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MEASURES OF RADIAL VELOCITY OF κ CASSIOPEIÆ, g PERSEI, 69 TAURI AND ϵ CYGNI

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MEASURES OF RADIAL VELOCITY OF κ CASSIOPEIÆ

(1900, $\alpha = 0^h\ 27^m{\cdot}3$, $\delta = +\ 62°\ 23'$, mag 4·24, type B)

This star was announced as a spectroscopic binary by Campbell, in *Lick Observatory Bulletin* No. 199, from 6 plates taken between 1902 and 1911, which showed a range in velocity of about 25 km.

Fifty-two plates were made here in 1913 and 1914 with the old single-prism spectrograph; those from plate 6184 to the end were made with the present arrangement having a dispersion of about 33 angstroms per millimetre at $H\gamma$. The hydrogen, helium and silicon lines are fair for a star of this type, but the measures upon them are not as accordant as could be desired. A table is given showing the data regarding these lines. The H and K lines of calcium are exceedingly good and the measures upon these two alone are about as reliable as upon all the rest put together. Their velocities are, however, more negative than those for the other lines. On the assumption of a constant velocity for the star, the weighted mean for the calcium lines on 51 plates, with a total weight of 107, is $-16{\cdot}77$ km. per second, with a probable error for a plate of $\pm\ 4{\cdot}45$ km. per second. The corresponding velocity for the other lines on 50 plates, with a total weight of 115, is $-3{\cdot}02$ km. per second. The extreme range in the case of the general lines is 59 km., while for the calcium lines it is only 34 km. A considerable amount of each may be regarded as fictitious owing to errors of measurement, but it would seem that this star is another example of the ever increasing class of spectroscopic binaries in which the displacements shown by the calcium absorption is much less than that for the other elements.

While there seems no doubt of the binary character of the star, the period has not yet been determined and the measures are published in case some one, who has not the equipment for observation, may wish to do some astronomical work by determining a period to fit the observations.

LINES MEASURED IN κ CASSIOPEIÆ

λ	Element	n	Wt.	Residual	
				Numerical	Algebraic
4567·967	*Si*	17	7¼	9·9	−5·8
4552·762	*Si*	27	10⅛	9·4	−5·8
4471·676	*He*	37	17	7·8	+0·7
4388·100	*He*	15	5¾	11·0	+5·0
4340·634	*H*	32	13⅝	13·0	+6·5
4143·928	*He*	14	5¾	13·8	−1·1
4116·330		5	2¼	8·1	+1·0
4101·890	*H*	35	11⅜	6·7	+2·8
4089·120		12	4½	11·7	−8·3
4026·352	*He*	29	10⅞	9·8	−2·1
3970·177	*H*	10	3⅞	8·9	−6·4

SUMMARY OF VELOCITIES OF κ CASSIOPEIÆ

Plate	Date	General Lines			*H* and *K*	
		Vel.	*n*	Wt.	Vel. + 13·8	Wt.
	1913					
5672	Sept. 15	+ 1·4	6	2¾	+ 2·8	2
5687	" 22	+ 0·4	4	2½	+ 2·4	2½
5706	" 26	− 6·2	5	3½	+ 0·7	2
5713	" 29	− 4·5	3	1¾	+ 0·9	2
5730	Oct. 1	−14·6	3	1½	+ 2·5	2½
5738	" 3	± 0·0	4	1	− 2·0	1
5744	" 4	+ 2·5	3	1½	− 7·2	2½
5840	Dec. 22	+ 3·1	4	2¼	.....	.....
5859 a	" 31	+17·0	5	2½	− 5·6	1½
5859 b	" 31	+12·9	6	3¼	+ 1·0	1
	1914					
5876	Jan. 5	.....	.....	.....	− 7·7	2
5881	" 12	.....	.....	.....	− 7·0	1½
6184	July 14	− 9·0	7	2¾	− 2·8	2
6199	" 17	− 1·7	6	2¾	+ 0·7	1½
6217	" 21	± 0·0	3	1¾	− 9·0	2
6271	Aug. 11	− 6·3	8	2¼	− 3·1	2
6277	" 14	− 4·6	6	1½	−11·9	2
6288	" 19	−17·0	8	2½	−18·4	2
6292	" 21	−40·8	4	1¼	−10·2	3
6309	" 25	−31·3	4	1¼	−23·8	2¼
6319	" 27	+ 4·6	5	2	− 2·6	2
6329	" 31	−25·5	6	2½	− 9·4	¾
6332	Sept. 2	− 0·3	6	2½	− 1·3	1½
6336	" 4	+ 2·2	6	1	− 2·0	2¼
6341	" 7	+ 2·8	5	1⅜	+ 1·4	3
6343	" 8	−18·7	7	2¼	−11·4	2½
6357	" 11	− 9·4	7	2¼	− 6·3	2¼
6361	" 12	−22·0	5	1¾	− 6·4	2¼
6364	" 13	+ 3·9	7	4	+ 1·1	1½
6365	" 13	+ 9·8	7	3	+ 3·0	3
6370	" 14	−13·6	6	2¼	− 3·4	2
6377	" 15	+12·4	9	3¼	+ 3·8	5
6383	" 16	+11·6	6	2¾	− 6·8	2¼
6391	" 17	−11·7	4	1¾	− 4·2	2½
6399	" 18	+13·0	8	3	+10·3	1
6406	" 19	− 5·1	10	5¼	− 4·2	2½
6416	" 21	+10·8	6	1¾	−15·4	2¼
6427	" 25	− 6·0	5	2½	− 7·0	2¼
6433	" 27	−21·7	5	1¾	− 2·8	2¼
6440	" 28	+ 1·0	5	2¾	− 1·0	2
6447	" 30	− 9·8	8	3½	− 2·0	2¼
6455	Oct. 1	− 8·1	4	1	− 3·5	2
6464	" 2	− 3·6	6	1½	+ 3·3	1½
6480	" 4	− 3·8	4	1¾	+ 8·2	1¾
6499	" 13	− 5·6	4	1¼	− 0·3	1½
6513	" 21	− 5·0	7	2½	+ 7·3	1¾
6520	" 22	+ 2·6	6	3	+ 7·0	2½
6529	" 23	+ 8·8	5	2½	+ 9·9	2
6535	" 28	−23·0	6	2½	− 9·9	2¼
6543	Nov. 2	−12·5	3	1	− 3·6	2
6553	" 4	−19·0	4	2	− 4·0	2¼
6555	" 14	+ 5·0	7	4¼	− 6·0	3

