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MEASURES OF RADIAL VELOCITY OF 23 COMÆ BERENICES, δ SERPENTIS AND χ SERPENTIS

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MEASURES OF RADIAL VELOCITY OF 23 COMÆ BERENICES

(1900, $\alpha = 12^h\ 29^m \cdot 9$, $\delta = +\ 23°\ 11'$, mag. 4·78, type A)

This star was announced a spectroscopic binary by Lee, in the *Astrophysical Journal*, XXXII, p. 304, from 5 plates, in which 3 of the plates showed complexities of the lines. Later, Professor Frost, with his usual kindness in such matters, sent the writer these three plates with the remark, "that while the duplicities are not remarkably obvious yet one or more lines seem to be safely double". At a first glance one would rather hesitate to accept the duplicity of the lines, but a closer examination shows the possibility, at least, of such an interpretation being placed upon them.

Seventy-seven plates have been taken here without any decisive evidence of the component spectra. In addition to the hydrogen series, the *K* line of calcium λ 3933, the magnesium line λ 4481 and the iron line at λ 4549 are recorded in the order of decreasing intensity. The mean value of the velocities, which do not vary over a great range, is − 16·2 km. per sec.; Campbell, in *Lick Observatory Bulletin* No. 211, used − 20 km. per sec. from the Yerkes results combined with six of his own. Nevertheless, from the changes which take place in the widths and intensities of the lines, particularly in the case of λ 4481 and λ 4549, it would seem to be beyond a doubt that two quite similar spectra are present, but that the lines are never sufficiently separated to be resolved on our plates. On many plates the λ 4481 line is quite faint, while λ 4549 disappears altogether. At other times, presumably when the spectra are superposed, these are narrow, well-defined lines. Practically all the plates have been measured twice.

The curve of velocity-frequency suggests a binary in which the probable error of measurement is from one-third to one-half the total range of variation (See Young, *R.A.S.C. Journal*, X, page 366). Higher dispersion than one-prism and the use of fine-grained plates, which give better lines for measurement, are necessary for a successful effort to get its orbit.

SUMMARY OF MEASURES OF 23 COMÆ

Plate	Plate	Date		Julian Day	Velocity	n	Remarks
		1908					
1491	S. 27	April	15	2,418,047·767	−23·9	5	
		1911					
4073	S. 27	Mar.	7	2,419,103·774	−25·6	1	4481 dependable.
4095	S. 27	"	10	106·883	−10·0	4	
4131	S. 27	"	18	114·711	−12·0	4	sl. underexposed, lines fuzzy.
4148	S. 27	"	28	124·843	− 4·9	3	4481 not strong.
4165	S. 27	April	3	130·805	−27·8	3	sl. underexposed, lines fair.
4191	S. 27	"	11	138·789	−19·3	4	4481 suggests close double.
4198	S. 27	"	17	144·705	−20·2	4	
4217	S. 27	"	19	146·758	−18·7	3	poor agreement.
4223	S. 27	"	20	147·748	−24·4	4	lines fair, but *K* not accordant.
4259	S. 27	"	25	152·725	−33·0	3	lines good.
4356	S. 27	June	8	196·571	−19·0	4	lines good.
		1912					
4785	S. 30	Jan.	12	414·934	− 6·5	3	poor plate.
4811	S. 30	"	19	421·968	−14·6	3	
4816	S. 30	"	25	427·884	−10·6	4	lines only fair.
4846	S. 30	Feb.	14	447·827	−14·9	3	4549 and 4481 very faint.
4865	S. 30	"	28	461·889	−14·0	2	
4877	S. 30	Mar.	10	472·816	−21·0	3	4481 faint, yet reliable.
4889	S. 30	"	13	475·812	−29·5	4	4481 faint, *K* suspicious double.
4897	S. 30	"	18	480·821	− [illegible]·3	3	sl. underexposed.
4910	S. 30	"	22	484·779	−16·5	3	fair.
4918	S. 30	"	25	487·787	−29·4	2	4481 and *K* dependable.
4926	S. 30	"	29	491·801	−18·4	4	*K* good, others diffuse.
4930	S. 30	"	31	493·734	−24·7	3	*K* fair, others ill-defined.
4936	S. 30	April	3	496·771	−30·3	4	only fair, poor agreement.
4943	S. 30	"	8	501·701	− 7·3	3	*K* −42·0, real difference.
4949	S. 30	"	11	504·779	−27·7	1	*K* a good line.
4955	S. 30	"	12	505·750	−20·8	3	*H* suspicious double.
4968	S. 30	"	19	512·731	−12·3	3	fair.
4972	S. 30	"	20	513·699	−29·2	1	*K* alone dependable.
4979	S. 30	"	23	516·730	−20·8	4	lines little fuzzy.
4987	S. 30	"	27	520·725	−11·8	3	fair plate.
4995	S. 30	"	30	523·753	−10·8	4	plate not the best.
5000	S. 30	May	2	525·702	−16·9	3	not very dependable.
5017	S. 30	"	15	538·632	−15·3	2	not very dependable.
5026	S. 23	"	31	554·619	−10·4	4	excellent agreement.
5034	S. 23	June	6	560·597	−24·2	1	underexposed.
5040	S. 23	"	7	561·670	− 1·8	4	good.
5044	S. 30	"	12	566·600	− 8·2	4	fair lines, poor agreement.
5053	S. 23	"	17	571·622	−26·0	2	several metallic lines, *K* broadened.
5057	S. 23	"	18	572·671	± 0·0	1	4481 very sharp; 4549 broad and −40.
5061	S. 23	"	21	575·619	− 5·8	1	4481 good; 4549 narrow but −40.
5063	S. 23	"	24	578·607	−14·4	1	underexposed.
5067	S. 23	"	25	579·632	− 3·4	2	underexposed. 4481, 4549 agree.
5077	S. 23	"	27	581·604	−24·8	2	4481, 4549 sharp.
5085	S. 23	July	2	586·606	− 5·4	3	underexposed but fair lines.
5105	S. 23	"	16	600·591	−14·0	3	same as 5085.
		1913					
5343	S. 27	Feb.	3	802·897	+ 0·1	4	fair.
5353	S. 27	"	6	805·892	+ 2·6	3	fair.
5366	S. 27	"	12	811·888	−21·7	3	sl. underexposed.
5375	S. 27	"	17	816·771	−22·1	5	lines sl. fuzzy.
5386	S. 27	"	18	817·740	−20·2	4	not best agreement.

