09	24 7 2.06	2.3	10	11	57.44	57.36	19974	-.048	.17	3172	-.047	-.16

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
701	3 3696	4.59 F0	14 54 34.131	-.69	-4 8 37.94	-16.1	9	10	59.26	59.48	20115	.033	.71	3177	.004	.39
702	50 2126	5.68 F5	14 54 43.357	1.12	49 49 55.73	-23.1	10	10	58.89	58.89	20119	-.025	.10	3179	.048	-.02
703	39 2820	5.58 F2	14 57 41.820	-.28	39 27 46.01	3.1	6	6	55.87	55.87	20183	-.054	.76	3182	-.005	.26
704	2 3928	5.68 K5	14 58 43.778	.20	-2 33 28.32	-2.6	10	10	57.92	57.92	20202	.004	-.02	3183	-.001	-.44
705	25 2861	4.93 K5	14 59 54.951	-.05	25 12 17.12	-5.4	7	6	56.26	56.39	20224	-.055	.24	3185	-.078	-.06
706	16 2725	6.99 G0	15 0 13.806	-1.53	16 14 57.45	7.9	7	8	60.70	60.18	20231	-.027	1.05	3187	.065	-.19
707	60 1582	5.89 A2	15 0 16.562	-.31	60 24 0.77	1.2	8	7	61.05	60.86	20233	-.011	-.48	3188	.048	-.58
708	72 664	6.66 G0	15 0 21.938	-8.63	71 57 38.58	8.9	7	8	59.99	60.30	20236	-.120	-.32	3189	.013	.04
709	2 2905	4.62 K0	15 0 22.256	-.38	2 17 11.57	.5	7	7	59.52	59.52	20237	-.030	.61	3190	.008	-.03
710	35 2642	5.66 K0	15 1 6.192	-.36	35 24 2.44	.3	7	7	56.57	56.57	20252	-.028	.32	3191	-.007	-.04
711	45 2251	6.43 F5	15 1 20.450	-.87	44 50 20.55	.5	10	10	60.48	60.48	20258	-.082	.67	3192	-.022	-.17
712	6 3001	6.22 G5	15 5 11.310	-.06	5 41 22.34	-2.5	7	6	56.11	56.24	20346	-.007	.36	3196	.007	-.12
713	50 2146	6.27 K0	15 6 44.197	-.06	50 14 43.80	-2.8	9	6	55.50	55.72	20380	-.034	.59	3197	-.001	.13
714	19 2935	5.98 M3	15 9 47.628	-.09	19 9 47.05	.2	9	8	55.86	55.91	20442	-.038	.24	3199	-.019	-.10
715	23 2789	6.25 A0	15 11 19.095	.36	23 10 4.83	8.9	6	7	55.93	56.01	20474	-.053	.82	3201	.016	-.11
716	38 2629	6.42 K0	15 11 41.229	-.09	38 27 3.72	-4.8	11	9	58.68	58.41	20483	-.014	.76	3202	-.032	-.20
717	29 2640	5.26 A0	15 12 23.631	-.54	29 20 55.76	2.2	8	8	57.89	57.89	20495	-.004	.21	3204	-.019	.19
718	74 609	6.66 K0	15 17 47.451	-.28	74 13 32.89	3.8	8	7	57.92	58.27	20613	-.213	.02	3208	.092	.08
719	5 4057	5.60 K2	15 18 28.891	-.36	-5 38 43.76	-2.2	8	8	57.43	57.43	20636	-.002	.88	3209	.049	1.21
720	52 1869	5.52 A3	15 18 36.781	.11	52 8 16.41	.5	7	7	57.39	57.39	20641	-.027	.53	3210	.008	.20
721	13 2928	6.20 A0	15 20 1.015	-.03	12 44 43.26	-1.6	7	6	56.96	56.57	20681	-.033	.61	3213	-.013	.12
722	63 1192	5.78 K2	15 21 47.914	-.30	63 31 10.37	-9.8	9	9	59.07	59.07	20706	.002	.58	3215	.019	.11
723	45 2284	6.24 K2	15 22 23.831	-.23	45 26 48.78	-.8	6	6	58.74	58.74	20720	-.002	.55	3216	-.024	.46
724	34 2645	5.87 K0	15 24 19.797	-.87	34 30 32.33	4.8	6	6	55.25	55.25	20761	-.071	.10	3218	-.008	-.62
725	25 2916	6.26 K5	15 25 29.702	-.04	25 16 28.30	-2.9	7	6	56.13	56.24	20786	.000	.59	3219	-.018	.06
726	2 2965	5.12 A5	15 26 6.499	-.59	2 0 52.26	-4.5	6	6	55.48	55.48	20805	-.016	.60	3221	-.025	-.09
727	55 1756	6.30 A2	15 27 39.139	-.13	55 21 56.21	2.5	11	9	57.36	57.35	20833	-.033	.95	3222	.005	.70
728	64 1074	5.88 G5	15 30 13.140	-1.75	64 22 35.67	7.4	9	7	57.26	57.07	20894	-.057	.64	3225	.031	.52
729	0 2982	5.76 K0	15 30 23.168	-.09	-1 1 4.78	-4.2	6	6	56.26	56.26	20896	-.056	-.09	3226	-.023	-.11
730	77 592	5.33 K5	15 32 51.296	-1.49	77 30 59.92	.7	7	6	56.40	56.39	20952	-.072	.49	3229	-.012	.25
731	18 3044	6.06 K0	15 33 16.947	-.56	17 49 15.24	-2.2	7	6	56.83	57.23	20962	.004	.35	3230	-.006	.00
732	11 2826	6.11 G5	15 33 30.513	-.29	11 25 50.68	-1.9	7	7	55.16	55.16	20968	.115	.48	3231	-.104	-.13
733	85 263	6.98 K0	15 34 32.660	.12	84 59 40.58	-5.6	6	8	59.76	59.04	20994	-.268	.14	3959	-.262	-.22
734	35 2711	6.19 K0	15 36 52.813	.00	34 50 12.73	-2.4	10	9	56.71	56.96	21048	-.051	-.17	3238	-.012	-1.44
735	69 806	5.86 K0	15 37 29.985	-.96	69 26 40.86	4.7	9	9	57.43	57.43	21065	-.117	.55	3240	.026	-.07
736	13 2982	5.26 A0	15 39 26.095	.26	13 0 23.86	-2.0	8	6	55.34	55.63	21105	-.016	.50	3243	-.023	.10
737	81 523	6.97 G5	15 39 47.680	-1.67	80 46 30.49	4.6	7	7	56.13	56.31	21114	-.187	-.03	3244	.176	-.15
738	52 1898	5.48 A0	15 41 28.979	-.70	52 31 4.60	2.5	7	7	55.86	55.86	21154	-.046	.19	3247	-.008	-.06
739	2 2989	5.80 G5	15 41 30.713	-.56	2 40 27.24	-15.7	7	6	56.01	56.27	21155	.062	.68	3248	-.006	.18
740	32 2621	5.60 K0	15 42 0.946	-.28	32 40 21.44	-1.9	8	7	57.14	56.83	21161	-.028	.45	3249	-.019	.11
741	26 2737	4.73 G5	15 47 29.713	-.59	26 13 13.20	-7.5	7	6	57.57	57.28	21276	-.013	.70	3252	.000	.02
742	13 3024	6.16 G0	15 50 52.209	-1.05	13 21 6.87	-56.4	9	10	57.28	57.20	21337	-.014	.10	3254	-.021	-.04
743	56 1838	5.92 K0	15 51 6.546	-.25	55 58 25.34	5.1	10	9	57.21	56.98	21345	-.044	.08	3255	.010	-.15
744	9 3116	6.20 A2	15 52 15.150	-.02	8 43 34.48	-.6	7	6	55.71	55.77	21367	-.006	.25	3256	.000	-.60
745	20 3166	5.76 K5	15 52 22.276	-.58	20 27 22.41	3.9	11	10	57.69	57.91	21368	-.007	-.13	3257	.008	-.31
746	38 2712	5.47 F2	15 53 58.298	.30	38 5 25.34	7.4	7	7	55.31	55.59	21402	-.097	.38	3259	-.017	.01
747	50 2239	5.90 F0	15 57 39.077	.06	50 1 21.91	-6.1	6	6	57.05	57.04	21499	.063	.79	3260	.012	-.04
748	4 3096	5.90 K0	15 58 22.058	-.31	4 33 57.75	7.0	8	8	58.90	58.90	21508	.018	.64	3262	.015	.26
749	18 3101	5.28 G5	15 58 59.395	-.37	17 57 19.03	14.5	7	6	58.82	58.74	21525	.014	.54	3263	.010	-.12
750	30 2738	4.91 A0	15 59 26.279	-.24	29 59 23.10	-1.5	7	7	56.30	56.30	21534	-.046	.06	3264	-.008	-.38

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
751	23 2886	4.82 A2	16 0 8.350	.08	22 56 30.94	1.5	8	7	57.56	58.04	21552	-.068	.35	3268	-.047	-.22
752	65 1095	7.10 A2	16 0 28.373	-.07	65 5 18.79	-1.1	8	6	56.34	56.62	21560	.071	.80	3270	.059	.28
753	46 2142	4.64 B9	16 1 14.270	.52	46 10 28.88	-6.7	9	9	56.74	56.74	21580	-.057	.54	3271	-.018	.37
754	70 863	6.74 A0	16 4 58.919	.49	70 23 43.31	3.0	6	7	55.05	54.95	21669	-.234	-.16	3272	.085	.42
755	10 2958	5.63 A5	16 5 14.133	-.14	10 1 27.53	-1.5	6	6	55.78	55.95	21682	-.039	.73	3274	-.009	.45
756	68 864	5.40 A0	16 6 10.691	-.67	67 56 30.77	6.0	7	6	57.54	57.25	21705	-.048	.65	3276	.029	.39
757	17 2982	5.90 A0	16 9 12.785	.02	16 47 37.55	-.4	8	6	54.53	54.53	21777	-.009	.28	3279	-.001	.42
758	42 2683	6.01 K5	16 10 8.149	-.09	42 30 5.81	2.1	7	7	55.45	55.75	21802	-.018	.09	3281	-.080	-.78
759	13 3089	6.96 A3	16 10 37.553	.32	12 55 37.11	1.1	9	8	56.44	56.68	21808	-.201	.79	3282	.032	-.06
760	5 3165	5.64 K0	16 10 46.845	.27	5 8 51.22	-1.3	7	6	56.75	56.79	21815	-.011	.66	3283	.031	.26
761	21 2886	6.58 A2	16 10 57.905	-.16	21 41 32.98	.9	7	6	57.57	57.29	21820	-.132	.93	3284	-.024	1.19
762	29 2803	5.73 A0	16 14 44.448	.12	29 16 22.12	-2.5	11	10	57.29	56.90	21900	-.032	.64	3287	-.019	.37
763	73 713	5.98 A0	16 15 21.345	-.38	73 31 3.66	2.8	7	6	55.87	55.76	21916	-.120	1.03	3289	-.111	.79
764	26 2817	6.63 G5	16 16 19.188	-.07	26 1 1.86	-.4	8	8	56.43	56.43	21937	.008	.10	3290	-.001	-.16
765	60 1665	5.64 M3	16 16 24.937	.10	59 52 33.00	2.0	10	9	57.86	58.12	21943	-.053	.73	3291	-.004	.24
766	49 2491	6.19 K0	16 17 47.203	-.22	49 9 24.98	2.7	8	9	56.39	56.41	21974	-.074	-.01	3292	.003	.09
767	40 3005	5.54 F2	16 18 12.213	-1.09	39 49 38.33	-.6	9	9	58.00	58.00	21984	-.064	.68	3293	.023	.19
768	31 2845	4.72 K0	16 20 8.807	-.77	31 0 25.25	10.6	7	7	56.70	56.70	22020	-.022	.66	3294	-.021	.41
769	37 2750	5.53 A3	16 23 37.170	-.01	37 30 24.70	-1.7	6	7	56.24	56.28	22108	.015	.39	3296	-.006	.12
770	0 3529	5.47 K2	16 26 0.971	-.04	0 46 31.92	-7.0	8	6	55.69	55.79	22148	.037	.31	3300	.018	-.08
771	42 2714	5.02 M3	16 26 59.861	.22	41 59 26.37	-.8	9	9	57.66	57.66	22172	-.001	.00	3303	-.006	-.12
772	51 2106	6.37 K0	16 27 26.689	.26	51 30 58.69	-.4	9	7	57.70	58.20	22185	-.020	.79	3304	-.015	-.52
773	79 498	5.54 A3	16 28 27.667	-3.98	79 4 19.96	10.9	6	7	58.13	58.62	22205	-.076	.31	3305	.080	.49
774	35 2828	6.47 K5	16 29 12.684	.05	35 19 54.17	-3.2	9	8	56.82	56.37	22224	-.106	.85	3308	.011	-.03
775	5 3223	5.56 B8	16 30 7.897	.10	5 37 34.59	-.5	10	8	57.18	57.73	22244	-.015	.44	3309	.005	.19
776	11 3008	4.92 K5	16 30 15.762	-1.22	11 35 38.58	-8.4	7	7	56.72	56.72	22250	-.008	.44	3310	.008	-.09
777	17 3053	6.27 A0	16 33 11.686	-.04	17 9 32.60	-.7	8	9	57.85	58.12	22314	-.018	.48	3313	.007	-.13
778	46 2194	5.95 G5	16 34 43.515	-.15	46 42 49.04	.4	8	7	56.61	56.92	22344	-.020	-.11	3314	-.029	.16
779	13 3177	6.20 F2	16 35 29.613	-.26	13 47 13.34	-6.3	7	6	56.62	56.81	22361	-.008	.54	3316	-.006	.31
780	27 2661	7.08 M0	16 35 47.194	-.04	27 8 35.44	-4.0	9	7	56.14	56.31	22369	.014	.64	3318	.080	.03
781	56 1907	5.44 G5	16 36 59.588	.00	56 6 45.46	6.5	10	9	56.85	56.99	22398	-.051	.05	3320	.014	-.00
782	25 3115	6.22 K2	16 38 56.091	-.22	24 57 13.89	.0	7	7	56.73	56.73	22452	-.013	-.24	3323	.007	-.01
783	1 3290	5.86 F0	16 39 10.387	-.72	1 16 30.40	4.8	7	7	57.21	57.21	22460	.021	-.07	3324	.012	-.29
784	64 1145	5.00 K0	16 40 33.892	.02	64 41 1.33	-1.9	9	7	56.78	57.31	22489	-.103	.65	3326	.043	.54
785	50 2319	6.64 F5	16 41 8.295	1.27	50 1 51.88	-11.8	8	7	56.95	57.04	22501	-.018	.52	3328	-.067	-.11
786	34 2830	5.90 F2	16 42 0.868	-.59	34 7 46.98	4.8	6	8	56.79	57.08	22522	-.025	.16	3330	-.012	-.60
787	8 3271	5.38 K2	16 43 25.706	-.02	8 40 20.10	1.0	9	8	57.57	57.83	22560	-.012	.06	3332	-.002	-.48
788	5 3272	5.28 A0	16 45 18.558	-.15	5 20 5.96	-4.2	7	6	56.62	57.01	22605	-.014	.30	3333	-.019	-.15
789	42 2749	6.15 M3	16 45 43.602	-.02	42 19 37.12	-2.9	9	7	57.93	58.47	22611	-.020	.29	3336	-.076	-.15
790	53 1897	7.13 K0	16 48 13.982	-.28	53 0 7.32	-.3	8	8	58.22	58.22	22672	-.030	.23	3338	-.013	.05
791	30 2884	5.86 K5	16 48 41.748	-.06	29 53 26.13	-.6	7	7	57.62	57.76	22682	-.008	.11	3339	.005	-.32
792	18 3261	6.87 F5	16 50 28.157	.08	18 8 39.73	-4.0	9	10	57.90	58.37	22732	.048	1.02	3340	.030	-.12
793	5 4374	5.35 K0	16 51 55.165	-.26	-6 4 25.39	-2.3	7	8	59.91	59.86	22783	.002	.21	3342	.019	.25
794	21 3002	5.48 K0	16 52 45.761	.38	21 2 15.73	-.2	8	7	57.75	58.20	22802	-.018	.35	3343	-.008	.24
795	60 1713	7.16 K0	16 53 20.672	.26	60 26 30.40	-1.5	9	7	57.71	58.37	22817	-.063	-.16	3344	-.014	.07
796	70 906	6.95 A2	16 54 55.859	-.27	70 32 34.28	-5.6	8	6	56.12	56.14	22855	.006	1.63	3345	.051	.40
797	14 3155	6.51 G5	16 55 14.460	-.61	13 57 33.56	6.5	8	8	56.21	56.47	22861	.012	-.01	3346	.004	-.44
798	24 3095	6.36 K0	16 55 37.701	.03	24 27 26.52	-3.1	8	6	56.51	56.69	22870	.000	.33	3347	.020	-.81
799	42 2774	6.38 K2	16 56 15.452	-.11	42 35 18.76	-5.9	9	9	58.82	58.83	22882	-.027	.86	3349	-.043	-.59
800	73 751	6.24 A5	16 57 15.354	-.07	73 12 14.35	-2.5	8	6	58.10	57.80	22910	-.148	.15	3351	-.059	.48

No.	B.D. No.		M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
								α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
801	6	3332	6.38 A5	16 58 2.960	.24	6 39 26.15	-4.5	11	11	60.00	60.00	22927	.023	.30	3352	.050	-.13
802	56	1934	6.11 K0	16 58 26.258	-.60	56 45 41.23	3.1	7	7	59.82	59.82	22938	-.063	.74	3353	.007	.14
803	25	3183	5.95 K0	17 0 15.579	.38	25 34 29.27	8.4	8	6	55.10	55.29	22985	-.010	.46	3356	-.021	.32
804	0	3224	5.62 B3	17 2 57.494	.00	- 0 49 30.05	-.5	11	8	56.57	56.98	23058	.008	.48	3357	.000	.05
805	49	2583	6.32 K0	17 3 29.978	.30	48 52 19.53	-7.7	11	9	57.07	57.51	23071	-.075	.37	3359	-.025	-.17
806	22	3073	5.72 K2	17 4 10.997	-.73	22 9 2.28	-4.7	11	11	58.12	58.12	23089	-.008	.97	3360	-.009	.15
807	40	3109	5.12 K0	17 7 55.918	-.48	40 50 19.28	.4	10	8	58.18	58.84	23172	.051	.51	3365	-.031	.09
808	52	2032	6.13 B9	17 9 21.728	-.14	52 28 9.06	-1.3	9	9	59.29	59.29	23200	-.070	.21	3367	.009	-.23
809	10	3165	5.56 K5	17 10 6.256	.04	10 38 39.16	-3.0	8	8	58.38	58.38	23220	-.028	-.01	3369	-.011	-.21
810	63	1336	5.47 A3	17 12 6.390	.20	62 55 52.13	4.8	8	7	56.40	56.37	23266	-.076	.18	3370	-.018	.22
811	11	3156	5.28 K5	17 16 15.814	.01	10 55 2.06	-9.6	7	7	56.22	56.22	23382	.005	.17	3372	.001	.08
812	38	2910	5.98 K0	17 16 42.420	-.16	38 51 41.87	7.1	11	9	58.05	58.71	23390	.006	.37	3373	.003	-.06
813	28	2719	5.78 K0	17 16 50.733	.32	28 52 26.04	-.9	9	9	59.43	59.43	23393	-.005	-.15	3375	-.009	-.37
814	46	2293	5.77 K2	17 18 56.212	-.32	46 17 20.22	4.0	8	8	55.87	56.10	23452	-.054	.04	3377	-.015	-.18
815	70	925	7.00 A0	17 19 32.713	-.45	70 50 12.61	1.4	8	6	56.17	56.54	23472	.072	.94	3380	.028	.28
816	53	1937	5.95 K5	17 20 40.295	.21	53 28 2.11	-.7	13	9	55.98	56.54	23505	-.051	.44	3381	.021	.07
817	23	3100	5.70 A3	17 22 0.913	-.32	23 0 19.87	-4.5	9	9	57.92	57.92	23546	-.031	.71	3383	-.032	.22
818	80	544	5.91 K2	17 23 22.490	.64	80 10 58.73	.0	7	6	56.81	57.01	23599	-.227	.36	3384	-.233	.37
819	7	3368	5.98 A0	17 23 54.053	-.01	7 38 16.47	-.9	6	6	59.07	59.56	23614	-.024	.22	3385	.010	-.72
820	27	2809	6.36 A5	17 24 0.560	.02	26 55 14.89	1.6	9	9	59.82	59.82	23619	.002	.44	3387	-.004	.33
821	20	3481	5.42 B5	17 24 39.532	-.02	20 7 20.02	1.3	10	10	61.19	61.19	23641	.013	.38	3388	-.004	.00
822	34	2971	5.91 B9	17 24 58.256	-.31	34 44 11.25	3.7	6	6	59.81	59.81	23647	.035	.23	3389	-.011	-.32
823	58	1731	6.52 A2	17 25 19.640	-.11	58 41 35.10	1.2	7	7	56.97	56.97	23654	-.052	-.08	3390	-.036	-.01
824	0	3697	5.16 A5	17 26 16.486	-.42	0 22 10.62	1.1	7	8	55.40	55.54	23677	-.020	.72	3391	.024	-.21
825	5	4461	5.69 A2	17 30 49.528	-.32	-5 42 35.08	-10.2	11	8	57.25	58.13	23788	-.005	.61	3392	-.033	-.15
826	19	3354	5.59 F5	17 31 12.347	-.24	19 17 29.12	-9.7	8	7	56.54	56.53	23798	.010	-.02	3393	.008	-.31
827	16	3218	5.66 K0	17 31 25.095	-.15	16 21 5.59	-6.1	8	7	57.78	57.96	23803	.069	.31	3394	.032	.01
828	37	2908	6.15 K0	17 33 59.140	.10	37 19 55.69	-1.6	11	8	56.79	57.37	23863	-.033	1.36	3395	-.129	-.55
829	74	717	7.06 K2	17 34 3.384	-1.78	74 15 33.42	3.6	9	8	57.64	57.91	23865	.027	.56	3396	.048	.45
830	30	3033	5.76 A2	17 34 42.462	.21	30 48 52.97	-1.1	8	8	56.67	56.66	23879	-.006	.23	3397	.067	-.31
831	62	1559	7.14 K2	17 34 44.449	-.45	62 29 30.78	-.6	8	7	58.64	58.23	23883	-.097	-.26	3398	-.067	-.59
832	24	3218	5.67 A0	17 35 27.378	-.11	24 20 18.12	-.1	11	9	57.06	57.53	23901	-.023	.30	3400	.010	-.26
833	57	1791	6.84 K0	17 39 46.178	-.19	57 20 2.69	3.1	14	9	56.07	56.32	24010	.014	.17	3406	.096	.38
834	14	3321	6.21 F5	17 41 5.201	-.07	14 18 58.70	2.7	8	8	55.92	56.04	24052	.029	.03	3407	-.052	.05
835	44	2757	6.57 K2	17 41 36.511	-.38	44 6 18.88	3.8	10	8	56.93	57.28	24067	-.006	.01	3408	-.022	-.13
836	31	3090	6.25 B9	17 43 47.310	-.05	31 31 23.67	-.4	10	9	55.31	55.61	24116	.033	.18	3410	.048	-.17
837	38	2997	6.51 K0	17 44 13.712	.03	38 53 59.93	-3.8	11	9	57.71	57.74	24128	-.044	.57	3411	.033	.12
838	36	2937	6.63 K5	17 45 7.983	.05	36 6 17.09	-2.9	8	8	57.17	57.17	24155	-.009	-.26	3414	.008	-.15
839	25	3353	5.34 K0	17 46 47.376	-.06	25 38 17.19	-4.3	6	7	57.86	57.67	24199	-.016	.02	3415	-.006	-.45
840	50	2468	5.19 A2	17 47 52.510	-.55	50 47 31.86	20.4	11	11	58.72	58.72	24221	-.025	.62	3416	-.034	.01
841	48	2581	6.43 B8	17 48 44.687	-.02	48 24 24.66	.9	6	7	56.47	56.47	24253	-.043	.56	3417	-.003	-.12
842	1	3412	6.45 K0	17 49 24.251	-.12	-1 13 31.94	-.4	8	7	58.13	58.63	24271	.034	.38	3418	.011	-.18
843	40	3228	6.06 K0	17 50 26.956	-.15	39 59 30.83	4.7	7	7	56.86	56.86	24309	-.028	.12	3419	-.033	-.18
844	6	3566	5.82 F5	17 50 47.970	-.85	6 6 36.28	6.9	9	8	57.23	57.84	24320	.004	-.01	3420	-.006	-.52
845	11	3283	6.26 F5	17 51 53.762	-.52	11 8 28.78	-17.6	7	6	57.23	57.34	24349	.068	.76	3422	.014	-.17
846	22	3237	5.69 K2	17 53 44.651	-.04	22 28 13.51	-.3	10	9	57.95	58.20	24392	-.019	-.11	3427	-.002	-.58
847	55	1995	6.10 F0	17 54 28.557	.37	55 58 33.05	11.6	7	6	55.79	56.01	24410	-.028	.65	3428	-.035	.11
848	72	818	5.54 F2	17 56 2.851	.07	72 0 38.67	.0	8	6	56.16	56.19	24459	-.102	.96	3429	-.034	1.05
849	6	3597	6.18 B3	17 58 26.402	.00	6 16 7.71	-.6	7	7	56.86	56.86	24515	-.035	.29	3432	-.001	-.05
850	45	2638	5.92 K2	17 58 30.383	-.09	45 30 10.14	-3.8	7	7	57.70	57.70	24518	.014	.53	3433	.009	-.09

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
851	33 3009	6.27 K5	17 59 45.919	.16	33 18 36.40	2.4	7	6	55.35	55.50	24554	-.013	-.16	3434	-.043	-.05
852	66 1077	6.87 F5	18 5 14.169	.30	66 56 20.77	1.4	8	7	55.82	55.98	24704	-.070	.37	3440	.091	.15
853	50 2525	6.35 K0	18 5 41.613	-.03	50 48 50.31	9.9	9	9	57.39	57.39	24714	-.021	.26	3441	.014	.07
854	14 3427	6.30 A2	18 6 16.989	-.11	14 16 32.38	-1.8	9	9	57.99	57.99	24734	.031	1.24	3442	.019	-.11
855	20 3674	4.32 B3	18 6 37.101	.00	20 48 18.92	-1.2	7	6	57.58	58.23	24740	-.010	.33	3443	.005	.04
856	3 3620	5.70 K0	18 8 10.326	.14	3 18 46.19	-.1	10	8	56.13	56.54	24783	-.011	-.07	3445	.013	-.17
857	54 1950	5.94 K0	18 9 30.040	1.29	54 16 15.70	24.8	12	9	56.87	57.53	24820	-.059	.30	3447	.009	.13
858	31 3199	5.02 M0	18 10 1.155	-.10	31 23 30.04	1.9	8	7	56.21	56.15	24831	-.023	.60	3448	-.005	-.17
859	60 1813	6.32 A0	18 10 30.925	-.18	60 23 46.33	.5	8	8	57.58	57.80	24848	.019	-.36	3449	.050	-1.06
860	38 3113	5.88 A0	18 11 24.620	-.13	38 45 30.67	.7	12	9	56.28	56.86	24874	.012	.26	3451	-.088	.17
861	68 984	6.11 K0	18 15 34.454	.27	68 44 17.02	-6.1	8	7	58.60	58.89	24975	-.036	.63	3455	-.009	.26
862	13 3593	6.18 B5	18 15 45.483	-.07	13 45 24.30	-2.6	6	6	57.24	57.24	24977	-.002	1.48	3456	-.005	.23
863	24 3381	5.49 K5	18 17 7.132	.06	24 25 26.14	-.3	10	10	58.43	59.03	25003	-.005	.42	3457	.036	-.35
864	49 2782	5.09 M0	18 20 15.788	-.30	49 5 43.97	4.9	8	7	56.55	56.70	25085	-.042	.40	3458	-.032	.05
865	17 3555	5.48 K0	18 20 36.388	.46	17 48 0.07	1.8	12	8	56.55	57.31	25093	.017	-.02	3460	.007	-.12
866	39 3410	5.04 A2	18 22 34.846	-.19	39 28 44.16	-1.1	8	7	57.44	57.71	25137	-.037	.59	3463	-.014	-.13
867	65 1271	4.99 K0	18 25 50.449	1.61	65 31 57.07	-2.8	8	7	56.27	56.53	25212	-.011	.42	3465	.015	.35
868	79 587	6.61 K0	18 27 23.128	-1.04	79 11 25.93	7.5	9	8	57.18	57.38	25244	.238	-.53	3467	.012	-.03
869	3 3727	6.50 B5	18 27 36.044	-.07	4 1 49.99	-2.0	8	7	58.81	58.82	25256	.047	1.24	3469	.008	.21
870	23 3363	5.99 K5	18 30 41.232	.04	23 34 41.79	1.0	6	6	59.38	59.38	25328	.018	.26	3472	.034	.16
871	52 2232	6.43 B9	18 31 2.603	-.16	52 4 38.04	.5	6	6	59.86	59.86	25343	-.014	.21	3474	.009	-.14
872	56 2113	4.95 F8	18 31 42.669	-.11	57 0 24.55	-.7	8	7	58.49	59.04	25362	-.017	.22	3475	-.015	.28
873	86 282	6.82 M0	18 31 47.968	-.69	86 37 43.45	2.9	10	9	60.79	61.02	25364	-.334	.43	3960	.151	.33
874	20 3847	6.44 A2	18 32 10.393	-.01	20 25 34.85	-.6	7	6	58.40	58.89	25371	-.004	.52	3476	-.014	-.03
875	0 3521	5.80 A0	18 35 1.751	.05	- 0 21 11.10	-2.4	9	9	59.13	59.13	25456	.022	.35	3480	.012	.28
876	43 3027	6.26 A5	18 35 13.600	.21	43 10 42.59	-1.4	11	8	58.92	59.67	25464	-.055	.73	3481	-.062	-.08
877	14 3603	6.86 A0	18 36 18.343	.06	15 2 17.56	3.3	10	7	57.89	58.15	25497	.002	-1.21	3483	-.031	.50
878	62 1637	5.60 A0	18 37 6.339	-.14	62 28 50.49	4.2	6	6	56.94	56.94	25519	-.079	.34	3484	.010	-.19
879	5 3891	6.30 G0	18 37 9.137	.06	5 13 4.45	-1.5	13	10	58.68	59.43	25520	-.014	1.43	3485	.018	-.34
880	31 3332	6.47 A0	18 39 47.934	.01	31 34 5.51	.4	9	9	57.32	57.32	25583	-.003	.08	3487	.016	-.68
881	55 2107	5.08 A0	18 41 39.776	-.06	55 29 17.52	2.0	7	7	55.73	55.73	25635	-.029	.19	3491	-.001	.18
882	41 3137	5.88 B9	18 44 36.972	-.06	41 23 12.91	-.9	10	8	57.53	58.04	25732	-.010	.52	3493	-.081	-.52
883	4 3884	6.34 K5	18 45 33.710	.01	4 11 5.10	-.3	8	8	59.30	59.30	25756	-.033	1.08	3494	.036	-.12
884	48 2770	6.02 A3	18 46 56.889	-.20	48 42 34.12	4.2	10	8	56.25	56.56	25799	-.029	.61	3497	-.040	-.08
885	3 4392	6.04 A3	18 48 44.548	-.03	-3 22 40.63	-2.7	8	8	58.06	58.06	25862	.003	.29	3500	-.009	-.37
886	79 604	6.33 A5	18 49 11.478	.78	79 53 4.71	7.5	10	10	58.17	58.17	25868	-.109	-.24	3501	-.117	.47
887	13 3787	6.09 B9	18 49 44.338	-.07	13 54 16.37	-1.9	11	7	57.00	57.49	25886	.013	1.34	3503	.022	.76
888	36 3307	5.51 B3	18 51 58.674	-.02	36 54 29.13	-.6	10	6	56.79	57.30	25934	-.007	.19	3506	.016	-.38
889	10 3720	6.83 K2	18 52 0.478	.08	10 44 38.82	2.4	6	6	56.77	56.77	25937	-.014	-.69	3507	.022	-.70
890	22 3524	4.56 G0	18 52 38.152	.02	22 34 49.52	.1	9	8	57.57	57.70	25954	.000	-.06	3508	.010	.21
891	6 3978	5.66 G5	18 53 1.113	.10	6 33 4.45	-9.0	7	6	59.17	59.25	25964	.016	.21	3509	.014	.34
892	57 1922	5.71 K0	18 55 54.231	-.46	57 44 52.94	-6.9	9	9	56.64	56.64	26049	-.042	.56	3513	-.048	.07
893	65 1309	5.78 K0	18 56 12.432	-.43	65 11 26.66	-1.8	9	8	56.05	56.23	26055	-.017	-.29	3514	.019	-.04
894	50 2708	5.24 B3	18 58 58.143	.19	50 27 42.79	-.1	10	7	56.14	56.68	26138	-.115	.64	3515	-.005	.07
895	69 1018	6.40 B9	18 59 11.481	.36	69 27 37.12	-4.2	9	6	56.05	56.27	26146	-.240	2.27	3517	-.023	.18
896	26 3429	5.50 B3	18 59 15.383	-.08	26 13 8.97	-1.2	7	7	55.94	56.48	26151	.008	.22	3518	.001	-.16
897	82 572	6.83 A0	18 59 20.993	.53	82 18 5.65	2.2	9	7	56.61	56.46	26155	.059	-.16	3961	.092	-.07
898	19 3888	6.25 K0	19 0 41.767	-.03	19 35 12.56	-.8	8	6	54.91	55.04	26198	.006	.31	3521	.024	-.25
899	10 3787	5.10 B8	19 4 37.316	-.04	10 59 34.02	-3.1	7	8	56.92	56.88	26315	.005	.01	3525	.037	.02
900	41 3232	6.15 B3	19 4 39.701	-.03	41 20 7.25	-.9	9	7	58.89	58.82	26318	.008	.46	3526	-.047	-.32