VELOCITIES OF THE *H* AND *K* LINES

Plate	Vel. *H* 3968·625	Wt.	Vel. *K* 3933·825	Wt.	Weighted Mean	Reduction to Sun	Radial Velocity
5672	−24·4	1	−23·7	1	−24·05	+13·10	−11·0
5687	−19·7	1½	−27·9	1	−23·00	+11·56	−11·4
5706	−20·0	1	−27·2	1	−23·60	+10·52	−13·1
5713	−24·8	1	−20·7	1	−22·75	+ 9·83	−12·9
5730	−13·7	1	−25·2	1½	−20·60	+ 9·35	−11·3
5738	−23·3	½	−25·7	½	−24·50	+ 8·73	−15·8
5744	−28·1	1	−30·5	1½	−29·54	+ 8·53	−21·0
5859 a	− 4·7	½	− 2·6	1	− 3·31	−16·14	−19·4
5859 b	+ 5·0	½	+ 1·6	½	+ 3·30	−16·14	−12·8
5876	− 2·8	1	− 6·3	1	− 4·55	−16·94	−21·5
5881	− 2·7	½	− 2·8	1	− 2·77	−18·07	−20·8
6184	−32·5	1	−34·1	1	−33·30	+16·74	−16·6
6199	−32·0	¾	−28·1	¾	−30·05	+16·94	−13·1
6217	−41·6	1	−38·6	1	−40·10	+17·31	−22·8
6271	−42·5	½	−31·8	1½	−34·48	+17·57	−16·9
6277	−38·8	1	−47·3	1	−43·05	+17·35	−25·7
6288	−50·4	1	−47·9	1	−49·15	+16·99	−32·2
6292	−41·3	1½	−40·7	1½	−41·00	+16·99	−24·0
6309	−52·9	¾	−54·8	1½	−54·17	+16·53	−37·6
6319	−35·8	1¼	−27·6	¾	−32·75	+16·40	−16·4
6329	−39·1	¾	.....	.....	−39·10	+15·85	−23·2
6332	−26·1	¾	−35·4	¾	−30·75	+15·63	−15·1
6336	−23·1	¾	−34·9	1½	−30·97	+15·22	−15·8
6341	−27·0	1¼	−27·4	1¾	−27·23	+14·79	−12·4
6343	−36·4	1¼	−43·3	1¼	−39·85	+14·66	−25·2
6357	−39·8	¾	−31·8	1½	−34·47	+14·35	−20·1
6361	−40·9	¾	−30·8	1½	−34·17	+13·98	−20·2
6364	−32·6	½	−23·4	1	−26·47	+13·73	−12·7
6365	−26·0	1¼	−23·4	1¾	−24·48	+13·72	−10·8
6370	−30·1	1	−31·3	1	−30·70	+13·46	−17·2
6377	−21·9	2½	−24·6	2½	−23·25	+13·28	−10·0
6383	−31·1	¾	−35·0	1½	−33·70	+13·10	−20·6
6391	−28·0	1	−32·9	1½	−30·92	+12·87	−18·0
6399	−13·6	¾	−19·7	¼	−15·12	+12·62	− 3·5
6406	−29·0	1	−31·2	1½	−30·32	+12·34	−18·0
6416	−37·8	¾	−42·7	1½	−41·07	+11·89	−29·2
6427	−29·4	¾	−32·9	1½	−31·73	+10·94	−20·8
6433	−28·2	¾	−26·4	1½	−27·00	+10·36	−16·6
6440	−17·4	½	−27·5	1½	−25·00	+10·23	−14·8
6447	−30·7	¾	−23·1	1½	−25·63	+ 9·79	−15·8
6455	−26·9	¾	−26·8	1¼	−26·84	+ 9·58	−17·3
6464	−15·8	½	−21·9	1	−19·87	+ 9·36	−10·5
6480	− 9·9	1	−20·2	¾	−14·30	+ 8·69	− 5·6
6499	−28·5	½	−15·9	1	−20·10	+ 6·03	−14·1
6513	− 8·6	¾	−11·4	1	−10·20	+ 3·72	− 6·5
6520	− 4·5	1	−14·2	1½	−10·32	+ 3·52	− 6·8
6529	−12·3	½	− 5·3	1½	− 7·05	+ 3·18	− 3·9
6535	−25·3	¾	−25·0	1½	−25·10	+ 1·38	−23·7
6543	−15·7	¾	−18·2	1¼	−17·30	− 0·10	−17·4
6553	−17·0	1	−17·0	1¼	−17·00	− 0·84	−17·8
6555	−17·2	1¼	−15·0	1¾	−15·92	− 3·93	−19·8

MEASURES OF κ CASSIOPEIÆ

λ	5672		5706		5713		5730		5738		5744		5840	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel,	Wt.	Vel.	Wt.
4567	.....	....	.....	....	.....	....	.....	....	.....	....	− 8·3	½	.....	....
4552	−19·7	½	−42·0	½	.....	....	.....	....	.....	....	.....	....	.....	....
4471	16·7	½	17·3	1	−10·7	½	−18·1	½	−10·2	¼	+ 4·6	½	+21·4	½
4388	0·0	½	.....	....	.....	....	.....	....	.....	....	.....	....	20·9	½
4340	7·2	½	8·8	1	.....	....	40·4	½	−18·1	¼	−14·6	½	2·2	¾
4143	3·0	¼	21·6	½	.....	....	.....	....	.....	....	.....	....	.....	....
4101	.....	....	.....	....	12·3	¾	.....	....	−15·4	¼	.....	....	+32·3	½
4026	−19·2	½	− 1·2	½	−21·0	½	−13·5	½	+ 9·0	¼	.....	....	.....	....
Weighted mean	− 11·67		− 16·71		− 14·33		− 24·00		− 8·70		− 6·00		+ 17·24	
V_a	+ 13·41		+ 10·91		+ 10·15		+ 9·66		+ 9·11		+ 8·84		− 13·79	
V_d	− ·03		− ·11		− ·04		− ·03		− ·10		− ·03		− ·11	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 1·4		− 6·2		− 4·5		− 14·6		± 0·0		+ 2·5		+ 3·1	

MEASURES OF κ CASSIOPEIÆ—*Continued*

λ	5859 a		5859 b		6184		6199		6217		6271		6277	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4567	.....	....	+21·9	½	−13·3	¼	.....	....	− 9·2	¾	.....	....	.....	....
4552	.....	....	43·1	½	32·7	½	−11·9	½	.....	....	− 5·9	¼	−10·9	¼
4471	+51·0	½	33·8	¾	24·0	¼	15·8	¾	23·5	½	24·6	½	−42·6	¼
4388	.....	....	47·0	½	37·2	½	.....	....	.....	....	19·8	¼	.....	....
4340	36·5	½	.....	....	.....	....	40·7	½	.....	....	34·0	¼	−40·2	¼
4143	13·5	½	18·7	½	.....	....	.....	....	.....	....	.....	....	−25·4	¼
4116	.....	....	.....	....	16·5	¾	.....	....	.....	....	.....	....	.....	....
4101	23·8	½	.....	....	39·1	¼	16·1	½	−23·2	½	25·8	¼	−21·4	¼
4089	+41·1	½	.....	....	.....	....	5·7	¼	.....	....	14·6	¼	+ 9·2	¼
4026	.....	....	+ 7·3	½	−17·4	¼	−13·9	¼	.....	....	34·0	¼	.....	....
3970	.....	....	.....	....	.....	....	.....	....	.....	....	−31·6	¼	.....	....
Weighted mean	+ 33·18		+ 29·02		− 25·71		− 18·62		− 17·26		− 23·87		− 21·90	
V_a	− 15·76		− 15·76		+ 16·91		+ 17·18		+ 17·50		+ 17·81		+ 17·66	
V_d	− ·10		− ·10		+ ·11		+ ·04		+ ·09		+ ·04		− ·03	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 17·0		+ 12·9		− 9·0		− 1·7		± 0·0		− 6·3		− 4·6	

MEASURES OF κ CASSIOPEIÆ—*Continued*

λ	6288		6292		6309		6319		6329		6332		6336	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4567	.....	....	−56·4	½	−41·5	½	.....	....	−32·6	½	.....	....	.....	....
4552	−30·5	½	.....	....	.....	....	.....	....	.....	....	−22·9	½	.....	....
4471	39·8	½	.....	....	43·8	½	−29·5	½	22·3	½	.....	....	−11·8	½
4388	19·4	½	.....	....	.....	....	.....	....	30·8	½	−36·8	½	−25·8	½
4340	49·2	½	74·5	½	58·9	½	−10·1	½	68·9	½	− 3·0	½	−19·3	½
4143	20·1	½	.....	....	.....	....	−11·8	¾	.....	....	.....	....	.....	....
4101	48·7	½	.....	....	.....	....	−30·4	½	49·6	½	−27·8	½	− 4·0	½
4089	.....	....	.....	....	.....	....	.....	....	.....	....	+ 4·4	½	.....	....
4026	40·8	½	44·2	½	.....	....	+ 5·4	½	.....	....	− 9·0	½	− 9·4	½
3970	−30·3	½	−57·6	½	−53·3	½	.....	....	−36·0	½	.....	....	+ 3·5	½
Weighted mean	− 33·97		− 57·82		− 47·80		− 11·80		− 41·32		− 15·90		− 13·05	
Va	+ 17·31		+ 17·17		+ 16·77		+ 16·57		+ 16·17		+ 15·81		+ 15·45	
Vd	− ·04		+ ·10		+ ·04		+ ·11		− ·04		+ ·10		+ ·05	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 17·0		− 40·8		− 31·3		+ 4·6		− 25·5		− 0·3		+ 2·2	