SUMMARY OF MEASURES OF 23 COMÆ—*Concluded*

Plate	Plate	Date		Julian Day	Velocity	n	Remarks
		1913					
5389	S. 27	Feb.	23	2,419,822·758	−13·3	5	fairly narrow lines.
5399	S. 27	"	24	823·832	−16·4	4	fair plate.
5403	S. 27	"	25	824·785	−15·2	4	poor lines, tempr. change.
5404	S. 27	"	25	824·833	−21·1	4	4481 ill-defined.
5411	S. 27	"	28	827·734	−24·3	4	4481 fairly sharp.
5422	S. 27	Mar.	7	834·811	− 4·1	3	barely trace 4481, 4549.
5440	S. 27	"	17	844·725	−11·6	5	4481, 4549 no contrast.
5442	S. 27	April	1	859·772	−22·4	4	4481 faint.
5449	S. 27	"	7	865·687	−20·5	4	*K* ill-defined.
5458	S. 27	"	9	867·673	−24·0	4	fair, agreement not best.
5464	S. 27	"	13	871·722	−20·4	4	agreement poor, 4481 sharp.
5471	S. 27	"	14	872·694	−13·1	4	all lines distinct.
5477	S. 27	"	15	873·759	− 4·9	4	poor plate.
5481	S. 27	"	16	874·668	−18·2	4	4481 and *K* sl. fuzzy.
5491	S. 27	"	17	875·691	− 9·4	3	4481 fair but poor agreement.
5493	S. 27	"	20	878·658	−17·6	5	only fair.
5505	S. 27	"	24	882·603	−18·9	5	4481, 4509 narrow, distinct.
5515	S. 27	"	29	887·768	−30·9	4	4481, 4549 ill-defined.
5519	S. 27	"	30	888·749	− 9·3	3	fair lines.
5523	S. 27	May	1	889·600	−21·9	5	4549 narrow, others broad.
5529	S. 23	"	2	890·611	−23·1	3	4481 narrow, strong.
5538	S. 27	"	7	895·604	−15·5	3	all fairly definite.
5555	S. 27	"	25	913·646	−12·8	2	4481 fair, others uncertain.
5558	S. 27	"	29	917·585	+ 6·8	3	4481 best, alone gives −2.
5586	S. 27	June	16	2,419,935·598	−26·0	2	

MEASURES OF 23 COMÆ

λ	1491		4073		4095		4131		4148		4165		4191	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	−27·8	½	.....	....	− 8·4	¾	− 5·3	¼	.....	....	−30·7	¼	−29·2	½
4481	13·6	1	−30·8	1	20·3	1¼	13·3	¼	.....	....	8·0	¾	− 8·0	1
4340	12·5	½	.....	....	10·0	½	8·8	¼	− 1·4	¾	.....	....	−12·4	½
4101	0·3	½	.....	....	.....	....	.....	....	− 1·2	¼	.....	....	.....	....
3933	− 4·0	1	.....	....	− 8·1	½	−30·3	⅛	+ 1·4	1	−46·2	¼	+ 4·2	1
Weighted mean	− 10·83		− 30·83		− 13·57		− 12·15		+ 0·02		− 20·16		− 8·20	
V_a	− 12·60		+ 5·46		+ 4·01		+ 0·32		− 4·42		− 7·13		− 10·62	
V_d	− ·19		·00		− ·20		+ ·09		− ·21		− ·19		− ·20	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 23·9		− 25·6		− 10·0		− 12·0		− 4·9		− 27·8		− 19·3	

λ	4198		4217		4223		4259		4356		4785		4811	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	−14·3	⅛	.....	....	−23·3	¾	.....	....	.....	....	.....	....	.....	....
4481	2·3	¼	−30·5	⅛	−10·0	¾	−13·3	1	+ 8·2	1	−26·8	⅛	−29·4	½
4340	8·7	½	+ 9·6	¼	−23·9	¾	17·2	¾	+10·0	1¼	39·3	¼	50·0	½
4101	.....	....	.....	....	.....	....	.....	....	− 0·6	½	.....	....	.....	....
3933	− 5·9	1	− 6·0	⅛	+18·6	¾	−18·9	1	+ 8·3	¾	−28·4	½	−33·8	½
Weighted mean	− 6·72		− 4·33		− 9·65		− 16·40		+ 7·66		− 31·28		− 37·73	
V_a	− 13·07		− 13·87		− 14·27		− 16·15		− 26·30		+ 25·13		+ 23·52	
V_d	− ·09		− ·18		− ·17		− ·14		− ·10		− ·04		− ·11	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 20·2		− 18·7		− 24·4		− 33·0		− 19·0		− 6·5		− 14·6	

MEASURES OF 23 COMÆ—*Continued*

λ	4816		4846		4865		4877		4889		4897		4910	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	−18·3	½	−45·6	½	−18·0	¾	−29·5	½	−41·1	¾	− 7·6	¼	− 4·4	½
4340	41·6	¾	20·0	½	.....	....	15·2	¾	29·5	¾	+ 5·0	¼	11·8	1¼
4101	37·5	¼	.....	....	.....	....	.....	....	9·6	½	.....	....	.....	....
3933	−30·4	¾	−22·9	½	−26·6	¾	−32·3	½	−41·6	½	− 3·8	¾	−24·7	¾
Weighted mean	− 32·22		− 29·50		− 22·30		− 24·17		− 31·42		− 2·80		− 14·16	
V_a	+ 21·89		+ 14·81		+ 8·74		+ 3·58		+ 2·27		− 0·13		− 1·93	
V_d	·00		+ ·03		− ·17		− ·10		− ·11		− ·13		− ·10	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		— ·28	
Radial Velocity	− 10·6		− 14·9		− 14·0		− 21·0		− 29·5		− 3·3		− 16·5	