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	$100\mu'$	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	$\Delta\alpha$	$\Delta\delta$	No.	$\Delta\alpha$	$\Delta\delta$
901	16 3758	6.46 F5	19 6 25.852	-.22	16 46 18.82	-9.9	9	7	57.30	58.06	26374	-.010	.21	3529	-.040	.69
902	5 4040	5.37 F2	19 6 32.908	-.10	5 59 35.63	-7.8	10	6	56.28	56.41	26379	.003	.55	3530	-.001	.17
903	65 1326	6.19 A2	19 9 34.725	-.01	65 53 41.30	3.3	12	8	58.17	58.69	26449	-.027	.04	3531	.018	.13
904	31 3497	5.77 A0	19 9 50.862	-.10	31 11 55.60	-.3	10	8	56.39	55.63	26459	.029	-.04	3532	.023	-.30
905	56 2209	5.24 K0	19 10 43.801	.44	56 46 23.95	4.4	6	7	57.29	56.91	26475	-.022	-.07	3535	.018	-.31
906	76 717	5.06 F0	19 11 1.113	1.34	76 28 41.98	-12.1	7	7	57.18	57.59	26484	-.060	.08	3536	.102	.08
907	2 3824	5.10 B8	19 11 11.394	.04	2 12 25.34	.0	10	8	59.64	60.28	26490	.012	-.36	3537	.023	-.52
908	21 3713	4.60 B5	19 14 3.978	-.07	21 18 3.03	-.5	8	6	56.25	56.80	26569	.009	.18	3540	.033	.02
909	46 2658	6.04 F5	19 15 25.257	-.16	46 54 15.69	28.8	10	7	56.70	57.17	26604	.028	.83	3541	-.024	.33
910	40 3665	6.70 A0	19 17 17.724	.02	40 16 1.90	1.0	10	10	57.36	57.76	26653	.010	.10	3543	.018	-.56
911	5 4936	5.10 G5	19 17 52.725	.74	-5 30 38.92	4.7	11	7	57.59	57.54	26669	.010	-.09	3544	.008	-.19
912	34 3503	6.29 B8	19 18 43.437	.05	35 5 28.10	.8	7	7	56.00	56.00	26690	-.020	-.20	3545	-.036	-.57
913	0 3725	5.95 K0	19 19 47.230	.32	- 0 20 54.74	-2.8	8	6	56.72	57.10	26723	.022	.12	3546	.009	-.40
914	65 1345	4.63 A2	19 20 24.837	.21	65 37 5.63	4.1	9	9	58.17	57.91	26735	-.095	.63	3547	.001	.36
915	9 4081	6.25 F8	19 20 25.393	.06	9 48 52.54	9.4	7	7	56.16	56.16	26736	-.060	.84	3548	.002	-.16
916	83 552	6.34 A2	19 21 39.137	.44	83 22 9.99	1.0	9	9	59.11	59.11	26773	-.005	.65	3962	.155	.85
917	49 2994	6.31 B9	19 22 5.049	-.02	50 10 22.07	1.6	7	6	56.42	56.73	26782	-.025	.47	3549	-.023	.10
918	29 3584	4.86 B3	19 22 9.191	.09	29 31 20.32	1.0	7	6	57.88	58.28	26785	-.009	.09	3550	.010	-.21
919	36 3557	5.15 A0	19 24 20.977	.00	36 12 59.50	.7	9	9	57.67	57.67	26846	-.016	.38	3554	.002	-.03
920	13 4020	6.26 B5	19 25 15.871	-.12	14 10 47.93	-1.3	8	6	57.10	57.62	26875	.107	.52	3555	-.001	-.26
921	62 1716	6.46 K5	19 25 51.874	.23	62 27 16.03	5.0	8	7	56.61	56.32	26888	.046	.20	3556	.020	.38
922	70 1073	6.25 K2	19 31 24.739	-.21	70 52 51.50	5.7	8	8	55.63	55.63	27023	-.120	-.75	3561	-.044	.02
923	59 2060	6.43 K5	19 32 23.080	.12	60 2 56.52	-.3	8	9	56.92	56.67	27048	-.055	.75	3563	.047	-.04
924	22 3741	6.12 B9	19 33 59.924	.00	22 28 25.49	-2.7	8	8	56.62	56.62	27097	-.010	1.36	3564	.016	-.32
925	74 831	7.13 K0	19 36 13.817	.28	74 15 52.32	1.8	7	8	55.74	55.61	27174	-.137	.39	3568	-.019	.49
926	3 4097	6.37 B3	19 36 18.759	-.06	3 15 59.85	.4	11	9	57.23	57.26	27176	.043	.11	3569	.014	.41
927	29 3684	4.79 K0	19 37 24.028	-.02	30 2 12.85	3.9	7	6	56.07	56.28	27203	.014	-.05	3570	.016	-.22
928	54 2193	5.86 F5	19 37 33.698	.43	54 51 21.57	16.6	10	7	56.47	56.86	27206	-.053	.16	3571	-.030	.19
929	42 3413	5.39 B8	19 37 48.744	.15	42 42 6.35	2.7	9	7	57.07	57.18	27213	.013	.36	3572	-.002	-.06
930	0 3813	5.52 A0	19 38 8.743	.09	- 0 44 18.89	1.5	7	7	57.71	57.71	27222	-.025	-.10	3573	-.002	-.22
931	13 4098	5.84 B3	19 38 46.555	-.05	13 41 53.90	-1.8	7	7	57.71	57.71	27235	-.016	.61	3574	-.017	.39
932	45 2949	5.05 F2	19 39 17.508	.83	45 24 20.44	11.1	8	7	57.89	58.06	27249	-.065	1.07	3575	.005	.23
933	32 3531	5.89 A2	19 40 49.072	-.09	32 18 25.58	-.9	9	9	55.60	55.49	27292	.061	.62	3577	-.047	-.85
934	3 4701	6.50 B3	19 43 15.361	.00	-3 0 22.06	-.2	7	6	56.32	56.45	27344	-.009	.15	3579	.009	-.25
935	40 3902	5.62 B2	19 48 54.256	-.06	40 28 17.80	-.9	7	6	57.32	57.61	27492	.003	.53	3584	-.034	-.17
936	22 3833	4.91 B3	19 48 54.846	.12	22 28 54.16	-2.1	9	7	58.81	59.87	27493	.012	.39	3585	.007	.24
937	52 2547	5.17 K2	19 49 22.404	-.15	52 51 37.73	-6.9	9	9	60.63	60.63	27506	-.021	.35	3586	-.008	.19
938	24 3914	5.67 F5	19 49 55.268	-.07	24 51 45.31	1.1	9	9	60.57	60.57	27516	.012	-.62	3587	-.013	-.38
939	46 2793	5.51 B0	19 50 28.593	-.08	46 53 51.25	-.4	9	8	58.61	58.86	27529	.011	.47	3588	-.017	-.33
940	11 4055	5.29 A2	19 53 52.128	.19	11 17 22.61	.6	9	7	56.50	56.33	27604	.020	-.01	3590	.002	-.31
941	58 2013	5.13 K2	19 54 58.168	-.15	58 42 42.80	-2.1	10	8	58.02	58.23	27635	-.034	.18	3591	.017	.14
942	16 4081	5.38 B9	19 55 29.163	.04	16 39 11.14	1.4	8	8	58.60	58.60	27648	.025	-.15	3592	.028	-.39
943	39 3968	5.43 B3	19 55 29.559	.01	40 13 56.85	-.3	6	6	56.97	56.97	27649	-.015	.50	3593	.001	-.17
944	30 3837	5.44 B8	19 56 38.919	.21	30 50 48.86	-.2	8	6	56.85	56.94	27677	.016	.01	3594	.002	.37
945	0 4375	6.35 G5	19 56 50.103	.12	1 14 22.90	5.3	8	6	56.16	56.66	27681	-.002	1.13	3596	.004	.57
946	36 3806	5.15 B3	19 58 5.062	-.02	36 54 16.54	.3	8	6	56.14	56.31	27724	-.012	-.51	3599	-.010	-.28
947	4 4325	6.80 K5	20 0 43.441	.12	4 35 20.27	-1.6	8	8	58.14	58.14	27796	-.039	1.53	3603	-.017	-.14
948	64 1405	5.43 M0	20 0 56.996	.08	64 40 50.70	-1.2	8	6	58.98	58.93	27806	-.007	.34	3604	.043	.07
949	76 771	6.43 M0	20 1 2.424	-.78	76 20 33.75	-5.7	10	7	57.84	57.80	27809	-.081	.30	3605	.067	.09
950	67 1222	4.66 K0	20 2 35.937	.22	67 43 51.55	4.9	6	7	56.96	56.63	27856	-.020	.47	3608	-.001	.15

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	$\Delta\alpha$	$\Delta\delta$	No.	$\Delta\alpha$	$\Delta\delta$
951	19 4277	5.26 K0	20 2 56.358	.17	19 50 47.50	7.9	8	8	59.35	59.35	27868	.015	.20	3609	.006	-.03
952	47 3004	5.98 A0	20 2 58.943	.06	48 5 11.56	.1	6	6	59.64	59.64	27869	-.019	.15	3610	-.012	-.06
953	23 3896	5.08 B3	20 4 44.389	.07	23 28 9.23	.1	8	6	57.73	58.44	27910	-.003	.50	3611	-.012	.57
954	61 1970	5.57 K0	20 4 45.248	1.69	61 50 59.97	7.3	8	6	59.11	58.44	27911	-.001	.44	3612	.051	.41
955	52 2623	5.72 F5	20 4 54.744	2.38	53 1 1.83	25.7	9	8	61.33	61.56	27912	-.095	.04	3613	-.031	.16
956	73 897	6.86 K0	20 5 9.911	.35	73 45 54.36	2.6	9	9	60.67	61.43	27920	-.158	.28	3614	.088	.29
957	34 3881	6.07 B8	20 5 46.520	-.10	34 16 36.52	-1.7	7	6	58.84	59.57	27938	.073	.85	3615	-.113	.19
958	10 4189	6.23 B5	20 6 15.148	-.06	10 34 43.96	-.7	6	6	57.52	57.52	27951	.008	.66	3616	.014	-.32
959	42 3642	6.25 K2	20 12 1.725	-.14	43 13 35.19	.5	10	9	57.41	57.62	28098	.045	.15	3620	-.082	-.89
960	4 4395	6.57 G5	20 13 36.751	-.33	4 25 37.23	-5.5	9	7	56.62	56.78	28148	.036	.38	3623	.030	-.14
961	0 4475	6.92 A3	20 16 4.000	.48	0 29 2.90	1.5	10	7	57.13	57.31	28220	-.027	-.28	3624	.018	.77
962	34 3967	5.18 F5	20 16 43.728	.01	34 49 31.85	-.9	8	6	55.75	55.83	28242	-.038	.49	3627	-.007	.36
963	14 4263	6.34 G5	20 18 0.943	-.08	14 24 36.66	.7	10	6	57.06	57.34	28288	.023	-.35	3629	.049	-.75
964	68 1121	5.99 M3	20 19 53.092	.31	68 43 13.42	3.8	8	8	57.02	57.02	28324	-.089	-.01	3631	-.010	.21
965	31 4062	4.60 K2	20 21 51.737	.29	32 1 39.55	-.2	8	6	57.14	57.32	28378	.053	-.07	3633	.027	.05
966	20 4559	5.80 K0	20 23 27.758	.03	21 14 44.15	-.9	10	7	55.91	55.72	28418	-.041	.34	3634	.002	.21
967	16 4259	6.17 K0	20 24 6.045	.06	17 9 2.85	-1.6	7	6	55.96	56.03	28435	-.016	.74	3635	.009	.05
968	7 4477	6.26 K0	20 25 41.478	.24	8 16 14.35	1.5	8	6	56.39	56.65	28466	.003	-.02	3638	.016	-.60
969	55 2411	5.87 B9	20 28 12.118	.02	55 53 59.19	1.1	7	6	58.09	57.99	28531	-.033	-.30	3640	-.017	.08
970	48 3142	4.89 B3	20 28 30.528	.08	48 46 57.80	.7	6	6	59.57	59.57	28537	-.016	.11	3641	-.006	.00
971	42 3778	6.41 B3	20 31 7.789	.04	43 1 12.84	.7	8	7	57.80	57.53	28604	-.039	.16	3644	-.045	-.61
972	80 659	5.62 K0	20 31 28.037	1.22	81 15 11.85	1.7	11	8	58.64	58.88	28611	-.060	.44	3963	-.049	.35
973	51 2895	6.26 F0	20 33 22.971	-.04	51 40 51.29	-.3	9	9	58.41	58.41	28667	-.021	.10	3646	.005	.04
974	3 4961	5.22 K5	20 34 7.408	.02	-2 43 28.35	-.2	10	6	57.77	58.35	28684	.010	-1.07	3648	.003	-.32
975	25 4302	5.52 B9	20 34 56.552	.07	26 17 12.75	-.7	9	7	57.32	57.50	28702	-.011	-.03	3649	-.029	-.20
976	0 4064	5.39 K0	20 36 51.132	.64	0 18 33.83	-1.4	10	6	58.48	58.33	28761	.005	.01	3651	.028	-.24
977	38 4187	6.44 B9	20 39 7.959	-.01	38 54 12.39	.8	13	7	56.75	57.11	28830	.010	.14	3653	-.027	.65
978	59 2272	5.95 F5	20 39 14.210	.10	60 19 26.45	18.6	10	6	56.51	56.93	28832	-.020	.40	3654	.022	-.29
979	41 3856	5.60 B8	20 40 7.991	.09	41 32 13.25	.5	10	6	57.17	57.50	28854	-.051	.13	3655	-.025	-.19
980	66 1318	5.57 A5	20 42 33.790	.38	66 28 31.47	3.8	11	7	56.27	56.64	28919	-.080	.06	3656	.019	-.06
981	24 4229	5.13 K2	20 42 42.566	-.26	25 5 26.48	-17.8	7	7	56.83	56.83	28920	.005	.07	3657	-.009	.24
982	47 3188	5.65 K0	20 46 10.370	.07	47 38 48.71	-2.8	12	9	59.29	59.82	29012	-.131	1.13	3662	-.012	.14
983	7 4556	6.23 A0	20 47 21.158	.13	7 40 37.69	1.4	9	8	58.62	59.11	29039	.037	-.05	3664	.021	-.26
984	43 3739	5.07 A5	20 48 18.224	1.13	43 52 12.50	13.4	9	10	58.33	58.27	29066	-.019	.11	3666	-.009	.09
985	63 1663	6.38 B0	20 48 24.826	-.17	63 51 18.95	-.6	11	7	58.10	58.10	29069	-.035	.03	3667	.028	-.16
986	32 3980	5.68 K2	20 51 52.229	-.14	33 14 48.02	2.9	7	7	55.85	55.85	29159	-.015	-.03	3668	.002	-.16
987	13 4572	5.39 K0	20 53 14.589	.07	13 31 46.80	-1.2	11	8	57.58	58.17	29201	.027	.16	3669	.038	-.24
988	50 3233	5.80 F0	20 54 50.128	.34	50 32 9.00	-2.0	12	9	57.35	57.77	29243	-.024	.38	3670	-.004	-.16
989	56 2515	6.14 B3	20 54 56.717	.02	56 41 39.99	1.0	12	7	59.05	58.78	29246	-.018	-.15	3671	-.013	.21
990	75 764	6.21 G5	20 55 21.200	.97	75 43 57.32	4.5	8	8	59.11	59.11	29254	-.110	.67	3672	-.010	.42
991	18 4675	5.96 M0	20 58 10.495	-.16	19 8 3.12	-5.4	7	8	59.18	58.98	29329	.020	.10	3675	-.003	.35
992	58 2201	5.75 K2	20 58 11.409	.52	59 14 33.53	1.0	10	7	59.43	59.20	29330	-.008	.47	3676	-.025	-.07
993	35 4357	6.08 K0	20 59 13.290	-.14	35 49 44.71	.9	9	9	59.85	59.43	29350	.033	-.36	3677	-.142	-.78
994	2 5434	6.78 F5	21 0 54.274	.22	-1 46 41.94	-1.3	13	8	56.44	57.18	29400	-.041	.32	3678	-.014	-.20
995	1 4418	6.42 G5	21 2 13.034	.59	2 4 14.79	-6.2	8	7	56.18	56.26	29435	.016	-.34	3681	.008	.06
996	52 2859	6.08 K0	21 2 15.866	.59	53 5 9.99	1.6	7	6	57.27	57.36	29438	-.092	1.13	3682	-.037	-.07
997	26 4073	6.23 K2	21 4 12.862	.25	26 43 23.89	-1.7	8	6	58.04	58.15	29491	.022	.24	3686	.019	-.41
998	30 4318	5.7- F5	21 4 24.241	-.04	30 58 59.90	-.3	8	8	59.65	59.65	29502	.021	.34	3687	.026	-.09
999	47 3292	4.88 K5	21 4 52.575	.05	47 26 48.34	-.1	6	6	59.55	59.55	29519	-.052	.35	3688	-.044	-.03
1000	15 4340	6.52 K0	21 5 12.479	.28	15 27 25.68	-5.8	6	6	59.82	59.82	29530	.019	.00	3689	.004	-.15

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
1001	6 4754	6.38 K5	21 5 59.925	-.11	6 47 10.90	.0	11	7	57.48	58.21	29548	.024	.48	3692	.014	-.02
1002	70 1164	5.96 F2	21 6 5.934	-1.14	71 13 52.63	-10.8	10	7	60.25	60.07	29550	-.054	-.23	3693	-.042	-.49
1003	67 1288	6.80 A2	21 7 0.912	.52	68 3 3.81	1.1	9	8	60.31	60.15	29575	-.290	-.03	3694	.077	.34
1004	80 690	6.02 A2	21 15 30.691	-.14	81 1 19.86	.2	7	7	56.97	56.97	29792	-.150	.53	3964	-.171	.14
1005	55 2549	6.18 K2	21 15 44.442	.17	55 35 14.35	1.5	8	6	56.30	56.67	29798	-.020	.09	3699	.008	-.07
1006	10 4516	6.32 K5	21 16 26.690	.21	10 59 30.30	1.5	8	7	57.06	57.38	29821	-.023	.45	3700	-.002	-.00
1007	43 3877	5.06 0+	21 16 35.138	-.01	43 44 5.02	-.9	8	7	58.10	58.59	29823	.001	-.01	3701	-.006	-.13
1008	48 3345	5.65 B5	21 17 45.344	.12	49 17 53.59	.9	7	7	56.44	56.44	29856	-.007	.33	3702	-.050	.11
1009	64 1527	5.18 B3	21 18 20.069	.06	64 39 34.06	.5	7	6	56.08	56.30	29875	-.005	.27	3703	.084	-.13
1010	23 4294	5.82 K0	21 18 48.620	1.71	23 38 39.90	-12.6	10	8	56.28	56.57	29884	-.004	.45	3704	.009	.16
1011	13 4692	6.71 B5	21 21 12.151	-.09	13 50 6.66	-.7	12	6	56.06	56.89	29947	.089	.11	3706	.030	.51
1012	4 5446	5.69 K0	21 22 40.519	-.12	-3 46 19.67	-7.1	6	6	56.57	56.57	29993	.014	.49	3708	-.012	-.22
1013	76 836	6.68 A0	21 22 50.878	-.29	76 52 31.59	-2.8	7	7	57.86	57.86	29998	-.168	.46	3709	-.014	-.35
1014	0 4726	6.40 F5	21 23 54.622	.66	0 53 18.07	-15.3	10	9	58.26	58.65	30022	.015	-.06	3711	.014	-.14
1015	15 4416	6.78 F8	21 24 45.063	-.51	15 54 27.32	-7.2	7	7	56.33	56.05	30035	-.009	-1.36	3713	.044	-.18
1016	36 4568	5.20 B3	21 25 18.866	.00	36 53 55.31	.3	8	7	57.56	57.84	30044	-.006	.15	3714	-.000	.48
1017	26 4164	5.38 A0	21 25 27.705	.30	27 23 24.60	2.1	7	6	59.82	60.00	30048	.000	.76	3715	.013	.47
1018	31 4462	5.74 F0	21 25 59.886	.96	32 0 20.03	7.6	7	7	57.81	57.81	30063	.013	.31	3716	.011	.15
1019	59 2383	6.44 M0	21 26 2.350	-.16	59 31 55.01	-1.4	7	7	57.97	57.97	30065	-.095	.21	3717	.006	.04
1020	66 1405	5.42 B5	21 26 48.253	-.28	66 35 26.38	-1.6	8	6	58.47	59.56	30081	-.078	.10	3718	-.051	.17
1021	37 4359	4.98 K0	21 32 43.815	1.02	38 18 32.82	9.8	8	8	57.33	57.33	30219	-.034	.15	3722	-.015	.21
1022	61 2169	4.87 B2	21 36 34.688	-.05	61 51 21.74	-.1	7	7	57.12	57.12	30302	.001	.54	3725	.041	.43
1023	1 4517	5.33 K0	21 37 1.044	-.21	2 1 4.60	-8.2	12	8	57.74	58.26	30315	.013	.52	3729	.046	.49
1024	42 4177	5.35 K5	21 38 13.159	.50	43 2 46.43	1.8	9	7	57.59	58.13	30338	.007	.41	3730	-.013	.23
1025	54 2595	6.16 K0	21 39 3.750	.06	54 38 39.14	-.2	7	7	56.52	56.52	30362	-.037	.55	3731	.011	-.01
1026	5 4850	5.63 M0	21 39 45.344	.07	5 27 5.14	-.4	8	7	55.96	56.13	30378	.000	-.01	3732	.009	-.03
1027	50 3410	4.78 B3	21 40 18.938	.02	50 57 39.30	.1	8	6	57.43	58.02	30391	-.024	.39	3733	.013	.18
1028	14 4668	6.10 G0	21 42 6.541	1.80	14 32 35.61	-9.2	10	6	55.99	56.52	30443	-.162	-1.10	3737	.021	.09
1029	22 4472	5.45 K0	21 43 46.184	.02	22 43 2.99	-.2	6	6	57.65	58.49	30479	.007	.11	3739	-.011	-.27
1030	19 4793	6.16 B3	21 47 6.567	-.10	20 13 43.73	.0	7	6	55.73	55.90	30555	.074	.24	3744	.030	.74
1031	83 618	7.02 A5	21 47 32.649	4.96	83 48 21.85	2.7	7	7	57.25	57.25	30564	-.176	.69	3965	.234	.23
1032	40 4648	6.49 A0	21 47 37.847	-.07	40 54 53.85	-.5	6	6	56.21	56.21	30566	.006	.01	3745	-.050	.30
1033	31 4577	7.10 K5	21 52 42.663	-.11	32 6 5.43	.4	8	6	56.86	56.72	30677	.025	-.30	3747	-.003	-.39
1034	55 2644	6.01 B9	21 53 12.092	-.10	56 22 26.25	-.2	12	8	58.10	58.45	30691	-.010	.30	3749	-.008	.06
1035	67 1375	7.02 F0	21 53 33.591	.95	67 30 57.95	1.2	7	7	56.00	56.00	30699	-.236	-.07	3750	.042	-.29
1036	11 4696	5.59 A2	21 54 30.027	-.23	11 50 17.76	-1.0	8	7	57.16	57.24	30719	.055	.24	3751	.040	.23
1037	47 3618	6.35 A0	21 55 7.359	.07	48 25 47.39	-2.2	8	6	57.41	57.29	30729	-.046	1.01	3754	-.000	-1.03
1038	79 721	6.60 M3	21 55 13.295	.13	80 4 15.48	.0	11	10	58.53	58.51	30730	-.169	-.02	3755	-.085	.12
1039	62 2007	4.9- M2	21 55 14.392	-.04	63 23 13.43	.4	8	6	58.07	58.37	30731	-.075	.04	3756	-.032	-.20
1040	74 946	6.64 K5	21 57 23.138	-.15	74 45 26.59	-.6	8	8	56.24	56.24	30772	-.040	.47	3758	.072	.39
1041	6 4940	5.99 B3	21 57 38.013	.04	6 28 37.43	-.2	10	8	57.09	57.19	30779	.031	.80	3759	.027	.41
1042	52 3083	5.66 B5	22 0 0.367	.03	52 38 26.35	.4	8	7	55.59	55.58	30828	-.008	.34	3763	-.032	.11
1043	15 4548	6.72 A0	22 0 14.074	-.04	15 44 41.79	-2.7	9	8	57.55	57.41	30835	.042	1.06	3764	.031	.43
1044	2 5681	4.66 B5	22 0 43.687	.09	-2 23 51.25	-1.1	9	7	56.83	57.27	30844	.041	.02	3765	.004	-.37
1045	28 4284	5.58 A0	22 3 18.565	.16	28 43 13.03	-1.0	7	7	56.26	56.26	30899	.031	-.21	3768	.006	-.41
1046	44 4043	5.32 K5	22 4 0.239	-.06	44 46 14.28	-1.4	7	6	56.41	56.52	30919	-.006	.49	3769	-.004	.35
1047	58 2393	6.31 G5	22 5 28.281	-.26	58 35 46.54	-2.1	9	6	56.06	56.07	30955	-.015	.25	3770	-.004	-.01
1048	20 5093	6.40 A2	22 8 8.248	-.16	20 43 53.94	-1.1	12	7	56.77	57.24	31025	.069	.58	3772	.028	.31
1049	10 4701	5.92 K5	22 8 10.107	-.22	11 22 42.79	-5.2	11	9	59.65	59.65	31026	-.083	-.45	3773	.006	-.42
1050	50 3602	5.44 A2	22 9 13.003	1.43	50 34 33.27	4.0	6	7	57.12	57.19	31046	-.050	.64	3774	-.006	-.10

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ′	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
1051	56 2727	5.42 F8	22 10 0.170	2.79	56 35 24.62	12.5	9	8	58.02	58.20	31070	-.020	.26	3775	.021	-.00
1052	33 4456	5.42 K0	22 10 34.845	.17	34 21 26.97	-4.8	9	6	55.45	55.83	31081	-.031	.22	3776	-.030	.14
1053	42 4333	5.70 A0	22 12 38.079	.46	42 42 19.19	-2.0	7	6	55.85	56.05	31127	-.028	.17	3778	-.016	.06
1054	7 4834	6.03 A0	22 13 30.363	.02	8 18 0.76	.7	10	7	57.38	57.95	31139	.107	-.58	3780	.036	.29
1055	6 5960	5.80 G5	22 14 29.923	.00	-5 38 14.94	2.5	9	8	58.50	58.47	31163	.004	.20	3782	.025	.57
1056	26 4399	6.80 K5	22 15 28.326	-.33	26 41 10.17	.0	6	6	58.35	58.35	31191	.064	.01	3783	.012	.18
1057	75 820	6.56 A0	22 17 44.876	.26	76 14 12.07	1.4	12	8	57.36	57.94	31227	-.135	-.43	3784	-.017	.02
1058	35 4785	6.60 K0	22 20 37.069	.02	36 24 18.19	6.0	8	6	56.25	56.07	31287	-.008	-.59	3787	-.006	-.38
1059	14 4790	6.73 A0	22 21 34.101	.25	15 1 40.37	-.8	12	11	57.98	58.27	31309	-.074	-.23	3790	-.003	-.15
1060	70 1240	5.69 K0	22 24 43.118	.15	70 30 57.46	1.9	8	7	58.33	58.28	31365	.048	-.33	3794	.059	.18
1061	55 2750	6.42 B8	22 25 5.224	.26	56 10 41.80	.7	9	7	56.83	57.45	31372	-.079	.25	3795	.032	.52
1062	3 4710	4.93 K0	22 25 19.620	.52	4 26 40.02	-30.8	6	6	58.31	58.31	31377	.013	.79	3796	.042	.44
1063	64 1664	5.66 B0	22 25 28.478	.02	64 52 37.18	.1	6	6	59.21	59.21	31380	-.102	.13	3797	.054	.16
1064	46 3719	4.61 K0	22 27 26.477	.03	47 27 2.01	-.4	11	10	58.15	58.01	31426	-.063	.56	3799	.021	.42
1065	42 4420	4.54 B3	22 28 19.472	-.07	42 51 59.70	-.2	8	8	59.23	59.23	31449	-.012	.01	3800	.021	-.04
1066	3 5460	6.29 K0	22 28 43.386	-.15	-3 10 4.47	-3.1	7	7	57.00	57.00	31462	.108	.29	3802	.055	-.03
1067	19 4949	6.31 F0	22 30 10.348	1.10	19 58 18.50	3.0	9	6	57.58	58.04	31486	.031	.37	3804	.022	.28
1068	39 4871	5.80 A3	22 30 13.466	.03	39 31 19.63	-.3	9	9	58.87	58.87	31488	-.017	.07	3805	-.040	.23
1069	15 4670	6.36 K0	22 30 20.161	.06	15 36 18.34	.9	6	6	58.72	58.72	31490	.060	1.07	3806	.001	-.07
1070	61 2314	6.51 A2	22 32 5.085	.23	61 31 9.98	2.2	8	9	58.94	58.91	31519	-.059	.06	3808	.050	.20
1071	34 4729	6.50 K5	22 34 32.113	-.02	35 23 33.62	.0	8	8	58.17	58.17	31568	-.008	.13	3812	.026	-.44
1072	23 4576	6.93 A3	22 35 10.231	-.24	23 44 29.47	-.9	10	8	60.09	60.68	31582	.028	.12	3813	.007	-.00
1073	3 4745	6.90 A3	22 36 17.957	.32	4 16 11.08	.0	6	6	58.35	58.35	31605	-.081	-.12	3815	-.000	.70
1074	80 731	6.90 F8	22 39 20.340	.56	81 7 50.93	.9	9	8	56.39	56.35	31671	.087	.71	3966	-.047	.54
1075	53 2960	6.26 K2	22 40 17.725	-.02	53 38 48.71	.1	8	6	57.00	57.73	31690	-.059	.29	3817	-.008	.25
1076	57 2595	6.51 F5	22 43 5.042	-.85	57 53 9.05	-13.7	8	7	56.31	56.25	31755	-.017	.63	3822	.025	.26
1077	32 4529	7.11 A2	22 49 12.980	.27	32 33 0.68	-1.2	7	6	55.75	55.58	31879	-.020	.62	3827	-.030	-.10
1078	9 5122	5.30 F5	22 49 51.921	3.50	9 34 8.90	4.7	10	11	58.33	58.19	31899	.011	.07	3828	.006	.10
1079	16 4831	5.72 K0	22 50 34.448	-.17	16 34 31.45	-2.6	10	8	58.61	59.47	31908	.017	.14	3829	-.005	.13
1080	59 2595	6.32 K2	22 51 3.669	.23	59 50 5.44	1.0	11	8	57.77	58.89	31922	-.060	.14	3830	.032	.08
1081	47 3985	5.20 B3	22 54 51.518	.13	48 24 59.70	-.4	7	6	58.14	58.56	31998	-.046	.03	3833	-.020	-.10
1082	3 4799	6.43 K2	22 54 59.979	.42	3 32 31.17	4.3	10	9	59.52	59.94	32002	.015	-.55	3834	-.009	-.46
1083	38 4904	6.07 B3	22 55 21.868	-.07	39 2 28.12	.2	7	7	57.30	57.03	32010	.047	-.05	3835	.022	.31
1084	3 5539	6.21 G5	22 55 41.009	-.14	-2 39 47.60	-.1	6	6	60.22	60.22	32015	.066	-.76	3836	.014	-.84
1085	72 1079	6.64 K0	22 56 13.808	-.50	72 51 57.78	-3.1	9	7	56.93	57.56	32025	-.195	.52	3837	.002	-.30
1086	51 3514	6.41 K2	22 56 59.954	-.37	52 23 9.08	2.8	8	6	56.97	57.89	32039	.012	.45	3838	-.026	.10
1087	56 2923	5.48 G0	22 57 58.209	-.06	56 40 36.96	.8	6	6	58.04	58.04	32063	-.005	-.03	3839	.058	.44
1088	0 4443	6.40 K0	22 58 4.030	.24	-0 4 58.62	1.9	6	6	58.23	58.23	32065	.034	.29	3840	.008	.06
1089	79 759	7.26 K2	22 58 17.318	1.52	80 4 30.49	4.4	8	8	59.85	59.85	32070	-.297	-.24	3841	.116	.03
1090	66 1575	5.50 K0	23 1 38.002	.39	66 56 22.44	1.6	7	7	56.41	56.41	32142	-.093	.34	3844	-.006	.21
1091	24 4716	4.98 K0	23 4 40.352	-.06	25 11 52.71	-3.0	8	7	56.88	56.88	32201	.014	-.11	3848	-.024	-.46
1092	34 4847	6.54 K0	23 4 42.162	.42	35 21 56.67	.0	7	6	57.12	57.37	32202	-.004	.68	3849	.005	-.09
1093	20 5278	5.93 A5	23 5 0.507	.79	20 51 51.51	-5.2	8	8	60.72	60.72	32209	-.039	.95	3850	-.015	.28
1094	29 4862	7.25 B9	23 5 15.380	-.21	29 47 1.18	-.4	7	6	60.58	60.56	32215	.052	-.49	3851	.003	.06
1095	45 4149	5.56 K5	23 5 21.691	-.16	46 7 1.23	-3.0	7	7	61.68	61.68	32216	-.006	.73	3852	.013	.45
1096	63 1931	6.41 K0	23 5 54.936	.11	63 57 6.32	.3	7	8	60.33	60.50	32232	-.002	.47	3853	.080	-.25
1097	1 4686	5.56 G5	23 6 7.189	.93	1 51 19.42	11.0	10	7	58.65	58.89	32233	.010	.54	3854	-.018	.42
1098	42 4592	5.85 F5	23 8 8.169	-1.80	43 16 31.55	-18.8	9	6	57.58	57.85	32288	-.011	.20	3857	-.043	.14
1099	10 4902	5.94 K0	23 10 55.435	-.11	10 47 34.36	.6	11	7	58.80	58.85	32331	.045	.45	3858	.002	.21
1100	4 5852	5.55 A2	23 12 59.693	-.12	-3 46 9.72	.2	10	7	58.62	58.43	32369	.031	-.43	3860	-.011	-.31