MEASURES OF κ CASSIOPEIÆ—*Continued*

λ	6341		6343		6357		6361		6364		6365		6370	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4567	.....	....	.....	....	−19·8	¼	.....	....	+13·0	½	+33·1	¼	−14·8	½
4552	−22·0	⅛	−48·0	¼	15·4	¼	.....	....	−12·8	½	− 3·9	¼	18·8	¼
4471	12·7	¼	36·5	½	29·1	½	−36·3	¼	−12·4	¾	0·0	½	57·3	½
4388	.....	....	14·8	¼	.....	....	.....	....	−27·0	¾	.....	....	.....	....
4340	1·6	½	28·2	½	29·5	¼	32·8	½	.....	....	−48·6	½	41·6	¼
4143	.....	....	.....	....	32·9	¼	.....	....	.....	....	+30·0	½	.....	....
4116	.....	....	.....	....	.....	....	42·8	½	.....	....	.....	....	.....	....
4101	10·5	¼	41·7	¼	.....	....	32·8	¼	−22·5	¼	+ 6·6	½	34·6	¼
4089	.....	....	24·3	¼	.....	....	.....	....	− 7·2	¾	.....	....	.....	....
4026	−28·7	¼	−41·2	¼	20·9	¼	−31·8	¼	+ 2·2	½	−26·3	½	− 2·4	½
3970	.....	....	.....	....	−18·4	½	.....	....	.....	....	.....	....	.....	..
Weighted mean	− 12·00		− 33·38		− 23·70		− 36·00		− 9·82		− 3·95		− 27·06	
Va	+ 14·97		+ 14·81		+ 14·63		+ 14·10		+ 13·88		+ 13·88		+ 13·67	
Vd	+ ·10		+ ·13		·00		+ ·16		+ ·13		+ ·12		+ ·07	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 2·8		− 18·7		− 9·4		− 22·0		+ 3·9		+ 9·8		− 13·6	

MEASURES OF κ CASSIOPEIÆ—*Continued*

λ	6377		6383		6391		6399		6406		6416		6427	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4567	+15·3	¼	−15·2	½	.....	....	.....	....	.....	....	.....	....	.....	....
4552	− 3·2	½	+22·8	½	−11·9	½	+21·2	¼	− 7·0	1	+17·3	½	.....	....
4471	+ 8·2	½	− 6·8	¼	34·7	½	+12·2	½	25·6	½	.....	....	−17·6	½
4388	− 1·0	¼	−15·1	½	.....	....	−24·4	¼	20·3	¾	+ 6·0	¼	.....	....
4340	− 6·4	½	+ 0·4	½	12·8	¼	− 5·0	½	26·7	¾	− 1·3	¼	−39·6	½
4143	−16·3	¼	.....	....	.....	....	.....	....	23·9	¼	−13·0	¼	+ 2·4	½
4116	.....	....	.....	....	−33·1	½	.....	....	7·4	¼	.....	....	.....	....
4101	+ 2·8	¼	+ 2·4	½	.....	....	− 1·6	¼	19·9	½	+12·7	¼	−21·9	½
4089	+ 1·1	¼	.....	....	.....	....	− 7·5	¾	23·8	¼	.....	....	.....	....
4026	− 5·3	½	.....	....	.....	....	− 5·2	¼	14·5	¾	−15·1	½	− 8·2	½
3970	.....	....	.....	....	.....	....	+22·8	¼	− 6·7	¼	.....	....	.....	....
Weighted mean	− 0·86		− 1·45		− 24·60		+ 0·37		− 17·41		− 1·14		− 16·98	
V_a	+ 13·46		+ 13·25		+ 13·01		+ 12·79		+ 12·57		+ 12·13		+ 11·20	
V_d	+ ·10		+ ·13		+ ·14		+ ·11		+ ·05		+ ·04		+ ·02	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 12·4		+ 11·6		− 11·7		+ 13·0		− 5·1		+ 10·8		− 6·0	

MEASURES OF κ CASSIOPEIÆ—*Continued*

λ	6433		6440		6447		6455		6464		6480		6499	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4567	.....	....	− 19·3	½	− 20·9	¼	.....	....	.....	....	.....	....	.....	....
4552	− 50·0	¼	.....	....	.....	....	.....	....	− 14·7	¼	.....	....	− 4·5	¼
4471	29·7	½	− 12·4	½	− 31·4	¾	− 9·7	¼	− 1·2	¼	− 20·3	½	6·2	½
4388	.....	....	.....	....	− 2·6	¼	.....	....	.....	....	.....	....	.....	....
4340	.....	....	+ 3·4	¾	− 33·1	½	28·1	¼	− 33·6	¼	− 3·7	½	.....	....
4143	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	26·1	¼
4101	27·9	¼	− 6·6	½	− 31·4	¼	20·4	¼	− 41·1	¼	− 20·4	½	− 15·1	¼
4089	25·7	½	.....	....	+ 10·5	¼	.....	....	.....	....	.....	....	.....	....
4026	− 35·6	¼	− 17·6	½	− 20·8	½	− 12·6	¼	+ 17·8	¼	+ 1·5	¼	.....	....
3970	.....	....	.....	....	− 9·1	¾	.....	....	− 4·8	¼	.....	....	.....	....
Weighted mean	− 32·05		− 9·20		− 19·55		− 17·70		− 12·93		− 12·46		− 11·60	
V_a	+ 10·73		+ 10·50		+ 10·04		+ 9·81		+ 9·52		+ 8·94		+ 6·34	
V_d	− ·09		+ ·01		+ ·03		+ ·05		+ ·12		+ ·03		− ·03	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 21·7		+ 1·0		− 9·8		− 8·1		− 3·6		− 3·8		− 5·6	

MEASURES OF κ CASSIOPELÆ—*Concluded*

λ	6513		6520		6529		6535		6543		6553		6555	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4567	+ 3·3	¼	.....	....	+ 7·1	¾	−14·7	¼	.....	....	.....	....	+ 1·2	½
4552	+ 1·6	¼	+17·0	½	.....	....	24·3	½	− 8·8	¼	−13·3	½	+12·2	¾
4471	−29·5	½	+ 4·6	1	+ 9·4	½	14·5	¼	18·0	½	18·0	¾	+23·6	¾
4388	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	+ 6·2	½
4340	−16·8	½	−25·3	½	+11·4	½	39·4	¾	.....	....	.....	....	+27·0	½
4143	+ 9·0	½	− 9·6	½	.....	....	.....	....	.....	....	32·3	¼	−12·3	¾
4116	−11·3	¼	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4101	− 6·2	½	− 5·3	¼	−15·5	¼	.....	....	− 4·7	¼	−16·2	½	+ 6·2	½
4089	.....	....	.....	....	.....	....	1·0	¼	.....	....	.....	....	.....	....
4026	.....	....	+11·4	¼	+ 4·2	½	−23·3	½	.....	....	.....	....	.....	....
Weighted mean	− 8·72		− 0·93		+ 5·60		− 24·36		− 12·40		− 18·16		+ 8·92	
V_a	+ 4·00		+ 3·68		+ 3·36		+ 1·78		+ 0·25		− 0·42		− 3·56	
V_d	·00		+ ·12		+ ·10		− ·12		− ·07		− ·14		− ·09	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 5·0		+ 2·6		+ 8·8		− 23·0		− 12·5		− 19·0		+ 5·0	

Dominion Observatory
Ottawa
April, 1919.

MEASURES OF RADIAL VELOCITY OF g PERSEI

BY W. E. HARPER, M.A.

(1900, $\alpha = 1^h\ 55^m{\cdot}6$, $\delta = +\ 54°\ 01'$, mag 4·99, type B8)

This star was announced as a spectroscopic binary by Frost and Adams, in *Astrophysical Journal*, vol. XIX, page 352, from 4 measures in 1903 and 1904, giving a range from −24 to +10. Later, Lee published 5 measures of plates taken in 1907 and 1908 in the same journal, vol. XXXIX, page 44, without increasing the range. Adams and Kapteyn also give a velocity of +12 from 1 plate in the same journal, vol. XXVII, page 188.

Sixteen plates were secured here in 1910 and 1911, and then the star was dropped from our list as it was learned that the Allegheny observatory had it on their list and were working up its orbit.

The plates on the whole are not of as good quality as could be obtained, but the measures should be approximately correct. On some of the plates, the lines have the appearance of being doubled, there apparently being a red component to the hydrogen lines about +105 km. per sec. for plate 4561. Our measures indicate a slightly greater range than previously recorded.