λ	4918		4926		4930		4936		4943		4949		4955	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	.....	....	+ 3·9	¼	−11·5	¼	−46·6	½	+ 2·4	¼	.....	....	− 5·8	½
4340	−25·3	½	−10·4	½	8·1	¼	9·6	¼	3·2	¾	.....	....	29·4	½
4101	.....	....	+ 2·7	¼	.....	....	18·8	¼	+ 2·1	½	.....	....	.....	....
3933	−26·5	1	−22·0	1	−23·9	¾	−11·8	¾	.....	....	−16·2	1¼	− 0·5	1
Weighted mean	− 26·10		− 12·75		− 18·26		− 22·43		+ 2·70		− 16·20		− 9·05	
V_a	− 2·93		− 5·25		− 6·13		− 7·49		− 9·66		− 10·98		− 11·38	
V_d	− ·11		− ·14		− ·05		− ·12		− ·04		− ·18		− ·13	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 29·4		− 18·4		− 24·7		− 30·3		− 7·3		− 27·7		− 20·8	

MEASURES OF 23 COMÆ—*Continued*

λ	4968		4972		4979		4987		4995		5000		5017	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	.....	....	.....	....	−11·5	½	.....	....	.....	....	.....	....	.....	....
4481	−11·1	¼	.....	....	−14·3	½	+ 9·8	¾	+14·2	½	−12·0	½	+18·6	½
4340	+ 3·0	¼	.....	....	+19·9	¼	− 1·7	½	+16·3	½	+ 0·3	½	.....	....
4101	.....	....	.....	....	.....	....	.....	....	− 6·0	¼	.....	....	.....	....
3933	+ 6·6	¾	−14·2	1	− 1·9	¾	+ 7·0	¾	+ 2·9	¾	+10·7	1	− 3·3	½
Weighted mean	+ 2·34		− 14·20		− 4·65		+ 5·85		+ 7·90		+ 2·40		+ 7·65	
V_a	− 14·21		− 14·59		− 15·73		− 17·18		− 18·19		− 18·86		− 22·55	
V_d	− ·13		− ·10		− ·15		− ·16		− ·21		− ·14		− ·09	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 12·3		− 29·2		− 20·8		− 11·8		− 10·8		− 16·9		− 15·3	

λ	5026		5034		5040		5044		5053		5057		5061	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481	+15·3	1	+ 2·5	¾	+29·0	1	+38·2	½	+ 2·9	1	+27·6	1½	+21·4	1
4340	16·2	1	.....	....	25·9	½	17·7	½	− 3·2	¼	.....	....	.....	....
4101	16·3	½	.....	....	31·4	½	24·0	¼	.....	....	.....	....	.....	....
3933	+15·2	1½	.....	....	+17·6	1	+ 5·0	¾	.....	....	.....	....	.....	....
Weighted mean	+ 15·61		+ 2·50		+ 25·10		+ 18·85		+ 1·68		+ 27·60		+ 21·40	
V_a	− 25·60		− 26·24		− 26·35		− 26·64		− 27·14		− 27·04		− 26·72	
V_d	− ·13		− ·13		− ·23		− ·16		− ·21		− ·28		− ·22	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 10·4		− 24·2		− 1·8		− 8·2		− 26·0		± 0·0		− 5·8	

MEASURES OF 23 COMÆ—*Continued*

λ	5063		5067		5077		5085		5105		5343		5353	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	.....	....	+24·7	¾	− 4·0	1	+28·5	¾	+19·5	½	.....	....	.....	....
4481	+12·7	¾	+22·7	¾	+ 8·3	1	16·9	1¼	5·1	1	−21·0	½	−13·7	1
4340	.....	....	.....	....	.....	....	.....	....	.....	....	0·4	¾	6·8	¾
4101	.....	....	.....	....	.....	....	.....	....	.....	....	24·4	½	.....	....
3933	.....	....	.....	....	.....	....	+20·7	½	+12·0	½	−35·6	½	−23·6	¾
Weighted mean	+ 12·70		+ 23·70		+ 2·15		+ 21·15		+ 10·42		− 18·13		− 14·60	
V_a	− 26·60		− 26·56		− 26·48		− 26·01		− 23·83		+ 18·66		+ 17·57	
V_d	− ·22		− ·25		− ·22		− ·25		− ·27		− ·11		− ·09	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 14·4		− 3·4		− 24·8		− 5·4		− 14·0		+ 0·1		+ 2·6	

λ	5366		5375		5386		5389		5399		5403		5404	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	.....	....	−53·6	¾	−34·0	½	−19·2	½	−22·6	¼	.....	....	−35·4	¼
4481	−23·2	½	18·9	½	44·3	¾	14·0	1	29·4	¾	−10·7	½	34·0	¼
4340	38·5	½	49·8	¼	19·2	1	40·6	½	26·6	¼	25·0	¾	21·4	¾
4101	.....	....	21·2	½	.....	....	7·3	¼	.....	....	27·7	¾	.....	....
3933	−42·4	1	−32·0	¾	−30·5	¾	−34·1	¾	−23·3	½	−34·1	½	−35·6	¾
Weighted mean	− 36·60		− 35·16		− 32·85		− 23·77		− 26·23		− 24·77		− 30·50	
V_a	+ 15·25		+ 13·24		+ 12·83		+ 10·65		+ 10·21		+ 9·75		+ 9·75	
V_d	− ·11		+ ·10		+ ·14		+ ·10		− ·07		+ ·06		− ·07	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 21·7		− 22·1		− 20·2		− 13·3		− 16·4		− 15·2		− 21·1	

MEASURES OF 23 COMÆ—*Continued*

λ	5411		5422		5440		5442		5449		5458		5464	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	−30·0	½	.....	....	− 1·6	½	.....	....	.....	....	−10·7	¼	.....	....
4481	35·5	1	.....	....	1·9	½	−20·7	½	−15·6	1	−18·9	¾	−27·1	¾
4340	31·6	¼	− 4·2	½	10·5	1	19·2	¾	− 8·5	¼	+ 7·6	½	− 2·5	¼
4101	.....	....	14·2	¼	27·4	¼	9·2	¼	+ 2·6	¼	.....	....	− 1·1	¼
3933	−29·1	½	−10·3	¾	−22·0	¾	−14·3	¾	−10·0	½	−26·8	¾	+ 6·0	¾
Weighted mean	− 32·40		− 8·92		− 11·87		− 15·57		− 11·00		− 14·71		− 8·40	
V_a	+ 8·42		+ 5·16		+ 0·50		− 6·49		− 9·19		− 9·98		− 11·67	
V_d	·00		− ·09		+ ·04		− ·11		·00		+ ·02		− ·09	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 24·3		− 4·1		− 11·6		− 22·4		− 20·5		− 24·0		− 20·4	