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3 (Supp.)		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
1101	27 4521	6.50 G5	23 13 19.487	.09	27 58 30.10	-.3	9	9	60.04	60.04	32375	.008	.11	3861	-.025	-.34
1102	70 1311	5.62 A3	23 13 41.370	.32	70 36 55.13	.8	8	8	58.85	59.60	32388	-.037	.15	3862	.068	.17
1103	52 3410	5.65 F8	23 14 25.025	1.23	52 56 37.29	-23.7	8	7	56.52	56.79	32409	-.039	.43	3863	.013	-.02
1104	74 1016	6.44 A2	23 15 32.491	.56	75 1 33.48	.6	12	8	57.94	58.29	32436	-.147	.48	3865	.031	.07
1105	41 4752	5.98 K2	23 17 29.224	.33	41 48 14.92	1.1	8	6	56.12	56.58	32485	.070	.33	3870	.016	.05
1106	4 4997	5.18 K0	23 17 47.646	.51	5 6 29.47	-5.8	7	6	57.98	58.19	32491	.020	.36	3871	.024	-.41
1107	16 4912	6.55 F0	23 18 27.149	.69	16 58 41.55	2.4	9	7	56.11	56.34	32509	-.056	.87	3872	.003	.17
1108	20 5317	6.22 A0	23 20 10.903	.11	20 33 16.01	-1.6	11	9	57.56	57.97	32535	.014	.48	3873	.012	-.25
1109	59 2710	5.93 K5	23 20 18.044	.05	59 51 32.89	-.2	7	6	57.29	57.05	32538	-.062	.35	3874	-.010	.03
1110	64 1810	7.00 K0	23 25 4.968	-.12	65 20 47.85	-6.9	10	8	57.64	58.24	32636	-.042	.02	3877	.019	-.80
1111	86 344	5.62 F0	23 27 33.601	10.19	87 1 54.54	2.0	9	6	58.64	59.43	32680	-.608	.16	3967	-.450	.08
1112	48 4070	6.38 K2	23 27 43.884	.31	48 51 26.37	-.3	10	9	57.77	57.88	32684	-.022	.63	3882	-.037	.92
1113	27 4566	6.68 K0	23 29 0.989	.10	28 23 25.29	-1.5	8	6	56.35	56.73	32710	.022	.51	3884	.010	-.27
1114	52 3469	7.02 K0	23 30 12.448	.04	53 24 37.06	.4	8	7	56.63	56.61	32743	-.018	.02	3888	.019	-.32
1115	21 4952	5.51 M3	23 30 57.605	.05	22 13 21.77	-1.8	7	6	55.62	55.75	32759	-.004	.42	3889	.008	-.23
1116	2 5986	5.98 A2	23 31 34.676	.68	-1 31 26.37	-.7	7	7	57.21	57.21	32774	-.009	-.57	3890	-.029	-.60
1117	32 4667	5.74 K0	23 32 9.530	-.04	33 13 14.47	2.2	8	6	57.85	58.38	32779	-.019	.67	3891	.004	.33
1118	70 1327	6.13 K0	23 32 47.933	.13	71 21 56.26	.5	9	8	58.60	58.58	32793	-.052	.12	3893	.115	.00
1119	23 4769	6.60 M0	23 33 25.488	.13	24 17 3.04	1.4	6	6	56.41	56.41	32814	-.085	-.05	3894	-.053	-.01
1120	1 4744	5.65 F5	23 33 50.111	-.73	1 49 28.50	6.2	10	9	57.47	57.79	32818	.011	.11	3895	.012	-.19
1121	17 4952	5.42 A0	23 35 25.099	.31	18 7 25.06	2.0	9	7	58.52	58.87	32842	.013	.57	3896	-.006	.68
1122	49 4180	5.32 B9	23 36 42.407	-.21	50 11 40.87	-.4	7	7	56.54	56.68	32864	-.001	.17	3897	.010	-.12
1123	73 1047	6.08 G5	23 37 9.288	-.17	73 43 32.38	1.1	7	7	59.02	59.18	32872	-.164	.38	3898	-.020	.10
1124	35 5074	6.30 F5	23 38 10.343	1.91	36 26 35.52	2.6	7	6	57.44	57.73	32892	.010	-.10	3899	.036	-.34
1125	60 2609	6.54 K2	23 40 7.387	.72	61 24 8.21	-.6	9	8	58.20	58.36	32930	-.146	-.14	3900	.041	.32
1126	15 4872	6.51 K0	23 40 11.371	.60	16 3 29.27	1.4	8	7	57.61	57.46	32932	.032	.17	3901	.014	.16
1127	9 5268	5.39 M0	23 40 49.514	.01	10 3 14.16	1.5	10	8	58.01	58.57	32945	.008	.45	3902	-.006	.28
1128	68 1393	7.03 B8	23 42 35.596	-.16	69 28 38.52	-1.1	10	9	57.25	57.52	32974	-.050	.45	3907	.054	-.40
1129	2 4709	5.30 N0	23 43 50.119	-.26	3 12 33.44	-1.6	8	7	56.13	56.34	32995	.029	-.23	3908	.017	-.23
1130	57 2804	5.09 K0	23 44 36.049	.78	58 22 24.30	5.7	7	6	56.58	56.73	33010	-.017	.23	3909	.051	.11
1131	28 4649	5.91 A3	23 47 7.233	.47	28 33 50.54	2.7	7	6	56.19	56.25	33062	-.008	.14	3913	.002	-.07
1132	35 5110	5.91 G5	23 47 9.667	-.07	36 8 52.68	-5.0	9	9	57.74	57.74	33063	.030	.45	3914	-.059	.08
1133	39 5174	6.68 F8	23 48 46.466	1.86	39 55 17.26	-5.4	7	6	56.49	56.77	33093	-.082	-.47	3916	.049	-.87
1134	2 4725	5.85 K2	23 49 24.139	.06	2 39 8.09	-1.1	10	9	58.66	58.42	33112	.012	-.42	3918	-.020	-.57
1135	76 934	6.49 F5	23 49 31.839	8.05	77 19 21.35	-8.8	10	8	57.94	57.99	33113	-.099	.02	3919	.108	-.23
1136	0 4585	5.98 M3	23 52 12.973	-.33	- 0 10 7.67	-.7	10	7	58.25	59.03	33165	.014	-.19	3920	-.024	-.21
1137	41 4902	6.04 F5	23 54 30.950	.02	42 22 47.72	-.4	7	6	56.46	56.58	33211	-.005	.15	3923	-.081	.25
1138	31 5012	6.36 B5	23 56 15.906	.07	32 6 12.12	.3	9	7	59.07	59.17	33253	-.031	-.36	3927	-.094	-.17
1139	58 2685	6.37 K0	23 57 58.014	-.98	59 16 54.32	-2.1	8	8	57.40	57.40	33294	-.069	.31	3928	.070	.02
1140	49 4309	6.36 K0	23 58 45.403	.09	49 42 12.12	-1.0	8	7	56.78	57.48	33311	-.007	.41	3929	.047	-.07
1141	72 1135	6.52 A0	23 59 4.400	1.65	73 20 1.74	.6	10	8	58.31	58.58	33322	-.052	-.47	3930	.055	.62
1142	7 5121	5.78 F0	23 59 56.200	-.68	8 12 28.12	-4.6	8	8	57.63	57.63	33341	.021	.40	3933	.009	.02

Part III

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ′	No.		Epoch		O - G.C.			O - PZT		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
1	44 50	8.0 F0	0 13 6.814	.15	45 15 58.83	-1.1	6	6	57.76	57.76		.	.	50	-.005	.08
2	44 62	7.0 F5	0 17 53.219	.59	45 13 54.77	-.6	9	8	58.50	58.72	411	-.074	-1.73	62	-.045	.29
3	44 128	8.5 MA	0 34 53.225	.12	45 19 46.07	1.5	8	7	58.35	58.15		.	.	128	-.007	.54
4	44 162	7.8 A3	0 43 40.212	-.21	45 9 12.93	.5	6	6	56.15	56.15		.	.	162	-.019	-.01
5	44 186	8.8 A5	0 49 56.687	-.35	45 10 13.19	-1.7	8	7	58.91	58.79		.	.	186	-.013	.01
6	45 237	6.2 K0	0 54 49.186	.07	45 34 10.12	-.5	8	8	59.86	59.86	1142	-.019	-.71	237	-.015	.07
7	44 215	7.0 F5	0 58 27.329	.96	45 11 0.81	-1.5	10	9	57.57	57.88	1220	-.052	.22	215	-.011	.21
8	44 252	8.7 F8	1 7 3.205	.54	45 28 53.72	-1.5	7	6	60.75	60.76		.	.	252	.029	.09
9	44 279	7.5 K2	1 16 6.724	-.02	45 26 35.91	1.8	6	7	58.43	58.91		.	.	279	-.021	.28
10	44 312	8.1 K0	1 25 43.179	.58	45 22 31.34	.3	8	7	58.30	58.51		.	.	312	.046	.13
11	44 341	6.3 A0	1 35 30.407	-.16	45 8 45.30	.8	6	6	60.10	60.10	1977	.053	-.83	341	-.030	-.10
12	44 392	8.1 A5	1 54 49.049	-.14	45 21 22.66	.7	9	9	58.38	58.38		.	.	392	.004	.07
13	45 523	8.1 A3	2 0 0.274	.04	45 32 14.34	-.5	7	8	59.86	59.87		.	.	523	.017	-.35
14	44 473	8.8 A0	2 19 32.509	-.07	45 16 56.94	.4	7	6	60.09	59.82		.	.	473	-.002	.17
15	44 483	7.6 G5	2 21 50.211	-.23	45 25 22.41	-7.8	7	7	57.32	57.32		.	.	483	-.007	.02
16	44 512	7.3 G5	2 27 10.357	.05	45 12 36.57	-.8	9	8	60.00	60.65		.	.	512	.004	.26
17	44 558	8.4 F8	2 38 28.570	.86	45 16 54.40	-3.0	8	7	58.44	58.67		.	.	558	.003	.07
18	44 569	8.1 F8	2 41 28.781	-.18	45 23 21.61	-4.4	8	7	58.15	58.63		.	.	569	-.041	.38
19	45 721	8.6 K2	3 8 17.948	-.19	45 33 1.95	-1.7	7	6	58.54	58.82		.	.	721	-.015	.12
20	44 648	6.4 MA	3 12 40.005	.28	45 9 45.27	-3.0	8	9	57.89	57.77	3884	-.143	.84	648	-.012	.25
21	44 677	7.5 B8	3 18 4.401	-.06	45 12 28.93	1.0	9	8	60.18	60.36		.	.	677	-.007	.32
22	44 695	7.6 B8	3 22 11.223	-.01	45 20 25.63	.2	6	6	60.80	60.80		.	.	695	-.034	.24
23	44 744	8.1 K2	3 31 35.559	-.13	45 16 59.93	-.1	7	7	58.86	58.86		.	.	744	-.008	.15
24	45 828	8.1 K0	3 48 7.121	-.10	45 18 15.38	.3	7	7	58.72	58.72		.	.	828	-.009	.24
25	45 836	7.9 K0	3 50 29.510	.03	45 21 53.78	-2.9	7	7	57.64	57.64		.	.	836	.006	-.08
26	45 858	8.6 A0	3 56 23.118	.14	45 33 25.49	-1.2	8	6	57.78	58.34		.	.	858	-.004	.23
27	45 887	7.8 G5	4 7 24.433	.16	45 16 24.43	-4.0	8	8	58.42	58.77		.	.	887	-.009	-.11
28	45 921	7.6 A0	4 17 17.963	.22	45 20 46.10	-2.8	8	8	61.21	61.21	5241	-.041	-1.05	921	-.022	.09
29	45 955	7.7 B9	4 30 27.484	.00	45 31 54.93	-1.0	6	7	57.55	57.58	5546	.026	1.76	955	.016	.06
30	45 987	7.7 A0	4 44 15.229	.07	45 24 5.62	-3.3	8	8	59.16	59.16	5822	-.043	-.02	987	.030	.04
31	45 1023	7.8 B9	4 57 39.214	-.09	45 22 25.35	-.8	8	6	56.70	56.90		.	.	1023	-.018	.12
32	45 1115	8.5 A0	5 21 38.155	.04	45 11 3.92	.2	10	9	57.98	58.32		.	.	1115	-.023	-.15
33	45 1131	7.8 F8	5 28 57.594	-.06	45 30 7.13	-3.5	12	10	59.15	59.95		.	.	1131	-.017	.10
34	45 1132	7.9 G5	5 29 3.028	.11	45 27 22.37	-1.9	8	8	61.06	61.67		.	.	1132	-.020	-.06
35	45 1150	8.1 G5	5 35 20.198	.70	45 25 18.06	-10.8	8	8	58.38	58.38		.	.	1150	-.005	-.18
36	45 1178	8.0 F3	5 45 2.891	-.02	45 13 17.67	-2.2	8	8	61.48	61.48		.	.	1178	-.033	.02
37	45 1216	6.6 A0	5 55 42.869	-.01	45 37 0.35	-1.6	7	7	60.90	61.04	7534	-.231	.81	1216	-.025	-.15
38	45 1225	7.6 A0	5 57 36.651	-.02	45 9 36.03	-1.1	5	5	61.42	61.42		.	.	1225	-.021	.22
39	45 1235	7.2 A2	6 0 51.717	.04	45 35 24.90	-5.5	7	6	59.96	59.96	7672	-.011	.24	1235	-.013	.11
40	45 1248	7.3 A0	6 4 37.146	-.07	45 33 44.46	-2.0	12	9	59.16	60.18	7768	-.037	-.51	1248	-.017	.00
41	45 1289	7.4 K0	6 18 3.539	.05	45 38 7.72	-1.5	6	6	59.66	59.66	8157	-.131	-.95	1289	-.003	.13
42	45 1296	8.0 K5	6 20 52.420	.13	45 11 41.68	.3	8	9	60.61	60.34		.	.	1296	-.028	.18
43	45 1346	8.7 G5	6 40 22.187	.09	45 24 50.52	-3.2	8	8	61.25	61.25		.	.	1346	.013	.47
44	45 1363	9.0 A2	6 50 50.657	-.12	45 14 50.89	-4.1	7	7	60.34	60.34		.	.	1363	-.053	-.27
45	45 1380	8.9 A0	6 59 55.064	-.02	45 30 1.06	-.7	8	11	60.84	61.39		.	.	1380	-.056	-.41
46	45 1394	7.8 K0	7 7 13.694	-.12	45 19 47.90	-.8	7	6	59.42	60.16		.	.	1394	-.033	-.10
47	45 1408	6.7 K0	7 11 59.668	-.08	45 29 52.30	-2.9	6	6	58.50	58.50	9602	-.078	-.62	1408	-.013	-.15
48	45 1415	7.6 F2	7 14 24.095	-.08	45 13 12.66	-6.9	6	6	58.86	58.86		.	.	1415	-.020	-.43
49	45 1441	8.1 G5	7 27 57.568	-.08	45 13 6.42	-2.3	8	8	61.69	61.69		.	.	1441	.010	-.33
50	45 1476	7.6 K0	7 40 45.672	.00	45 29 20.47	-2.9	8	8	58.55	58.55		.	.	1476	.006	-.38

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O − G.C.			O − PZT		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
51	45 1496	8.0 K2	7 46 58.963	.09	45 28 4.50	-1.0	6	6	58.18	58.18		.	.	1496	-.038	-.13
52	45 1509	8.1 A3	7 53 21.659	-.19	45 35 3.33	-1.1	7	7	60.03	60.03		.	.	1509	-.032	-.07
53	45 1550	7.8 K0	8 8 24.259	.31	45 21 32.67	-.4	7	7	61.29	61.29		.	.	1550	-.010	.19
54	45 1568	8.1 K0	8 19 5.873	-.37	45 30 44.88	-7.3	6	6	56.00	56.02		.	.	1568	-.014	-.21
55	45 1601	7.8 F0	8 30 49.157	-.28	45 22 7.49	-2.3	6	8	58.55	57.96	11719	-.076	1.28	1601	-.051	-.28
56	45 1613	8.1 G5	8 37 33.098	.00	45 19 40.04	1.5	7	8	60.17	59.43		.	.	1613	-.024	-.18
57	45 1624	8.1 F5	8 40 29.361	-.23	45 38 6.62	-5.2	7	8	60.01	60.28		.	.	1624	-.034	-.40
58	45 1649	6.1 K0	8 48 48.203	-.11	45 30 6.24	-3.4	6	6	58.03	58.03	12226	.035	.68	1649	-.020	-.05
59	45 1680	8.4 G5	9 3 59.564	-.58	45 22 42.02	-4.9	7	7	60.58	60.58		.	.	1680	.003	.12
60	45 1708	6.6 K0	9 18 6.170	-.07	45 34 59.96	-3.0	7	7	57.22	57.53	12885	-.050	.09	1708	-.007	-.30
61	45 1762	6.8 K0	9 43 31.084	.48	45 20 51.43	-13.0	6	7	59.42	58.81	13451	-.040	.04	1762	-.014	-.33
62	45 1769	8.0 F2	9 47 19.964	-.78	45 19 8.23	-9.1	8	9	58.97	58.89		.	.	1769	-.021	-.22
63	45 1778	8.7 G5	9 52 36.891	.16	45 25 7.99	-.9	6	7	57.93	57.97		.	.	1778	.007	-.07
64	46 1566	6.5 K0	9 54 48.099	.05	45 39 12.66	-3.4	6	6	57.28	57.28	13704	-.018	.03	1566	-.011	-.05
65	45 1798	7.5 F2	10 4 2.076	-.07	45 18 15.83	-.6	6	6	56.60	56.60		.	.	1798	.003	-.08
66	45 1811	7.8 K2	10 11 8.528	-.09	45 20 7.77	.4	9	9	56.57	56.57		.	.	1811	.010	.05
67	45 1814	7.4 F5	10 13 27.825	-.13	45 17 34.36	2.3	9	9	58.44	58.44		.	.	1814	-.015	.12
68	45 1819	7.8 G5	10 14 27.375	-.63	45 16 9.02	-2.0	7	6	61.20	61.51		.	.	1819	-.026	-.21
69	45 1832	6.5 K0	10 25 36.207	-.19	45 28 5.43	-2.3	8	7	59.56	59.89	14377	-.010	.05	1832	-.009	-.31
70	46 1643	8.4 K5	10 32 46.108	-.22	45 30 56.27	1.6	6	6	59.25	59.25		.	.	1643	-.002	.14
71	46 1671	8.0 K0	10 49 38.774	-.71	45 33 11.35	-3.6	10	9	57.66	57.28		.	.	1671	-.017	-.19
72	45 1879	7.0 K0	10 56 8.846	-.48	45 27 58.58	-3.7	7	7	58.41	58.41	15079	-.038	.13	1879	-.031	-.20
73	45 1890	9.0 G5	11 1 40.631	.09	45 25 37.45	-2.6	7	7	58.28	58.28		.	.	1890	-.019	-.31
74	45 1903	7.5 G0	11 12 20.090	-.48	45 20 5.30	-6.1	6	6	57.11	57.11		.	.	1903	-.021	-.24
75	46 1717	7.9 A2	11 19 5.598	-.56	45 36 24.22	-1.5	9	8	58.84	58.78		.	.	1717	-.024	.46
76	45 1924	V.R MB	11 25 6.802	-.07	45 27 38.83	-2.3	6	6	57.12	57.12	15723	-.104	1.53	1924	-.021	-.02
77	45 1947	6.3 G0	11 36 7.325	-5.62	45 23 6.52	1.4	6	6	56.98	56.98	15976	-.026	-.30	1947	-.011	-.11
78	45 1952	7.9 F2	11 37 9.705	.15	45 26 1.82	-1.4	6	6	56.97	56.97	16003	-.061	.04	1952	-.015	.16
79	45 2001	8.8 F8	12 8 12.910	.30	45 27 13.76	-6.5	8	8	57.20	57.20		.	.	2001	-.025	-.15
80	46 1791	7.7 A3	12 29 13.736	-.26	45 30 5.50	-1.4	7	7	56.30	56.30		.	.	1791	-.008	-.18
81	46 1802	8.0 F0	12 35 10.333	.15	45 31 41.96	1.2	6	6	59.82	59.82		.	.	1802	-.027	.00
82	46 1805	7.1 F2	12 36 10.648	-1.35	45 29 31.94	-3.8	6	6	57.10	57.10	17219	.010	-.13	1805	.003	.01
83	46 1847	5.7 K0	13 3 37.450	-.18	45 32 7.88	2.5	13	13	57.78	58.78	17758	-.026	.13	1847	-.017	.29
84	45 2096	8.6 F5	13 12 12.563	-.02	45 26 41.22	-1.0	8	9	57.32	57.32		.	.	2096	.003	-.24
85	45 2104	8.7 F5	13 17 5.529	-1.38	45 21 45.07	-3.4	6	6	57.48	57.48		.	.	2104	-.024	-.28
86	45 2120	8.3 F5	13 33 51.745	-.44	45 16 12.71	-1.8	6	6	56.71	56.71		.	.	2120	-.017	-.15
87	45 2124	8.0 K2	13 38 14.772	.03	45 14 23.84	-1.1	8	9	56.58	56.32		.	.	2124	-.038	-.21
88	46 1894	8.9 F5	13 41 17.143	.06	45 35 46.84	-1.8	6	8	59.35	59.37		.	.	1894	.006	.01
89	45 2131	8.6 F5	13 46 33.414	-.35	45 25 6.64	1.0	6	6	61.67	61.67		.	.	2131	-.028	.16
90	45 2140	8.6 F8	13 55 33.197	-.08	45 23 55.83	.1	7	6	56.34	56.69		.	.	2140	.000	.10
91	45 2148	8.1 K0	13 59 10.972	.17	45 31 36.41	-.8	6	6	57.53	57.53		.	.	2148	.007	-.13
92	45 2178	9.1 G5	14 22 45.823	-1.45	45 22 22.13	3.4	7	6	59.09	59.05		.	.	2178	-.012	-.29
93	45 2203	8.4 F8	14 36 54.214	-.07	45 32 45.51	-1.7	7	7	57.98	57.98		.	.	2203	.011	.11
94	46 1981	7.7 G5	14 39 16.620	-1.10	45 37 44.32	-19.2	7	7	57.82	57.82		.	.	1981	.014	-.18
95	45 2214	6.8 F0	14 42 38.341	.52	45 23 47.60	-2.0	7	6	56.93	57.37	19853	-.058	-.34	2214	.003	-.14
96	45 2230	8.5 F8	14 49 57.384	-.68	45 22 33.18	6.8	6	6	57.06	57.06		.	.	2230	-.003	-.32
97	45 2233	7.9 F5	14 52 37.598	-.62	45 30 0.35	5.4	6	6	57.38	57.38		.	.	2233	.008	-.43
98	45 2266	8.7 G5	15 10 23.060	-.86	45 20 56.86	15.4	6	7	58.22	58.25		.	.	2266	-.039	.35
99	45 2277	7.9 K0	15 16 56.993	-.39	45 11 52.96	.9	7	6	58.24	58.38		.	.	2277	.005	.14
100	45 2284	6.2 K2	15 22 23.825	-.16	45 26 48.70	-.3	6	6	58.74	58.74	20720	-.002	.51	2284	-.011	.04

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - PZT		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
101	45 2307	8.8 K2	15 34 0.411	.15	45 36 45.95	-2.1	8	8	58.17	58.17		.	.	2307	-.007	.05
102	45 2317	7.9 F0	15 37 32.745	.27	45 16 42.30	1.4	6	6	58.42	58.42		.	.	2317	.001	-.09
103	45 2325	8.0 G5	15 42 27.956	-.41	45 28 19.01	3.1	6	6	58.63	58.63		.	.	2325	.003	.02
104	45 2355	8.7 F2	15 58 7.369	-.27	45 35 35.49	-.5	9	9	60.58	60.58		.	.	2355	.017	.00
105	45 2374	7.4 K0	16 6 25.426	-.03	45 30 41.85	.9	9	8	58.98	59.30	21715	-.016	.63	2374	.001	.07
106	45 2404	7.4 G5	16 23 47.729	-.64	45 29 26.99	1.7	10	9	58.57	59.03		.	.	2404	.014	-.17
107	45 2446	8.4 G5	16 43 41.726	-.28	45 11 37.95	-.5	7	6	59.23	58.85		.	.	2446	-.004	.12
108	45 2453	8.4 G0	16 47 27.440	-.33	45 17 13.06	-.7	9	10	60.38	60.08		.	.	2453	-.028	.21
109	45 2504	6.9 K2	17 10 12.150	-.01	45 23 1.02	-1.2	10	10	61.42	61.42	23223	.014	1.12	2504	.005	-.19
110	45 2509	7.4 B3	17 12 0.261	-.12	45 25 45.63	-1.1	7	6	56.39	56.36	23262	.006	.63	2509	-.008	.14
111	45 2521	6.6 F0	17 18 23.785	-.36	45 21 24.64	8.6	9	9	58.22	58.22	23433	-.084	.43	2521	-.010	.28
112	45 2531	8.3 K0	17 23 11.716	-.06	45 23 44.55	1.3	9	9	57.85	57.85		.	.	2531	-.035	.41
113	45 2573	7.3 G0	17 36 37.716	.02	45 35 3.35	4.7	8	6	56.24	56.80		.	.	2573	-.017	.60
114	45 2620	8.2 G5	17 53 14.154	.41	45 33 40.04	2.2	8	9	59.05	58.76		.	.	2620	-.010	.14
115	45 2621	8.0 A0	17 53 17.773	-.07	45 13 27.32	.4	7	7	60.57	60.57		.	.	2621	.002	.04
116	45 2635	6.2 B9	17 57 26.441	-.07	45 28 41.02	2.5	10	8	57.82	58.63	24495	-.049	.41	2635	-.006	.07
117	45 2638	5.9 K2	17 58 30.380	-.05	45 30 10.11	-3.0	7	7	57.70	57.70	24518	.014	.56	2638	-.013	.24
118	45 2643	7.4 B9	17 59 40.981	-.11	45 21 0.48	1.4	9	8	55.76	55.90	24549	-.072	.52	2643	-.037	.08
119	45 2667	8.5 F0	18 8 22.117	.02	45 36 21.48	-1.8	9	7	57.67	58.00		.	.	2667	.018	.00
120	45 2684	6.3 G0	18 14 6.177	-.81	45 11 34.62	-11.2	11	11	59.55	59.55	24937	-.093	.26	2684	-.007	.13
121	45 2690	7.9 A0	18 16 45.231	-.01	45 8 7.59	.8	13	10	58.57	58.75		.	.	2690	-.020	.35
122	45 2704	8.1 A0	18 21 37.319	.00	45 11 34.87	3.0	7	7	57.69	57.69		.	.	2704	-.039	.31
123	45 2731	8.5 K0	18 29 41.197	.33	45 25 10.45	.2	8	6	57.52	57.80		.	.	2731	-.028	.03
124	45 2747	8.0 F0	18 35 47.799	-.10	45 37 38.80	1.1	7	7	58.68	58.68		.	.	2747	-.006	.19
125	45 2777	6.8 F0	18 47 8.232	.26	45 12 10.63	8.5	13	10	57.99	58.40	25807	-.005	1.14	2777	-.011	.29
126	45 2824	8.9 F5	19 2 16.791	.18	45 31 58.15	-.9	7	7	57.03	57.03		.	.	2824	-.035	-.13
127	45 2865	7.3 A0	19 13 56.276	.10	45 14 47.90	-1.0	9	9	57.12	57.34	26561	.037	-.41	2865	-.006	-.19
128	45 2877	8.6 K	19 18 55.964	-.07	45 29 59.04	.6	6	6	57.79	57.79		.	.	2877	-.006	.14
129	45 2971	7.5 K0	19 44 44.947	-.04	45 36 44.82	-.8	12	10	57.42	57.59		.	.	2971	-.015	-.42
130	45 3001	7.8 K0	19 52 12.060	-.09	45 20 19.36	.1	9	9	58.82	58.72		.	.	3001	-.009	.15
131	45 3038	7.5 A2	20 0 11.287	.28	45 20 10.60	2.3	7	6	57.08	57.16		.	.	3038	-.013	.41
132	45 3066	8.1 G5	20 6 32.260	-.12	45 23 48.88	-3.3	11	7	59.52	60.87		.	.	3066	-.023	.63
133	44 3414	7.5 K2	20 14 58.135	.03	45 11 0.64	1.6	6	6	58.47	58.47		.	.	3414	.011	-.15
134	44 3429	7.0 F5	20 18 11.253	.18	45 12 19.90	-2.0	6	6	59.63	59.63		.	.	3429	-.005	.06
135	45 3191	7.3 B9	20 27 9.419	.00	45 33 4.79	-.5	8	7	58.41	58.21		.	.	3191	-.027	-.07
136	45 3233	6.5 B3	20 37 41.800	-.03	45 29 21.19	.2	9	6	56.79	57.86	28793	-.042	-.08	3233	-.027	-.29
137	45 3275	6.7 K5	20 45 37.752	-.02	45 23 43.44	-1.8	9	8	60.14	60.83	28997	-.026	.76	3275	-.019	.26
138	44 3590	7.5 A0	20 46 42.879	.04	45 15 58.32	.1	8	6	59.63	60.13		.	.	3590	-.002	.00
139	44 3622	8.9 K	20 51 47.539	.14	45 11 36.68	.1	7	7	56.97	56.97		.	.	3622	.000	-.18
140	45 3410	7.3 G0	21 5 5.611	-.08	45 28 25.45	-1.0	6	7	61.31	61.36	29526	-.017	-.24	3410	-.029	-.12
141	45 3438	6.7 A0	21 9 27.769	-.08	45 28 7.33	-.6	8	8	56.63	56.63	29628	.090	-.32	3438	.019	-.16
142	45 3476	7.6 B9	21 14 9.152	-.03	45 31 20.27	-.7	10	8	56.67	57.16		.	.	3476	.027	.00
143	44 3825	8.5 G0	21 26 15.459	-.01	45 21 34.47	-3.7	8	8	61.85	61.85		.	.	3825	-.040	.03
144	44 3840	7.0 B5	21 28 8.501	-.02	45 16 27.04	-.5	9	9	58.51	58.51	30119	-.143	.05	3840	-.030	.31
145	44 3877	V.R MC	21 34 8.268	.59	45 9 0.61	.9	8	7	58.05	58.26		.	.	3877	.009	.52
146	45 3637	6.5 MB	21 40 13.488	-.07	45 32 13.65	-1.7	9	8	58.47	58.44	30390	-.041	-.12	3637	.004	.05
147	45 3813	6.5 G5	22 6 39.436	-.56	45 29 45.74	5.1	10	8	57.88	58.44	30985	-.116	1.07	3813	.014	.15
148	45 3941	7.3 A2	22 24 54.895	-.25	45 32 3.81	-1.5	8	8	57.69	57.69	31370	-.167	1.25	3941	.020	-.01
149	45 3958	8.2 K2	22 27 45.260	-.05	45 29 17.25	.5	8	7	59.21	59.29		.	.	3958	-.013	.01
150	44 4183	7.9 K0	22 35 36.962	-.19	45 8 52.88	.5	9	7	60.57	60.82		.	.	4183	-.029	-.10

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - PZT		
							α	δ	α	δ	No.	$\Delta\alpha$	$\Delta\delta$	No.	$\Delta\alpha$	$\Delta\delta$
151	45 4002	7.1 F8	22 36 2.565	-1.05	45 34 11.67	-16.9	7	6	57.34	57.76	31599	.115	.86	4002	.008	.17
152	44 4209	8.3 K2	22 41 1.647	.06	45 15 57.99	1.7	9	9	58.36	57.71		.	.	4209	-.024	.23
153	44 4263	8.1 K0	22 50 58.138	-.02	45 25 37.34	.1	7	7	60.32	60.32		.	.	4263	-.013	.16
154	45 4094	8.4 F8	22 53 55.346	-.16	45 31 29.04	-3.7	7	6	58.69	59.36		.	.	4094	-.020	-.31
155	44 4307	7.9 K0	22 59 17.431	.26	45 14 27.62	2.1	8	6	56.54	57.11	32090	.053	.24	4307	-.007	-.10
156	44 4320	8.8 F5	23 1 58.636	.17	45 12 42.53	.8	6	8	59.56	59.08		.	.	4320	.016	.11
157	44 4347	7.1 K0	23 8 31.436	-.75	45 14 40.62	-27.5	7	7	59.14	59.14		.	.	4347	-.016	.15
158	44 4373	6.3 B9	23 15 34.815	.24	45 12 56.60	-.9	6	6	57.26	57.26	32437	-.056	.44	4373	.008	.14
159	44 4424	7.9 K0	23 26 3.175	.02	45 25 4.34	-.4	6	6	58.76	58.76		.	.	4424	-.014	.48
160	44 4464	7.8 A2	23 36 53.598	-.06	45 26 34.99	-.9	6	6	60.25	60.25		.	.	4464	.048	.23

Part IV

No.	B.D. No.		M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3		
								α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
1	62	2356	6.26 B1	0 0 50.742	.	63 21 44.19	.	9	8	59.78	59.88		.	.		.	.
2	62	2363	7.36 B	0 3 26.872	-.21	63 24 5.10	1.8	6	6	59.75	59.75	85	.027	-1.17		.	.
3	58	11	6.70 B3	0 7 56.261	.11	59 23 43.73	-.2	6	6	57.58	57.58	177	-.039	.87		.	.
4	76	5	6.23 B9	0 13 21.546	.43	76 40 23.62	.5	13	13	59.61	59.61	303	-.120	.44	8	-.028	.18
5	50	72	8.3 K	0 23 36.660	.	51 0 13.58	.	9	9	57.87	57.87		.	.		.	.
6	63	81	7.40 B5	0 39 51.531	.	64 1 3.73	.	7	7	59.04	59.04		.	.		.	.
7	62	160	7.06 B3	0 48 23.038	-.45	63 30 34.40	-.3	8	8	58.29	58.29	1017	.149	.63		.	.
8	62	175	7.7 B2	0 55 20.029	.	63 26 37.92	.	7	7	59.91	~~59.91~~		.	.		.	.
9	60	188	7.26 B3	1 10 52.755	-.50	60 37 7.24	3.0	8	6	57.29	57.12	1472	.169	-1.03		.	.
10	59	260	7.26 B5	1 26 33.891	.	59 59 36.44	.	6	6	58.57	58.57		.	.		.	.
11	62	259	7.46 B0	1 27 53.760	.25	63 5 25.26	.9	8	8	60.02	60.02	1825	-.241	-.20		.	.
12	59	271	7.26 B3	1 29 54.198	-.12	60 25 48.68	-3.2	7	8	57.67	57.45	1865	.015	1.90		.	.
13	63	274	5.62 B5	1 59 16.495	.09	64 8 59.39	.1	8	8	58.55	58.55	2451	-.110	.41		.	.
14	57	494	5.90 A2	2 5 9.924	-.13	58 11 13.02	.7	7	7	58.79	58.79	2549	.041	-.08		.	.
15	56	438	6.36 B3	2 7 59.125	-.15	57 24 38.30	.9	6	6	58.96	58.96	2604	.072	-.45		.	.
16	57	519	6.50 A0	2 10 8.640	-.14	58 19 37.83	2.4	7	8	59.96	59.96	2648	.035	-1.18		.	.
17	57	526	7.8 A0	2 12 25.423	.	58 3 42.50	.	9	10	59.60	59.41		.	.		.	.
18	56	471	6.42 B1	2 13 20.901	.02	56 49 26.27	.1	9	9	59.34	59.55	2721	-.044	.24		.	.
19	63	315	7.05 B5	2 14 52.867	.08	64 11 41.51	.0	10	9	61.22	61.16	2760	-.082	.54		.	.
20	56	222	6.66 B0	2 15 32.610	-.01	56 54 20.88	-.4	6	7	61.07	60.59	2772	-.056	.67		.	.
21	56	530	6.66 B0	2 15 41.998	.05	56 56 22.03	.7	6	6	59.76	59.76	2774	-.047	-.42		.	.
22	55	588	6.84 B9	2 17 13.155	-.17	55 40 49.60	-.3	9	10	58.11	58.29	2800	.057	.25		.	.
23	56	568	6.54 A2	2 18 22.314	-.05	57 0 54.35	-.7	6	7	57.98	57.94	2822	-.009	.73		.	.
24	56	591	7.46 A0	2 19 20.034	.	57 1 4.91	.	9	8	59.09	59.12		.	.		.	.
25	56	593	6.95 B8	2 19 26.586	.03	57 9 35.98	.1	8	10	60.48	60.74	2848	-.063	.22		.	.
26	55	612	6.24 B2	2 21 43.137	-.02	56 23 3.58	1.1	6	6	57.18	57.18	2885	.010	-.58		.	.
27	57	568	7.32 B1	2 23 9.783	-.40	57 27 17.06	-1.0	10	9	59.89	60.21	2925	.184	.56		.	.
28	57	576	7.30 A2	2 26 21.082	.33	57 35 54.96	1.0	9	8	60.26	60.44	2973	-.230	-.39		.	.
29	57	582	7.20 B3	2 28 15.518	-.53	57 28 37.28	-.4	8	8	59.77	59.77	3014	.202	1.01		.	.
30	60	502	7.8 B	2 28 54.062	.	61 14 8.57	.	8	8	61.57	61.57		.	.		.	.
31	60	504	8.0 B	2 29 1.136	.	61 9 29.69	.	9	8	61.04	60.95		.	.		.	.
32	59	535	7.3 B9	2 40 5.636	.	59 36 39.79	.	8	8	61.06	60.55		.	.		.	.
33	2	44	3.58 A2	2 40 42.283	-.95	3 1 32.63	-14.7	13	13	61.60	62.06	3276	-.019	.33	96	-.006	.28
34	57	632	7.2 B2	2 43 8.216	.	57 31 28.58	.	7	7	57.96	57.96		.	.		.	.
35	57	634	8.1 B2	2 43 40.987	.	57 28 5.79	.	6	6	58.75	58.75		.	.		.	.
36	59	552	7.11 B0	2 47 15.362	.25	60 12 43.03	-2.7	8	7	58.82	58.82	3398	-.118	1.54		.	.
37	63	367	7.78 B	2 51 13.002	.05	63 57 18.03	2.1	6	6	57.81	57.48	3477	-.029	-1.14		.	.
38	61	525	6.54 B0	3 4 47.818	-.26	62 11 38.07	-2.3	8	8	60.17	60.17	3731	.091	1.90		.	.
39	29	566	7.06 B3	3 25 42.237	-.13	30 12 12.19	-.5	10	9	60.62	60.58	4131	.055	-.08		.	.
40	58	607	4.76 A0	3 25 54.146	.11	58 42 26.64	.2	9	8	59.90	60.28	4140	-.089	.25		.	.
41	56	824	6.79 B0	3 33 48.330	-.22	56 34 32.22	.6	7	7	57.54	57.53	4300	.074	-.04		.	.
42	33	698	5.04 B2	3 39 12.048	-.01	33 48 22.37	-1.0	10	9	59.44	59.73	4420	.043	.22		.	.
43	33	704	7.9 B3	3 40 13.084	.	33 57 30.23	.	7	7	57.84	57.84		.	.		.	.
44	31	66	3.94 B1	3 41 10.581	.07	32 7 53.41	-.9	11	12	61.78	61.86	4461	-.054	.34	132	-.028	.08
45	31	643	8.4 A5	3 41 25.799	.02	32 0 22.90	-.9	6	6	60.39	60.39	4465	-.008	.24		.	.
46	31	649	6.51 B3	3 43 32.090	-.05	32 8 8.91	-2.5	6	7	57.79	57.79	4516	.029	1.03		.	.
47	33	717	6.36 B3	3 44 41.950	-.02	33 26 47.77	-.3	8	7	60.05	59.81	4548	-.023	-.11		.	.
48	52	714	6.76 B0	3 45 40.707	-.03	52 30 12.25	.5	8	8	60.26	60.26	4571	.045	-.37		.	.
49	33	728	5.73 B3	3 48 41.497	.06	34 12 35.57	-.7	8	6	57.23	57.32	4649	-.059	.13		.	.
50	33	730	7.49 B3	3 49 6.877	.	34 4 23.94	.	7	7	60.18	60.18		.	.		.	.