OTTAWA MEASURES OF g PERSEI

Plate	Date, G.M.T.	Vel.	n	Wt.	Remarks
3720	1910, Oct. 7·816	−27	6	3¾	
3727	" 10·777	−15	3	1	
4401	1911, June 29·836	−18	5	2½	
4491	Aug. 14·819	+ 8	3	⅞	
4513	" 30·871	+ 5	2	2	
4541	Sept. 12·768	− 4	1	½	4481 gives +59
4551	" 13·835	+19	3	1¼	
4561	" 17·778	+ 4	4	3¾	4481 gives +38
4568	" 18·867	+17	3	1¾	
4576	" 19·751	+ 9	3	1¼	
4592	" 22·808	+23	3	1½	
4593	" 23·729	+15	4	2¼	
4616	Oct. 9·786	− 1	4	2½	
4643	" 13·696	− 9	3	⅞	
4668	" 27·784	± 0	2	1	
4683	Nov. 3·628	−26	5	3	

MEASURES OF *g* PERSEI

λ	3720		3727		4401		4491		4513		4541		4551	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549·766	−41·0	½	.....	....	−43·8	½	.....	....	.....	....	.....	....	.....	....
4481·400	28·4	¾	−10·6	¼	24·6	½	.....	....	.....	....	.....	....	+15·1	½
4340·634	42·0	¾	23·1	¼	31·8	½	−16·1	½	−18·2	1	−23·0	½	−14·5	½
4101·890	24·0	¼	.....	....	34·4	½	+ 6·6	¼	.....	....	.....	....	− 2·6	¼
4026·352	54·9	¾	.....	....	.....	....	.....	....	−14·9	1	.....	....	.....	....
3933·825	−35·2	¾	−35·5	½	−42·0	½	−35·1	⅛	.....	....	.....	....	.....	....
Weighted mean	− 39·17		− 26·18		− 35·32		− 14·33		− 16·55		− 23·00		− 0·24	
V_a	+ 12·81		+ 11·82		+ 17·08		+ 22·80		+ 21·68		+ 19·59		+ 19·38	
V_d	− ·10		− ·04		+ ·19		+ ·09		·00		+ ·06		− ·03	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 26·7		− 14·7		− 18·3		+ 8·3		+ 4·9		− 3·6		+ 18·8	

MEASURES OF *g* PERSEI—*Continued*

λ	4561		4568		4576		4592		4593		4616		4643	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549·766	.....	....	+ 9·7	¼	.....	....	.....	....	.....	....	.....	....	.....	....
4481·400	.....	....	− 2·5	¾	−20·6	½	+10·1	½	− 1·9	1	− 8·3	1	−24·9	½
4471·676	.....	....	.....	....	−13·4	¼	.....	....	.....	....	.....	....	.....	....
4340·634	− 9·8	1	− 2·6	¾	+ 4·2	½	3·1	½	− 5·8	½	13·4	½	15·1	¼
4101·890	22·5	1	.....	....	.....	....	+ 3·6	½	− 1·0	½	18·5	½	−10·1	⅛
4026·352	−31·0	¾	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
3933·825	0·0	1	.....	....	.....	....	.....	....	+ 2·8	½	−15·4	½	.....	....
Weighted mean	− 14·80		− 0·74		− 9·20		+ 5·60		− 1·44		− 12·76		− 20·00	
V_a	+ 18·52		+ 18·26		+ 18·05		+ 17·29		+ 17·06		+ 12·24		+ 10·90	
V_d	+ ·03		− ·05		+ ·04		− ·02		+ ·09		− ·04		+ ·04	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 3·5		+ 17·2		+ 8·6		+ 22·6		+ 15·4		− 0·8		− 9·3	

MEASURES OF g PERSEI—*Concluded*

λ	4668		4683											
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481·400	.....	....	−41·2	1	.....	....	.....	....	.....	....	.....	....	.....	....
4340·634	− 7·3	½	17·6	½	.....	....	.....	....	.....	....	.....	....	.....	....
4101·890	.....	....	10·3	½	.....	....	.....	....	.....	....	.....	....	.....	....
4026·352	.....	....	23·4	½	.....	....	.....	....	.....	....	.....	....	.....	....
3933·825	− 3·0	½	−41·4	½	.....	....	.....	....	.....	....	.....	....	.....	....
Weighted mean	− 5·15		− 28·27		.....		.....		.....		.....		.....	
V_o	+ 5·66		+ 2·95		.....		.....		.....		.....		.....	
V_d	− ·10		+ ·04		.....		.....		.....		.....		.....	
Curv.	− ·28		− ·28		.....		.....		.....		.....		.....	
Radial Velocity	+ 0·1		− 25·6		.....		.....		.....		.....		.....	

Dominion Observatory
Ottawa
April, 1919.

MEASURES OF RADIAL VELOCITY OF 69 TAURI

BY W. E. HARPER, M.A.

(1900, $\alpha = 4^h\ 20^m \cdot 3$, $\delta = +22°\ 35'$, mag. 4.40, type A5)

This star was announced a spectroscopic binary by Frost, in the *Astrophysical Journal*, volume XXIX, page 238, from 5 plates taken in 1905, 1908 and 1909. He stated that the spectrum was a very difficult one to deal with, owing to the diffuse and complex character of the lines. In the hope of obtaining measures of the component spectra, the star was placed upon our list and some twenty odd plates secured in 1910,1911, 1912 and 1913, of which 22 are given in the accompanying table. All but those in December, 1913, were made with the old single-prism spectrograph, whose dispersion at $H\gamma$ is 32·4 angstroms per millimetre; those in December, 1913, were made with camera Ia, whose dispersion is 54·5 angstroms per millimetre. To say that we have confirmed Frost's statement that it is a very difficult spectrum to deal with, would seem to sum up about all that we can say about the star. However, on plate 4646 the lines are much sharper than usual and numerous metallic lines, other than those appearing in the measures, are recorded whose velocities agree with those from the other lines. It would seem that the component spectra are superposed on this date, so that these fainter lines, which in general show no trace, are here of sufficient contrast to be measurable. Thus, it would appear that the velocity of the system must be in the neighbourhood of that given by this plate, namely, +50 km. per sec. The prevailing tendency to high positive velocities of the other plates bear this out. The star might possibly be worked up by using higher dispersion and fine-grained plates, attention being paid only to the metallic lines.

OTTAWA MEASURES OF 69 TAURI

Plate	Date	Vel.	Lines	Remarks
3659	1910, Sept. 15·902	+40	1	plate underexposed.
3669	" 16·836	− 6	2	
3834	Dec. 8·604	+14	3	
3891	" 21·804	+ 3	1	
3904	" 30·578	+21	2	
3923	1911, Jan. 9·664	+76	3	very poor lines.
3937	" 16·628	+58	4	
4618	Oct. 9·903	+80	1	
4635	" 12·812	+77	1	
4646	" 13·840	+50	9	much sharper lines than usual.
4708	Dec. 3·812	+41	2	
4730	" 19·633	+38	2	
5198	1912, Sept. 16·846	+15	3	
5211	Oct. 1·753	+55	2	poor plate.
5760	1913, Oct. 7·853	−27	2	components +60 and −106.
5789	Nov. 4·798	+27	3	
5796	" 5·795	+58	3	
5816	Dec. 8·737	+20	3	
5825	" 13·685	+59	3	
5847	" 22·740	+25	3	
8385	1917, Dec. 15·545	+22	1	
8398	" 28·627	+ 9	1	

MEASURES OF 69 TAURI

λ	3659		3669		3834		3891		3904		3923		3937	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	+97·4	⅛
4481·400	.....	....	.....	....	+17·0	¼	.....	....	.....	....	.....	....	.....	....
4340·634	+11·5	¼	−42·2	¼	15·8	½	+14·7	¼	+43·1	¼	+80·0	⅛	81·0	¼
4271·760	.....	....	.....	....	.....	....	.....	....	.....	....	110·0	⅛	.....	....
4236·107	.....	....	−27·1	¼	.....	....	.....	....	.....	....	.....	....	.....	....
4101·890	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	51·1	⅛
4045·975	.....	....	.....	....	.....	....	.....	....	+30·0	¼	+100·0	⅛	.....	....
3933·825	.....	....	.....	....	+22·6	¾	.....	....	.....	....	.....	....	+87·8	¼
Weighted mean	+ 11·54		− 34·65		+ 19·40		+ 14·70		+ 36·55		+ 96·67		+ 81·02	
V_a	+ 28·70		+ 28·28		− 4·89		− 11·59		− 15.68		− 20·01		− 22·62	
V_d	·00		+ ·12		+ ·12		− ·26		+ ·09		− ·09		− ·11	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 40·0		− 6·5		+ 14·4		+ 2·6		+ 20·7		+ 76·3		+ 58·0	