λ	5471		5477		5481		5491		5493		5505		5515	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	− 1·7	1	+ 7·7	¼	.....	....	+10·0	¼	+15·7	½	+ 9·3	1	.....	....
4481	+ 1·6	1	+24·9	½	− 1·9	½	− 8·5	¾	− 7·4	½	−10·3	¾	− 0·5	½
4340	+ 4·1	½	−12·4	½	−12·1	¾	+20·4	½	+ 1·4	½	+ 5·9	½	−13·7	½
4101	.....	....	.....	....	− 0·5	¼	.....	....	−21·1	½	− 0·8	½	+ 1·1	½
3933	− 5·9	1	+10·4	1	+ ·07	½	.....	....	+ 5·2	½	−26·1	½	−24·8	1
Weighted mean	− 0·70		+ 8·09		− 4·90		+ 4·27		− 2·84		− 2·72		− 12·56	
V_a	− 12·09		− 12·53		− 12·97		− 13·35		− 14·47		− 15·95		− 17·80	
V_d	− ·04		− ·16		·00		− ·07		·00		+ ·02		− ·22	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 13·1		− 4·9		− 18·2		− 9·4		− 17·6		− 18·9		− 30·9	

MEASURES OF 23 COMÆ—*Concluded*

λ	5519		5523		5529		5538		5555		5558		5586	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	+14·3	1	− 4·5	1	− 1·8	½	+10·6	¾	.....	....	.....	....	0·0	½
4481	7·1	1	− 0·6	½	+ 3·0	1½	2·2	¾	+18·0	¾	+23·3	1	+ 2·0	¾
4340	.....	....	− 2·9	½	−27·8	½	.....	....	− 5·0	¼	48·0	¾	.....	....
4101	.....	....	+ 4·2	½	.....	....	.....	....	.....	....	.....	....	.....	....
3933	+ 6·7	1	−10·5	½	.....	....	+ 2·6	¾	.....	....	+27·5	½	.....	....
Weighted mean	+ 9·37		− 3·13		− 4·12		+ 5·15		+ 12·25		+ 32·47		+ 1·20	
V_a	− 18·17		− 18·54		− 18·76		− 20·36		− 24·61		− 25·25		− 26·75	
V_d	− ·21		+ ·04		+ ·02		·00		− ·14		− ·09		− ·18	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 9·3		− 21·9		− 23·1		− 15·5		− 12·8		+ 6·8		− 26·0	

Dominion Observatory

Ottawa

April, 1919.

MEASURES OF RADIAL VELOCITY OF δ SERPENTIS

BY W. E. HARPER, M.A.

(1900, $\alpha = 15^h\ 30^m{\cdot}0$, $\delta = +10°\ 53'$, mag. 4·23, type A5)

This star was announced a spectroscopic binary by Campbell, in *Lick Observatory Bulletin* No. 199, from 5 plates scattered over the years 1905 to 1911. The range of velocity from the five plates—considering the mean of the measures on each—is from −26 to − 52 km. per second.

Forty-three plates were made here with the single-prism spectrograph, mostly in the year 1913, as given in the accompanying table of measures. The spectrum is characterized by intensely strong *H* and *K* lines of calcium, moderately strong hydrogen, and faint and diffuse metallic lines. There is a 5·2 magnitude star of the same type about 3″ distant, in position angle 180°, which on nights of poor seeing is confused with the main star, but any effect its spectrum might have on the measures is negligible. Apart from one or two plates, our measures lie between − 38 and − 53 km. per sec. and it has not been possible to obtain a satisfactory period, though the curve of velocity-frequencies would verify the binary character of the star. If the better plates of our own observatory were alone considered, a curve whose period is approximately four months and a range of 15 km. might be suggested, but the Lick observations do not bear this out.

The second column of the table of lines used indicates the number of times the line was measured. The residuals are in the sense, mean minus measured. No revision of the wave-lengths has been made.

LINES USED IN δ SERPENTIS

λ	n	Residual		λ	n	Residual	
		Num.	Alg.			Num.	Alg.
4549·766	30	11·4	+ 7·4	4250·616	3	12·8	+ 4·6
4534·139	6	10·6	+ 8·0	4246·996	3	6·9	− 6·9
4481·400	36	9·4	− 4·1	4233·328	14	7·3	− 4·6
4443·976	4	9·7	+ 9·7	4227·010	9	5·4	+ 1·2
4395·286	7	14·4	+14·4	4198·494	11	12·4	−11·7
4375·103	11	10·9	+ 3·5	4143·928	8	12·3	+ 8·5
4352·006	6	15·2	+ 2·7	4101·890	12	11·6	− 0·5
4340·634	32	8·2	− 1·1	4063·756	10	15·7	+ 1·6
4325·939	20	8·8	+ 2·8	4045·975	25	6·3	+ 2·9
4289·915	15	13·3	−12·1	4005·430	10	8·7	− 2·7
4271·760	11	9·5	+ 2·2	3933·825	1	11·8	+11·8