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
51	48 1019	7.02 B3	3 51 45.694	.25	48 53 41.14	1.4	7	7	59.41	59.41	4704	-.133	-1.28		.	.
52	52 726	6.70 O5	3 51 50.306	.14	52 29 44.17	-.9	6	6	60.67	60.67	4708	-.108	.51		.	.
53	30 591	6.2 B0	3 52 15.157	-.07	30 54 0.82	-.7	6	7	58.59	58.78	4720	.004	.20		.	.
54	60 84	5.22 *	3 52 51.357	-.06	60 57 52.79	-1.2	13	13	61.36	61.36	4727	-.049	-.16	145	.008	-.06
55	34 768	5.48 B3	3 53 14.917	.08	34 56 11.34	-.1	7	7	61.00	61.00	4734	-.056	.13		.	.
56	32 714	6.70 B3	4 1 32.142	.16	32 26 7.29	-1.7	9	9	60.43	60.43	4891	-.080	.43		.	.
57	61 669	6.75 B2	4 1 44.297	-.06	61 58 0.41	.2	7	7	59.25	59.25	4898	.000	-.42		.	.
58	61 676	7.04 B0	4 3 26.097	-.26	62 11 49.35	-.8	9	8	61.35	61.30	4932	.182	.85		.	.
59	31 703	6.87 B3	4 3 28.249	-.03	32 15 4.93	-.2	9	7	57.52	57.92	4933	.053	.20		.	.
60	33 785	6.61 B3	4 3 43.445	.13	33 18 46.45	-.6	6	6	59.87	59.87	4943	-.061	.11		.	.
61	-13 893	5.50 B3	4 26 47.474	.02	-13 9 25.87	-.4	8	8	60.75	60.75	5458	-.044	.39		.	.
62	18 661	7.2 G0	4 34 20.177	-.10	18 26 34.64	-.7	7	7	59.56	59.56	5621	.007	-.36		.	.
63	36 937	7.95 F0	4 44 25.360	.	36 38 4.18	.	6	7	61.00	60.71		.	.		.	.
64	35 930	6.18 B2	4 52 59.521	-.12	36 5 25.28	1.1	6	6	58.48	58.48	6011	.035	-.56		.	.
65	-14 1003	5.87 B3	4 55 27.315	.06	-14 18 28.34	1.3	6	6	58.50	58.50	6055	-.046	-1.38		.	.
66	34 980	5.81 B0	5 12 59.772	.10	34 15 25.68	2.7	9	9	60.03	60.03	6429	-.083	.92		.	.
67	37 1146	6.71 O5	5 17 19.029	-.06	37 23 21.32	-1.2	7	7	60.25	60.25	6532	-.028	.81		.	.
68	37 1160	7.39 B0	5 19 10.665	.	37 37 43.31	.	7	6	60.94	60.80		.	.		.	.
69	3 871	4.99 B3	5 20 12.228	-.02	3 29 52.67	-.1	7	7	60.21	60.21	6607	.025	.28		.	.
70	-2 1235	3.44 B1	5 21 57.673	.00	-2 26 29.78	.2	11	12	60.62	60.42	6655	-.063	-.37	200	-.007	-.28
71	20 948	6.83 B2	5 22 11.875	.00	20 32 23.32	-.1	7	7	59.51	59.51	6664	-.050	-.13		.	.
72	30 898	5.72 B9	5 23 56.097	.10	30 10 1.02	-1.2	7	8	58.64	58.32	6703	-.091	.15		.	.
73	33 1049	7.50 B1	5 24 27.703	.	33 54 17.44	.	7	7	60.13	60.13		.	.		.	.
74	35 1137	6.71 B5	5 26 21.948	.01	35 20 10.80	-.7	8	8	59.36	59.36	6767	-.029	.11		.	.
75	-7 1106	4.64 B3	5 29 30.624	-.01	-7 20 13.22	-.4	7	8	59.85	59.64	6850	-.013	-.37		.	.
76	-1 935	5.30 B2	5 30 9.465	-.01	-1 37 35.27	-.8	6	7	60.39	60.50	6863	-.019	.40		.	.
77	-1 943	5.4 B2	5 30 59.082	-.03	-1 11 22.46	.2	9	8	61.34	61.29	6884	.003	.47		.	.
78	9 879	3.66 O5	5 32 22.922	.01	9 54 8.53	-.6	8	8	61.30	61.30	6915	-.022	.32		.	.
79	-6 1234	4.67 B1	5 32 35.944	.03	-6 2 1.67	.4	9	9	61.94	61.94	6926	-.027	-.23		.	.
80	-5 1315	5.36 O5	5 32 48.982	.02	-5 25 16.07	.3	6	6	61.62	61.62	6931	-.046	.04		.	.
81	-4 1183	6.54 B0	5 32 53.366	-.08	-4 31 32.13	3.1	7	6	61.91	61.94	6932	.039	-1.65		.	.
82	-4 1185	4.65 B3	5 32 55.053	.02	-4 52 10.73	.1	7	9	62.29	62.22	6934	-.034	-.06		.	.
83	-5 1319	5.17 B1	5 32 55.470	.00	-5 26 51.03	.6	10	11	60.59	60.64	6935	-.010	-.44		.	.
84	-6 1262	5.75 B1	5 35 0.530	.09	-5 58 2.09	.4	7	7	58.65	58.65	6994	-.062	-.52		.	.
85	-2 1326	3.78 B0	5 36 14.046	-.01	-2 37 38.34	.2	12	11	61.29	61.25	7031	-.031	-.08	213	-.006	.08
86	-2 1338	2.05 B0	5 38 14.058	.00	-1 58 2.76	-.1	14	13	60.42	60.01	7089	-.023	.24	1631	.010	.18
87	25 941	6.86 B2	5 40 33.644	-.12	25 25 4.15	.8	9	11	58.88	58.56	7152	.018	-.81		.	.
88	24 1033	6.03 B3	5 53 52.299	.05	24 14 38.87	-.2	6	6	60.28	60.28	7483	-.035	-.11		.	.
89	25 1052	4.90 B2	5 54 53.373	.03	25 56 58.47	-.3	6	6	60.02	60.02	7507	-.087	-.06		.	.
90	37 138	2.71 A0	5 56 18.635	.40	37 12 39.31	-8.3	11	10	62.25	62.19	7557	-.076	.28	228	-.038	.32
91	20 1233	4.71 B2	6 0 56.908	.04	20 8 29.11	-.8	8	8	59.63	60.02	7675	-.085	.28		.	.
92	21 1120	8.0 B2	6 4 38.343	-.09	21 52 50.20	-.9	9	9	60.88	60.88	7769	.040	.36		.	.
93	23 1226	5.76 B1	6 6 41.763	.08	23 7 24.76	-.4	7	6	57.67	57.93	7827	-.050	.42		.	.
94	22 125	V.R M0	6 11 51.453	-.48	22 31 23.15	-1.3	14	13	59.47	59.98	7969	-.040	.07	236	-.010	-.04
95	23 1275	6.26 B2	6 13 55.629	.04	23 45 34.51	-.4	7	7	60.93	60.93	8039	-.045	-.25		.	.
96	23 1300	7.03 B0	6 16 16.630	.04	23 29 27.55	-.9	8	7	60.78	60.76	8104	-.041	.34		.	.
97	-11 1460	5.49 B2	6 19 4.836	-.07	-11 44 55.63	-.5	6	6	59.30	59.30	8186	.006	-.05		.	.
98	7 1273	5.8 G5	6 22 30.970	.12	7 6 52.82	.3	8	8	62.15	62.15	8291	-.102	-.39		.	.
99	30 1238	5.0 G0	6 25 21.221	.04	30 31 32.62	-1.6	7	7	59.54	59.54	8371	-.069	-.30		.	.
100	5 1283	6.80 B2	6 29 16.038	.04	4 58 47.29	.4	7	7	59.09	59.09	8477	-.067	-.76		.	.

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O − G.C.			O − FK3		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
101	4 1302	7.14 B2	6 29 29.957	−.13	4 51 39.25	−1.7	8	9	61.71	61.40	8489	.031	1.13		.	.
102	15 1246	6.7 G5	6 32 5.555	.08	15 22 15.46	−.1	8	9	61.47	61.54	8560	−.042	−.84		.	.
103	10 1193	8.1 B2	6 33 23.972	.	10 19 36.91	.	6	7	60.59	60.77		.	.		.	.
104	6 1309	6.06 B0	6 34 43.202	.04	6 10 44.19	−.3	7	7	59.70	59.70	8631	−.041	.14		.	.
105	5 1334	6.16 B1	6 35 13.204	−.03	5 0 2.97	1.8	6	6	61.51	61.50	8651	−.047	−1.41		.	.
106	1 1443	6.13 B0	6 36 2.578	−.05	1 39 31.21	−.5	6	6	59.69	59.69	8671	.012	−.09		.	.
107	10 122	4.68 O5	6 38 13.415	−.01	9 56 36.65	−.7	11	11	61.22	61.22	8720	−.047	−.41	253	−.011	−.29
108	6 1351	6.20 B2	6 39 18.147	.07	6 23 39.96	−.8	6	6	58.18	58.18	8747	−.061	.55		.	.
109	17 1357	5.14 A0	6 39 29.627	.06	17 41 44.48	−9.1	7	9	60.69	60.75	8755	−.032	.16		.	.
110	4 1414	5.78 B0	6 41 0.355	.04	3 59 0.60	−.6	9	7	59.97	59.83	8790	−.072	−.02		.	.
111	1 1531	6.06 B3	6 46 28.752	.04	1 3 34.82	−.4	6	6	60.40	60.40	8916	−.056	.05		.	.
112	58 100	4.54 G0	6 52 57.124	−.08	58 29 25.52	−13.7	11	12	61.78	62.07	9082	−.086	.15	265	.012	.28
113	−10 1848	7.32 B0	7 2 3.601	.	−10 22 43.21	.	9	8	59.31	59.33		.	.		.	.
114	−11 1790	5.28 B3	7 4 19.804	−.09	−11 12 55.99	−.6	9	8	59.30	59.34	9389	.014	.50		.	.
115	61 938	6.73 K0	7 5 9.537	−.09	60 52 23.71	−5.1	8	9	60.15	60.37	9411	−.001	−.04		.	.
116	−10 1892	6.20 O5	7 6 58.136	.02	−10 15 54.03	−2.1	8	6	59.19	59.57	9459	−.043	1.91		.	.
117	−10 1933	5.99 B1	7 12 5.997	−.04	−10 13 43.67	−1.2	8	8	61.17	61.17	9605	−.037	.59		.	.
118	−8 1872	6.17 B5	7 19 38.117	.03	−8 53 0.66	2.0	6	6	60.01	60.01	9823	−.022	−.92		.	.
119	−14 1966	6.24 B5	7 31 4.075	−.08	−14 13 45.10	−.6	7	8	57.92	57.95	10113	.012	.64		.	.
120	−13 2267	5.34 G0	7 49 27.276	−.45	−13 45 54.89	−34.4	11	10	60.95	61.64	10629	−.047	−.31	298	−.003	−.09
121	6 209	3.48 F8	8 44 7.578	−1.30	6 36 11.95	−5.4	10	10	60.76	60.76	12102	−.064	.15	329	−.035	.12
122	28 1660	6.06 K0	8 49 37.019	−3.65	28 31 20.99	−24.0	9	8	58.91	59.51	12244	−.053	.19		.	.
123	31 197	5.60 K0	8 51 11.932	.28	30 46 11.56	−2.4	10	10	59.25	59.24	12289	−.031	−.48	333	.017	−.55
124	67 64	4.87 F8	9 6 1.210	−.44	67 20 19.52	−7.8	9	7	62.23	62.26	12619	−.299	−.51	344	.187	−1.15
125	37 201	3.82 A2	9 15 44.293	−.26	37 0 54.22	−12.9	16	15	59.38	59.86	12830	−.049	−.02	349	−.017	.02
126	20 253	2.61 K0	10 17 13.327	2.17	20 5 41.06	−15.4	11	12	60.85	60.95	14177	−.053	.00	1632	−.025	.15
127	14 2367	5.48 K0	11 13 15.007	−.05	13 34 49.95	−1.5	7	7	57.29	57.29	15487	−.015	−.01		.	.
128	11 242	4.03 F5	11 21 19.260	1.13	10 48 17.77	−7.9	15	13	57.79	57.46	15652	.018	1.01	430	.044	.81
129	−0 2601	3.65 F0	12 39 6.961	−3.78	−1 10 30.17	.8	9	10	58.64	59.70	17270	−.175	1.72	477	−.167	1.34
130	−17 3918	7.5 B0	13 41 48.237	.	−17 41 10.96	.	8	6	58.82	59.66		.	.		.	.
131	14 277	3.86 A2	14 38 45.576	.36	13 56 30.83	−2.0	12	11	58.36	58.72	19777	−.014	1.01	543	.004	.55
132	27 248	2.70 K0	14 42 48.090	−.38	27 17 3.02	1.7	12	11	60.11	60.62	19856	−.030	.46	1633	−.010	.20
133	17 2780	4.69 K0	14 42 54.316	−.42	17 10 29.71	−5.8	10	10	58.17	58.17	19858	−.033	.36		.	.
134	26 274	3.93 A0	15 40 38.399	−.80	26 27 10.88	4.2	14	12	58.38	58.45	21130	−.017	.54	581	.003	.20
135	61 160	2.89 G5	16 23 18.446	−.30	61 37 37.56	5.8	11	11	61.54	61.54	22101	−.020	−.02	615	.000	−.19
136	2 319	3.85 A0	16 28 23.322	−.21	2 5 30.28	−7.4	12	11	59.63	59.38	22203	−.051	.47	617	.002	−.09
137	4 3235	5.73 A0	16 38 9.587	−.03	4 18 56.89	−1.8	9	7	57.04	57.63	22430	.003	.50		.	.
138	31 292	3.00 G0	16 39 23.595	−3.72	31 41 35.43	39.3	9	10	59.79	59.97	22464	−.052	−.04	1634	−.024	−.61
139	−15 4467	2.63 A2	17 7 30.456	.25	−15 39 51.86	9.4	11	8	60.66	60.98	23158	−.030	.44	637	−.028	.11
140	14 327	3.48 M3	17 12 21.916	−.08	14 26 45.54	3.7	13	12	60.65	60.50	23277	−.032	.23	640	−.017	−.24
141	−19 4800	7.28 B3	17 58 55.335	.06	−19 6 23.77	−.2	9	9	59.01	59.01	24529	−.055	.73		.	.
142	1 3578	6.09 B3	18 2 5.798	−.04	1 54 54.08	−.6	7	7	56.07	56.07	24617	−.002	.40		.	.
143	−19 4895	7.14 B2	18 9 17.322	.04	−19 26 44.70	−1.0	9	9	59.86	59.86	24812	−.061	1.09		.	.
144	−18 4886	6.37 O5	18 14 32.459	−.03	−18 28 58.14	−.3	9	9	60.76	60.76	24950	−.027	.40		.	.
145	−15 4911	6.64 B0	18 14 45.472	−.02	−15 27 0.86	1.6	10	10	60.82	60.82	24955	−.041	−.03		.	.
146	−12 4980	7.34 B0	18 15 17.635	−.10	−12 15 46.16	1.0	8	7	61.33	61.17	24969	.045	−.37		.	.
147	−18 4896	6.38 B0	18 15 46.998	.08	−18 38 26.15	.2	8	8	59.41	58.91	24978	−.046	−.17		.	.
148	−12 4988	8.5 B0	18 15 52.746	.	−12 7 38.23	.	8	7	60.46	60.89		.	.		.	.
149	71 97	4.24 A0	18 21 28.413	−.18	71 18 42.84	4.1	14	10	59.49	60.53	25114	−.111	.51	693	−.079	.12
150	−14 5039	6.84 B0	18 22 24.810	.14	−14 0 25.72	1.4	7	7	58.00	58.00	25133	−.091	−.13		.	.

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
151	58 189	4.85 A2	18 23 10.650	-.55	58 46 17.50	6.0	10	11	60.17	60.29	25151	-.048	.51	694	-.003	.40
152	-9 4736	7.8 B2	18 23 48.934	.	-9 13 55.85	.	6	6	58.07	58.07		.	.		.	.
153	-15 5004	8.1 B0	18 29 45.347	.	-15 44 21.38	.	8	11	59.53	59.52		.	.		.	.
154	-18 4994	6.98 B0	18 30 14.262	.00	-18 24 24.40	-1.3	5	5	60.33	60.33	25320	-.049	.24		.	.
155	22 3648	5.40 B0	19 15 36.601	-.03	22 56 3.01	-.8	6	6	58.95	58.95	26613	.027	.16		.	.
156	20 4218	6.44 B0	19 38 17.110	-.05	20 21 36.65	-2.5	9	7	58.04	58.76	27226	.019	1.31		.	.
157	44 327	2.97 A0	19 43 24.640	.44	45 0 28.90	4.8	13	13	58.53	58.53	27347	-.025	.74	742	-.072	.27
158	33 3602	6.35 B0	19 46 56.022	.01	33 18 39.84	-.5	8	6	56.97	57.42	27433	-.039	.25		.	.
159	69 107	3.99 K0	19 48 21.216	1.53	70 8 27.24	4.0	13	13	60.16	60.16	27471	-.019	.53	747	-.006	.21
160	18 4276	6.29 O	19 50 7.878	-.05	18 32 31.19	-.6	6	6	58.43	58.43	27523	.009	-.37		.	.
161	47 2939	5.70 B2	19 50 38.685	-.10	47 48 6.71	-1.0	9	7	59.47	60.00	27531	-.039	.24		.	.
162	47 2945	6.15 B2	19 51 32.377	-.14	47 40 36.81	-1.2	8	6	57.99	58.77	27549	.016	.92		.	.
163	52 259	4.80 A3	19 54 20.121	-.47	52 18 19.47	-2.9	14	12	59.95	59.68	27618	-.017	.18	750	-.007	.02
164	31 3925	5.69 B0	20 2 38.403	-.13	32 4 33.03	-1.4	6	6	59.77	59.77	27858	.007	.68		.	.
165	35 3952	7.30 B	20 4 3.268	.	35 31 39.86	.	9	9	60.04	60.04		.	.		.	.
166	-9 5382	6.45 B3	20 8 27.432	.02	-8 59 30.23	.0	9	9	60.39	60.39	27998	-.011	.16		.	.
167	21 4088	6.11 B0	20 9 9.757	-.04	21 43 30.70	.5	11	9	60.22	60.78	28024	-.035	-1.23		.	.
168	39 4082	7.47 B3	20 10 46.739	.	40 7 1.11	.	8	8	59.11	59.11		.	.		.	.
169	38 3956	7.10 B2	20 11 33.524	-.16	38 36 48.36	-.7	10	8	57.84	58.01	28086	.080	.21		.	.
170	36 3958	7.02 O5	20 12 39.095	.	37 12 2.37	.	6	6	60.93	60.93		.	.		.	.
171	37 3867	7.12 B2	20 15 32.454	-.13	38 4 46.90	-.3	7	6	58.80	58.98	28210	.064	.03		.	.
172	40 4103	5.82 B2	20 16 20.615	-.03	40 34 30.67	-.4	8	6	58.98	59.27	28228	-.003	-.08		.	.
173	37 3879	7.74 B1	20 17 1.258	.	38 7 19.34	.	7	6	59.05	59.10		.	.		.	.
174	38 4006	7.29 B2	20 17 19.596	.	39 6 56.05	.	7	7	58.58	58.58		.	.		.	.
175	37 3892	7.6 B8	20 17 58.695	.	38 11 3.35	.	7	7	59.20	59.20		.	.		.	.
176	40 4150	7.05 B0	20 21 31.046	.	40 35 49.04	.	7	6	59.31	59.27		.	.		.	.
177	40 4165	7.45 B	20 24 35.011	.	41 12 51.50	.	9	8	60.04	60.48		.	.		.	.
178	-18 5689	4.96 F0	20 26 0.572	-.12	-17 58 49.57	-2.0	17	14	60.22	60.27	28481	-.010	.23	766	-.008	-.06
179	-15 5696	6.19 G0	20 28 16.291	-.31	-15 13 28.61	-5.5	8	7	58.97	59.31	28533	.024	1.46		.	.
180	43 3630	7.15 B	20 28 52.818	.	44 8 45.66	.	6	7	59.16	59.37		.	.		.	.
181	14 4353	4.69 A2	20 32 58.215	.29	14 30 2.10	1.2	8	7	57.51	57.91	28659	.001	.00		.	.
182	14 445	3.72 F5	20 35 12.257	.74	14 25 11.59	-3.0	13	11	59.02	59.35	28709	-.004	-.20	771	-.008	-.48
183	35 433	4.47 B5	20 45 27.543	.03	36 18 21.91	-.3	12	11	62.01	61.97	28994	.001	.51	784	.005	-.01
184	45 3291	4.89 B2	20 47 13.945	.01	45 55 40.34	-.1	7	6	57.58	57.73	29036	-.045	.14		.	.
185	54 2429	8.2 B	20 49 47.461	.	55 18 1.22	.	6	7	57.66	57.65		.	.		.	.
186	32 3974	6.35 B5	20 49 58.174	-.11	32 39 36.16	.5	7	7	58.92	58.92	29111	.043	-.32		.	.
187	48 3242	7.13 B2	20 52 15.467	-.04	49 20 33.74	.2	10	8	58.12	58.49	29172	-.031	-.17		.	.
188	46 3111	5.76 B8	20 54 8.358	-.06	47 13 31.15	-.3	8	8	58.54	58.54	29219	-.025	.43		.	.
189	44 3639	6.01 O5	20 54 48.827	-.08	44 43 54.16	.7	6	6	57.52	57.52	29241	.018	-.03		.	.
190	45 3364	5.24 B3	20 59 26.076	.03	45 57 31.12	.7	6	6	59.03	59.03	29354	.002	-.06		.	.
191	54 2470	7.16 B2	21 2 25.934	-.10	55 1 51.18	.2	8	7	57.92	57.95	29440	.010	.04		.	.
192	35 4426	6.40 B1	21 9 3.020	.14	36 5 39.37	-1.5	6	6	58.00	58.00	29616	-.079	1.05		.	.
193	59 237	5.62 B2	21 10 31.800	-.06	59 46 49.57	-.2	14	14	57.58	58.09	29655	-.054	.27	798	-.040	.22
194	37 424	3.82 F0	21 12 47.666	1.32	37 49 55.96	43.7	13	12	58.43	58.67	29723	-.029	-.06	799	-.009	-.12
195	57 2309	6.41 B3	21 15 56.345	-.03	58 24 3.34	.4	6	6	57.89	57.89	29804	-.037	-.07		.	.
196	61 2112	6.64 B0	21 17 54.111	-.29	61 38 47.25	-1.4	7	6	59.11	59.34	29861	.051	.93		.	.
197	46 3294	7.10 B2	21 22 1.859	.	46 56 57.07	.	6	6	57.18	57.18		.	.		.	.
198	54 2533	7.6 B0	21 22 57.263	.	55 9 2.27	.	12	9	61.09	62.00		.	.		.	.
199	36 4557	5.84 B0	21 23 44.254	.02	36 27 1.89	-.5	8	9	58.82	58.69	30016	-.012	-.31		.	.
200	58 2272	7.4 B2	21 27 31.345	.	58 31 12.86	.	7	6	58.41	58.36		.	.		.	.

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3		
							α	δ	α	δ	No.	Δα	Δδ	No.	Δα	Δδ
201	59 2395	5.52 B0	21 29 36.797	-.05	60 14 18.59	.1	8	8	59.27	59.27	30150	-.023	.38		.	.
202	56 2589	7.36 B0	21 30 7.889	-.12	57 16 52.44	-.1	8	8	59.37	59.37	30162	.006	.32		.	.
203	57 2374	6.98 B0	21 40 50.237	.15	57 30 24.68	-.2	7	6	59.30	59.39	30408	-.108	-.30		.	.
204	24 449	4.27 F5	21 42 22.733	.23	25 24 52.17	1.5	12	11	59.76	59.86	30450	-.007	.42	816	-.002	.05
205	61 2193	5.97 B2	21 43 30.670	-.13	62 13 47.53	.1	6	6	59.07	59.07	30473	-.067	.61		.	.
206	59 2420	7.03 B3	21 46 8.441	-.11	59 28 3.78	1.4	8	8	58.21	58.21	30530	.014	-.77		.	.
207	52 3043	6.56 B2	21 48 15.876	-.07	52 27 47.45	-.9	8	8	57.96	57.96	30579	-.037	1.03		.	.
208	28 4215	5.62 F5	21 50 15.765	-.48	28 33 30.65	-6.5	8	8	56.59	56.59	30625	-.008	.04		.	.
209	62 1994	6.76 B1	21 51 9.714	.00	62 28 34.56	2.0	10	8	58.10	58.46	30645	-.098	-.74		.	.
210	61 2216	7.10 B3	21 52 21.848	-.10	62 22 40.00	1.5	8	8	58.32	58.32	30671	-.004	-.44		.	.
211	60 2320	6.90 B3	21 55 46.214	-.19	61 3 23.34	.1	7	7	58.86	58.86	30744	.060	.48		.	.
212	61 2233	6.48 B0	21 59 9.339	-.05	62 14 48.71	1.0	7	7	57.15	57.15	30812	-.022	-.41		.	.
213	57 2441	5.50 B0	22 0 23.522	-.06	57 45 31.29	.1	12	10	58.76	59.17	30837	-.015	.31		.	.
214	59 2456	6.74 B5	22 2 15.942	.02	59 34 18.21	.1	7	7	57.44	57.44	30874	-.024	.20		.	.
215	61 2246	5.17 O5	22 3 36.142	.01	62 2 10.82	.3	9	8	58.81	58.94	30907	-.108	.48		.	.
216	47 3692	6.16 B3	22 3 53.310	-.08	47 59 15.90	.4	6	6	59.37	59.37	30917	.023	.10		.	.
217	58 2402	5.19 O	22 9 48.477	.01	59 10 2.53	-.9	7	7	57.46	57.46	31066	-.102	.10		.	.
218	45 3879	8.3 B	22 16 55.923	.	45 33 4.46	.	6	6	60.34	60.34		.	.		.	.
219	36 4835	6.39 B3	22 24 32.171	.09	37 11 19.09	-.2	8	8	58.47	58.47	31360	-.051	-.34		.	.
220	39 4841	6.07 B3	22 25 14.711	-.01	39 33 16.89	-1.0	8	8	61.07	61.17	31375	-.039	.71		.	.
221	40 4854	7.00 B5	22 32 17.553	-.19	40 30 58.41	-.6	9	8	58.47	58.44	31522	.069	.51		.	.
222	38 4808	6.55 B5	22 33 38.317	-.10	39 22 7.94	-.2	8	8	61.64	61.53	31550	-.002	.21		.	.
223	38 4808	5.83 B3	22 33 38.546	.00	39 22 30.62	-.5	7	6	60.99	61.36	31551	-.013	.61		.	.
224	49 3903	6.20 B3	22 33 48.428	.03	49 48 41.36	.8	6	6	58.79	58.79	31556	-.009	.01		.	.
225	37 4631	6.75 B3	22 34 7.230	-.04	37 34 58.17	.0	9	8	58.94	59.08	31564	.009	-.06		.	.
226	38 4817	8.1 B3	22 35 14.440	.	39 10 43.98	.	8	8	61.05	61.05		.	.		.	.
227	36 4898	6.67 B3	22 36 48.597	-.12	37 6 53.48	-.3	8	8	58.68	58.68	31617	.028	.39		.	.
228	39 4912	5.18 B2	22 39 14.054	-.08	39 57 50.16	-.1	8	8	58.20	58.20	31670	.052	.53		.	.
229	37 4670	6.22 B3	22 40 38.920	.06	37 32 25.80	-.8	9	8	59.12	59.18	31704	-.052	.26		.	.
230	64 1717	6.83 B3	22 46 3.894	.02	64 47 52.48	.5	8	8	57.13	57.02	31826	-.113	-.06		.	.
231	47 3931	7.8 B5	22 47 6.629	.	47 39 54.82	.	9	8	57.85	57.99		.	.		.	.
232	41 4623	5.84 B5	22 48 6.148	.06	41 41 17.76	.0	9	9	58.41	58.41	31861	-.001	.07		.	.
233	61 2356	8.4 B3	22 50 34.238	.	62 10 28.59	.	7	6	58.02	58.06		.	.		.	.
234	49 3965	8.5 B5	22 50 47.909	.	49 35 55.77	.	8	8	59.80	59.80		.	.		.	.
235	42 4529	7.4 B5	22 52 5.572	.	43 15 43.12	.	7	6	59.02	59.42		.	.		.	.
236	42 4538	7.68 B5	22 53 31.061	.	43 17 32.25	.	7	9	58.57	58.82		.	.		.	.
237	40 4949	5.54 B3	22 54 6.307	-.06	41 20 11.89	.0	10	7	59.14	59.59	31987	.007	.09		.	.
238	62 2136	7.76 B5	22 54 33.131	-.01	62 36 4.44	.4	8	7	61.20	61.14	31994	-.015	-.14		.	.
239	43 4355	7.02 B3	22 56 29.096	.10	43 34 14.51	.9	7	6	59.56	59.69	32029	-.098	-.49		.	.
240	62 2146	7.36 B5	22 56 35.637	.19	63 26 19.15	.4	6	6	59.95	59.95	32032	-.118	-.16		.	.
241	37 4744	6.39 B3	22 58 34.821	-.03	38 26 20.92	-.4	7	7	57.89	57.89	32073	.014	-.35		.	.
242	43 4378	6.32 B3	23 0 27.602	-.02	43 47 22.28	-.1	6	6	58.20	58.38	32114	.002	.02		.	.
243	62 2170	7.46 B5	23 4 6.399	.15	62 56 33.26	1.1	10	6	59.50	60.19	32185	-.175	-.19		.	.
244	58 2545	4.91 B1	23 4 29.452	.10	59 8 57.43	.3	8	8	58.58	58.58	32197	-.068	-.06		.	.
245	45 4147	6.56 B5	23 5 0.275	.01	45 47 51.36	.0	7	7	61.69	61.68	32208	-.055	.68		.	.
246	74 106	4.56 G5	23 6 17.943	.22	75 7 0.93	-2.1	9	10	61.89	61.95	32237	-.089	-.17	874	-.047	-.45
247	48 3950	6.53 B3	23 7 0.536	.10	49 22 45.77	.0	9	8	58.20	58.37	32253	-.054	.24		.	.
248	73 1023	5.74 A0	23 12 49.888	1.16	73 57 30.74	1.0	12	9	58.16	58.52	32366	-.192	.19		.	.
249	30 505	5.21 K2	23 31 28.057	.38	31 2 56.62	-1.2	13	12	59.74	60.16	32772	-.008	-.34	887	-.010	-.45
250	60 2636	6.98 B0	23 51 20.071	.02	60 34 30.86	1.0	10	9	59.42	59.51	33149	-.073	-.88		.	.

No.	B.D. No.	M+Sp.	R.A. 1950	100μ	Decl. 1950	100μ'	No.		Epoch		O - G.C.			O - FK3		
							α	δ	α	δ	No.	$\Delta\alpha$	$\Delta\delta$	No.	$\Delta\alpha$	$\Delta\delta$
251	60 2637	7.6 B0	23 51 43.166	.	61 19 40.53	.	8	7	59.88	59.90		.	.		.	.
252	61 2562	7.16 B0	23 52 11.889	-.42	61 33 38.91	-1.9	6	7	60.03	60.28	33163	.094	1.39		.	.
253	56 3115	6.05 B0	23 53 2.641	-.11	57 8 2.57	.0	6	6	58.93	58.93	33184	.001	.68		.	.
254	58 2676	8.4 B0	23 55 15.661	.	59 26 30.63	.	7	6	57.61	57.43		.	.		.	.
255	54 3082	4.93 B2	23 56 27.669	.09	55 28 36.02	-.2	7	8	59.58	59.85	33257	-.047	.18		.	.