MEASURES OF 69 TAURI—*Continued*

λ	4618		4635		4646		4708		4730		5198		5211	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527	.....	....	.....	....	+40·2	½	+38·7	¼	+56·2	¼	−23·5	⅛	+55·6	⅛
4481·400	.....	....	.....	....	40·6	½	.....	....	.....	....	.....	....	.....	....
4340·634	+56·7	¼	+55·0	¼	28·1	1	+48·5	¼	+41·1	¼	−33·5	¼	+ 4·2	¼
4233·328	.....	....	.....	....	23·6	½	.....	....	.....	....	.....	....	.....	....
4227·010	.....	....	.....	....	31·3	½	.....	....	.....	....	.....	....	.....	....
4143·928	.....	....	.....	....	35·8	½	.....	....	.....	....	.....	....	.....	....
4101·890	.....	....	.....	....	19·3	½	.....	....	.....	....	+20·1	⅛	.....	....
4045·975	.....	....	.....	....	20·7	¼	.....	....	.....	....	.....	....	.....	....
3933·825	.....	....	.....	....	+ 4·2	¼	.....	....	.....	....	.....	....	.....	....
Weighted mean	+ 56·70		+ 55·00		+ 28·80		+ 43·63		+ 48·65		− 12·63		+ 29·90	
V_a	+ 22·94		+ 21·90		+ 21.62		− 2·24		− 10·39		+ 28·21		+ 25·05	
V_d	+ ·11		+ ·04		− ·04		− ·21		+ ·04		+ ·10		+ ·12	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 79·5		+ 76·7		+ 50·1		+ 40·9		+ 38·0		+ 15·4		+ 54·8	

MEASURES OF 69 TAURI—*Concluded*

λ	5760		5789		5796		5816		5825		5847		8385	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527	−75·3	½	+21·3	½	+61·0	½	.....	....	.....	....	.....	....	.....	....
4481·400	.....	....	.....	....	.....	....	.....	....	+57·2	½	+28·6	½	.....	....
4340·634	−37·8	½	+20·0	½	44·6	½	+29·6	½	.....	....	40·0	½	+31·2	½
4101·890	.....	....	.....	....	.....	....	21·0	½	84·1	½	.....	....	.....	....
3933·825	.....	....	− 2·1	½	+34·7	½	+25·1	½	+58·3	½	+44·3	½	.....	....
Weighted mean	− 50·30		+ 14·80		+ 46·22		+ 25·20		+ 66·53		+ 37·63		+ 31·20	
V_a	+ 23·43		+ 12·30		+ 11·83		− 5·06		− 7·64		− 12·16		− 8·58	
V_d	·00		− ·06		− ·06		− ·10		− ·04		− ·18		+ ·17	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 27·2		+ 26·8		+ 57·7		+ 19·8		+ 58·6		+ 25·0		+ 22·5	

Dominion Observatory
Ottawa
April, 1919.

MEASURES OF RADIAL VELOCITY OF ϵ CYGNI

BY W. E. HARPER, M.A.

(1900, $\alpha = 20^h\ 42^m \cdot 2$, $\delta = +33^\circ\ 36'$, mag. 2·64, type K)

This star was announced a spectroscopic binary by Curtis and Burns in *Lick Observatory Bulletin* 107. Their 7 plates show a range of about 7 km. Lord published 5 velocities in *Astrophysical Journal*, XXI, 319, showing a range of 4·4 km. with a mean value of −13·0 km. per sec. Campbell uses −10 km. per sec. for his statistical treatment of K–type stars. Küstner gives 6 measures in *Astrophysical Journal*, XXVII, 319, in which a range of 9·1 km. is shown.

Fifty plates were made here during the years 1907, 1908, 1909, 1914 and 1915, with the three-prism spectrograph, III L, which has a dispersion at λ 4415 of 10·1 angstroms per millimetre. The star has excellent lines for measurement, and as 15 or 20 were measured on each plate the results should be fairly reliable. The extreme range shown by our measures is from −4·5 to −14·6 km., but, apart from a few such plates, no great range is shown in the measures. The mean velocity, on the assumption of a constant velocity for the star, using the 50 plates with equal weights is −10·0 km. per sec. The residuals from this mean value follow the probability curve fairly closely and yield a probable error for a plate of ± 1·47 km. per sec., a value somewhat higher than might be expected from the good quality of the lines. If the 1914 and 1915 plates alone are used, —and they number 41 out of the 50—there is a reasonable appearance of the observations falling into a curve whose period is 19·664 days and range 5 km. Barring the plate of Aug. 4, 1914, (a memorable date) a considerable reduction in the probable error is effected. Five of the Lick observations are thereby satisfied but the first two are discordant.

While no doubt a small range exists, a satisfactory period has not yet been obtained. The measures are published so that if others should wish to attempt a period the data will be available to them.

OTTAWA MEASURES OF ϵ CYGNI

Plate	Date	Julian Date	Vel.	Plate	Date	Julian Date	Vel.
1163	1907, Nov. 29	2,417,909·48	− 8·2	6039	1914, Apr. 17	2,420,240·84	−12·0
1172	Dec. 4	914·54	9·1	6087	May 30	283·85	8·7
1186	" 12	922·52	10·3	6107	June 13	297·85	11·1
1210	1908, Jan. 3	944·45	8·5	6149	July 5	319·70	4·5
1556	May 25	2,418,087·85	9·0	6170	" 9	323·81	7·9
1618	June 20	113·77	13·7	6181	" 14	328·62	13·1
1795	Aug. 19	173·76	14·5	6194	" 16	330·84	13·7
2735	1909, Aug. 10	529·63	7·6	6208	" 19	333·79	·9·6
2736	" 10	529·69	− 8·5	6213	" 21	335·60	− 8·8

OTTAWA MEASURES OF ε CYGNI—*Continued*

Plate	Date	Julian Date	Vel.	Plate	Date	Julian Date	Vel.
6225	1914, July 25	2,420,339·72	− 5·9	7065	1915, June 17	2,420,666·81	−12·7
6229	" 28	342·83	7·9	7070	" 20	669·79	10·1
6237	" 30	344·71	10·0	7086	July 1	680·84	8·1
6240	Aug. 1	346·68	12·1	7094	" 9	688·80	11·7
6259	" 4	349·76	7·6	7095	" 10	689·68	7·7
6278	" 15	360·68	8·9	7097	" 12	691·81	10·9
6282	" 18	363·81	6·6	7100	" 13	692·80	10·3
6297	" 22	367·70	12·4	7106	" 17	696·68	11·5
6298	" 24	369·54	9·1	7107	" 19	698·59	10·1
6320	" 27	372·75	8·9	7114	" 20	699·84	11·3
6325	" 31	376·56	8·4	7117	" 22	701·84	14·6
6334	Sept. 4	380·55	7·1	7120	" 23	702·86	11·8
6347	" 9	385·54	11·2	7121	" 26	705·58	11·6
6393	" 17	393·68	8·1	7131	" 29	708·58	10·9
6534	Oct. 27	433·53	10·6	7136	Aug. 1	711·67	9·7
7056	1915, June 8	657·83	−10·5	7142	" 8	718·66	−12·0