SUMMARY OF MEASURES OF δ SERPENTIS

Plate	Date	Julian Date	n	Wt.	Vel.	Remarks
	1913					
5344	Feb. 3	2,419,802·944	8	4	−52	
5355	" 6	805·961	6	3	42	
5367	" 12	811·935	10	5	38	
5379	" 17	816·882	8	4	38	
5401	" 24	823·923	8	4	39	
5406	" 25	824·913	6	2	48	underexposed.
5424	Mar. 7	834·896	5	2	40	underexposed.
5444	April 1	859·857	8	4	40	
5462	" 9	867·790	4	2	62	poor plate.
5466	" 13	871·814	3	2	59	only fair.
5475	" 14	872·805	7	4	54	
5479	" 15	873·834	7	3	52	
5485	" 16	874·804	9	4	46	
5495	" 20	878·753	7	4	53	
5501	" 23	881·753	5	2	52	underexposed.
5509	" 24	882·724	4	2	48	
5513	" 25	883·808	4	2	29	poor plate.
5517	" 29	887·847	6	3	50	
5521	" 30	888·833	8	4	53	
5527	May 1	889·708	7	3	48	
5533	" 2	890·744	8	3	48	underexposed.
5542	" 7	895·734	6	3	54	
5547	" 11	899·801	4	2	39	poor plate.
5553	" 14	902·816	10	5	50	
5557	" 25	913·744	7	3	45	
5562	" 29	917·708	7	3	44	
5565	June 4	923·748	5	3	38	underexposed.
5571	" 8	927·707	8	4	42	
5575	" 9	928·675	8	4	42	
5582	" 13	932·687	8	3	37	underexposed.
5588	" 16	935·690	5	3	42	
5594	" 18	937·692	6	3	38	narrow spectrum.
5596	" 20	939·702	2	1	25	very poor plate.
5597	" 23	942·755	9	4	39	fuzzy lines.
5605	July 2	951·651	4	2	51	very poor plate.
5608	" 7	956·676	6	3	43	
5619	" 14	963·659	7	3	42	fuzzy lines.
5631	" 25	974·619	5	2	38	narrow spectrum.
5638	" 30	979·591	6	3	42	
5644	Aug. 6	2,419,986·584	8	4	−41	
	1914					
5961	Feb. 23	2,420,187·862	10	4	−28	
6234	July 30	344·560	7	3	−52	narrow slit.
	1915					
6803	Feb. 18	547·881	10	5	−31	excellent plate.

MEASURES OF δ SERPENTIS

λ	5344		5355		5367		5379		5401		5406		5424	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	.....	....	−65·1	½	−58·9	½	−67·7	½	.....	....	.....	....	.....	....
4481	−83·9	¾	76·0	½	59·5	½	70·0	½	−59·2	½	.....	....	−55·4	¾
4395	.....	....	.....	....	.....	....	55·5	½	.....	....	−79·3	½	.....	....
4375	.....	....	.....	....	.....	....	.....	....	.....	....	67·7	¾	.....	....
4352	.....	....	.....	....	80·1	¼	.....	....	.....	....	.....	....	.....	....
4340	77·2	¾	68·1	½	59·2	¾	49·9	½	61·3	¾	73·4	¾	57·5	½
4325	81·2	¾	.....	....	50·4	½	72·3	½	.....	....	77·2	¾	.....	....
4271	75·4	½	.....	....	.....	....	.....	....	.....	....	.....	....	66·3	½
4233	.....	....	59·6	½	.....	....	72·5	½	.....	....	60·7	½	62·0	½
4198	.....	....	.....	....	.....	....	.....	....	53·7	½	.....	....	.....	....
4143	90·2	½	.....	....	54·2	¼	.....	....	78·2	½	.....	....	.....	....
4101	62·1	¾	75·0	½	74·6	¾	.....	....	50·3	½	.....	....	.....	....
4063	84·7	¼	.....	....	67·0	½	.....	....	83·2	½	.....	....	.....	....
4045	−86·9	¼	.....	....	60·0	1	68·1	½	81·6	½	.....	....	.....	....
4005	.....	....	−64·4	½	−71·1	1	−54·7	½	−54·3	½	−71·5	½	−76·8	½
Weighted mean	− 78·69		− 68·03		− 63·80		− 63·84		− 63·82		− 71·84		− 62·84	
V_a	+ 26·39		+ 26·41		+ 26·21		+ 25·84		+ 24·97		+ 24·83		+ 22·89	
V_d	+ ·09		+ ·06		+ ·03		+ ·12		·00		− ·19		·00	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 52·5		− 41·8		− 37·8		− 38·2		− 39·1		− 47·5		− 40·2	

λ	5444		5462		5466		5475		5479		5485		5495	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	.....	....	.....	....	.....	....	.....	....	−52·8	½	−48·7	½	−65·2	½
4481	−37·4	½	.....	....	−69·3	½	−58·5	¾	59·4	½	56·6	½	39·3	½
4443	.....	....	.....	....	.....	....	.....	....	.....	....	44·8	½	.....	....
4340	67·4	½	.....	....	75·2	¾	58·6	¾	51·7	½	64·7	½	66·3	½
4325	.....	....	−87·3	½	.....	....	69·5	½	45·8	½	44·4	½	60·3	¾
4290	76·3	½	.....	....	.....	....	.....	....	.....	....	.....	....	63·2	½
4271	67·2	½	.....	....	.....	....	.....	....	71·5	½	.....	....	.....	....
4233	63·4	½	74·7	½	−62·9	¾	.....	....	.....	....	58·1	½	.....	....
4227	.....	....	.....	....	.....	....	67·5	¼	.....	....	44·6	½	63·7	½
4198	53·9	½	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4143	35·9	¾	.....	....	.....	....	72·2	½	.....	....	63·0	½	−64·9	¾
4101	.....	....	.....	....	.....	....	69·2	¾	.....	....	.....	....	.....	....
4063	.....	....	57·6	½	.....	....	.....	....	87·2	½	−73·3	½	.....	....
4045	−50·2	¾	−77·7	½	.....	....	−61·7	½	−61·7	½	.....	....	.....	....
Weighted mean	− 54·98		− 74·32		− 69·10		− 64·52		− 61·44		− 55·36		− 60·62	
V_a	+ 15·34		+ 12·31		+ 10·79		+ 10·28		+ 9·89		+ 9·46		+ 7·79	
V_d	− ·11		+ ·04		− ·02		− ·02		− ·09		− ·04		+ ·05	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 40·0		− 62·2		− 58·6		− 54·5		− 51·9		− 46·2		− 53·1	