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A LARGE 10 MHz ARRAY FOR RADIO ASTRONOMY

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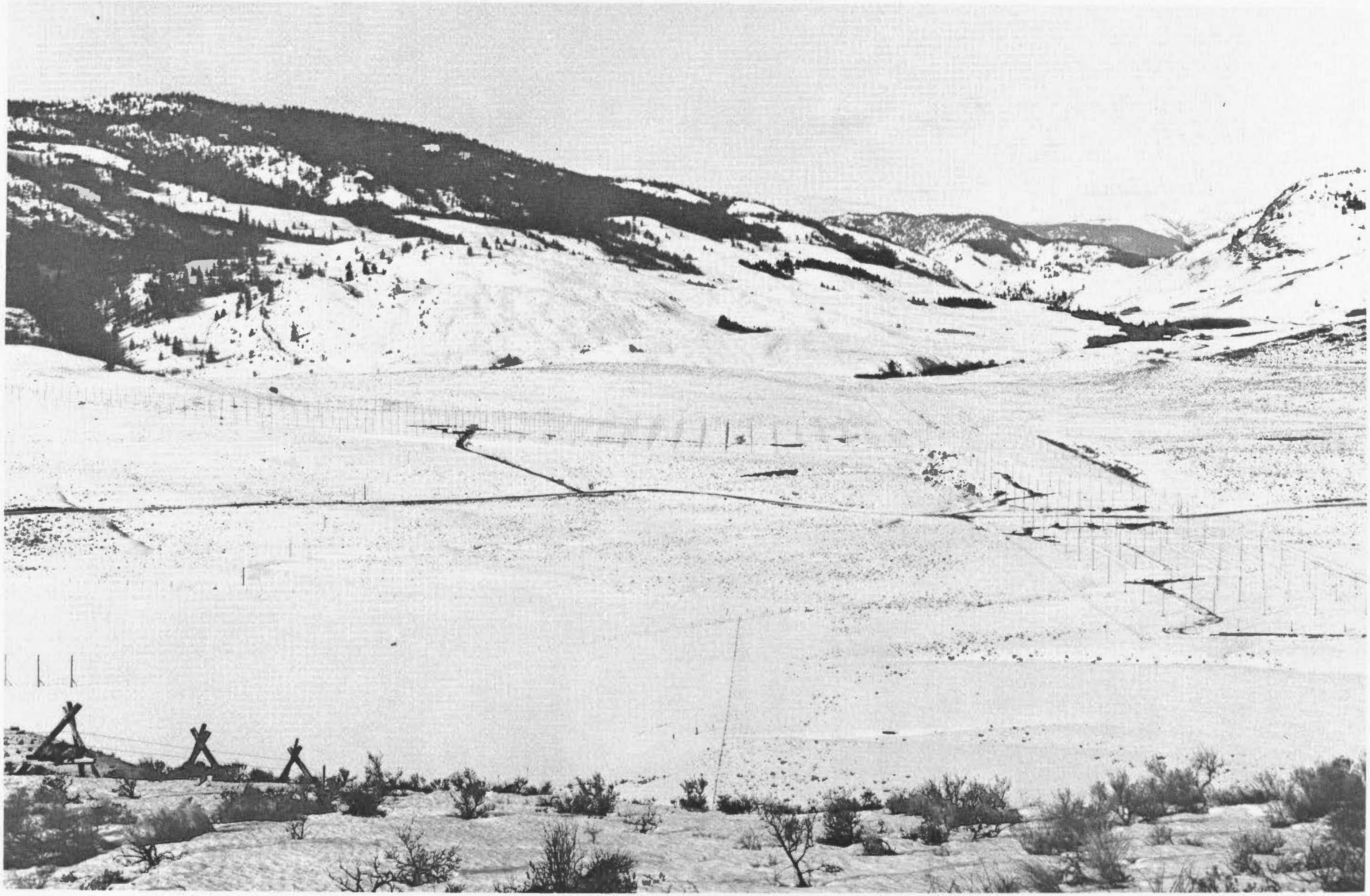

Figure 1. A photograph of the 10 MHz array taken from a hill to the east.

A LARGE 10 MHz ARRAY FOR RADIO ASTRONOMY

J. A. GALT*, C. R. PURTON† AND P. A. G. SCHEUER§

ABSTRACT: A large array-type transit radio telescope for frequencies near 10 MHz is described. It is built in the shape of a horizontal 'T' and consists of 400 half-wave dipoles suspended from wooden poles above a reflecting screen. The voltages from the two arms of the 'T' are multiplied, giving the instrument a pencil beam response. It has a collecting area of 192,000 m^2, and when used with a bandwidth of 8 KHz, can detect sources to a flux limit of $70 \times 10^{-26} Wm^{-2} Hz^{-1}$. The beamwidth is $2^{\circ}.6 \times 2^{\circ}.4$ at the zenith. An elaborate phasing system is employed which allows observations at many different declinations simultaneously. Fluxes have been measured with this instrument for 166 astronomical sources and a map of the galactic radiation has been prepared.

RÉSUMÉ: Les auteurs décrivent une grande antenne, constituée d'éléments alignés, pour les radiotélescopes à transit fonctionnant à des fréquences de près de 10 MHz. Elle a la forme d'un «T» horizontal et consiste en 400 dipôles demi-onde suspendus à des poteaux de bois au-dessus d'un écran réflecteur. Les tensions provenant des deux bras du «T» sont multipliées, ce qui donne à l'instrument une réponse unique. Il a une surface de captation de 192,000 m^2 et, lorsqu'on l'emploie sur une largeur de bande de 8 KHz, il peut détecter des sources à une limite de flux de $70 \times 10^{-26} Wm^{-2} Hz^{-1}$. La largeur du faisceau est de $2^{\circ}.6 \times 2^{\circ}.4$ au zénith. Un système élaboré de mise en phase permet des observations à plusieurs déclinaisons différentes simultanément. On a mesuré les flux de 166 radiosources à l'aide de cet instrument et on a dressé une carte du rayonnement galactique.

Introduction

Most high-resolution radio astronomical studies have been made at frequencies high enough that ionospheric effects are of little importance. As the frequency is lowered, observations become progressively more difficult because of absorption, refraction and scintillation. There are the further difficulties of the large physical size necessary to achieve a reasonable resolution, and of the very limited bandwidth which can be found free of man-made interference. It has, however, become imperative that the discrete sources and the background radiation be observed over as wide a frequency range as possible in order to detect changes in the slope of their spectra. The slope and curvature of the radio spectra are of great importance in recognizing the type of source being studied and in elucidating the physical processes involved.

The low-frequency surveys which have been published include the 38 MHz synthesis surveys at Cambridge (Costain and Smith, 1960; Williams, Kenderdine and Baldwin, 1966), the 26.3 MHz compound grating surveys at Clark Lake, California (Erickson and Cronyn, 1965; Erickson, 1965), the interferometer survey between 20 and 38 MHz in the Ukrainian S.S.R. (Bazelyan, Braude, Vaisberg, Krymkin, Men' and Sodin, 1965), the 19.7 MHz cross survey of the southern sky in New South Wales (Shain, Komesaroff and Higgins, 1961), the 4.7 MHz survey in Tasmania, (Ellis, Green and Hamilton, 1963) and the 13 MHz synthesis survey at Cambridge (Andrew, 1966).

To extend these measurements both to lower frequencies and to lower flux levels two large arrays have been built at the Dominion Radio Astrophysical Observatory, Penticton, B.C. The 22 MHz array which has a beamwidth of $1^{\circ} \times 1^{\circ}.6$ at the zenith and a collecting area of 65,000 m^2, has been described elsewhere (Galt and Costain, 1965; Costain, Lacey and Roger, 1967). The present paper describes the 10 MHz antenna which was undertaken as a joint project with Cambridge University. Both antennas were put into operation late in 1964 and have been used intensively ever since in an effort to obtain as much data as possible before the next period of solar activity, when it is anticipated that ionospheric conditions will become unfavorable for decametric radio astronomy.

General Description

The array, which is in the form of a 'T' is shown in Figure 1; its dimensions are given in Figure 2. It consists of 400 dipoles supported by wooden poles one-eighth wavelength above a reflecting screen. To obtain the best fit of the antenna to the terrain the plane of the

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*Dominion Radio Astrophysical Observatory, Penticton, B.C.
†National Research Council, Ottawa, Ont.
§Mullard Radio Astronomy Observatory, Cambridge, U.K.

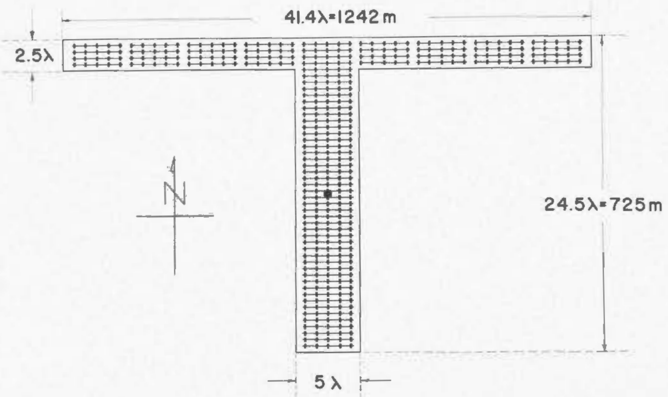

Figure 2. Dimensions of the 10 MHz radio telescope. The dipoles are shown as short vertical lines.

array was tipped down to the north by $2^{\circ}\!.8$ and down to the east by $1^{\circ}\!.6$. To have the N-S plane of the instrument pass through the north celestial pole in spite of the E-W tilt, the azimuth of the antenna arms was decreased by $\beta = 1^{\circ}\!.8$ where β is given by

$$\tan \beta = \tan \varphi \sin \psi$$

φ is the latitude and ψ is the angle which the plane of the array makes with the horizontal measured along a true E-W line. The over-all effect was to shift the broadside response from the zenith to a higher declination and earlier hour angle. In other words, the antenna behaved as though it were located at latitude 52° 06′ N, longitude 117° 13′ W instead of its geographical position, 49° 19′ N, 119° 37′ W.

The array is supported on 590 wooden poles of various lengths up to 20 m depending on the terrain. The E-W arm consists of four lines of 45 dipoles each, making a total of 180 dipoles. The N-S arm consists of 48 lines of 5 dipoles each, making a total of 240 dipoles. The 20 dipoles in the overlap region are included in both arms.

The receivers and recorders are housed in a trailer situated at the centre of the N-S arm. The receiving system multiplies the voltages from the two arms, using the technique of phase switching (Ryle, 1952), amplifies the product and presents the output on a pen recorder. This system is similar to that used for the Mills cross (Mills and Little, 1953) and for the 22 MHz 'T'. The response of the instrument in any particular direction is then proportional to the product of the voltage responses of the individual arms. Since the voltage response of each arm is a fan beam, and since the two beams are mutually perpendicular, the result for the complete instrument is a pencil beam, $2^{\circ}\!.6$ E-W by $2^{\circ}\!.4$ N-S at the zenith.

When used with a bandwidth of 8 KHz the antenna is capable of measuring sources to a flux limit of about $70 \times 10^{-26}\text{Wm}^{-2}\text{Hz}^{-1}$. This is still well above the confusion limit for reliable identification of individual sources. Greater sensitivity would require the use of larger bandwidths but this is seldom possible because of interference.

Dipoles

The individual elements of the array are 3-wire folded dipoles with a resonant impedance of 365 ohms, and are oriented to accept N-S polarization. The N-S separation of the dipoles is 0.5λ, permitting phasing in that direction. If a larger spacing had been used a grating response would have appeared when the array was phased away from the zenith. The E-W separation is 0.9λ, which was considered to be the maximum spacing consistent with a tolerably low end-fire response. The exact length of the dipole was determined experimentally by erecting a block of 20 dipoles above the reflecting screen, and adjusting the lengths until each dipole was resonant at 10.02 MHz when all the remainder were terminated with resistances approximately equal to their impedances. The dimensions in Figure 3 were so determined and used throughout the array. In order that all dipoles should appear purely resistive the dipoles along the extreme north and south edges of the array were made slightly shorter than the internal dipoles.

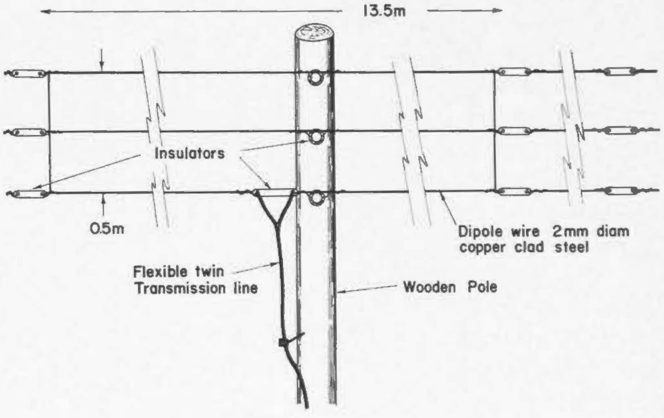

Figure 3. Dimensions of the dipoles.

Reflecting Screen

The ground plane or reflecting screen is placed 3.75 m beneath the centre of the dipoles. It consists of a grid of fine galvanized steel wire 0.7 mm in diameter running north-south, spaced at intervals of 1.2 m. In places where the reflecting screen is closer to the actual ground than 1.2 m the spacing between wire is reduced appropriately. The reflecting screen is supported by taut steel wires which also serve to guy the poles and maintain the correct dipole spacing. The reflecting screen extends 0.5λ beyond the centre of the end dipoles in the N-S direction. In the E-W direction the screen extends beyond the dipoles 0.9λ in the E-W arm and 0.7λ in the N-S arm. The area of the reflecting screen is $213.5\lambda^2 = 192{,}000$ m².

Feeder System, General

Throughout the array, dipoles are fed in parallel in E-W lines of five. The feeder system for a line of five dipoles is shown in Figure 4. An accurately cut 0.5λ length of 225-ohm flexible twin transmission line whose conductors are embedded in polystyrene foam connects each dipole to a horizontal open-wire transmission line ($Z_0 = 370\ \Omega$) running east-west 30 cm above the reflecting screen. The flexible twin lines are soldered to the open wire transmission line at intervals of 1.0λ. Shorting blocks were placed on the open-wire line 0.25λ from the extreme attachment points. The impedance at the centre of this open-wire line resulting from the effective superposition of five dipoles in parallel was 73 ohms. At this point the power was transferred by means of a transformer balun to a 50-ohm coaxial cable (polyfoam equivalent of RG-8/U).

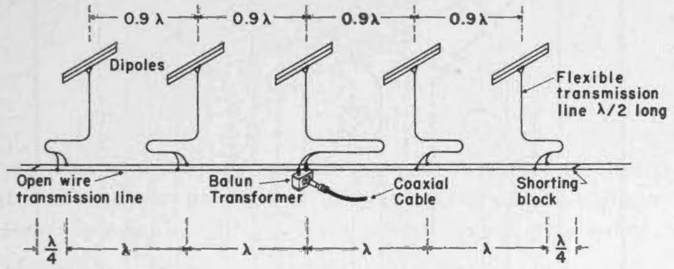

Figure 4. Method of collecting power from a line of five dipoles.

The dipoles in adjacent lines interacted through their mutual impedances, and the impedance at the output was, in general, reactive. This reactance was cancelled by a small adjustment in the position of the shorting block at one end of the open-wire transmission line.

Feeder System, E-W Arm

A diagram of the coaxial cable branching network used for each of the four lines of 45 dipoles in the E-W arm is shown in Figure 5. In the region common to both arms the power from each balun is split in a hybrid ring, half the power going to each arm. To reduce side lobe responses, grading attenuators were inserted between the baluns and the feeder cables as shown; the hybrid ring acted as a 3-db attenuator.

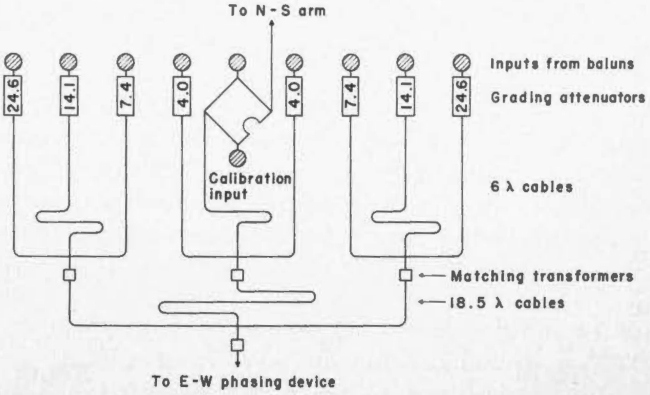

Figure 5. Coaxial cable feeder system for one line of the E-W arm.

As originally designed and built the path lengths from each balun to the phasing device were identical. This arrangement provides compensation for changes in the electrical length of the cable with temperature and also preserves the bandwidth of the feeder system. It does, however, introduce more attenuation than is necessary, because of the extra cable length required in the central branch of the network. Since cable attenuation was greater than expected the signal from the E-W arm was not as large as had been intended. To overcome this difficulty the long central cable was shortened from 18.5λ to 0.5λ and the grading attenuators changed appropriately. The observations prior to July 1965 were made with the feeder system as in Figure 5; those made after July 1965 used the modified configuration. An increase in signal from the E-W arm of about 6 db was realized by the change.

Feeder System, N-S Arm

A coaxial cable of length 15.5λ was run from each of the 48 baluns in the N-S arm to the trailer at the centre of the arm. Each cable was connected to a grading attenuator inside the trailer, and these in turn were connected to the input of the N-S phasing device. The attenuation used is indicated in Figure 6.

Feeder System, 10 MHz Personnel

Power for the observer was usually obtained from a small bag containing 'Midnight Lunch'. This was transferred without attenuation while observations were in progress.

Phasing, General

To avoid loss of valuable time, moving the beam in declination had to be a simple and rapid operation.

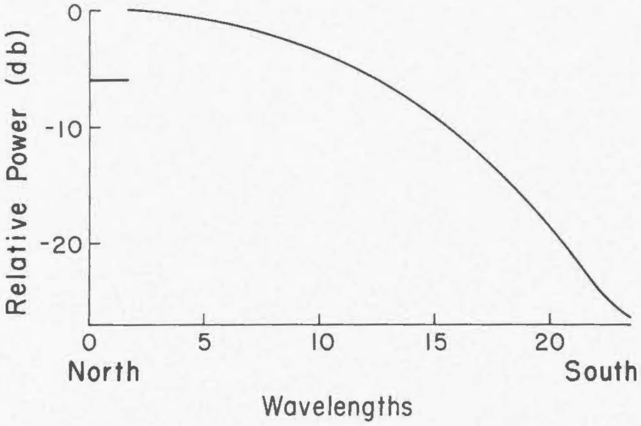

Figure 6. The grading attenuation shown as a function of position in the N-S arm.

Another requirement was the ability to observe several declinations simultaneously. This is a particularly useful feature at a frequency as low as 10 MHz where irregular refraction in the ionosphere is frequently encountered.

To satisfy these requirements two phasing devices were built, one for each arm of the 'T'. In its general form the phasing device used may be considered a 'black box' with *n* input ports and *n* output ports, where *n* is some power of two. The input ports are permanently connected to the elements of the array in a prescribed order. Each output port corresponds to a different phasing configuration of the array, in other words to a different declination for the antenna beam. To observe in a given direction the receiver is connected to the appropriate output port. Similar devices have been used at microwave frequencies (Butler, 1966).

Phasing, E-W Arm

The phasing device which was built for the E-W arm can be understood by reference to Figure 7. The actual circuit diagram of the device is shown in Figure 7 (a) while (b) is a schematic equivalent showing the phase relationships between the four input ports and the four output ports. The effective path lengths between the various ports (less an additive constant or 'zero length') are shown in the circles on each line in 7 (b). This device will be referred to as a nest of hybrid transformers or simply as a 'nest'. When the feeder cables from each of the four E-W lines of dipoles are connected (in order) to the input ports it can be seen that output port 0 will provide a beam phased for reception at the zenith. When output port 1 is used, a progressive phase delay of λ/4 is introduced between the lines of the array, thus producing a beam tipped 30° to the south of the zenith.

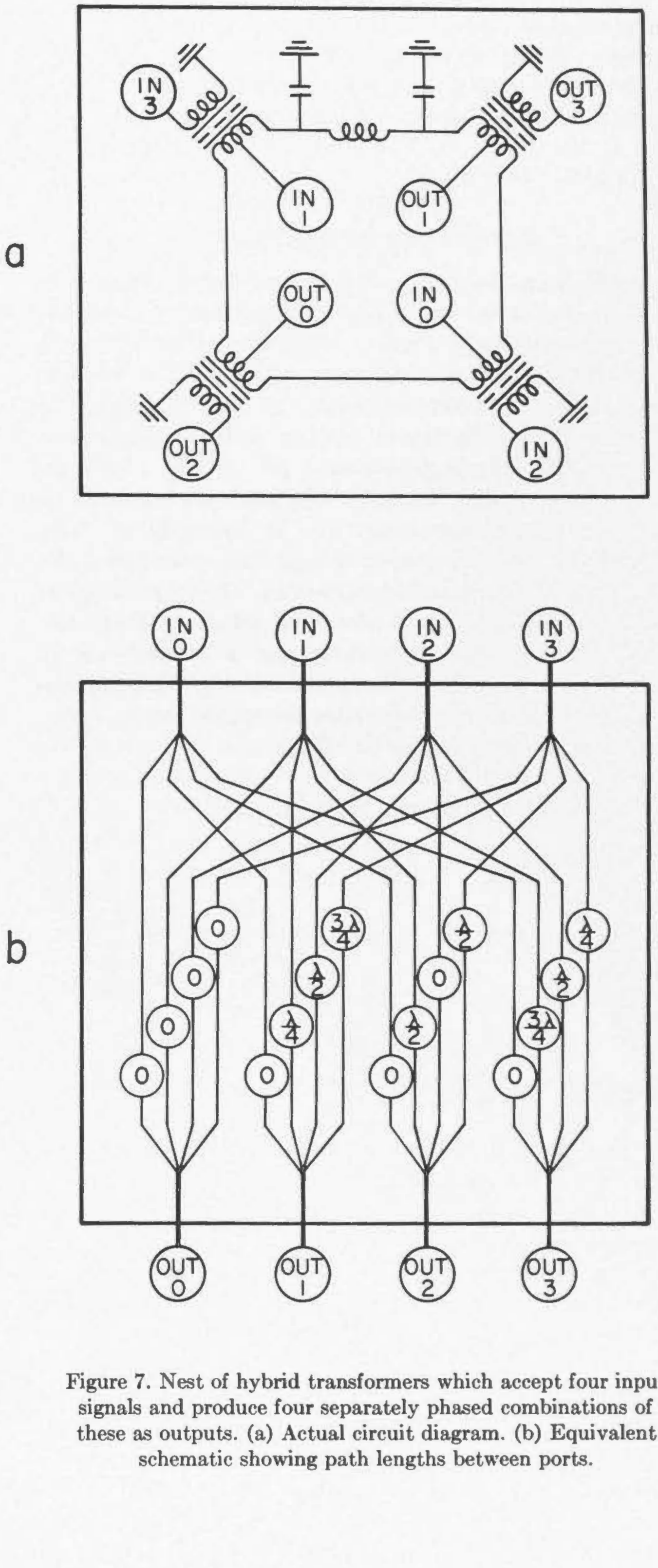

Figure 7. Nest of hybrid transformers which accept four input signals and produce four separately phased combinations of these as outputs. (a) Actual circuit diagram. (b) Equivalent schematic showing path lengths between ports.

Similarly output port 3 produces a beam 30° to the north. Output port 2 provides a phase delay of $\lambda/2$ between lines, producing end-fire beams both north and south. To obtain beams at intermediate elevations a set of cables of lengths $\lambda/8$, $2\lambda/8$ and $3\lambda/8$ can be switched in ahead of the nest. The complete circuit diagram of the E-W phasing device is shown in Figure 8. All unused output ports are terminated in 50-ohm loads.

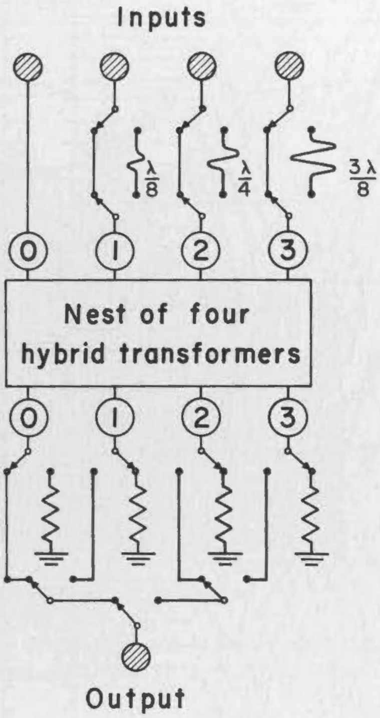

Figure 8.
Complete phasing network of E-W arm. All switches are remotely controlled coaxial relays.

Although the circuit shown selects only one beam at a time it is possible to bypass parts of the output relay system and observe as many as four beams simultaneously.

Phasing, N-S Arm

The N-S phasing system involves an extension of the principle described for phasing the four lines of the E-W arm. It is made up of 48 nests interconnected with cables of various lengths as shown in Figure 9. The input lines from the antenna are connected to the ports at the top of the diagram, and the output ports provide the various phasings, or beams, from the southern horizon through the zenith to the northern horizon. Each beam corresponds to a unique declination, the angular separation between adjacent beams at zenith angles θ_i and θ_j being given by

$$(\sin \theta_i - \sin \theta_j) = \frac{1}{32}$$

In general, a device of this sort will have 2^n input ports and 2^n output ports, where n is an integer. The present device for which $n = 6$, would accommodate 64 lines of dipoles. As only 48 lines could be built in the land available, the remaining 16 inputs were terminated with 50-ohm resistors and treated as antennas graded to zero. All 64 output ports were available simultaneously, and the number which could be used for observing was limited only by the number of receivers available.

The transformers used in the construction of the N-S phasing device were 50-ohm unbalanced to 100-0-100-ohm balanced. The π section was designed to give a 90° phase shift with a terminating impedance of 100 ohms. Because the transformers differed somewhat in their characteristics, it was necessary to match each port to $50 + j0$ ohms by the insertion of a capacitor and a resistor between the connector and the transformer winding. Measurements were then made to determine the small departure from the ideal of Figure 7 (b). The difference appeared in the form of phase and attenuation errors which were associated with the individual ports of the nest. Errors in phase were corrected by appropriate changes in the lengths of the interconnecting cables. To compensate for the errors in the attenuation of the ports three sets of attenuators were inserted as shown in Figure 9. The two sets of inter-level attenuators insure that equal powers are transferred between each pair of nests. They also compensate for the differences in loss of the various interconnecting cables (RG-58C/U) due to the differences in length required for phasing. The input attenuators compensate for the differences in attenuation of the various input ports. A set of output compensating attenuators was not made because the attenuation associated with an output port affected one beam only and could be treated as a simple factor applied to observations with that beam. Compensating attenuators were typically a few tenths of a decibel, and were made to an accuracy of a few millibels. Interconnecting cables were made to an accuracy of a few centimetres.

Even though the individual nests, cables and attenuators were carefully tested as they were built, it was necessary to perform over-all tests. One such test, which checked every path in the system at least once, involved measuring the phases and losses of a selected set of 64 paths from input connectors to output connectors. These phases and losses were compared with the nominal values worked out with the help of the diagrams of Figures 7 (b) and 8. Another test made use of a 1:48 resistively matched power divider. The antenna input cables were removed and the 48 cables from the power

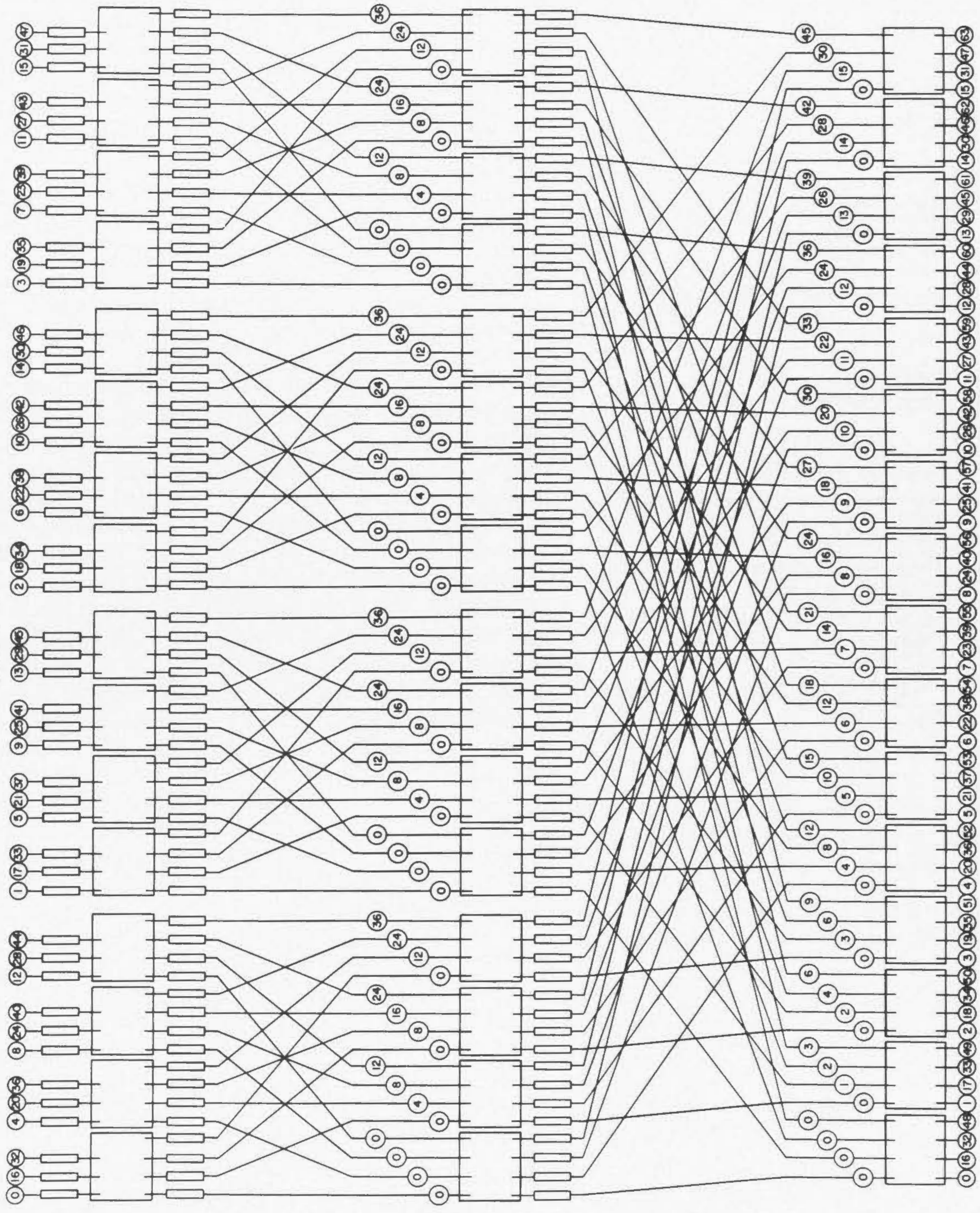

Figure 9. The large blocks represent nests of the type shown in Figure 7. The circled numbers on the interconnecting cables indicate extra lengths in units of $\lambda/64$. The small rectangles are compensating attenuators.

divider inserted in their place. A signal at 10.02 MHz was inserted into the input of the 1:48 divider and output power was measured at each of the 64 output ports. Figure 10 shows the result of such a test. Every fourth output is low corresponding to a zero in an ideal network. Near the 'main beam' measurements agree with theoretical calculations to 0.5 db while the agreement for the 'sidelobes' is usually ± 2 db.

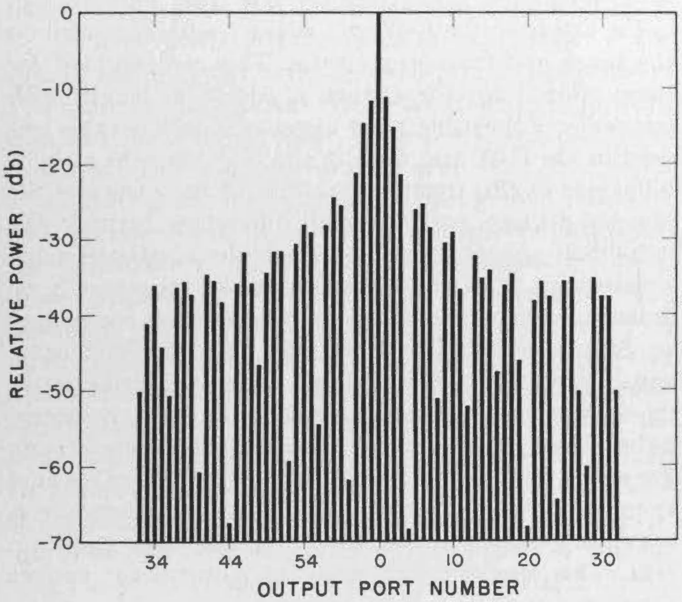

Figure 10. Relative power output from the N-S phasing device when 48 inputs are excited with equal phase and amplitude.

Measurement of Cable Lengths

Conventional methods were used to cut the cables in the feeder systems to the nearest quarter wavelength but it was found that normal impedance bridge methods were not accurate enough for final trimming because of reflections from discontinuities in the foamed dielectric of the cable. To overcome this difficulty a system for measuring cable lengths was devised which senses only the wave travelling in one direction. The system is shown in Figure 11 and is similar to that used by Swarup and Yang (1961) at much higher frequencies. When a signal is fed into a cable $(2n+1)\lambda/8$ long which is terminated in either an open or a short circuit, it will return to the driving point in quadrature with the input signal. With this phase relationship the resultant voltage at the driving point is unchanged whether there is an open or a short circuit at the far end of the cable. An AC-driven chopper alternately shorts and opens the far end of the cable and the detected voltage at the chopper frequency is measured. By adjusting the line stretcher for a null, a very sensitive electrical length measurement can be obtained. Reflections from cable discontinuities no longer contribute to the measurement because they are not modulated at the chopper frequency. The estimated accuracy of this method was .0015λ for a relative measurement, and .005λ for an absolute measurement.

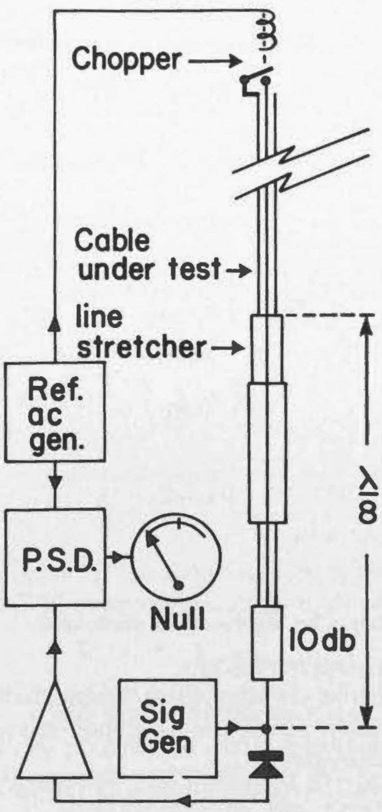

Figure 11. Apparatus used for measuring the electrical lengths of cables in the feeder systems.

Receivers

At a frequency of 10 MHz the receiver should not present great problems because the sky brightness temperature is many times greater than receiver noise temperature. In the present case, however, because of the large losses in the coaxial cable feeder system, low noise preamplifiers were built, to use with slightly modified communication receivers. The method of phase switching described by Ryle (1952) and by Mills and Little (1953) is used to multiply the voltages from the N-S and E-W arms to produce a pencil beam from the two fan beams. A diagram of the apparatus is shown in Figure 12.

Narrow band (8 khz–6 db) crystal filters were inserted immediately after the phasing networks to delineate the reception band and to prevent very strong out-of-band signals from causing cross modulation in

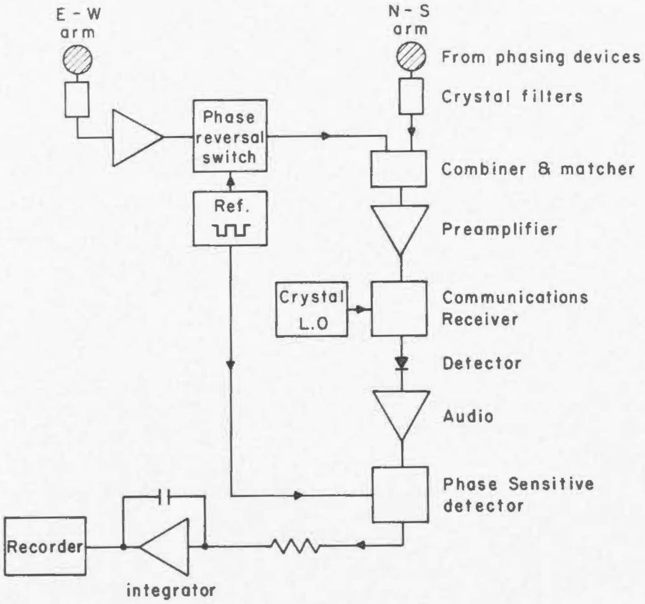

Figure 12. Receiving apparatus for observing one declination.

subsequent nonlinear circuits. So that these filters shall not degrade the system, their phase vs. frequency characteristics must be well matched.