MEASURES OF ε CYGNI

λ	1172		1210		1556		1795		2735		6039		6087	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4586·191	.....	....	.....	....	.....	....	.....	....	− 5·1	1	.....	....	.....	....
4584·018	.....	....	.....	....	.....	....	.....	....	.....	....	−28·3	1	−28·8	1
4581·618	+11·0	1	+ 4·6	1	−27·6	1	.....	....	5·2	1½	27·0	1	26·1	1
4580·407	.....	....	.....	....	.....	....	−14·7	1	14·5	1	.....	....	33·8	1
4565·726	10·9	1½	8·4	1	33·0	1	14·3	1	13·0	1½	29·0	1	31·7	1
4556·202	.....	....	.....	....	.....	....	.....	....	15·9	¾	.....	....	.....	....
4554·257	9·7	1	6·7	1	33·4	1	10·9	1	10·0	1	25·4	1	25·5	1
4552·594	11·9	1	.....	....	.....	....	.....	....	12·4	1	28·5	1	30·1	1
4549·766	14·3	1½	3·0	1½	32·5	1½	14·4	1½	10·0	1	29·2	1	26·4	1
4535·965	8·2	1½	5·0	1	26·5	1½	17·7	1½	8·9	1	26·7	1	25·2	1
4534·169	.....	....	8·8	1	.....	....	.....	....	.....	....	.....	....	.....	....
4531·202	7·5	1	3·7	½	.....	....	.....	....	15·5	¾	34·8	1	29·2	1
4528·807	9·2	1	3·2	1	25·6	½	14·5	1	10·7	1	28·3	1	26·9	1
4522·855	7·7	1	2·6	½	26·6	½	14·2	½	5·6	¾	.....	....	23·3	1
4520·397	.....	....	.....	....	.....	....	.....	....	.....	....	32·7	1	.....	....
4515·508	.....	....	.....	....	.....	....	.....	....	.....	....	33·1	1	.....	....
4494·664	.....	....	.....	....	.....	....	.....	....	15·4	¾	26·0	1	.....	....
4482·376	6·2	1	.....	....	.....	....	.....	....	8·6	1	.....	....	.....	....
4476·214	.....	....	3·0	1	29·9	1	9·7	1	.....	....	33·5	1	27·9	1
4469·545	12·6	1	7·3	1	.....	....	9·4	1	.....	....	23·0	1	25·2	1
4468·663	.....	....	.....	....	.....	....	.....	....	8·2	1	.....	....	.....	....
4466·727	13·3	1	8·8	1	19·5	1	.....	....	.....	....	−24·2	1	21·4	1
4454·962	.....	....	7·6	1	.....	....	−15·6	½	− 8·3	1	.....	....	.....	....
4415·354	6·0	1	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4395·286	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	−26·0	1
4352·908	+14·8	1	+ 7·0	1	−19·3	1	.....	....	.....	....	.....	....	.....	....
Weighted mean	+ 10·31		+ 5·80		− 27·73		− 13·64		− 10·12		− 28·65		− 27·17	
V_a	− 18·86		− 13·74		+ 18·93		− 0·35		+ 2·69		+ 16·69		+ 18·67	
V_d	− ·28		− ·27		+ ·10		− ·19		+ ·10		+ ·22		+ ·10	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 9·1		− 8·5		− 9·0		− 14·5		− 7·6		− 12·0		− 8·7	

MEASURES OF ε CYGNI—*Continued*

λ	6107		6149		6170		6181		6194		6208		6213	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4586·191	−22·9	1	.....	.....	.....	.....	.....	.....	−24·4	1	−16·7	1	−12·5	1
4584·018	27·6	1	−20·0	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4581·618	23·7	1	13·8	1	−16·6	1	−23·9	¾	16·5	½	19·0	1	15·3	1
4580·407	31·8	1	.....	.....	16·9	1	29·7	¾	27·4	1	21·8	1	20·1	1
4565·726	28·6	1	16·2	1	19·8	1	25·7	¾	25·7	1	19·2	1	22·6	1
4563·939	.....	.....	.....	.....	.....	.....	.....	.....	31·3	½	.....	.....	.....	.....
4556·202	.....	.....	.....	.....	.....	.....	.....	.....	22·7	½	20·3	1	.....	.....
4554·257	26·6	1	14·2	1	20·2	1	18·0	½	23·0	1	16·4	1	17·8	1
4552·594	32·4	1	12·6	1	22·2	1	26·4	¾	24·0	½	17·9	1	13·9	1
4549·766	30·1	1	19·7	1	19·2	1	27·9	¾	21·7	1	18·6	1	15·5	1
4535·965	28·5	1	17·5	1	20·3	1	23·8	1	22·5	1	13·6	1	17·2	1
4534·169	.....	.....	19·5	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4531·202	.....	.....	22·3	1	23·8	1	.....	.....	.....	.....	23·0	1	22·7	1
4528·807	28·5	1	19·6	1	18·3	1	.....	.....	24·4	½	19·6	1	20·2	1
4522·855	30·0	1	18·2	1	17·0	1	21·7	½	29·3	½	18·3	1	14·9	1
4520·397	.....	.....	.....	.....	19·9	1	.....	.....	.....	.....	.....	.....	.....	.....
4515·508	27·3	1	.....	.....	19·4	1	.....	.....	.....	.....	.....	.....	.....	.....
4494·664	.....	.....	18·6	1	22·4	1	.....	.....	18·8	½	19·6	1	19·5	1
4476·214	.....	.....	.....	.....	23·1	1	.....	.....	25·7	½	21·1	1	19·3	1
4472·957	21·3	1	18·3	1	.....	.....	24·2	1	19·9	1	17·8	1	18·2	1
4469·545	.....	.....	.....	.....	.....	.....	21·1	½	.....	.....	.....	.....	.....	.....
4466·727	24·6	1	15·0	1	−15·4	1	.....	.....	.....	.....	16·5	1	14·5	1
4464·772	.....	.....	13·9	1	.....	.....	.....	.....	17·5	½	.....	.....	15·5	1
4459·304	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	−19·7	1
4454·962	.....	.....	.....	.....	.....	.....	.....	.....	−25·8	½	−16·8	1	.....	.....
4415·354	29·4	1	.....	.....	.....	.....	−26·6	¼	.....	.....	.....	.....	.....	.....
4395·286	−35·2	1	−19·6	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Weighted mean	− 28·03		− 17·44		− 19·63		− 23·81		− 23·53		− 18·60		− 17·61	
V_a	+ 17·19		+ 13·04		+ 12·05		+ 10·79		+ 10·21		+ 9·40		+ 8·89	
V_d	·00		+ ·14		− ·06		+ ·22		− ·13		− ·08		+ ·22	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 11·1		− 4·5		− 7·9		− 13·1		− 13·7		− 9·6		− 8·8	

MEASURES OF ϵ CYGNI—*Continued*

λ	6225		6229		6237		6240		6259		6259*		6278	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4586·191	− 7·5	¾	−14·1	1	−13·4	1	−14·4	1	− 7·0	1	− 6·6	1	− 9·1	1½
4584·018	16·3	¾	13·5	¾	.....	.....	.....	.....	8·2	1	5·4	1	.....	.....
4581·618	16·2	1	12·8	1	14·7	1½	14·2	1	8·4	1	7·5	1	9·6	1½
4580·407	11·5	1	.....	.....	.....	.....	17.9	1	18·5	½	15·3	½	.....	.....
4565·726	17·5	1½	16·9	1	17·5	1½	17·2	1	14·8	1½	15·1	1½	12·0	1
4563·939	.....	.....	.....	.....	17·5	1	.....	.....	.....	.....	.....	.....	.....	.....
4556·202	.....	.....	.....	.....	.....	.....	19·2	1	22·9	1	21·6	1	9·9	¾
4554·257	10·7	1	11·8	1	21·7	¾	17·2	1	10·2	½	7·8	½	12·5	1
4552·594	15·3	1	16·3	¾	17·4	1	15·6	1	17·1	¾	16·7	¾	13·7	¾
4549·766	10·6	1½	10·6	1	17·6	1	19·3	1	12·6	1	11·4	1	8·0	¾
4535·965	13·5	1	14·9	¾	13·6	1	17·3	1	8·2	1	6·6	1	9·8	¾
4531·202	.....	.....	.....	.....	22·0	¾	21·1	½	.....	.....	.....	.....	5·2	½
4528·807	13·3	1	14·2	1	15·5	1	18·4	1	12·5	1	13·7	1	4·9	1
4525·285	15·0	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4522·855	13·7	¾	14·5	¾	14·6	1	14·8	1	9·0	1	9·4	1	8·0	1
4515·508	13·8	1	.....	.....	17·2	1	18·3	1	15·8	1	17·3	1	12·8	½
4501·448	.....	.....	.....	.....	19·5	1	.....	.....	.....	.....	.....	.....	.....	.....
4494·664	.....	.....	.....	.....	12·3	1	20·2	1	.....	.....	.....	.....	14·6	¾
4476·214	18·1	¾	16·2	1	11·8	1	.....	.....	4·7	1	5·8	1	10·9	1
4472·957	7·0	1	−16·5	¾	17·9	1	15·6	1	11·6	1	12·6	1	− 5·8	¾
4469·545	14·4	1	.....	.....	9·5	1	14·9	½	9·2	1	12·0	1	.....	.....
4468·663	.....	.....	.....	.....	19·1	1	.....	.....	.....	.....	.....	.....	.....	.....
4466·727	.....	.....	.....	.....	−12·3	1	.....	.....	.....	.....	.....	.....	.....	.....
4464·772	.....	.....	.....	.....	.....	.....	13·0	¾	6·4	1	6·8	1	.....	.....
4459·304	−12·5	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4454·962	.....	.....	.....	.....	.....	.....	−19·7	1	11·0	1	12·3	1	.....	.....
4415·354	.....	.....	.....	.....	.....	.....	.....	.....	14·1	1	13·1	1	.....	.....
4395·286	.....	.....	.....	.....	.....	.....	.....	.....	15·2	¾	17·7	¾	.....	.....
4371·312	.....	.....	.....	.....	.....	.....	.....	.....	12·3	¾	11·8	¾	.....	.....
4369·856	.....	.....	.....	.....	.....	.....	.....	.....	13·4	¾	14·4	¾	.....	.....
4352·908	.....	.....	.....	.....	.....	.....	.....	.....	13·9	1	13·4	1	.....	.....
4352·006	.....	.....	.....	.....	.....	.....	.....	.....	−10·4	1	−11·9	1	.....	.....
Weighted mean	− 13·36		− 14·25		− 15·92		− 17·12		− 11·82		− 11·88		− 9·76	
V_a	+ 7·70		+ 6·77		+ 6·15		+ 5·60		+ 4·64		+ 4·64		+ 1·15	
V_d	+ ·03		− ·16		·00		+ ·05		− ·11		− ·11		− ·02	
Curv.	− ·28		− ·28		− ·28		− ·66		− ·28		− ·28		− ·28	
Radial Velocity	− 5·9		− 7·9		− 10·0		− 12·1		− 7·6		− 7·6		− 8·9	