MEASURES OF δ SERPENTIS—*Continued*

λ	5501		5509		5513		5517		5521		5527		5533	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	−39·7	½	−66·9	¾	−39·2	½	−56·6	½	−57·6	½	−53·9	½	−37·5	½
4534	68·9	½	.....	....	40·4	½	.....	....	56·6	½	61·0	½	48·6	½
4481	.....	....	34·2	¾	33·7	½	73·9	½	.....	....	47·3	½	50·7	½
4395	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	64·6	½
4352	.....	....	.....	....	.....	....	.....	....	40·3	½	.....	....	.....	....
4340	57·7	½	.....	....	−23·5	½	48·7	½	48·1	½	60·4	½	.....	....
4325	.....	....	.....	....	.....	....	.....	....	.....	....	43·9	½	55·4	½
4290	67·4	½	58·8	½	.....	....	39·2	½	43·0	½	51·2	½	46·8	½
4233	.....	....	.....	....	.....	....	67·1	½	62·1	½	.....	....	.....	....
4227	.....	....	.....	....	.....	....	−47·3	½	.....	....	.....	....	.....	....
4198	.....	....	.....	....	.....	....	.....	....	62·4	½	−39·9	½	.....	....
4101	.....	....	.....	....	.....	....	.....	....	−74·9	½	.....	....	.....	....
4063	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	36·6	½
4045	−57·4	½	−59·7	½	.....	....	.....	....	.....	....	.....	....	−61·3	½
Weighted mean	− 58·22		− 54·00		− 34·20		− 53·80		− 55·62		− 51·09		− 50·20	
V_a	+ 6·53		+ 6·11		+ 5·69		+ 3·86		+ 3·43		+ 3·00		+ 2·57	
V_d	− ·12		+ ·09		− ·09		− ·17		− ·14		+ ·09		·00	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 52·1		− 48·1		− 28·9		− 50·4		− 52·6		− 48·3		− 47·9	

λ	5542		5547		5553		5557		5562		5565		5571	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	−60·1	½	−16·6	¼	−57·6	½	−24·0	½	−26·1	1	− 5·5	¾	−31·8	½
4534	.....	....	.....	....	46·3	½	19·9	½	.....	....	.....	....	.....	....
4481	56·6	½	38·5	¼	43·0	½	39·1	½	44·2	½	35·6	½	23·8	½
4443	52·3	½	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4395	60·4	½	.....	....	.....	....	.....	....	.....	....	.....	....	19·6	½
4375	.....	....	.....	....	52·1	½	49·3	½	27·5	½	22·7	1	.....	....
4352	.....	....	.....	....	.....	....	.....	....	.....	....	49·0	½	.....	....
4340	50·0	¾	.....	....	30·1	½	57·3	½	48·3	½	.....	....	21·0	½
4325	.....	....	37·5	½	62·3	½	.....	....	.....	....	.....	....	48·3	½
4271	.....	....	.....	....	.....	....	.....	....	25·7	¼	.....	....	39·9	¾
4246	.....	....	.....	....	.....	....	30·9	½	.....	....	.....	....	.....	....
4233	.....	....	.....	....	36·2	½	.....	....	.....	....	.....	....	.....	....
4227	.....	....	.....	....	52·7	½	−37·3	½	37·9	½	.....	....	.....	....
4198	.....	....	.....	....	.....	....	.....	....	.....	....	−28·4	½	23·9	½
4143	−47·3	¾	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4101	.....	....	.....	....	41·4	½	.....	....	.....	....	.....	....	.....	....
4045	.....	....	−46·9	½	−47·2	½	.....	....	−40·3	½	.....	....	−16·9	½
Weighted mean	− 53·60		− 37·27		− 46·89		− 36·83		− 35·09		− 25·72		− 28·85	
V_a	+ 0·39		− 1·40		− 2·75		− 7·33		− 9·01		− 11·36		− 12·93	
V_d	·00		− ·15		− ·09		− ·12		− ·08		− ·17		− ·12	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 53·5		− 39·1		− 50·0		− 44·6		− 44·5		− 37·5		− 42·2	

MEASURES OF δ SERPENTIS—*Continued*

λ	5575		5582		5588		5594		5597		5605		5608	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	−34·1	½	−35·6	½	−38·7	¾	− 7·2	¾	−35·5	¾	.....	....	−36·3	½
4534	.....	....	.....	....	.....	....	.....	....	24·2	½	.....	....	.....	....
4481	29·8	½	25·1	½	.....	....	30·5	½	24·1	½	−17·1	½	11·2	½
4443	.....	....	.....	....	.....	....	29·3	½	.....	....	.....	....	.....	....
4395	.....	....	.....	....	.....	....	.....	....	18·7	½	.....	....	.....	....
4375	17·6	½	.....	....	7·8	½	32·5	½	41·6	½	45·9	½	.....	....
4352	.....	....	.....	....	.....	....	21·2	½	3·8	½	.....	....	.....	....
4340	28·3	½	16·3	½	.....	....	.....	....	.....	....	.....	....	26·1	½
4325	.....	....	30·4	½	.....	....	.....	....	5·3	½	29·1	½	17·4	½
4290	24·2	½	.....	....	.....	....	.....	....	.....	....	.....	....	6·3	½
4271	.....	....	15·7	¾	35·2	½	.....	....	.....	....	.....	....	.....	....
4246	.....	....	.....	....	.....	....	.....	....	.....	....	−26·7	½	.....	....
4233	.....	....	.....	....	28·3	½	.....	....	.....	....	.....	....	.....	....
4227	.....	....	22·3	¼	.....	....	.....	....	.....	....	.....	....	.....	....
4198	42·3	½	.....	....	.....	....	.....	....	14·2	½	.....	....	.....	....
4101	18·8	½	.....	....	.....	....	−14·9	½	.....	....	.....	....	.....	....
4063	.....	....	10·8	¼	.....	....	.....	....	.....	....	.....	....	.....	....
4045	.....	....	.....	....	−14·6	½	.....	....	−11·8	½	.....	....	−27·6	½
4005	−29·9	½	−14·8	½	.....	....	.....	....	.....	....	.....	....	.....	....
Weighted mean	− 28·12		− 21·65		− 26·18		− 21·42		− 20·69		− 29·70		− 20·82	
Va	− 13·32		− 14·88		− 15·82		− 16·46		− 18·07		− 20·59		− 21·81	
Vd	− ·08		− ·12		− ·13		− ·14		− ·25		− ·13		− ·13	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 41·8		− 36·9		− 42·4		− 38·3		− 39·3		− 50·7		− 43·0	