The receiver employs conventional circuits (Bracewell, 1962). Output time constants from 8 to 100 seconds were used.

Observing Techniques

When preparing to observe an astronomical source whose declination is known the appropriate beam is chosen for each arm of the 'T'. A single beam of the E-W arm was broad enough in the N-S direction to cover the same range of declination as eight adjacent beams of the N-S arm.

Four or five receivers were in operation most of the time during the winters of 1964–65 and 1965–66, observing several declinations simultaneously. They were used to observe adjacent beams of the N-S arm within one beam of the E-W arm. However, the flexibility of the system made it unnecessary for the beams to be adjacent, or even confined to one beam of the E-W arm.

Sets of crystal filters were available for 10.01, 10.02, 10.03, 10.04 and 10.05 MHz, but 10.03 MHz appeared to be more often clear of interference than the other frequencies, hence most of the observations were conducted at this frequency. The bandwidth of the antenna, feeder systems and phasing devices was great enough that no difficulties arose in using these nearby frequencies even though the design frequency was 10.02 MHz.

An attempt was made to use the standard frequency guard bands assigned to the Radio Astronomy Service by the ITU. These bands were seldom free from interference. Also the bandwidth available outside the region occupied by the standard frequency transmissions themselves was so small that only the strongest sources could be detected even with the large antenna collecting area available.

It was generally necessary to insert an extra length of phasing cable into either the line from the N-S arm or the line from the E-W arm whose length depended on the beam and frequency in use. This compensated for three effects: (a) the change of electrical length with frequency of the cable, since a greater length of cable was used in the E-W arm than in the N-S arm; (b) a slight difference in effective phase centres of the arms and the phasing devices; and (c) small differences between the individual crystal filters. Although the lengths of cable required for (a) and (b) are calculable, (c) can only be determined experimentally. It was therefore convenient to determine the length of this extra phasing cable empirically, as follows. A large noise signal was introduced into the calibration port of the most northerly hybrid ring (see Figure 5). This signal passes through the entire system in a manner similar to that of a signal from the sky. The cable length needed to produce a maximum deflection was then determined by substitution. This length is the same as required for correct phasing of the 'T'.

Because the array could only be phased along the meridian, all observing was done by drift scans. A calibrating signal was introduced before or after the transit of each source.

Corrections must be applied for refraction and absorption in the ionosphere. In order to estimate the the ionospheric absorption, a Riometer was operated continuously using the $2^\circ\!.9 \times 11^\circ$ beam (to half power) of the N-S arm at the zenith. To estimate refraction, two adjacent beams of the N-S arm are used to observe one source, since the beams overlap considerably. The relative amplitudes obtained with the two beams give a unique value for the apparent declination of the source.

Calibration

The absolute calibration of a large array of this sort is a formidable task. One method is to use a separate dipole whose gain is readily calculated as the common element of two interferometers. One interferometer consists of the dipole and the N-S arm, the other consists of the dipole and the E-W arm. This method has been described by Little (1956) and used successfully with the Mills Cross at 85 MHz. The calibration dipole used with the 10 MHz array was erected over a dry lake bottom and is seen at the extreme left of Figure 1. This method of calibration has, so far, proved less accurate than other methods.

A second approach is the direct measurement of the absolute flux density of Cass A and Cyg A at 10 MHz using a completely independent simple interferometer. Flux measurements were made with an accuracy of ± 10 per cent by Bridle (1967). This method is reliable but restricts the calibration to declinations near the zenith.

A third method is the detailed calculation of the gain of the antenna, treating each arm independently. The beam of the arm was integrated to find the forward gain and the losses in cable, phasing devices, etc., were measured. The total loss for each arm could be checked by measuring the intensity of the background radiation with measurements made using the calibration dipole alone. Because of the different beam shapes involved, these comparisons must be treated with caution. The calculated value of the gain could be checked near the zenith using the results of the absolute flux density measurement. A severe complication entering these calculations was the effect of mutual interactions in the array. These interactions have two effects, both of which are a function of zenith angle. The change in impedance of the antenna causes, first, a power loss by reflection at the mismatch, and second, a redistribution of current near the edges of the array resulting in a slight distortion of the beam. Both these effects are present at the zenith, since the conditions under which the antenna was matched (one line driven, the remainder terminated in load impedances and having parasitic currents only) were different from the conditions under which it was used (all lines driven).

A fourth method used was purely empirical, and as such avoids many of the above complications. It relies on linear extrapolation from higher frequencies of the spectra of radio sources to provide flux densities at 10 MHz, then the use of these sources to calibrate the array. This was done using only elliptical galaxies away from the galactic plane which had straight spectra down to 26 MHz. The selection of sources provided a gain measurement over a wide range of zenith angles.

The final calibration used is based on the most reliable features of the latter three methods.

Results

The observations, which are continuing at the time of writing, include 132 sources whose fluxes have been well determined, 34 sources observed under difficult conditions and a map of the background radiation for a large part of the northern sky. These results have been reported elsewhere (Galt and Costain, 1965; Roger, Costain and Purton, 1965; Purton, 1966; and Bridle, 1967). Figure 13 (a) shows an exceptionally good record of the radio source Hercules A.

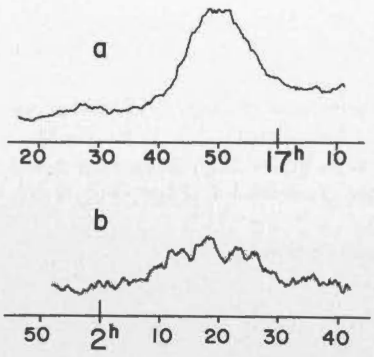

Figure 13.
(a) A record of the radio source Hercules A made under exceptionally good observing conditions. This source is at declination +5°0 and has a flux at 10 MHz of 5390 × 10^{-26}Wm^{-2}Hz^{-1}. (b) A record of a fainter radio source observed under scintillation conditions. 3C 66, flux = 735 × 10^{-26}Wm^{-2}Hz^{-1}.

Figure 13 (b) shows a more typical record of a transit of 3C 66 showing strong ionospheric scintillation.

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AN AUTOMATIC MEASURING ENGINE USED FOR THE 35-MM FILM FROM THE DECLINATION CIRCLE OF THE OTTAWA MIRROR TRANSIT TELESCOPE

Chris Morbey

ROGER DUHAMEL, F.R.S.C.
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AN AUTOMATIC MEASURING ENGINE USED FOR THE 35-MM FILM FROM THE DECLINATION CIRCLE OF THE OTTAWA MIRROR TRANSIT TELESCOPE

CHRIS MORBEY

ABSTRACT: An automatic measuring engine has been developed which is capable of measuring the 35-mm film from the declination circle of the Ottawa Mirror Transit Telescope. The accuracy of measurement is within 0.6 micron, which represents 0.1 second of arc on the declination circle. The rate of film measures is approximately four frames per minutes.

RESUMÉ: L'auteur décrit la conception et la construction d'un appareil automatique de mesure du film de 35 mm. qui sert à photographier le cercle de déclinaison du Cercle Méridien à réflexion d'Ottawa. La précision des mesures atteint 0.6 de micron près, ce qui représente 0.1 de seconde d'arc sur le cercle gradué. La vitesse de mesure du film est d'environ quatre photos à la minute.

Introduction

The declination circles of meridian instruments have usually been read with microscopes by an observer (McClenahan, *et al.*, 1951). Personal error, tedious observations, and the effects of the observer's body heat near the instrument necessitated the development of a photographic system which is remotely controlled. The concept of the Ottawa Mirror Transit Telescope has, from its inception, included a photographic system for the declination readout. It was decided, therefore, to develop a device which would measure the graduation lines on the film to the required accuracy. Other observatories (Watts, 1950; Naur, 1958) were engaged in similar activities at this time and it was decided to use their type of mechanical design from the outset.

A high measurement precision of the graduation lines necessitates a high contrast and sharpness of definition on the film. These factors can be realized only if the graduation lines on the circle have been engraved with utmost care and illuminated in the right direction with parallel light. There have been difficulties in obtaining a graduated circle with the qualities necessary for a photographic system.

There are several problems in measuring the distance between a graduation line inscribed on metal and a reference line. The first is the definition of the position of a graduation line. A line has two edges which are non-uniformly rough. If the roughness of the line can be resolved, the bisection of the area describes one definition of the centre of the line as a whole. For each section of a line a central line can be defined in the same way. The line of centroids along the length of the graduation defines a centre which is not necessarily straight. In this case, the definition must include another parameter: the distance from one end of the graduation. The inscribed graduations not only have rough edges but also have rough 'valleys'. The light which is reflected from the edges and from the inner parts of the graduation marks is therefore scattered in various and preferred directions. The position of the line is thus partly determined by the illumination.

A measurement of any graduation includes a reference or fiducial line which cannot be made arbitrarily sharp. In the case of the transit circle, the fiducial must remain in a fixed position relative to the moving graduation. In large instruments which are susceptible to temperature changes, expansions and contractions occur in the metals and the position of the fiducial is subject to error. There are several methods of construction and various selections of metals which can decrease these effects.

The distance between graduation and fiducial lines can be measured with greater precision by magnifying the images of both. The defects of the inscribed lines become larger upon magnification and there is thus a limit to the precision attainable. Ultimately the limit of precision depends on the sharpness of both graduation and fiducial lines.

— The measuring engine which would provide a readout of the distance measures should be easy to operate and, in the philosophy of the Ottawa design, should deliver its information to a tape punch for computer reduction and to an electric typewriter for editing purposes. The film should be easy to insert so that the same portion of the film strip is used each time. Control of the illumination intensity should produce consistent results from film to film. Since the contrast on different films will be non-uniform, the measuring engine should accept a wide range of contrasts. Because of the volume of star observations, the engine should provide the output in a short time. These considerations have led to an almost completely automatic measuring engine.

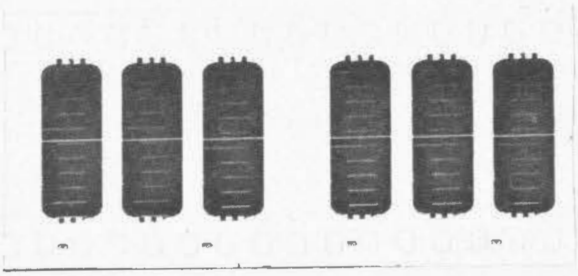

Figure 1. A typical section of 35-mm declination film (represents a 6X magnification of the 30-inch declination circle). The bright middle line on each frame is the fiducial mark. The small markings on the side of each frame designate the camera number. The film must be constrained in the film carriage so that identical sections of the graduation lines are measured on each frame.

Design Philosophy

The automatic measuring engine has been designed to measure the 35-mm film from the declination circle of the Ottawa Mirror Transit Telescope. Figure 1 illustrates a typical section of the film. The fiducial line, which is a fine wire fixed to a camera, is shown in the figure. The measuring engine is designed to provide a position readout of the fiducial line and of the adjacent graduation line on one side. When this has been completed the film is automatically advanced and the same measures are performed on the next frame. This procedure is carried out until there are no more frames left and all action ceases. Additional graduation lines can be measured in a semiautomatic fashion so that the scale of the film can be determined.

The engine operates on a phase-sensitive servomechanism principle and the output is available in both tape punch and typewriter form. The film is illuminated by an incandescent lamp which is perpendicular to the film surface (Figure 2). An image of the film is transferred by means of optics to a viewing screen and to an adjustable slit which is set wider than the image of the lines. At the slit, the light is divided and separated by a system of three prisms. The prisms are adjusted so that two beams are equally intense when the line is centred in the slit. The two beams then pass through a chopping wheel which cuts the light at a frequency of 60 Hz. The two beams of light then fall on a photocell which produces a signal of 120 Hz. This signal is preamplified and fed to a power amplifier which energizes the servomotor. The film carriage which supports the film and the film counter is coupled to the servomotor through a system of gear reductions. A complete servoloop is thus described. If the line which is being measured is not in the centre of the slit the resulting signal from the photocell will not be 120 Hz but will develop into 60 Hz. It is clear then that the line, as it is shifted about the centre of the slit position, will produce 60 Hz signals which differ in phase by 180 degrees. If the reference phase of the servomotor is set correctly it will stabilize at the middle of the line. Alternatively, the phase of the chopping wheel may be set to coincide with that of the motor.

A Coleman digitizer which reads the servomotor shaft position to one tenth of a revolution is attached to the servodrive. The number of counts between two graduation lines is

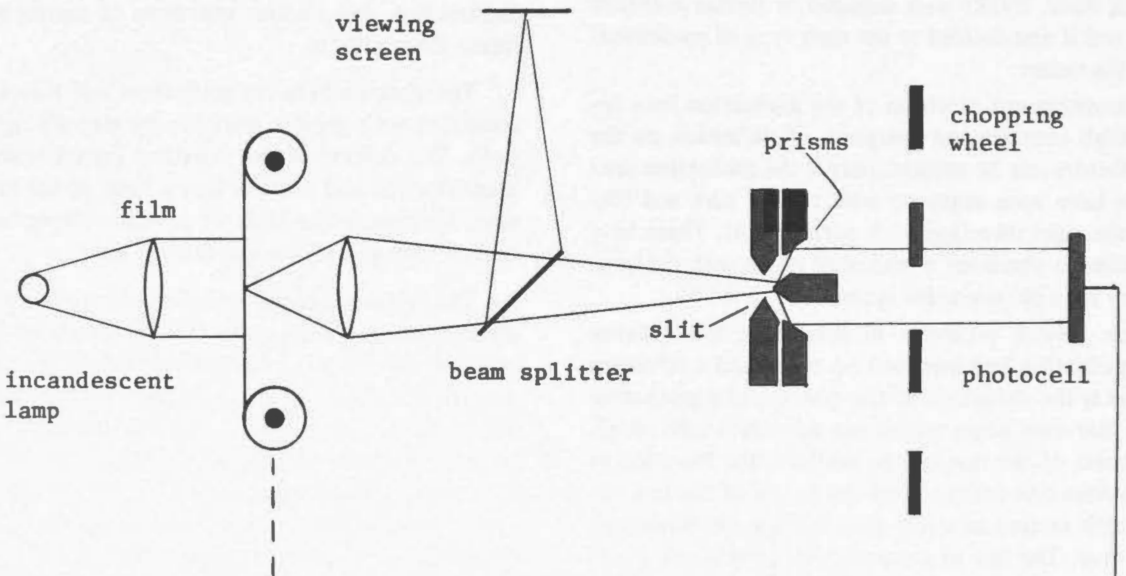

Figure 2. Block diagram showing the design philosophy used for the automatic measuring engine.

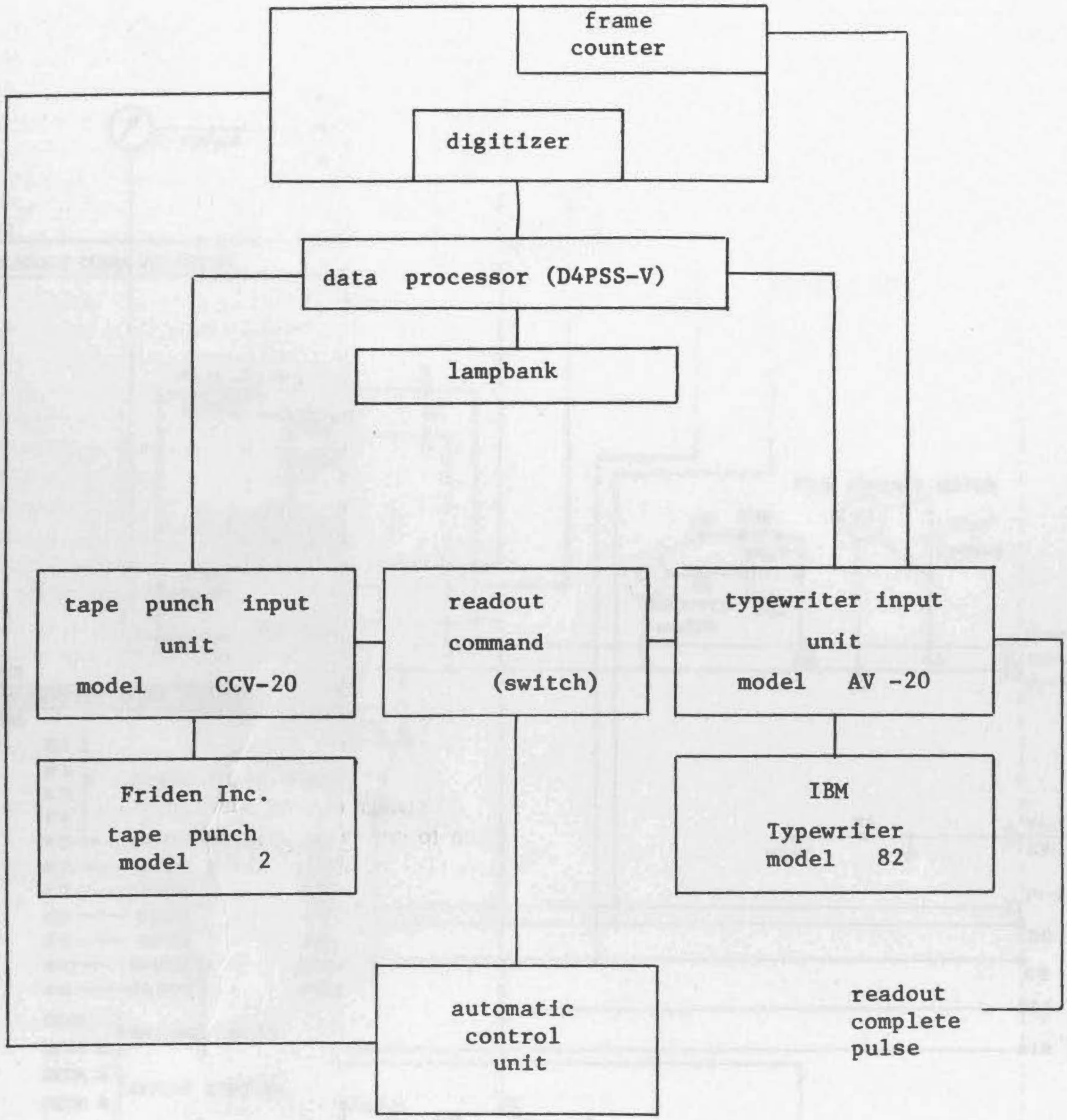

Figure 3. Block diagram showing the complete readout system.

approximately 5,800. The information of the shaft position is held in the memory of the data processor (Figure 3) until it is scanned by the typewriter and tape punch inputs. After completion of the readout the measuring engine advances to the next line and the servosystem settles on it and again readout ensues. The film advance motor is actuated and the next frame is in position to be measured.

The mechanical components of the engine are mounted on a rigid cast-iron surface. Most of the relays and associated electronics are located in a separate control chassis. D.C. power is supplied by a precision power source (HP/6265A) and the A.C. power is derived from a stable supply (HP/3907-15A). The film carriage can hold the film from one of the six declination circle cameras at a time.

Electrical Description

A description of the automatic operation of one cycle of measurement is as follows (Figure 4). There are four stages of operation: (1) return to zero, (2) delay and hunt at zero, (3) advance to line, and (4) delay and hunt at line. The sequence of measuring is started with the film carriage screw between the graduation line and the fiducial line. Relay K1 is closed after the manual mode is actuated and then the automatic mode is initiated. When relay K1 is closed a direct current goes via the normally open (n.o.) contact of relay K1-6 and the normally closed (n.c.) contact of relay K9 to the clutch, hence advancing the film. Direct current also goes to the delay circuit module. When the 100 μfd. capacitator in the film advance module has been charged sufficiently, the

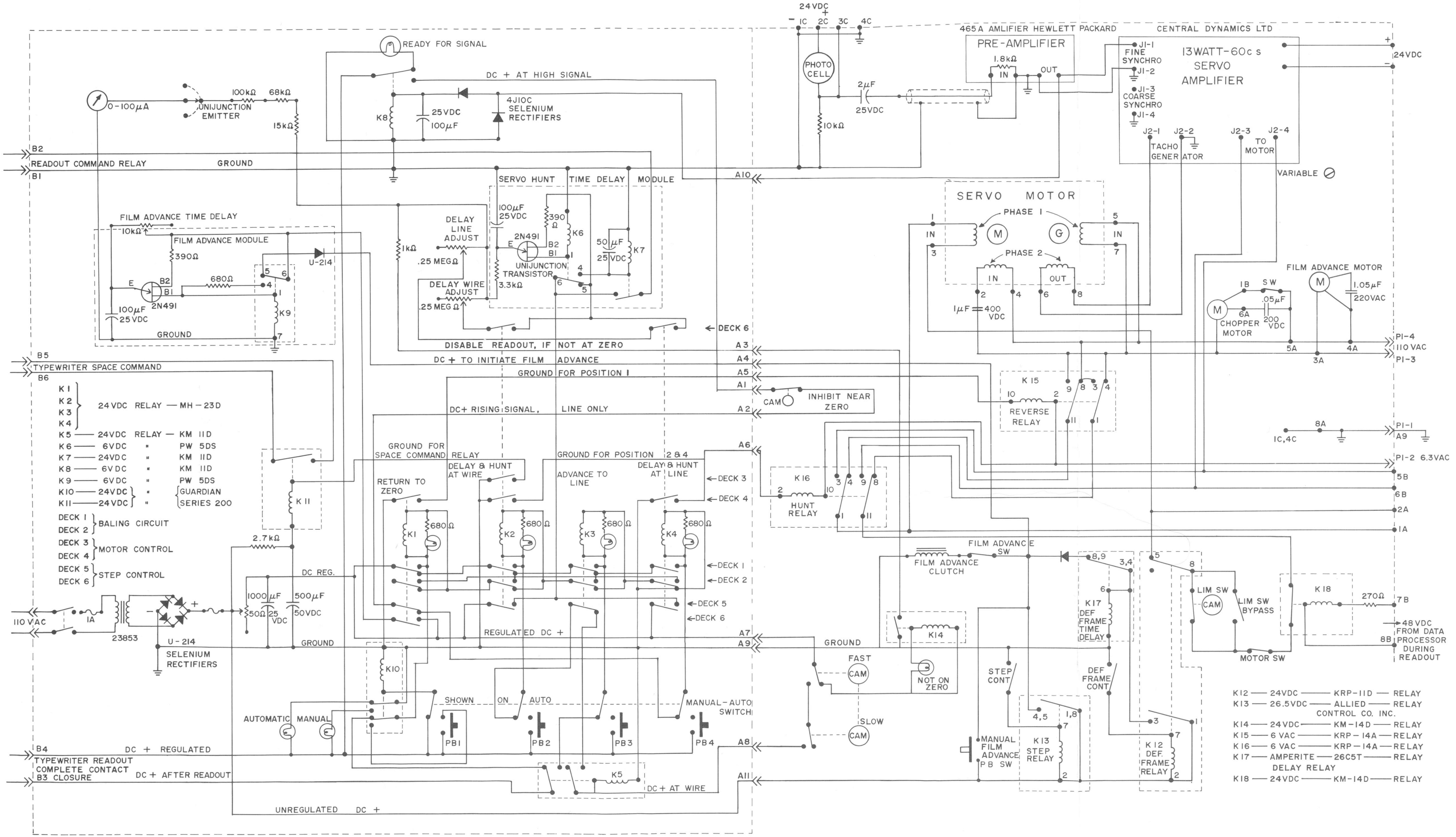

Figure 4. Automatic measuring engine control circuit.

unijunction transistor (2N491) fires and breaks the circuit. By this time the film step contact has been actuated and the clutch remains in operation until one frame has advanced and the step contact has been broken and hence relay K13. Relay K9 is latched by a 680-ohm resistor until stage one is finished. As the fiducial line is approached, relay K8 closes from the rising signal at the fiducial line but the 'inhibit near zero' cam-operated contact prevents passage of the direct current signal. When the fiducial line is reached, relay K5 is closed and direct current passes the n.o. contact of relay K5-1 via the n.c. contact of relay K3-5 to the trigger point of relay K2. Relay K2 is then latched and relay K1 is released. As relay K2 closes, the charge in capacitor C11 escapes into relay K11 closing relay K11 momentarily. The contact on relay K11 provides a circuit to actuate a 'space command' to the typewriter. The servosystem hunts for a balance position while direct current goes via relay K2-5 to relay K6; then to the n.c. contact of relay K6, and through relay K2-6 to charge the unijunction transistor capacitor through the 0.25 Meghom variable resistor. When the unijunction fires, relay K6 closes, sending direct current to the n.o. contact of relay K6 for a few milliseconds. This latches relay K7 which stays closed for about 100 milliseconds because of the storage capacitor. Deck one of relay K7 sends the readout command to the Coleman digitizer. The numerical position of the servosystem and the frame number is then read out to the typewriter while the tape punch receives only the servosystem position.

The voltage at the emitter of the unijunction transistor increases since the direct current through relays K5-1 and K3-5 restores relay K2; but before the unijunction can refire, the 'readout complete pulse' passes through the n.o. contact of relay K5-2 to the trigger point of relay K3, latching K3 hence breaking the relay K3-5 path to the trigger point of relay K2.

The servosystem runs to the graduation line, ignoring the rising signal as it leaves the fiducial line, but accepting the signal near the graduation line (through the n.c. contact of relay K1-5) which fires stage four. The servosystem hunts for a balance position while direct current goes via deck 5 of relay K4 to the unijunction time delay module as before. This time the delay is set by the 0.25 Megohm variable resistor in deck 6 of relay K4. Again the unijunction fires and readout follows. The readout complete pulse relatches relay K1 through the n.c. contact thus completing the cycle. As the servo leaves the graduation line, direct current from the rising signal is blocked by the n.o. contact of relay K1-5.

When a readout command is given, the information found by the digitizer is stored by the data processor and then the typewriter and tape punch inputs scan this information and feed it out to the typewriter and tape punch. The frame number information is derived from a frame counter and is scanned only by the typewriter input (Coleman digitizer handbook).

Precision of Measurement

There are several factors which directly influence the precision attainable with the measuring engine. The signal at the photocell and the resulting signal to the servomotor determine the torque which keeps the motor in a balanced position when the system is centred on a line. The relative phase of the reference frequency of the servomotor and that of the chopping wheel can be set so that the measuring engine settles on the centre of a line. An error in this adjustment results in different measures for the same two lines at different intensities of film illumination. Scratches near the graduation lines on the declination circle may alter the balance position of the servosystem if the resulting marks on the film lie within the slit width. If the film is not held securely in place (Figure 1) large random errors will occur. If the film does not have sufficient contrast, the servosystem cannot distinguish a line distinctly from the background and poor precision results. A nonstable source of A.C. effects a jittery balance position and the readout is therefore not stable. It is most important that the supply voltage for the photocell be extremely stable because any irregularities are amplified and fed directly to the servomotor.

The automatic measuring engine was set up to measure one frame repeatedly. Over 33 measurements the standard deviation was two units on the measuring engine which is equivalent to 0.6 micron on the declination film. The scale of the measuring engine unit is 3/58 micron and using this factor the uncertainty is 0.1 micron on the declination circle. Because the diameter of the declination circle is 30 inches, the equivalent angular standard deviation is 0.1 second of arc.

Listed below are some typical results as delivered by the electric typewriter. The same five frames were measured four times.

8701 01	8712 01	8700 01	8697 01
1679 01	1686 01	1676 01	1672 01
8697 02	8704 02	8691 02	8690 02
1683 02	1692 02	1674 02	1673 02
8669 03	8675 03	8659 03	8661 03
1758 03	1760 03	1745 03	1749 03
8730 04	8714 04	8713 04	8704 04
1808 04	1795 04	1792 04	1786 04
8791 05	8769 05	8758 05	8758 05
1906 05	1877 05	1882 05	1876 05

The accuracy of the measuring engine is not the final positional accuracy of a star in declination. Since the light from a star is reflected in the transit telescope mirror, the reading errors are doubled. Effects of eccentricity, the nonperpendicularity of the circle to the axis of rotation, and first terms of the circle's bending are averaged out in the three pairs of microscope readings. A complete analysis of the declination errors also utilizes information from the collimator measurements.

The rate of film measurement with the automatic measuring engine is approximately four or five frames per minute.

Discussion

The present photographic system is working reasonably well and a significant improvement has been achieved over the manual method; however, there is still a rather long delay before results can be tabulated. An improved system would observe the declination circle directly and the raw data would be available immediately. Photoelectric methods are being used at several observatories (Efimov and Otryashenkov, 1960; Lausten, 1967). A direct electrical system known as the "Inductosyn" (Farrand Controls Inc.) is presently undergoing experimental study at Washington (Klock, 1967). It is evident that the photographic system will have to be superseded by another method if any additional significant improvements are to be made. Any new system will have to be operated remotely and should not interfere with the declination circle in any way.

Acknowledgments

Much of the design has been initiated by Mr. George Brealey. Mr. Jacques Labreque has assisted in both the mechanical and electrical construction.

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A STUDY OF ULTRAVIOLET METEOR SPECTRA

Ian Halliday

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A Study of Ultraviolet Meteor Spectra

IAN HALLIDAY

ABSTRACT—The spectra of one Lyrid and one Perseid meteor are used as the basis for a list of spectral line identifications in the ultraviolet range from 3100 to 4000 A. Lines from six neutral atoms and five ions are listed, including the first identifications of Ti II and Cr II in meteor spectra. No lines are attributed to Si I or Co I. An enduring line at 3836.5 A was observed between heights of 87 and 75 km in the Lyrid spectrum. No satisfactory identification for this line was found since its association with lines of Fe I or Mg I is considered doubtful.

RÉSUMÉ—Le spectre d'un météor des Perséides et d'un autre des Lyrides constituent une base fondamentale permettant de dresser une liste afin d'établir l'identité de raies spectrales dans le champ d'activité 3100 à 4000 Å de l'ultraviolet. Les raies de six atomes neutres et de cinq ions comprenant les premières identifications de Ti II et de Cr II dans un spectre météorique y sont données. Aucune raie n'est décelée de Si I ou de Co I. On constate une raie persistante à 3836.5 Å entre les hauteurs de 87 et 75 km dans le spectre des Lyrides. Cette raie étant tellement rapprochée de Fe I ou Mg I, il semble fort douteux qu'il soit possible de l'identifier de façon satisfaisante.

Introduction

A meteor spectrograph designed for photography of the ultraviolet spectra of meteors began operation at the Meanook Meteor Observatory, Alberta, in 1957. The camera employs quartz optics and a 300-line-per-mm transmission diffraction grating mounted on a quartz blank. The instrument was included in a description of the spectrographic equipment at the Meanook and Newbrook Observatories (Halliday, 1958).

Most detailed lists of spectral line identifications in meteor spectra are limited at the short-wavelength end, near 3650 A, by the transmission of the optics (Millman, 1956; Halliday 1961, 1963; Ceplecha and Rajchl, 1963; Ceplecha, 1966). Two prismatic meteor spectra photographed with the 18-inch Schmidt telescope on Mount Palomar were described by Russell (1957). They recorded lines down to about 3400 A with modest dispersion but the meteors were not particularly bright.

Observational Material

This paper presents a list of line identifications in the ultraviolet region between 3100 and 4000 A. The identifications are based on the spectra of two bright meteors supported by other, somewhat less detailed spectra. The two meteors are a Perseid and a Lyrid and both were recorded by several cameras. The basic observational data are summarized below.

Perseid

A brilliant Perseid was photographed at Meanook and Newbrook at $8^h\ 15^m\ 30^s$ U.T., August 12, 1963. Two spectrograms of this meteor were reproduced recently in a paper dealing with meteor-wake radiation (Halliday, 1968). Exposure U2388 showed extremely good definition in the second- and third-order spectra of the λ3700 – 4000 region; hence it is used as the primary reference in this spectral region. The camera focal length was 203 mm, with a 400-line-per-mm grating yielding second- and third-order dispersions of 60 and 40 A/mm, respectively, on Kodak Tri-X Aerecon film. Portions of these orders are reproduced in Figure 1.

Lyrid

The most detailed spectrogram secured with the ultraviolet quartz spectrograph was produced by a Lyrid meteor at $6^h\ 57^m\ 38^s$ U.T., April 22, 1966. Six spectrographs recorded this bright meteor. The ultraviolet spectrum was on exposure V1990 and is reproduced in Figure 2 with an en-

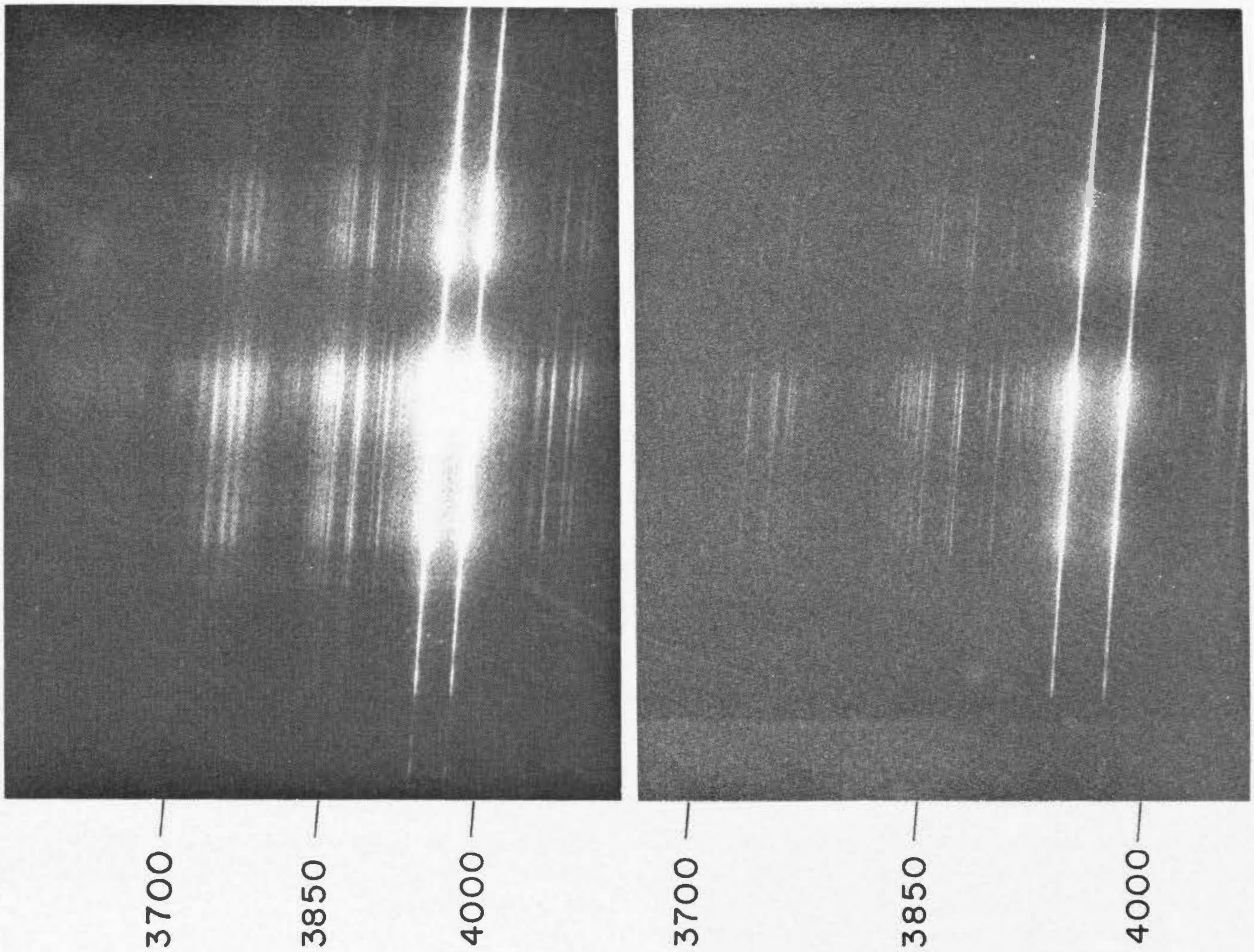

Figure 1. Exposure U2388, August 12, 1963. Portions of the second- and third-order spectra. Meteor motion from top to bottom.

larged portion in Figure 3. A rotating shutter with a closed-to-open ratio of 2:1 occulted this spectrogram 11.2 times per second and the most detailed portion of the meteor spectrum was produced by a short flare very near the bottom end of the next-to-last segment. The spectrum was recorded on Kodak spectroscopic 103-O emulsion on a glass plate with a dispersion of 159 A/mm.