*Check measurement

MEASURES OF ε CYGNI—*Continued*

λ	6282		6297		6298		6320		6325		6334		6347	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4586·191	− 2·0	¾	− 4·6	1	− 3·3	1	− 1·0	1	+ 1·5	1	+ 5·3	¾	+ 3·0	1
4584·018	9·8	1	.....	....	8·8	1	.....	....	.....	....	.....	....	− 4·4	1
4581·618	7·3	1	9·4	1	4·7	1	2·7	1	− 2·8	1½	− 2·9	1	− 2·6	1
4580·407	3·1	¾	6·9	1	8·3	1	7·0	1	− 3·8	1	− 5·1	¾	− 0·9	1
4565·726	6·6	1	14·0	1	8·0	1	6·3	1	− 5·2	1½	− 3·9	1	− 8·3	1
4556·202	.....	....	15·2	½	11·3	1	.....	....	.....	....	+ 4·6	1	.....	....
4554·257	8·5	1	13·0	¾	8·4	1	2·9	¾	− 5·6	1	.....	....	− 6·1	1
4552·594	5·4	1	17·5	½	7·1	1	6·6	1	− 7·2	1	− 2·6	1	− 6·1	1
4549·766	6·4	1	11·3	1	3·2	1	4·4	1	− 4·2	1½	− 3·3	1	− 6·1	1
4535·965	4·6	1	7·8	1	6·4	1	5·4	1	− 4·4	1	− 1·0	¾	− 6·8	1
4531·202	.....	....	.....	....	.....	....	4·0	1	−10·8	¾	.....	....	.....	....
4528·807	5·0	1	11·4	1½	10·0	1	5·4	1½	− 2·3	1	− 4·2	1	− 3·0	1
4522·855	3·0	1	5·6	1	8·8	1	2·9	¾	− 4·9	¾	− 6·1	1	− 5·5	1
4515·508	11·6	1	12·1	¾	5·6	1	.....	....	− 2·4	½	.....	....	.....	....
4494·664	2·4	½	17·4	1	8·4	1	9·5	¾	− 4·2	1	− 8·7	¾	− 7·3	1
4482·376	.....	....	.....	....	.....	....	.....	....	.....	....	+ 2·3	¾	.....	....
4476·214	10·1	1	.....	....	10·4	1	14·8	¾	− 4·1	1	− 5·3	1	− 6·1	1
4472·957	− 2·8	1	12·6	½	6·6	1	8·0	¾	− 5·8	1	− 1·2	1	− 4·2	1
4469·545	.....	....	8·3	½	9·2	1	0·9	¾	+ 0·5	1	.....	....	− 2·4	1
4466·727	.....	....	6·6	½	− 1·9	1	3·4	¾	− 4·3	1	+ 0·6	1	0·0	1
4464·772	.....	....	− 5·8	½	.....	....	.....	....	.....	....	+ 3·6	1	.....	....
4459·304	.....	....	.....	....	.....	....	.....	....	.....	....	− 0·3	1	.....	....
4454·962	.....	....	.....	....	.....	....	7·7	¾	.....	....	.....	....	.....	....
4427·420	.....	....	.....	....	.....	....	.....	....	− 6·5	½	.....	....	.....	....
4415·354	.....	....	.....	....	.....	....	−12·5	¾	− 5·8	1	.....	....	.....	....
Weighted mean	− 6·18		− 10·88		− 7·25		− 5·67		− 4·29		− 1·68		− 4·18	
V_a	+ 0·13		− 1·14		− 1·73		− 2·77		− 4·00		− 5·26		− 6·83	
V_d	− ·22		− ·11		+ ·16		− ·16		+ ·12		+ ·12		+ ·11	
Curv.	− ·28		+ ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 6·6		− 12·4		− 9·1		− 8·9		− 8·4		− 7·1		− 11·2	

MEASURES OF ϵ CYGNI—*Continued*

λ	6393		6534		7056		7056*		7065		7070		7086	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Vel.	Vel.	Wt.
4586·191	.....	....	+12·6	¾	−25·8	1	−23·0	1	−23·2	1	−16·7	1	−16·6	¾
4584·018	.....	....	7·3	1	33·9	½	33·0	1	30·4	1	.....	.....	.....	....
4581·618	.....	....	10·1	¾	29·7	1	28·6	1	28·6	1	21·9	1	23·8	¾
4580·407	+ 2·6	1	7·4	½	.....	....	.....	....	29·7	1	25·6	1	26·8	½
4572·156	.....	....	.....	....	34·0	1	.....	....	30·2	1	.....	.....	.....	....
4565·726	+ 8·4	1	9·3	¾	31·6	1	30·8	1	.....	....	.....	.....	.....	....
4554·257	.....	....	9·0	½	30·6	½	29·0	1	32·6	1	24·5	1	18·9	1
4552·594	+ 3·6	¾	9·0	½	28·6	1	26·3	1	30·4	1	.....	....	28·3	½
4549·766	+ 0·3	1	5·7	1	28·5	1	27·3	1	28·0	1	25·5	1	22·7	1
4535·965	+ 3·7	1	9·1	1	25·6	1	24·9	1	27·8	1	24·7	1	15·1	½
4534·169	.....	....	.....	....	24·5	1	.....	....	.....	....	.....	....	.....	....
4531·202	.....	....	2·4	1	.....	....	.....	....	30·9	1	27·3	1	.....	....
4528·807	− 1·2	1	6·4	1	28·9	1	26·2	1	30·6	1	29·7	1	27·2	1
4525·285	.....	....	.....	....	.....	....	.....	....	33·7	1	34·9	1	.....	....
4522·855	.....	....	10·5	¾	30·7	1	30·7	1	30·0	1	28·0	1	19·7	1
4515·508	.....	....	5·1	¾	.....	....	.....	....	.....	....	.....	.....	.....	....
4494·664	− 8·1	¾	6·2	1	.....	....	24·6	½	28·3	1	30·7	1	21·8	½
4482·376	.....	....	.....	....	.....	....	.....	....	26·4	1	.....	.....	.....	....
4476·214	− 1·1	1	1·3	1	22·6	½	.....	....	28·7	1	27·6	1½	21·8	1
4472·957	.....	....	5·9	1	26·8	1	22·8	1	24·6	1	21·3	1	.....	....
4469·545	.....	....	.....	....	26·0	1	.....	....	24·9	1	.....	....	.....	....
4468·663	.....	....	.....	....	29·4	1	.....	....	.....	....	.....	.....	.....	....
4466·727	.....	....	10·0	¾	31·1	½	26·6	½	.....	....	.....	....	−20·3	1
4464·772	+ 8·2	1	10·4	¾	.....	....	.....	....	.....	....	.....	.....	.....	....
4459·304	.....	....	+ 7·4	¾	31·5	1	28·5	1	.....	....	.....	.....	.....	....
4454·962	.....	....	.....	....	.....	....	.....	....	.....	....	26·3	1	.....	....
4427·420	.....	....	.....	....	.....	....	25·3	1	.....	....	26·4	1	.....	....
4415·354	− 0·9	1	.....	....	−28·6	1	−29·8	1	−32·3	1	−25·6	1	.....	....
4404·927	− 1·9	¾	.....	....	.....	....	.....	....	.....	....	.....	.....	.....	....
4395·286	− 0·8	1	.....	....	.....	....	.....	....	.....	....	.....	.....	.....	....
4352·908	+ 9·2	¾			.....	....	.....	....	.....	....	.....	.....	.....	....
4352·006	− 0·2	1	.....	....	.....	....	.....	....	.....	....	.....	.....	.....	....
Weighted mean	+ 1·62		+ 7·40		− 28·81		− 27·45		− 29·02		− 26·04		− 21·69	
V_o	− 9·28		− 17·62		+ 17·86		+ 17·86		+ 16·57		+ 16·14		+ 13·97	
V_d	− ·16		− ·09		+ ·04		+ ·04		+ ·03		+ ·07		− ·07	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 8·1		− 10·6		− 11·2		− 9·8		− 12·7		− 10·1		− 8·1	