MEASURES OF δ SERPENTIS—*Concluded*

λ	5619		5631		5638		5644		5961		6234		6803	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	−27·5	½	.....	....	.....	....	−31·3	½	−46·4	½	−20·2	½	.....	....
4481	20·0	½	.....	....	.....	....	14·6	½	34·2	½	3·7	¾	−27·5	½
4443	.....	....	.....	....	.....	....	33·3	¼	.....	....	.....	....	.....	....
4395	.....	....	.....	....	.....	....	.....	....	56·9	¼	.....	....	.....	....
4375	.....	....	.....	....	.....	....	4·0	½	.....	....	.....	....	.....	....
4352	.....	....	.....	....	.....	....	.....	....	64·8	¼	.....	....	.....	....
4340	17·8	½	−17·9	¾	−11·5	½	.....	....	57·1	½	38·5	¾	67·9	¾
4325	10·9	½	+ 2·6	¼	26·9	½	.....	....	.....	....	.....	....	71·9	¼
4289	8·9	1	−12·2	½	.....	....	10·5	½	.....	....	.....	....	60·2	¼
4271	.....	....	.....	....	9·9	½	14·0	½	.....	....	.....	....	.....	....
4250	.....	....	.....	....	.....	....	.....	....	79·7	½	.....	....	.....	....
4233	.....	....	.....	....	.....	....	0·0	½	.....	....	36·6	¼	.....	....
4227	.....	....	.....	....	.....	....	.....	....	54·6	½	.....	....	47·5	½
4198	.....	....	.....	....	10·3	½	.....	....	44·3	½	.....	....	.....	....
4143	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	59·4	¼
4101	.....	....	−22·1	½	.....	....	.....	....	.....	....	58·3	¼	65·6	½
4063	31·8	½	.....	....	22·0	½	.....	....	.....	....	.....	....	.....	....
4045	−20·0	½	− 5·9	½	−17·9	½	−30·5	¼	68·0	½	31·8	¼	57·5	½
4005	.....	....	.....	....	.....	....	.....	....	−36·7	½	−18·2	¼	44·2	½
3933	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	−68·2	½
Weighted mean	− 18·22		− 13·20		− 16·42		− 15·20		− 53·49		− 25·97		− 56·44	
V_a	− 23·26		− 24·87		− 25·20		− 25·67		+ 25·16		− 25·30		+ 25·80	
V_d	− ·21		− ·19		− ·17		− ·19		+ ·15		− ·13		+ ·12	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 42·0		− 38·5		− 42·1		− 41·3		− 28·5		− 51·7		− 30·8	

Dominion Observatory
Ottawa
April, 1919.

MEASURES OF RADIAL VELOCITY OF χ SERPENTIS

BY W. E. HARPER, M.A.

(1900, $\alpha = 15^h\ 37^m{\cdot}1$, $\delta = +13°\ 10'$, mag. 5·26, type B9)

This star was announced a binary by Adams in the *Astrophysical Journal*, XXXV, p. 176, from three measures in 1911 giving a range from − 4 to + 36.

Thirty plates, taken mostly in 1914, have been measured without giving a clue to the period. While slightly greater negative velocities have been secured than Adams got, yet, there are no velocities anything like as positive as he secured. No doubt if the observations were continued long enough, high positive velocities would be chanced upon and a period could be found, but the star has been dropped, temporarily at least, from our list. Our measures would indicate that the velocity of the system is about zero.

The character of the spectrum can be inferred from the lines in the accompanying table. Many other lines were measured on the best plates, but to make the measures as uniform as possible, the results were based on these 10 alone. The lines λ 4215 and λ 4077 are unusually strong in this spectrum. These are two of the lines which Adams uses in his spectral parallax determinations.

LINES USED IN χ SERPENTIS

λ	n	Residual		λ	n	Residual	
		Num.	Alg.			Num.	Alg.
4549·766	15	8·6	+4·0	4215·668	19	8·3	−3·8
4481·400	21	7·2	+1·7	4161·698	9	6·4	+2·4
4340·634	15	7·2	−2·2	4077·885	17	8·0	+4·4
4325·939	6	8·4	+4·8	4045·975	7	8·2	+1·2
4233·328	12	7·4	−6·4	3933·825	8	8·2	−3·6

SUMMARY OF MEASURES OF x SERPENTIS

Plate	Date, G.M.T.	Lines	Velocity
	1914		
5962	Feb. 23·915	6	+ 1·4
5981	Mar. 16·800	9	− 0·7
5991	" 20·859	5	− 8·2
5998	" 24·893	3	−15·4
6002	" 30·825	8	− 1·9
6005	" 31·826	4	−15·6
6012	April 3·813	7	− 4·6
6019	" 6·798	6	− 6·8
6027	" 12·802	6	− 0·5
6043	" 22·782	6	− 5·0
6057	May 1·807	4	+ 0·1
6069	" 8·811	7	+ 7·4
6079	" 24·699	4	−14·9
6083	" 28·675	1	+15·0
6089	June 4·670	4	− 4·4
6092	" 5·677	4	+ 8·5
6100	" 8·684	1	−12·1
6114	" 17·711	6	− 7·4
6120	" 19·660	7	+ 7·6
6134	" 26·702	10	− 1·8
6141	July 2·709	1	−12·4
6144	" 3·651	7	− 2·2
6167	" 9·635	3	+ 2·3
6190	" 16·669	2	+10·0
	1915		
6755	Jan. 28·929	5	+17·3
6793	Feb. 17·881	6	+ 8·9
6802	" 18·840	8	+12·5
6832	Mar. 3·850	6	− 0·6
6840	" 4·839	8	+ 1·9
	1916		
7783	Aug. 15·568	6	+15·2