Line Identifications

The wavelength measurements were performed as in an earlier study of Perseid meteors (Halliday, 1961) and the identifications, listed in Table 1, also follow the same pattern. Successive columns list the measured wavelength, the identification of the atom or ion with the multiplet number from Moore's (1945) tables, and the laboratory wavelengths of those lines which are considered to be significant contributors to the feature. From 3118 to 3665 A the measures are based on plate V1990; from 3679 to 4001 A exposure U2388 was used. Most of these measures are from the third-order spectrum but some twelve features were detected only in the stronger second order and these are indicated by a II in the final column.

Discussion of Identifications

Table 1 lists 82 separate features and the identifications involve 50 multiplets of 11 different atoms or ions. These multiplets are listed in Table 2. As in previous cases some of these multiplets are involved only in blended features and Table 3 lists 17 multiplets for which the identification is considered doubtful. None of the eleven atoms or ions in Table 2 would be removed from the list if all the doubtful multiplets were discarded.

Brief comments follow on each atom or ion involved in the identifications.

Mg I. Multiplet 3 is prominent and well resolved.

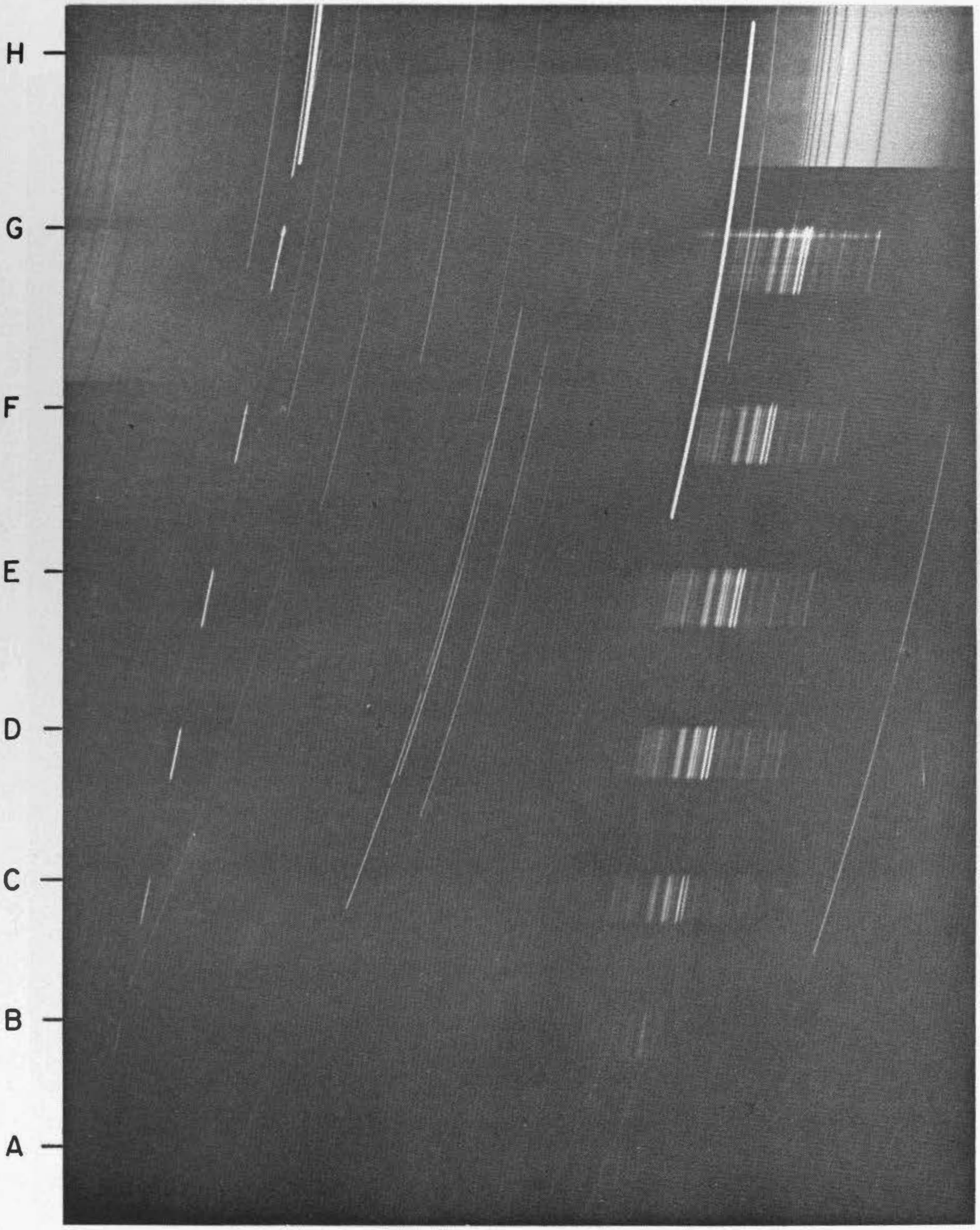

Figure 2. Exposure V1990, April 22, 1966. Letters indicate lower ends of meteor segments. Meteor motion from bottom to top.

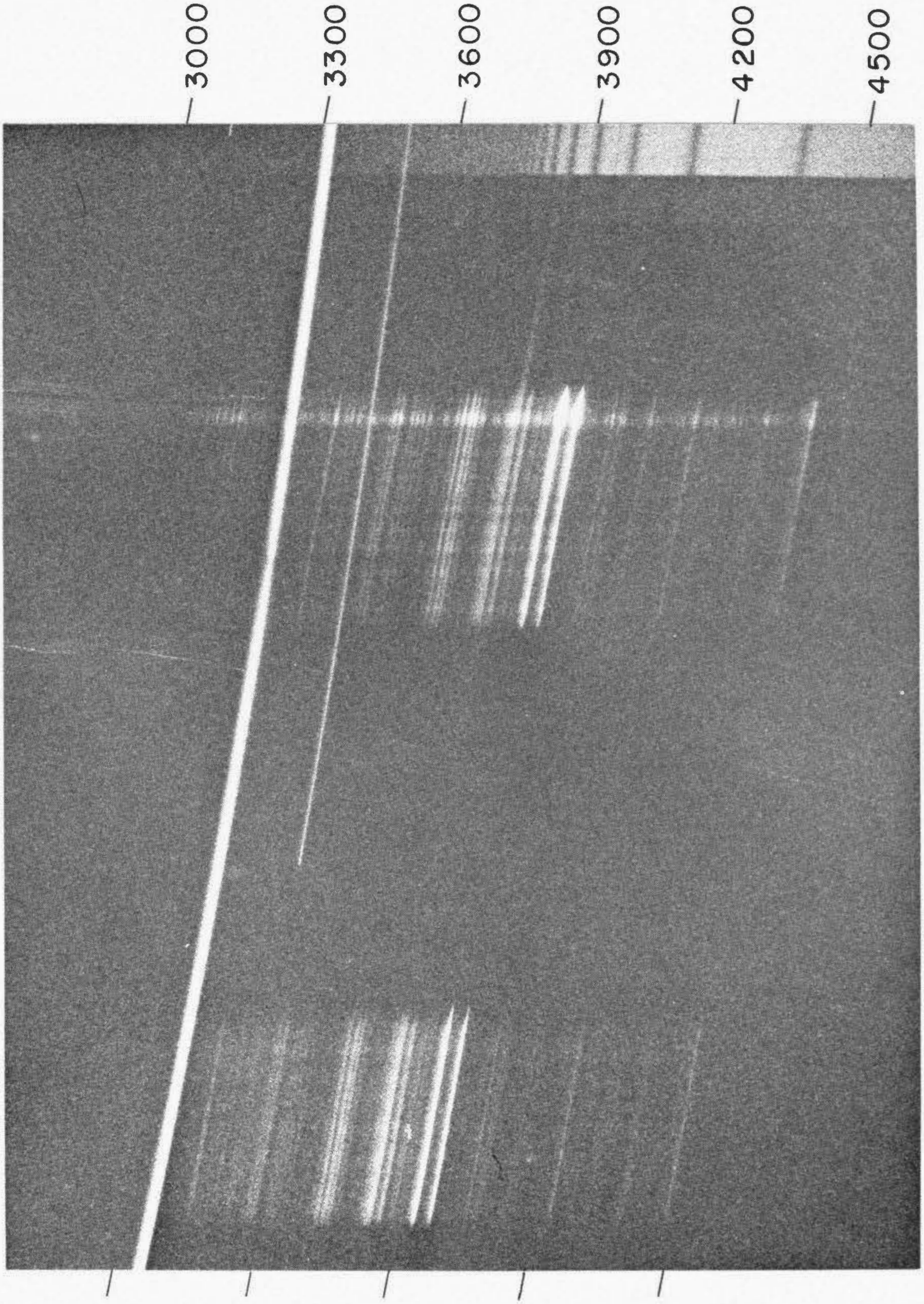

Figure 3. Enlarged portion of Figure 2 showing detail in ultraviolet meteor spectrum.

TABLE 1. MEASURED WAVELENGTHS AND IDENTIFICATIONS

λ_{meas}	Atom or Ion	Mult.	λ_{lab}	Order
3118–3137	Cr II	5	3118.7	
			3120.4	
			3125.0	
			3128.7	
			3132.1	
			3136.7	
3157.8	Ca II	4	3158.9	
3170.0	Fe II	6	3170.3	
3180.0	Ca II	4	3179.3	
			3181.3	
	Fe I	155	3180.2	
3195.4 *b*	Fe I	7	3193.2	
	Fe I	155	3196.9	
	Fe II	6	3192.9	
			3193.8	
	Fe II	7	3196.1	
3213.6	Fe I	7	3214.4	
	Fe I	158	3212.0	
	Fe II	6	3213.3	
3228.3	Fe II	6	3227.7	
3236.4	Ti II	2	3234.5	
			3236.6	
			3239.0	
	Fe I	7	3236.2	
3258.0	Fe II	1	3255.9	
	Fe II	81	3258.8	
			3259.0	
3276.1	Fe II	1	3277.3	
3362.8	Ca I	11	3361.9	
			3362.1	
	Ti II	1	3361.2	
	Cr II	21	3360.3	
3370.7 *b*	Ni I	6	3369.6	
	Ti II	1	3372.8	
	Cr II	4	3368.1	
3385.1 *b*	Ti II	1	3383.8	
			3387.8	
	Cr II	3	3382.7	
3410.3 *b*	Fe I	83	3407.5	
	Fe I	85	3413.1	
	Ni I	19	3414.8	
	Cr II	3	3408.8	
3424.2	Cr II	3	3421.2	
			3422.7	
3440.8	Fe I	6	3440.6	
			3441.0	
			3443.9	
3462.6	Fe I	6	3465.9	
	Ni I	17	3461.7	
3475.2	Fe I	6	3475.4	
			3476.7	
3491.7	Fe I	6	3490.6	
	Ni I	18	3493.0	
3523.4	Fe I	6	3526.0	
	Fe I	24	3521.3	
	Ni I	18	3524.5	
3541.4	Fe I	326	3541.1	
			3542.1	
3568.6	Fe I	24	3565.4	
			3570.1	
	Ni I	36	3566.4	
3582.4	Fe I	23	3581.2	
3593.6	Cr I	4	3593.5	
3607.2	Fe I	23	3608.9	
	Cr I	4	3605.3	
3619.0	Fe I	23	3618.8	
	Ni I	35	3619.4	
3631.8	Fe I	23	3631.5	
	Ca I	9	3630.7	
3646.1 *b*	Fe I	23	3647.8	
	Ca I	9	3644.4	
3665.6	Ni I	4	3664.1	
			3670.4	
3679.9	Fe I	5	3679.9	II
3686.7	Fe I	21	3687.5	II
	Fe I	385	3686.0	
3695.5	Fe I	394	3694.0	II
3705.7	Fe I	5	3705.6	
	Ca II	3	3706.0	
3709.1	Fe I	21	3709.3	II
3714.5	Cr II	20	3715.2	II
3719.8	Fe I	5	3719.9	
3727.7	Fe I	21	3727.6	II
3734.8	Fe I	21	3734.9	
3737.1	Fe I	5	3737.1	
	Ca II	3	3736.9	
3745.6	Fe I	5	3745.6	
			3745.9	
3748.6	Fe I	5	3748.3	
	Fe I	21	3749.5	
3753.7	Fe I	73	3753.6	II
	Cr II	20	3754.6	
3758.9	Fe I	21	3758.2	
3763.2	Fe I	21	3763.8	
3766.9	Fe I	21	3767.2	II
3787.4	Fe I	21	3787.9	II
3795.0	Fe I	21	3795.0	
3798.9	Fe I	21	3798.5	
			3799.5	
3806.0	Fe I	607	3806.7	II
	Fe I	608	3805.3	
3815.9	Fe I	45	3815.8	
3820.3	Fe I	20	3820.4	
3824.3	Fe I	4	3824.4	
3825.6	Fe I	20	3825.9	
3827.9	Fe I	45	3827.8	
3829.2	Mg I	3	3829.4	
3832.5	Mg I	3	3832.3	
3834.2	Fe I	20	3834.2	
3838.4	Mg I	3	3838.3	
3840.8	Fe I	20	3840.4	
	Fe I	45	3841.1	
3846.0	Fe I	124	3845.2	II
	Fe I	664	3846.8	
3849.9	Fe I	20	3850.0	
3856.3	Fe I	4	3856.4	
	Si II	1	3856.0	
3859.8	Fe I	4	3859.9	
3862.7	Si II	1	3862.6	
3865.2	Fe I	20	3865.5	
3872.5	Fe I	20	3872.5	
3878.5	Fe I	4	3878.6	
	Fe I	20	3878.0	
3886.5	Fe I	4	3886.3	
3888.6	Fe I	45	3888.5	
3895.8	Fe I	4	3895.7	
3899.8	Fe I	4	3899.7	
3903.2	Fe I	45	3902.9	
3906.3	Fe I	4	3906.5	
3920.5	Fe I	4	3920.3	
3923.3	Fe I	4	3922.9	
3933.7	Ca II	1	3933.7	
3944.8	Al I	1	3944.0	
3956.5	Fe I	278	3956.7	
3961.8	Al I	1	3961.5	
3968.6	Ca II	1	3968.5	
	Fe I	43	3969.3	
3996.9	Fe I	278	3997.4	
4001.7	Fe I	72	4001.7	

b—Feature noticeably broad.

TABLE 2. MULTIPLETS IDENTIFIED IN TABLE 1

Mg I	3	Cr I	4
Al I	1	Cr II	3, 4, 5, 20, 21
Si II	1	Fe I	4, 5, 6, 7, 20, 21, 23, 24, 45, 72, 73, 83, 85, 124, 155, 158, 278, 326, 385, 394, 607, 608, 664
Ca I	9, 11	Fe II	1, 6, 7, 81
Ca II	1, 3, 4	Ni I	4, 6, 17, 18, 19, 35, 36
Ti II	1, 2		

TABLE 3. DOUBTFUL MULTIPLET IDENTIFICATIONS

Cr II	4, 20, 21
Fe I	7, 72, 73, 83, 85, 124, 158, 326, 385, 607, 608
Ni I	6, 35, 36

Al I. Multiplet 1 is present in the Perseid spectrum. It has been observed previously but may often be obscured by the effects of overexposure of the H and K lines of Ca II.

Si II. Multiplet 1 is a rather weak contributor in the Perseid spectrum.

Ca I. Two multiplets appear to be present and both would be expected on the basis of a comparison with other multiplets of Ca I normally observed in the visual region.

Ca II. Multiplet 4 is a definite contributor at λλ3158 and 3180. Multiplet 3 is blended with lines of Fe I while multiplet 1 (the H and K lines) is the strongest multiplet in the spectrum.

Ti II. This appears to be the first identification of titanium in meteor spectra. Two multiplets of Ti II contribute to four features although the strongest line of Ti II, at 3349 A, is unfortunately obscured by the zero-order image of *η Ursae Majoris.*

Cr I. Multiplet 4 is present although its strongest member is too close to an ultimate line of Fe I to be observed directly.

Cr II. Several multiplets of Cr II are definite or probable contributors. The shortest wavelength observed is a broad feature from approximately 3118 to 3137 A, attributed to multiplet 5 of Cr II.

Fe I. Many multiplets of Fe I are observed although they are not prominent in the 3100 to 3400 A region. Numerous weak multiplets of Fe I are included in the list of doubtful identifications.

Fe II. A few multiplets of Fe II are the major contributors to several features near the short-wavelength end of the list.

Ni I. The identification of Ni I is difficult with the dispersion of these spectrograms since it has no outstanding lines and is frequently involved in blends with lines of Fe I. However, several multiplets of Ni I appear to be required to explain the intensities of some of these blends.

The apparent absence of certain lines from these spectra is worth noting. Exposure U2388 (the Perseid) shows no indication of the strong line of Si I at 3905.5 A. A weak feature at 3906.3 A is identified with a weak member of multiplet 4 of Fe I at 3906.5 A. The dispersion of the third-order spectrum makes this identification secure and there is thus some reason to doubt whether lines of Si I have previously been observed in other spectra of inferior dispersion.

No lines are attributed to cobalt in Table 1. Its ultimate line, at 3453 A, would not be confused by other lines on plate V1990, hence it must be an extremely weak contributor. Previous identifications of cobalt were by Russell (1957) who recorded a line at 3452 A in one of the two spectra to reach this wavelength and by Ceplecha and Rajchl (1963) and Ceplecha (1966), who measured a line at 3894 A which they identified with Co I, 34. They included a few other lines of Co I as possible contributors to some blends.

Enduring Radiation in the Ultraviolet

In a recent paper (Halliday, 1968) many of the multiplets commonly observed in meteor spectra were divided into five classes on the basis of their duration at a given point on the meteor trail. Class I multiplets decay very quickly and are not observed in meteor wakes. At the other end of the scale, the forbidden line of O I at λ5577 was the only entry in class V while class IV contains seven intersystem multiplets of low excitation which are normally enhanced in the wake spectrum. It was stressed that the observed intensities of wake lines may be strongly affected by the phasing of a rotating shutter relative to a particular flare and also by the orientation of the trail. Wake lines are enhanced when observed near the radiant of the meteor trail because of the increased path length containing the excited atoms.

The meteor of Figure 1 is the same Perseid used as the basis for classifying multiplets into the five classes. Exposure U2388, which provided the superior definition in the 3700 – 4000 A region of Table 1, was taken with camera U which does not have a rotating shutter. It thus records the integrated intensity of all lines and does not discriminate against any of the duration classes. The intense flare of this meteor was more than 70° from the Perseid radiant at both observing stations so no enhancement is expected from the orientation of the trail. This flare occurred in the height range from 84 to 83 km above sea level.

The lines identified in the more distant ultraviolet, from the Lyrid spectrum, came from a short flare close to the bottom of a segment, at a height of 76 km. The camera was occulted only 4 milliseconds after the flare (position *G* in Figure 2) hence the intense spectrum is relatively pure meteor-head radiation. Any class IV multiplets would be virtually excluded from the spectrum by the rotating shutter. As seen from Meanook this flare was 48° from the Lyrid radiant so again little or no enhancement due to trail orientation is involved.

The table classifying the duration of multiplets includes four multiplets of Fe I and one of Ca II between λλ3700 and 4000. The ultraviolet Lyrid spectrum produced only one addition to the table – a puzzling feature at 3836.5 A. Figures 2 and 3 show this feature most clearly just below the intense flare until it is obscured by the overlapping first-order spectra of the stars *Alcor* and *Mizar*. Careful measures at nine positions on the line in the occulted portion of the spectrum below the flare were made to establish this wavelength. Extrapolation of the wavelength positions below the flare was assisted by the presence of measurable H and K lines in a final segment at 73 km height (position *H* of Figure 2) superposed on the spectrum of *Mizar*. On original prints of the spectrogram the line can be traced completely through the occulted portions of the spectrum in the four breaks preceding the segment with the flare, up to an atmospheric height of 87 km (position *C* of Figure 2) and down to 75 km where the stellar spectra interfere.

This feature is difficult to identify. The meteor was also photographed with cameras 10 and 150, two of the jumping-film spectrographs (Halliday and Griffin, 1963). These cameras do not have rotating shutters and reveal that the flare recorded by camera V was followed almost immediately by a longer flare of similar intensity and then by a general decline in brightness during the remainder of the trail. The enduring line at λ3836 follows this intensity variation closely and is insensitive to the relatively long occulted period (59 milliseconds) just below the flare observed by camera V. In other words its behavior is similar to the forbidden oxygen line at λ5577 and belongs in class V as a long-enduring feature.

The straightforward identification of the feature is to attribute it to Mg I, 3, an unresolved multiplet on this dispersion, with three of its five components well resolved in the Perseid spectrum, as listed in Table 1. Millman (1950) observed a rather similar line in the first spectrogram to show an appreciable wake or train spectrum and listed both the magnesium and iron multiplets as the identification. There is now substantial evidence available on normal meteor wakes and it may be profitable to consider multiplets 1, 2 and 3 of Mg I. The peculiar line in the Lyrid spectrum is not due to Fe I since other, stronger lines would then be observed.

Multiplet 1 of Mg I is a low-excitation, intersystem line at 4571 A, usually present in a strong meteor wake and it is one of the class IV multiplets. The upper level of multiplet 1 is also the lower level of multiplets 2 and 3. Multiplet 2 has an excitation of 5.09 ev for the upper state and its strongest line, at 5183 A, is often well resolved from other lines. The other two lines, near 5170 A, are usually blended with strong wake lines, of class IV, from Fe I, 1. Multiplet 3 of Mg I requires an excitation of 5.92 ev and, on low dispersion, is blended with multiplets 4 and 20 of Fe I. In the normal wake spectra of strong flares λ5183 of multiplet 2 is present but decays rapidly, typical of class II, which is in keeping with its high excitation energy for a wake line. Multiplet 3, with its higher excitation, would be expected to decay even more rapidly but might still be a class II multiplet. The presence of the lower-excitation lines from Fe I in the wake makes this difficult to check.

The spectrogram of the Lyrid meteor from camera 150 shows that the film jumped three times during the flight of the meteor and at these locations on the trail it is possible to search for wake radiation recorded as an apparent upward extension of a given line above the jump. One of the jumps was near a height of 87 km (the upper limit at which λ3836 was observed in the wake on camera V) and camera 150 shows no trace of wake radiation at this location, including Mg I, 2 at λ5176. The instrumental transmission of this camera at λ3836 is not great so the absence of this line as a wake feature on the spectrogram from camera 150 is understandable.

A search was made for molecular features which might explain the wake line observed by camera V. The Schumann-Runge band system of O_2 includes a band head at 3840.6 A but other members of the system should also be observed if this were the proper identification.

The measured wavelength of 3836.5 A for the enduring line should not be in error by much more than 1 A on this dispersion. The observed position is within the 9 A interval covered by the Mg I, 3 multiplet but from the intensity values given in different identification tables the expected position of the unresolved multiplet would be 3834.5 A. The discrepancy of 2.0 A is sufficient that the wavelength can not be interpreted as strong support for the identification with Mg I, 3.

In summary, then, an enduring feature observed at λ3836.5 between heights of 87 and 75 km in the wake spectrum of a Lyrid meteor can not be identified with confidence at present. Its behaviour suggests an origin associated with some atmospheric constituent, an association which is strengthened by the fact that most bright meteors do not show an enduring line at this wavelength.

An identification with Mg I, 3 remains a possibility but is not supported by the normal behaviour of various lines of Mg I.

Future Observations

The spectral lines identified in this study can almost certainly be supplemented by other lines when brighter meteors are photographed with existing spectrographs. From the substantial number of blended features in Table 1 evidently higher dispersion would also improve the list of identifications, especially for lines from inconspicuous atoms such as Ni I or for determining the presence of atoms such as Co I.

Several of the multiplets already identified in these spectra should be contributors to normal wake spectra when an intense flare occurs just before the camera is uncovered, rather than just before it is occulted as in Figure 3. A careful search should be maintained for additional instances of the persistent feature at λ3836 and here again an improved dispersion could assist in the problem of its identification.

Acknowledgments

The author is indebted to the staff of the Meanook and Newbrook Meteor Observatories, who secured the observational material used in this study; to J. M. Grant and A. C. Taylor at Meanook and to T. E. Chmilar at Newbrook.

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THE 22.25 MHz RADIO TELESCOPE AT THE DOMINION RADIO ASTROPHYSICAL OBSERVATORY

C. H. Costain, J. D. Lacey and R. S. Roger

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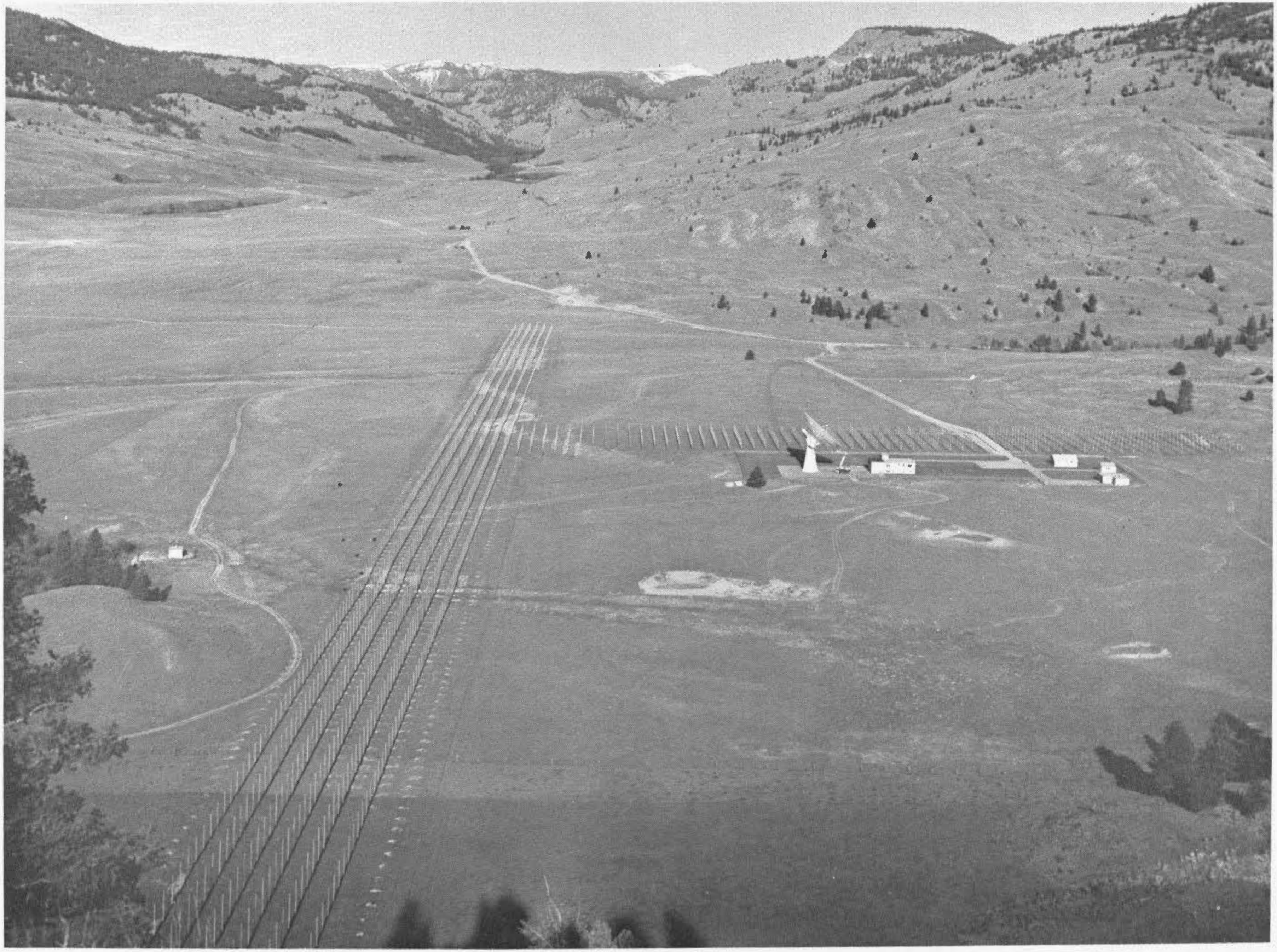

Figure 1. A photograph of the 22.25 MHz array taken from the east.

THE 22.25 MHz RADIO TELESCOPE AT THE DOMINION RADIO ASTROPHYSICAL OBSERVATORY

C.H. COSTAIN, J.D. LACEY and R.S. ROGER

ABSTRACT – Radio telescopes of the *T* and Cross configurations are compared and their relative merits discussed.

A large *T* array built at the Dominion Radio Astrophysical Observatory for radio astronomical observations at 22.25 MHz ($\lambda = 13.5$ m) is described. It consists of 624 full-wave dipoles above a reflecting screen 65,000 m^2 in area. The dipoles are arranged in an east-west section of dimensions $96\lambda \times 2.5\lambda$ and in a north-south section $32.5\lambda \times 4\lambda$. The instrument has a pencil-beam response of $1\overset{\circ}{.}1 \times 1\overset{\circ}{.}7$ at the zenith. Simultaneous observations at five adjacent declinations are made with a time-sharing technique.

Observations commenced in 1965 and will provide flux density measures for 400 to 500 radio sources down to a limiting flux density of $30 \times 10^{-26} \mathrm{Wm}^{-2}\mathrm{Hz}^{-1}$. A map of the galactic background radiation from the sky north of -20° declination is being prepared.

RÉSUMÉ – Les auteurs passent en revue les radiotélescopes constitués de réseau en forme de *T* et de réseau croisé et présentent les avantages de chacun.

Ils décrivent un grand réseau en forme de *T* construit à l'Observatoire fédéral de radio-astrophysique et destiné à des observations astronomiques sur la bande de fréquences de 22.25MHz ($\lambda = 13.5$ m). Le réseau est constitué de 624 dipoles à onde complète placés au-dessus d'un écran réflecteur d'une superficie de 65,000 mètres carrés. Les dipôles sont disposés sur un aérien orienté en direction est-ouest et de dimension correspondant à 96λ sur 2.5λ et sur un autre aérien en direction nord-sud de dimension correspondant à 32.5λ sur 4λ. La réponse du lobe principal est de $1\overset{\circ}{.}1$ sur $1\overset{\circ}{.}7$ au zénith. On peut procéder à des observations simultanées à cinq déclinaisons adjacentes grâce à une technique de partage du temps.

Les observations ont commencé en 1965 et elles fourniront des mesures de la densité de flux pour 400 à 500 radiosources à partir d'une densité de $30 \times 10^{-26} \mathrm{Wm}^{-2}\mathrm{Hz}^{-1}$. On prépare pour tout l'hémisphère boréal du ciel et jusqu'au 20^{e} degré de déclinaison sud une carte des émissions continues de la galaxie.

Introduction

Instrumental development in radio astronomy has been directed primarily towards the achievement of systems of high resolving power. With the great improvements in high-frequency receivers and antennas, the trend at most observatories has been towards the use of higher and higher frequencies where adequate resolving power may be obtained with structures of moderate size. Apart from the pioneer work of Shain (1958, 1961) there has until recently been a relative neglect of the low-frequency end of the radio astronomy spectrum.

Observations at low frequencies are, of course, required to extend our knowledge of the radio spectra of all sources of radio emission. Some studies, however, such as the examination of the complex structure of the galactic continuum radiation, are best carried out at the longer wavelengths where the intensities are very high. The low-frequency radio telescope is the most sensitive detector of the diffuse clouds of ionized hydrogen which appear in absorption against the bright galactic background (see Figure 12).

When the present instrument was planned, the largest low-frequency array in the northern hemisphere was the 38 MHz Moving-*T* at the Mullard Radio Astronomy Observatory, Cambridge (Costain and Smith, 1960). An operating frequency near 20 MHz was therefore desirable to extend spectral measurements about an octave. The choice of 22.25 MHz ($\lambda = 13.5$ m) was made after a careful study of the incidence of radio interference in nearby bands.

Because of the almost complete absence of previous measurements at this frequency, it was decided to build a general purpose telescope similar to the Mills Cross (Mills, *et al.*, 1958). In these systems, the voltage outputs of two long thin orthogonal arrays are multiplied together to produce the desired 'pencil-beam' response. The 22 MHz instrument is, in fact, a *T*-shaped array. The $96\lambda \times 2.5\lambda$ east-west arm and the $32.5\lambda \times 4\lambda$ north-south arm combine to provide a response of $1\overset{\circ}{.}1 \times 1\overset{\circ}{.}7$ at the zenith.

Several large interferometer systems, as opposed to pencil-beam instruments, are now being used to study small-diameter radio sources at low frequencies: the 26.3 MHz compound grating interferometer at Clarke Lake, U.S.A. (Erickson, 1965), and the broad-band arrays (10-25 MHz, 20-40 MHz) in the U.S.S.R. (Bazelyan, *et al.*, 1965; Brouk, *et al.*, 1967). The extremely favourable observing conditions encountered during early observations with parts of the 22 MHz array, prompted the decision, late in 1963, to build a similar instrument to operate at a frequency near 10 MHz (Galt, *et al.*, 1967). These arrays at the Dominion Radio Astrophysical Observatory are, at present, unique facilities in this frequency range in that they also permit observations of the extended features of the Galaxy.

This paper is devoted to a discussion of *T*-shaped antenna systems and a detailed description of the design and performance of the 22.25 MHz array. Brief descriptions of the instrument have appeared elsewhere, (Costain, 1962; Galt and Costain, 1965).

The *T*-Configuration

The equivalence of "perfect" Cross and *T* system has been discussed in detail elsewhere (Blythe, 1957; Ryle and Hewish, 1960; Mills, 1963). It can be easily demonstrated by reference to Figure 2(a). Since the output of a *T* or Cross is the product of the outputs of the two orthogonal arrays, the only relevant spacial components are those between the elements of one array and those of the other. It may be seen that all element spacings and orientations present in the uniform aperture are contained in the Cross and *T*, with each component appearing twice in the Cross configuration (c.f. the arrows in Figure 2(a)). The *L*-configuration, where a further arm of the Cross has been removed, does not contain all necessary element orientations. With an appropriate weighting of the elements, the Cross or *T* can precisely duplicate the response beam of the uniform aperture. However, rather than discard half of one arm of the Cross with the resultant loss in sensitivity, the alternative arrangement shown in 2(b) where the elements of the south arm are placed to provide a north-south arm of twice the width, may be used and is identical in both resolving power and sensitivity to the Cross. It is this *T*-configuration which will be considered in subsequent discussion.