*Check measurement

MEASURES OF ϵ CYGNI—*Continued*

λ	7094		7095		7097		7100		7106		7107		7114	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4586·191	−19·0	1	−17·9	½	−19·4	1	−17·6	1	−15·2	1	−12·5	1	−17·1	1
4584·018	.....	....	22·7	½	25·8	1	.....	....	.....	....	23·9	1	23·0	1
4581·618	27·4	1	15·4	½	21·0	1	22·3	1	20·9	1	18·5	1	20·0	1
4580·407	.....	....	18·9	½	26·2	1	21·3	1	30·6	½	.....	....	26·6	1
4565·726	.....	....	.....	....	.....	....	.....	....	21·8	1	22·0	1	22·4	1
4556·202	.....	....	.....	....	25·8	1	.....	....	.....	....	.....	....	21·5	1
4554·257	.....	....	22·0	½	17·4	1	23·8	1	27·1	1	17·1	1	19·2	1
4552·594	25·5	1	20·2	½	21·1	1	21·8	1	21·3	1	20·9	1	17·1	1
4549·766	22·4	1	11·2	½	21·3	1	18·5	1	22·4	1	16·8	1	20·0	1
4535·965	23·2	1	23·4	½	17·7	1	18·7	1	20·5	1	19·6	1	19·0	1
4531·202	.....	....	.....	....	23·8	1	.....	....	.....	....	.....	....	.....	....
4528·807	23·4	1½	−23·4	½	22·8	1	22·8	1	22·3	1	18·6	1	21·4	1
4522·855	22·8	1	.....	....	23·9	1	19·6	1	20·8	1	24·7	1	17·7	1
4494·664	21·4	1	.....	....	20·2	1	21·4	1	.....	....	21·1	1	17·5	1
4476·214	21·5	1	.....	....	18·7	1	26·3	1	20·5	1	21·0	1	.....	....
4472·957	20·4	1	.....	....	19·1	1	19·4	1	17·7	1	.....	....	21·1	1
4469·545	.....	....	.....	....	23·3	1	20·4	1	.....	....	.....	....	17·7	1
4466·727	17·8	½	.....	....	18·8	1	16·8	1	16·3	1	16·0	1	17·4	1
4464·772	.....	....	.....	....	.....	....	.....	....	15·9	1	17·4	1	18·8	1
4459·304	20·9	1	.....	....	.....	....	20·9	1	25·4	½	.....	....	21·9	1
4427·420	24·2	1	.....	....	.....	....	22·0	1	28·0	1	21·1	1	22·6	1
4415·354	29·0	1	.....	....	−30·7	1	−24·6	1	23·3	1	−22·5	1	−19·8	1
4395·286	27·6	1	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4352·908	23·2	1	.....	....	.....	....	.....	....	−21·6	1	.....	....	.....	....
4352·006	−27·1	1	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
Weighted mean	− 23·51		− 19·46		− 22·06		− 21·04		− 21·38		− 19·61		− 20·09	
V_a	+ 12·11		+ 11·88		+ 11·35		+ 11·09		+ 10·07		+ 9·52		+ 9·26	
V_d	− ·05		+ ·14		+ ·07		− ·06		+ ·12		+ ·23		− ·15	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 11·7		− 7·7		− 10·9		− 10·3		− 11·5		− 10·1		− 11·3	

MEASURES OF ϵ CYGNI—*Concluded*

λ	7117		7120		7121		7131		7136		7142			
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4586·191	−21·0	1	−19·6	1	−15·2	1	−10·8	1	−10·1	1	−10·2	1	.....	....
4584·018	.....	....	.....	....	21·0	1	21·8	1	14·2	1	.....	....	.....	....
4581·618	24·5	1	17·4	1	16·9	1	14·1	1	11·9	1	16·2	1	.....	....
4580·407	23·9	1	26·1	¾	21·6	1	21·9	1	20·7	1	18·3	1	.....	....
4565·726	23·0	1	24·6	¾	20·6	1	18·7	1	16·8	1	18·2	1	.....	....
4556·202	29·7	1	24·0	¾	.....	....	12·7	1	15·2	1	.....	....	.....	....
4554·257	24·8	1	15·3	¾	16·0	1	19·4	1	13·3	1	.....	....	.....	....
4552·594	22·6	1	18·6	¾	17·8	1	18·2	1	15·8	1	14·0	1	.....	....
4549·766	23·4	1	15·2	¾	19·2	1	16·3	1	13·9	1	14·7	1	.....	....
4535·965	24·1	1	18·0	1	19·8	1	17·4	1	13·8	1	16·0	1	.....	....
4531·202	28·8	1	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4528·807	22·9	1	16·9	¾	20·1	1	16·9	1	16·3	1	18·5	1	.....	....
4525·285	.....	....	.....	....	.....	....	22·7	1	.....	....	.....	....	.....	....
4522·855	22·9	1	−22·0	½	23·7	1	16·4	1	17·5	1	15·1	1	.....	....
4494·664	18·8	1	.....	....	16·8	1	19·1	1	14·6	1	21·1	1	.....	....
4476·214	25·2	1	.....	....	18·0	1	22·2	1	16·8	1	14·4	1	.....	....
4472·957	19·3	1	.....	....	17·5	1	15·2	1	13·3	1	11·8	1	.....	....
4469·545	.....	....	.....	....	20·0	1	.....	....	13·6	1	.....	....	.....	....
4468·663	.....	....	.....	....	17·3	1	.....	....	.....	....	.....	....	.....	....
4466·727	16·6	1	.....	....	15·0	1	11·2	1	5·9	1	6·7	1	.....	....
4459·304	17·4	1	.....	....	17·8	1	.....	....	.....	....	12·3	1	.....	....
4427·420	26·2	1	.....	....	21·8	1	14·7	1	14·6	1	18·7	1	.....	....
4415·354	−20·7	1	.....	....	19·0	1	−16·8	1	.....	....	−17·6	1	.....	....
4352·908	.....	....	.....	....	20·1	1	.....	....	−19·9	1	.....	....	.....	....
4352·908	.....	....	.....	....	−23·6	1	.....	....	.....	....	.....	....	.....	....
Weighted mean	− 22·94		− 19·67		− 19·04		− 17·18		− 15·17		− 15·24		.....	
V_a	+ 8·73		+ 8·31		+ 7·52		+ 6·73		+ 5·67		+ 3·49		.....	
V_d	− ·16		− ·19		+ ·23		− ·13		+ ·07		+ ·06		.....	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		.....	
Radial Velocity	− 14·6		− 11·8		− 11·6		− 10·9		− 9·7		− 12·0		.....	

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