MEASURES OF x SERPENTIS

λ	5962		5981		5991		5998		6002		6005		6012	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	.....	....	−21·5	¼	.....	....	.....	....	.....	....	.....	....	−23·5	¾
4481	−22·6	1	21·9	¾	−33·9	1	.....	....	−20·3	½	−24·9	1	32·6	1
4340	.....	....	10·5	¼	26·9	1	.....	....	23·6	¾	.....	....	17·2	¾
4325	.....	....	.....	....	35·3	¾	.....	....	.....	....	39·7	¾	7·9	¾
4233	18·6	½	1·2	½	.....	....	.....	....	1·6	¾	34·0	1	.....	....
4215	7·2	¾	23·3	1	.....	....	−39·7	¾	20·7	½	−20·1	¼	5·2	½
4161	22·6	½	33·4	½	.....	....	36·1	¼	22·0	¾	.....	....	.....	....
4077	30·6	½	32·7	¾	.....	....	−22·1	½	25·8	½	.....	....	8·2	¾
4045	−37·8	¾	8·9	½	19·8	¾	.....	....	22·4	¼	.....	....	.....	....
3933	.....	....	−22·3	¾	−20·6	1	.....	....	− 6·1	¼	.....	....	−30·0	¾
Weighted mean	− 23·05		− 21·09		− 27·30		− 33·20		− 17·90		− 31·30		− 19·18	
V_a	+ 24·66		+ 20·51		+ 19·33		+ 18·16		+ 16·23		+ 15·91		+ 14·83	
V	+ ·04		+ ·14		+ ·02		− ·09		+ ·02		+ ·02		+ ·02	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 1·4		− 0·7		− 8·2		− 15·4		− 1·9		− 15·6		− 4·6	

λ	6019		6027		6043		6057		6069		6079		6083	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	.....	....	− 5·0	¾	− 8·4	½	−24·6	¼	+21·4	½	−16·5	½	.....	....
4481	.....	....	−28·7	½	−28·8	¾	+ 6·3	½	−12·0	½	+ 4·5	½	+23·0	¾
4340	− 8·9	½	−27·5	½	−13·6	½	.....	....	+18·4	½	.....	....	.....	....
4233	.....	....	− 1·3	½	.....	....	.....	....	.....	....	− 5·6	½	.....	....
4215	11·7	¾	+ 3·4	1	− 4·2	½	.....	....	+ 4·8	½	.....	....	.....	....
4161	31·2	½	.....	....	+ 1·3	½	.....	....	− 4·6	¼	.....	....	.....	....
4077	34·6	½	−20·7	1	−11·2	¾	− 9·2	½	− 7·2	½	−25·8	¼	.....	....
4045	22·6	¾	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
3933	−15·6	½	.....	....	.....	....	+ 1·6	¾	+23·6	½	.....	....	.....	....
Weighted mean	− 20·30		− 11·70		− 12·14		− 3·20		+ 7·20		− 8·74		+ 23·00	
V_a	+ 13·75		+ 11·47		+ 7·45		+ 3·65		+ 0·66		− 6·04		− 7·66	
V_d	+ ·04		·00		·00		− ·09		− ·14		+ ·15		− ·03	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 6·8		− 0·5		− 5·0		+ 0·1		+ 7·4		− 14·9		+ 15·0	

MEASURES OF x SERPENTIS—*Concluded*

λ	6089		6092		6100		6114		6120		6134		6144	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	− 0·7	1	.....	....	0·0	½	+ 4·7	½	+27·3	¼	−11·1	½	+18·0	¼
4481	+ 4·5	¾	+17·6	1	.....	....	− 2·5	½	19·0	¼	+14·0	¾	15·5	¾
4340	.....	....	16·9	½	.....	....	+19·5	¼	10·5	¼	+41·6	½	26·4	1
4325	.....	....	.....	....	.....	....	.....	....	.....	....	+ 3·4	½	11·8	¾
4233	.....	....	21·8	1	.....	....	+11·0	½	27·4	½	+36·6	¾	18·1	½
4215	+20·6	¾	+22·0	½	.....	....	+34·8	¼	22·2	½	+26·3	½	25·4	¼
4161	.....	....	.....	....	.....	....	.....	....	.....	....	+12·8	¾	.....	....
4077	+ 1·8	½	.....	....	.....	....	+ 1·6	½	26·6	¼	+ 3·2	½	+10·8	½
4045	.....	....	.....	....	.....	....	.....	....	+30·0	¼	+ 9·0	½	.....	....
3933	.....	....	.....	....	.....	....	.....	....	.....	....	+21·2	½	.....	....
Weighted mean	+ 6·30		+ 19·60		0·00		+ 8·44		+ 23·95		+ 16·42		+ 18·05	
V_a	− 10·41		− 10·80		− 11·85		− 15·11		− 15·83		− 17·80		− 19·84	
V_d	− ·02		− ·06		− ·07		− ·17		− ·09		− ·19		− ·14	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 4·4		+ 8·5		− 12·1		− 7·4		+ 7·6		− 1·8		− 2·2	

λ	6167		6190		6755		6793		6802		6832		6840	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	+24·4	½	+14·1	¾	− 3·3	½	.....	....	+12·2	½	−22·6	½	−20·6	¾
4481	29·3	½	+52·2	¾	3·5	¾	−13·5	1	−22·5	½	23·1	½	6·7	¾
4340	.....	....	.....	....	11·7	¼	22·2	¾	−12·8	½	23·5	¼	24·5	½
4325	.....	....	.....	....	.....	....	21·0	½	−44·4	¼	9·9	¼	.....	....
4233	.....	....	.....	....	4·2	1	.....	....	− 8·0	¼	7·1	¼	43·1	½
4215	+17·9	½	.....	....	−19·1	¾	19·0	1	.....	....	−41·6	½	16·3	½
4161	.....	....	.....	....	.....	....	11·0	½	.....	....	.....	....	24·8	¼
4077	.....	....	.....	....	.....	....	−12·2	1	− 2·9	¼	.....	....	24·8	¼
4045	.....	....	.....	....	.....	....	.....	....	+ 0·5	¼	.....	....	.....	....
3933	.....	....	.....	....	.....	....	.....	....	−42·2	¼	.....	....	−20·0	¾
Weighted mean	+ 23·87		+ 33·15		− 7·90		− 16·27		− 12·62		− 23·91		− 21·28	
V_a	− 21·26		− 22·67		+ 25·29		+ 25·30		+ 25·22		+ 23·48		+ 23·36	
V_d	− ·06		− ·22		+ ·14		+ ·12		+ ·19		+ ·11		+ ·12	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 2·3		+ 10·0		+ 17·3		+ 8·9		+ 12·5		− 0·6		+ 1·9	

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