Both systems are, of course, unfilled apertures and as such are less sensitive than the uniform aperture of equivalent resolving power. Ryle and Hewish (1960) have expressed this effect in terms of an efficiency parameter E, which is the ratio of the effective collecting area of the system A_{eff} to that of the equivalent uniform aperture A. For the *T*-configuration shown in Figure 2(b), this is given by

$$E = \frac{A_{eff}}{A} = \sqrt{\frac{2\,d_1 d_2}{D_1 D_2}} = \frac{T_a}{T_b} \qquad (1)$$

where T_a is the aerial temperature (neglecting losses) obtained when the system is used to observe a region of uniform brightness, T_b. The major design parameters, therefore, for a given resolution, are the array widths d_1 and d_2, with the optimum values being those which ensure that the system has sufficient sensitivity to reach the confusion limit for point source observations.

Most practical systems employing the *T*-configuration have used it as an interim phase in the development of a Cross system (Bracewell and Swarup, 1961) or have used the aperture synthesis technique (Blythe, 1957; Costain and Smith, 1960; Crowther and Clarke, 1966). Discussion has centred largely on the sensitivity of the *T* to errors in the excitations of the array elements (Mills, 1963). However, the *T* offers some unique advantages over the Cross which merit serious consideration. The *T*-configuration of Figure 2(b) is superior to the Cross in three respects:

1. The number of phasing switches, multibeam elements, preamplifiers, cables, etc., needed for the north-south arm is reduced by half.
2. The extent in hour angle over which the side-lobes of the east-west array are significant is reduced by half because of the increased width of the north-south array.
3. The maximum north-south dimension required at the antenna site, for a given beamwidth, is also reduced by half.

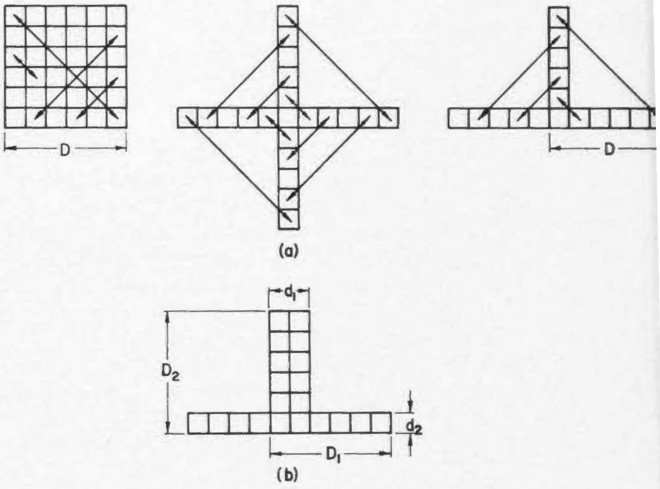

Figure 2. (a) Apertures of equal resolving power. (b) A *T*-configuration equivalent to the Cross in both resolving power and sensitivity.

Perhaps the major advantage of the *T*-configuration lies in the economies that result from halving the feeder and phasing arrangements of the north-south array. As mentioned above, for reasons of sensitivity, the area of the north-south array and therefore the cost of the basic structure, are likely to be similar in the *T* and Cross systems. The phasing and multibeam arrangements necessary to provide beam scanning in declination, however, remain a major cost factor and perhaps the most difficult engineering problem in the design of large arrays. For any large instrument, it seems likely that a monitor system to maintain the accuracy of the excitations of the north-south array can be installed for a small fraction of the cost of duplicating the entire north-south feeder system.

The side-lobes of unfilled apertures such as the *T* or Cross are always troublesome because these instruments are used to examine a universe populated with many bright radio sources. The side-lobes in hour angle are reduced to negligible values at angles beyond the first zero of the east-west response of the north-south array. The reduced angular extent of the hour angle side-lobes mitigates, to a large extent, the slightly larger declination side-lobes discussed below.

The *T* is inferior to the Cross in its greater sensitivity to errors in the excitations of the elements of the north-south array. These errors produce spurious side-lobe responses in declination and may be divided into two classes, random and systematic, whose effects are considered separately.

Errors in measurement in the adjustment of the excitations will result in random errors in amplitude and phase. In general, these errors will have a mean value of zero and rms values dependent to a large extent on the time and effort expended to reduce them. For a given rms error, the *T* system would be expected to have a declination side-lobe level $\sqrt{2}$ larger simply because only half the number of independent elements are used (Mills, *et al.*, 1958).

A more serious effect results from a systematic differential phase shift between the north-south and east-west arrays. This is illustrated in Figure 3 which shows the asymmetric side-lobes and the 0.14 beamwidth collimation error due to a gross differential phase error of 20°. Avoidance of this type of error requires some sort of system to monitor the differential phase. This is easily accomplished by the injection of a test signal into the overlap region common to both arrays.

The Central Overlap Region

One of the design problems in *T* and Cross systems is encountered in the region where the two arms intersect. In the original Mills Cross (Mills, *et al.*, 1958), the central dipoles of the east-west arm were removed. This results in a negative system response, elongated in the east-west plane. A portion of the output of the north-south arm, which had a similar though far from identical response, was added as compensation. Although this method worked well for a uniform background or point sources, it was subject to large errors when the system was used to observe intermediate broad components such as those encountered near the galactic plane.

A different technique, which offers a much more satisfactory solution, positions the elements in the overlap region so that they may be considered to be part of either array. Their outputs are divided with hybrid networks and are fed, with the appropriate weighting, into the feeder systems of both arrays. The output of the system then contains spacial Fourier components down to zero spacing and therefore precisely reproduces a pencil-beam response.

This method was used with the 10 MHz and 22 MHz arrays at the Dominion Radio Astrophysical Observatory.

The 22.25 MHz Array

General Description

The 22.25 MHz array is located near Penticton, British Columbia, Canada, at the Dominion Radio Astrophysical Observatory (longitude = 119°37′08″W; latitude = 49°19′14″N). It is a *T*-shaped array of 624 full-wave dipoles; 368 in the E-W arm, 240 in the N-S arm, and 16 common to both arms. The dipoles are polarized in the E-W direction. A full reflecting screen (area ~ 65,000 m^2) is mounted $\lambda/8$ below the dipoles and the entire structure is supported on a grid of 1698 wooden poles. The plane of the array was adjusted for the best average fit to the terrain. It was therefore necessary to skew the axis of the array slightly from the E-W direction in order that the axial plane of the E-W arm pass through the north celestial pole. The dimensions of the system are shown in Figure 4 and Figure 1 is a photograph of the array taken from the east. At the zenith, the instrument has an elliptical beam with half-power widths of 1°.1 in hour angle and 1°.7 in declination.

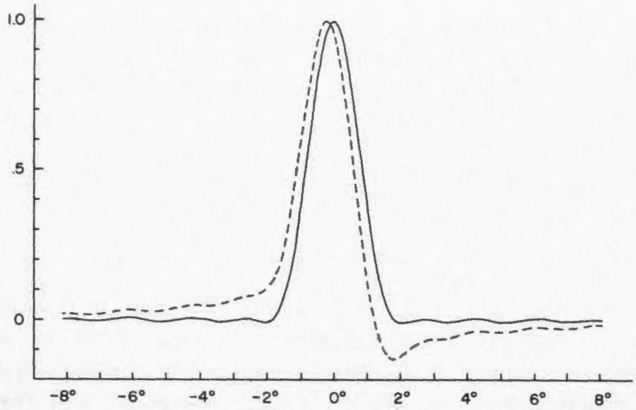

Figure 3. The declination polar diagram of a *T* with differential phase errors of 0° (solid line) and 20° (dashed line).

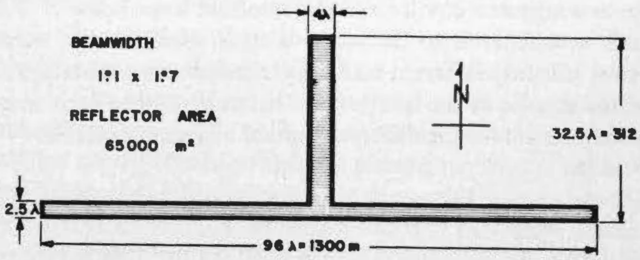

Figure 4. A schematic diagram of the 22.25 MHz array.

The outputs of the E-W and N-S arms are carried by coaxial cables to preamplifiers located at the centre of each arm and from there to the main observatory building. The signals are then amplified and correlated using the standard phase-switching technique. They are then integrated, digitized and punched on cards.

The array can be phased north and south of the zenith along the meridian. This phasing to any declination is accomplished by means of remotely-controlled switches operated from the main observatory building. A rapid-phasing network operating on a time-sharing basis, provides quasi-simultaneous observations of five adjacent declinations.

At 22 MHz, the mean sky brightness temperature of the order of 30,000°K completely dominates the receiver noise. Losses of 10 db may be tolerated with negligible deterioration in signal-to-noise, permitting the use of inexpensive coaxial cable for the bulk of the feeder system and the use of resistive attenuators for the grading of the aperture.

The array has an efficiency, as defined by Equation (1), of approximately 10 per cent, a value considerably higher than that usually employed (Shain, 1958; Mills, *et al.*, 1958). The effective collecting area of the instrument is therefore

$$A_{eff} \approx 30{,}000 \text{ m}^2 \qquad (2)$$

This efficiency permits observation of areas of low surface brightness away from the galactic plane. The collecting area is more than adequate for the detection of sources with flux densities near the confusion limit of $S = 33 \times 10^{-26} \mathrm{Wm^{-2} Hz^{-1}}$ (1 source per 20 beam areas). Under ideal observing conditions, the system is capable of providing flux density measures for approximately 600 radio sources.

Basic Element

The basic element in the array consists of two full-wave dipoles $\lambda/8$ above the reflecting screen (see Figure 5). A broad-band dipole (impedance 2000 ohms resistive) was constructed from two loops of wire. A vertical twin line couples the dipole to the feeders below the reflecting screen. A $\lambda/4$ shorted stub and a $\lambda/4$ transformer permit adjustment of the impedance to 400 ohms. Sections of 400-ohm line couple the two adjacent dipoles and the resultant impedance of 200 ohms is converted to 50 ohms with a coaxial balun transformer. Slightly different matching transformers were required for the dipoles in the interior and exterior rows of each array to compensate for the different mutual impedance effects.

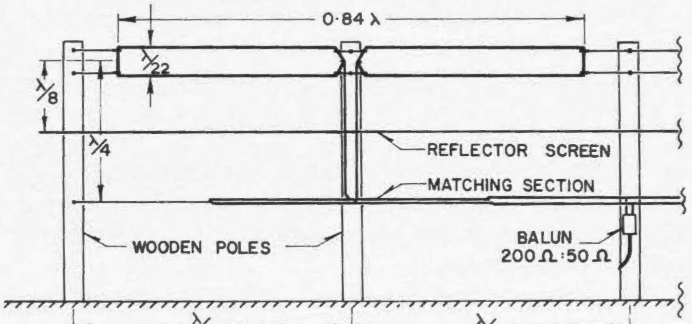

Figure 5. The basic element of the array. For simplicity, only one of the two full-wave dipoles is shown.

The Reflecting Screen

The ground plane of the array is accurately defined by a full reflecting screen which extends $\lambda/2$ beyond the dipoles in the N-S direction. It consists of fine galvanized steel wires aligned parallel to the dipoles and spaced $\lambda/22$ apart. The area of the reflecting screen is approximately 65,000 $\mathrm{m^2}$. The screen is supported by heavy guy wires which also serve to accurately position the self-supporting wooden poles.

The East-West Array

In the E-W arm, the elements are arranged in four rows. Each row has three groups of 32 full-wave dipoles. The rows are spaced $\lambda/2$ apart, and to permit phasing in the N-S direction, each row has its own feeder system as shown in Figure 6. To preserve the bandwidth of the system, a binary branching (Christmas tree) feeder network is used throughout. This provides an identical cable path of about $62\lambda_c$ from each dipole to the central junction. Of this length, $50\lambda_c$ is composed of phase-stable coaxial cable. At each junction, a coaxial matching section converts the impedance to 50 ohms. The coupling of the four rows in the N-S plane is also done with a branching network with phasing switches (see section on 'The Phasing System') installed at each junction. Originally this was done only at the centre of the array. More recently, to reduce system losses, a branching network and phasing switches were placed at points shown at *A* in Figure 6. The three sections of the array are then coupled to the central point with single lengths of less lossy cable.

Systems such as the *T* or Cross require a severe apodization of their apertures to reduce side-lobe responses. The excitation functions used are shown in Figure 7. For convenience, a common grading attenuator is used for each group of four dipoles (positions shown with X's in Figure 6). A uniform illumination is used in the N-S plane. The grating responses that would normally result from this staircase function fall on the zeros of the response of the 4λ aperture of the N-S array. This excitation function gives the E-W arm a

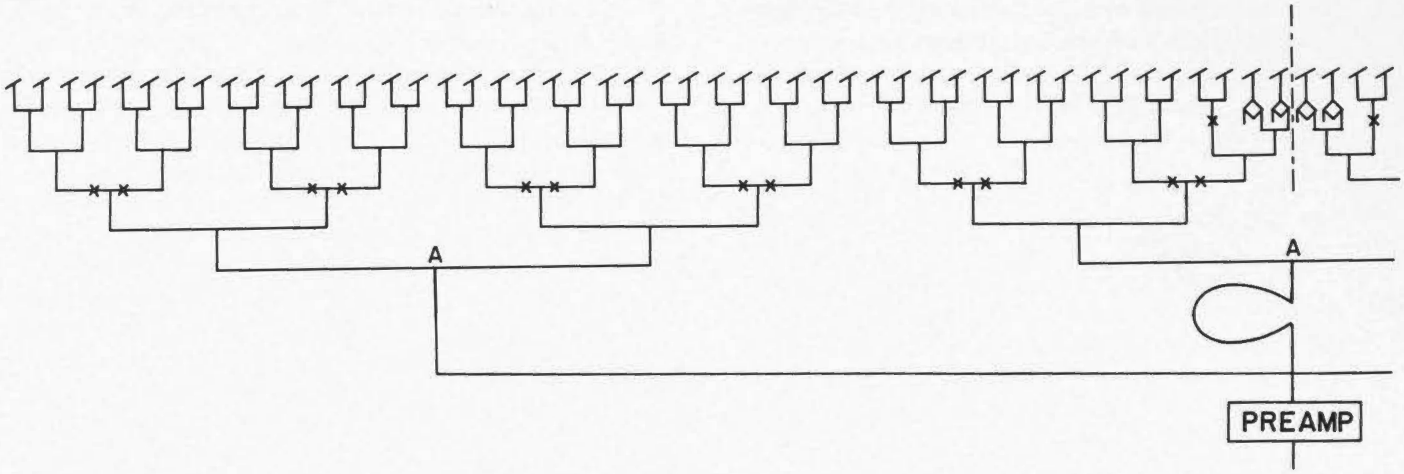

Figure 6. The feeder system for one row of the E-W array. The system is symmetrical about the dashed line. The diamonds indicate the hybrid networks which permit the dipoles in the overlapping region to be shared by both arrays. Grading attenuators are shown as X's.

voltage response with a half-width of 1°.1 in hour angle, a negative first side-lobe of 1 per cent, and remaining side-lobes less than 1 per cent.

When the E-W arm is used by itself in a total power system, it has a half-power beamwidth of 0°.8 by 26° at the zenith.

The North-South Array

The N-S arm consists of 64 rows spaced $\lambda/2$ apart, each with four full-wave dipoles. The four dipoles are coupled together and each row is then connected into the N-S feeder system shown in Figure 8. The total cable path to each dipole is made up of the same length and type of cable used in the E-W array to eliminate differential temperature effects.

To point the beam of an array employing a branching feeder system, the relative phases must be altered at each 2:1 junction. The phasing system is discussed in detail in the following section. However, the phasing of adjacent rows also imposes impedance matching problems because of the large mutual coupling at the $\lambda/2$ spacing.

When the relative phase of two adjacent rows was rotated through 360°, the junction impedance traced out an approximate cardioid pattern on a Smith impedance chart. By adjusting the dipole matching transformers and the lengths of cable between the dipoles and the junction, it was possible to arrange the pattern very close to the unit circle for all phasings except those corresponding to extreme zenith angles. Therefore, a single reactive stub for each phase increment was sufficient to make the junction impedance resistive with a maximum VSWR of 1.3. Because of circuit losses, further concessions to mutual effects at succeeding junctions were not required.

The aperture illumination of the N-S arm is uniform in the E-W plane and follows the function given in Figure 7 in the N-S plane. The zero order component from the overlap region of a *T*-configuration must appear with half the weight of the higher order spacial components to reproduce the component weighting of a uniform aperture. The computed voltage response for this function has a half-width of 1°.7 sec Z, where Z is the zenith angle. The first side-lobe is −1 per cent and all remaining side-lobes are less than 1 per cent.

When used alone as a total power array, the N-S arm has a response with a beamwidth in declination of 2°.1 sec Z and broad, low-level wings. The E-W beamwidth is 14°.

Initially, the desired illumination was achieved with resistive attenuators. In a recent modification coincident with the installation of the rapid-phasing switches described in the following section, a combination of attenuators and coaxial power dividers at the major junctions was used to achieve the same excitation with less over-all attenuation.

The Phasing System

As mentioned previously, the phasing of a branching feeder network requires the installation of a phasing switch at each junction. The main phasing system of the 22 MHz array employs three switches in the E-W arm and 63 switches in the N-S arm.

The phasing switches have 16 positions, each position corresponding to the insertion of an independent length of cable. The use of independent lengths of cable permits the introduction of a unique matching stub for each position of the switches used to phase the adjacent rows of dipoles. The cable lengths vary from 0 to $15\lambda/16$ in increments of $\lambda/16$ or 22°.5. The phase of any row can therefore be adjusted with a maximum error of ±11°. For survey work, the beam positions can be chosen so that the phasing required in the last three stages of the feeder system is an exact multiple of $\lambda/16$. The systematic errors introduced in the first two stages due to the incremental nature of the phase adjustment produce a phase modulation along the aperture with periods of 1λ and 2λ. The corresponding grating responses lie on the zeros of the N-S beam of the E-W array and are rejected.

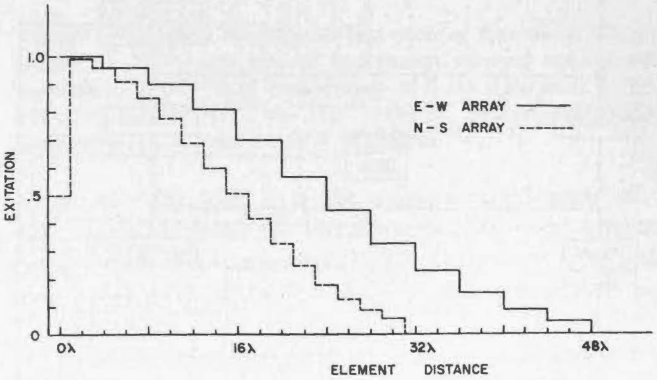

Figure 7. The excitation function for the E-W and N-S arrays.

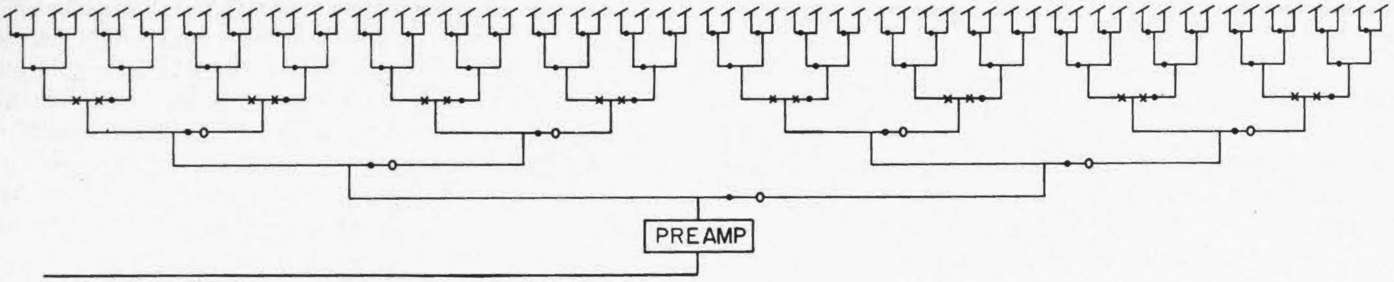

Figure 8. The feeder system of the N-S array: ● main phasing switches, ○ rapid phasing switches, X grading attenuators.

Since the switches at any one level in the feeder system require a common phase increment, they are coupled to drive one another in series. By setting the two master switches of the E-W array and the six of the N-S array to tabulated values, it is possible to rapidly point the beam of the instrument to any desired zenith angle in the N-S plane. The switches are driven by rotary solenoids with binary-coded master and slave wafers that permit selection of unique switch positions. Indicator lamps on the control panel and on individual switch housings provide an immediate indication of switch failure.

To permit faster sky coverage for mapping observations and position measurements for point sources, a rapid-phasing network has recently been added. The system operates on a time-sharing basis and provides simultaneous coverage of five adjacent declinations. Seven fast-acting crystal diode switches placed as shown in Figure 8, serve to shift the beam through angles of 0, ±0.263 and ±0.526 beamwidths (0°, ±0°.45, ±0°.90 at the zenith). The beam is pointed to each position four times in each integration period, permitting the observing intervals for each beam position to be arranged symmetrically around the same mean observing time.

Receiving and Auxiliary Equipment

The receivers and associated equipment used with the 22 MHz telescope are illustrated in Figure 9. The preamplifiers are located at the centre of each arm. The remaining units shown are all in the control room of the main observatory building.

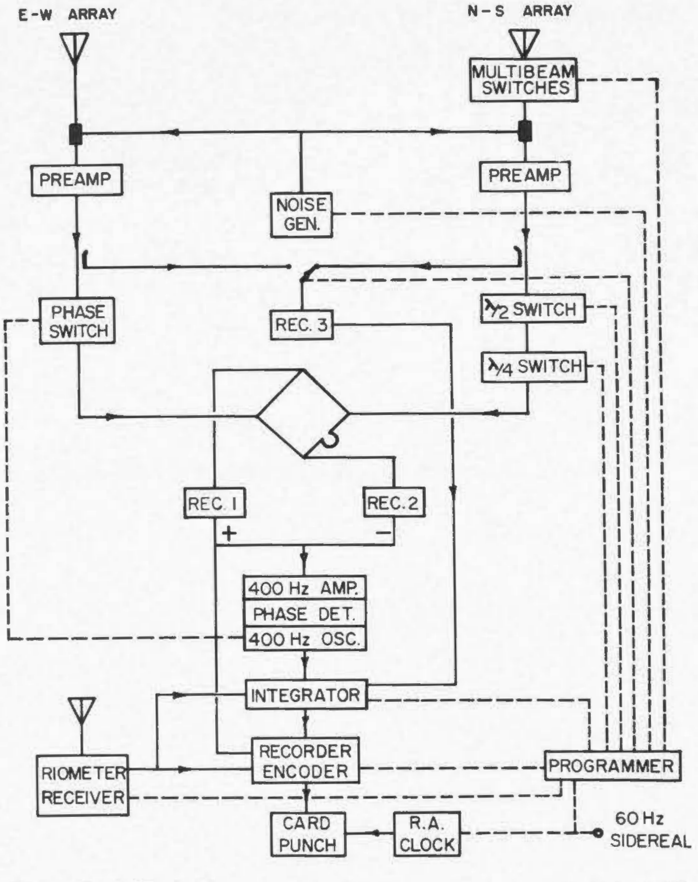

Figure 9. A block diagram of the 22.25 MHz Receiving System. Solid lines indicate signal paths. Dashed lines show control paths.

The receivers used are extremely gain-stable, stagger-tuned amplifiers. They have a flat pass-band of 300 kHz centred on 22.25 MHz with a gain that may be varied from 60 db to 120 db. The correlation is done using the standard phase switching technique developed by Ryle (1952). The use of receivers 1 and 2 to detect both the in-phase and anti-phase components improves the signal-to-noise by $\sqrt{2}$ and greatly aids in the suppression of interference incident on only one of the arms (Scott, *et al.*, 1961). Receiver 3 is used to monitor the total power outputs of the two arms.

The entire system is controlled by the programmer which permits unattended, automatic operation. It consists of a solid-state clock which is driven at the sidereal rate and synchronized to the right ascension clock, and solid-state logic circuits which generate the pulse trains required in the various parts of the system. The intensities for the five beam positions, the total powers from the two arrays, and the riometer output are recorded digitally. Provision is made for 30-second ($\delta<60°$) or 60-second ($\delta>60°$) integration periods and single or multibeam operation.

The $\lambda/2$ switch reverses the phase of the correlated signal for half of each integration period. A synchronous reversal of the integrator input ensures that only the correlated component is recorded, completely independent of any DC drifts that might develop in the system. The $\lambda/4$ switch is used only for testing; it provides a null indication of equal phase paths for the calibration, and for the arrays when a test signal is injected into the overlap region (c.f. section on 'The *T*-configuration'). Both switches employ coaxial reeds and have a low VSWR and a phase insertion accurate to better than 1°.

A diode noise generator inserts a stable, correlated calibration signal into the system during every second integration period. This provides a continuous measure of sensitivity and ensures the long-term continuity of the observations.

A 22.25 MHz riometer, connected to a separate cross-dipole antenna, continuously monitors the ionospheric absorption.

Calibration and Performance

An absolute calibration is particularly important for a large radio astronomy array operating at a frequency where few previous measurements have been made. A method which relates the system gain to that of a standard dipole was developed by Little (1958) for calibration of the original Mills Cross. A standard dipole has been constructed for the 22 MHz array but only preliminary measurements have been made.

An alternative method, which has been used to provide an interim calibration, relates all measurements to the flux density of the radio source *Cygnus A* (S = 29,000 $\mathrm{Wm^{-2}Hz^{-1}}$). This is the only source for which a 22 MHz value of sufficient accuracy is available (Kellermann, 1964) and this provides a measure of the instrument sensitivity near the

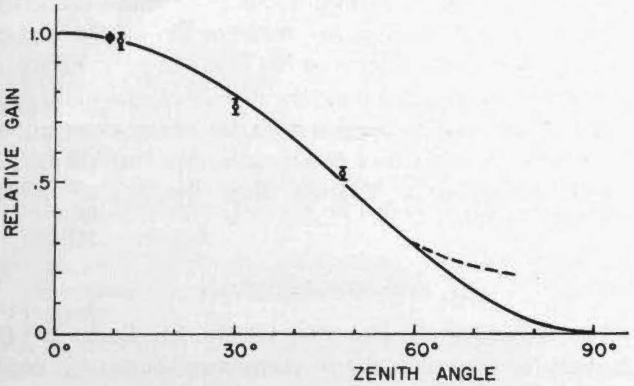

Figure 10. The relative gain of the 22.25 MHz Array as a function of zenith angle: – isolated element, • *Cygnus A* (3C 405), ○ mean of weaker sources in zenith angle zones 0° – 20°, 20° – 40°, 40° – 60°.

zenith. To extend this calibration to other zenith angles, one may use flux densities obtained by extrapolation for those sources which have well defined spectra down to 38 MHz. For the present work, the spectra have been determined from the 38 MHz and 178 MHz flux densities of the Mullard Observatory (Williams, *et al.*, 1966; Gower, *et al.*, 1967; Pilkington and Scott, 1965) and the 750 MHz and 1400 MHz values of the National Radio Astronomy Observatory (Pauliny-Toth, *et al.*, 1966). The ratio of flux densities measured in terms of the zenith calibration to the extrapolated flux densities was calculated for 98 sources. The results have been grouped for three zenith angle zones, $Z = 0°$ to $20°$, $20°$ to $40°$, and $40°$ to $60°$. The mean ratios are shown as the circles in Figure 10 together with the point for *Cygnus A*. The error bars shown are probable errors and are approximately 3 per cent.

The response of an isolated element, $\lambda/8$ above a reflecting screen, as a function of zenith angle, i.e.,

$$A\,(Z) = 2A_0 \sin^2\left(\frac{\pi}{4}\cos Z\right) \qquad (3)$$

is shown by the solid line in Figure 10.

The excellent agreement of the results from the fainter sources near the zenith with the *Cygnus A* calibration suggests that the method is reliable. There is no evidence for departures from the isolated element response given by Equation (3) for zenith angles less than 60°.

A possible departure for very large zenith angles, shown as the dashed curve in Figure 10, is suggested by observations of a few southern sources. Some deviation of this sort is to be expected when the mutual impedance effects are large enough to dominate the reflecting screen factor.

The brightness temperature scale, which depends on beam shape as well as on forward gain, may be derived from the flux density calibration using the relation

$$T_b = \frac{S\lambda^2}{2k\Omega} \qquad (4)$$

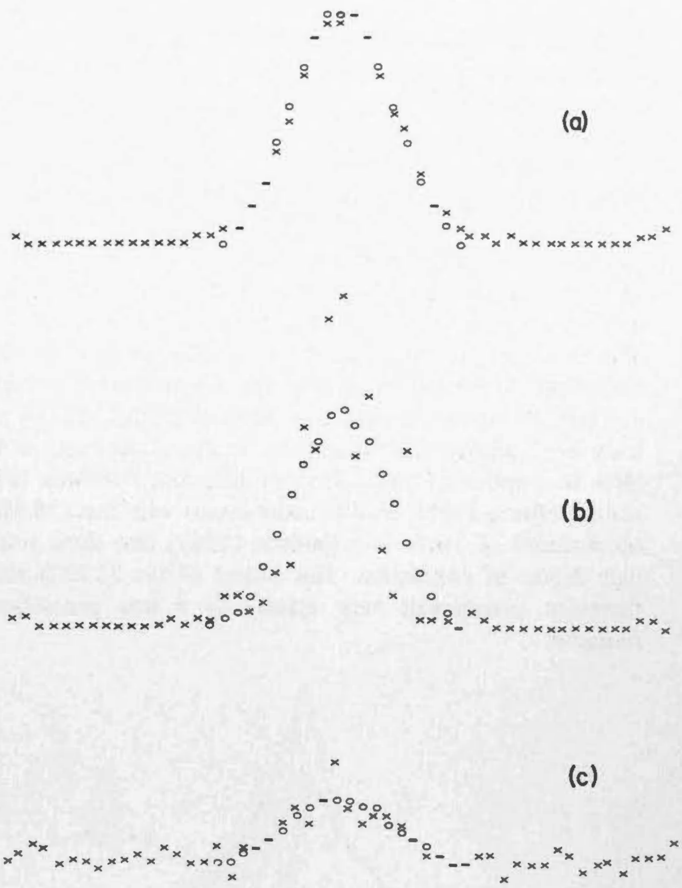

Figure 11. Facsimile of computer type-plots of three scans over point sources (X X X) with galactic background removed and theoretical beam shape (0 0 0) fitted (coincidence of X and 0 shown as –). (a) 3C 348, $S = 2690 \times 10^{-26}\,\mathrm{Wm^{-2}Hz^{-1}}$ (b) 3C 348, severe ionospheric scintillation. (c) 3C 190, $S = 50 \times 10^{-26}\,\mathrm{Wm^{-2}Hz^{-1}}$.

where $\Omega = \Omega_0/\cos Z$ is the effective solid angle of the instrument corrected for foreshortening. T_b is the brightness temperature of an extended source averaged over the system response and S is the flux density of the equivalent point source.

In general, the 22 MHz system has performed very much as expected. The beam shape, as indicated by observations of point sources, conforms very closely to the theoretical pattern. Figure 11 shows the computer reduction of three scans where the galactic background has been removed and the theoretical beam shape fitted: (a) 3C 348 ($S = 2690 \times 10^{-26}\,\mathrm{Wm^{-2}Hz^{-1}}$) under good observing conditions, (b) 3C 348 showing severe ionospheric scintillation, and (c) 3C 190 ($S = 50 \times 10^{-26}\,\mathrm{Wm^{-2}Hz^{-1}}$), a weaker source near the confusion limit.

The side-lobe responses are confined mainly to the two principal planes of the instrument. In hour angle, the first side-lobe is typically –3 to –4 per cent and the remainder are all less than 1 per cent, falling below the limit of detection (0.1 per cent) at angles greater than 10°. In declination, the first side-lobe is approximately –4 per cent and other nearby side-lobes are around 2 per cent or less. An examination of all available survey records for spurious responses in declination from the intense sources, *Cassiopeia A* and *Virgo A*, revealed no values greater than 1 per cent for angles more than 18° away from the main beam and a mean absolute value of less than 0.5 per cent.

The response of the system to an extended source is illustrated in Figure 12. This shows a scan across the galactic plane at $\delta = -12\overset{\circ}{.}2$ ($Z = 61°0$). The comparison scan (dashed line) at $\delta = -12\overset{\circ}{.}9$ was taken with a 50 MHz array at Jicamarca, Peru, directed to the zenith (Ochs, 1966). This array is a simple square aperture with a beamwidth of 1°1. The intensity has been scaled to provide the best fit. The agreement is excellent except for regions near $\alpha = 18^h15^m$ and $\alpha = 16^h20^m$ where absorption by interstellar ionized hydrogen is clearly indicated. This absorption is also evident on the 4.7 MHz observations (dotted line) of Ellis and Hamilton (Ellis and Hamilton, 1966). Similar comparisons with the 178 MHz observations of Turtle and Baldwin (1962) also show a very high degree of correlation. The output of the 22 MHz array therefore corresponds very closely to a true pencil-beam response.

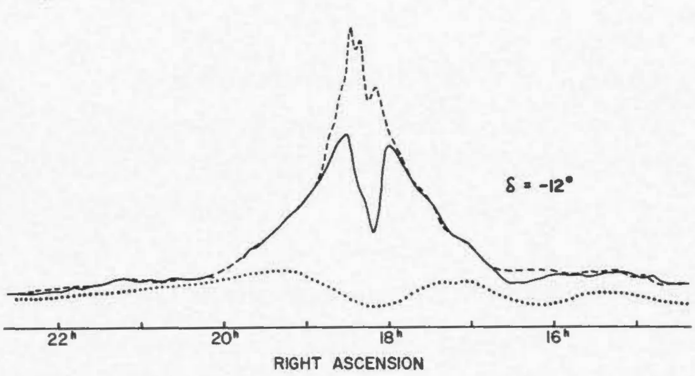

Figure 12. Scans across the galactic plane ($\delta = -12°$): ——22.25 MHz, ---- 50 MHz (Ochs, 1966), ... 4.7 MHz (Ellis and Hamilton, 1966) (not to scale).

Discussion

The performance of the array shows that the *T*-configuration may be used to produce a practical pencil-beam instrument. The declination side-lobes are small and the extra width of the N-S array has proven an effective means of suppressing the far-out side-lobes in hour angle. The sharing of the dipoles in the overlap region has resulted in an accurate total-power response.

It should be emphasized that the spurious responses of the system may be either positive or negative and have a mean value very near zero. The instrument is therefore largely free of the systematic bias that is present in the output of a conventional aperture where the side-lobe contribution is always positive.

The 22 MHz array has been in full operation since mid-1965 and is used primarily for two kinds of observations. First, drift scans of the type shown in Figure 12 have been made at half-beamwidth intervals and are being used to prepare a complete map of the northern sky from declination +90° to −20°. This will permit studies of the distribution of the thermal and nonthermal radiation from the galaxy. Secondly, several short scans of the type shown in Figure 11 have been made over the positions of each of about 400 radio sources. These results, coupled with the survey observations, will provide 22 MHz flux density measures for 400 to 500 sources down to a limiting flux density of $30 \times 10^{-26} \mathrm{Wm}^{-2}\mathrm{Hz}^{-1}$.

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