DEPARTMENT OF THE INTERIOR
CANADA

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PUBLICATIONS

OF THE

Dominion Observatory

OTTAWA

W. F. KING, C.M.G., LL.D., *Director.*

Vol. III, No. 3

The Spectroscopic Orbit of 12 Lacertæ

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OTTAWA
GOVERNMENT PRINTING BUREAU
1915

88612—1

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THE SPECTROSCOPIC ORBIT OF 12 LACERTÆ.

BY REYNOLD K. YOUNG, Ph.D.

The binary character of 12 Lacertæ ($\alpha = 22^h\ 37^m{\cdot}6$, $\delta = +39°\ 46'$, mag. 5·3, type B2) was announced by Adams in the Astrophysical Journal in 1912. The character of the spectrum may be judged from Table I, which gives the wave-lengths of the lines used. In addition to the wave-lengths there given, helium lines at λ 3963·875, λ 4009·417, the lines λ 4046, λ 4064, λ 4072 are also present. None of these latter lines were included in the final reductions.

TABLE I.

Wave-Length.	Element.	Wave-Length.	Element.
3933·727	*Ca*	4340·634	*H*
3964·875	*He*	4388·100	*He*
4026·352	*He*	4471·676	*He*
4101·890	*H*	4481·400	*Mg*
4143·928	*He*	4552·750	*Si*
4267·301	*C*	4567·950	*Si*

The observations, numbering 117, are given in Table III. When the writer began work on 12 Lacertæ in 1914, over fifty spectrograms had already been obtained and as this number usually suffices to determine the orbit of a binary, the star was removed from the observing programme until such time as those plates already on hand should be reduced. When this work was completed it was too late in the season to get more plates and while the 1913 and 1914 velocities indicated a short period, all efforts to harmonize the results failed, so that it was not until the fall of 1915 that a run of exposures made during the course of one night showed the true period. The individual observations do not fit any curve well. This and also the fact that the period is very short make the determination of the number of cycles performed between successive seasons difficult and a little uncertain. Between the first and last plate the star has travelled nearly eight thousand revolutions, so that if no mistake has been made in the whole number of cycles, the period should be accurate to within a second of time. Observations secured at other observatories, covering the same or part of the same epoch as those obtained here, would probably eliminate any uncertainty in this regard.

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TABLE II.

MOUNT WILSON OBSERVATIONS OF 12 LACERTÆ.

Date.	Julian Day.	Velocity.	Phase.
1911			
Aug. 16	2,419,265·958	+ 3	·046
Sept. 8	288·909	+ 6	·020
Sept. 16	296·794	− 8	·181
Oct. 11	321·815	−43	·100

TABLE III.

OTTAWA OBSERVATIONS OF 12 LACERTÆ.

Plate.	Observer*	Date.	Julian Day.	Velocity.	Weight.	Phase.	O–C.	Remarks.
		1913						
5623	P^1	July 14	2,419,963·831	−23·7	3	·095	+ 6·4	
5630	C	July 21	970·830	−10·6	2	·143	+ 4·5	
5634	P^1	July 25	974·785	− 5·1	2	·043	+ 3·4	
5642	P^1	July 30	979·792	+ 1·8	2	·030	+ 4·0	
5647	P^1	Aug. 7	987·813	− 9·3	2	·134	+ 9·0	
5664	P^1	Sept. 5	20,016·705	−28·2	1	·063	− 8·8	Exposed 110 min.
5665	P^1	Sept. 8	019·827	−42·1	2	·096	−11·7	
5670	P^1	Sept. 15	026·679	+ 9·3	2	·189	+ 7·0	
5680	C	Sept. 19	030·672	−16·3	1	·127	+ 8·0	Exposed 105 min.
5685	P^1	Sept. 22	033·660	+ 3·5	1	·026	+ 4·2	Exposed 115 min.
5692	Y	Sept. 24	035·686	−35·1	2	·121	− 7·8	
5704	P^1	Sept. 26	037·748	−11·5	2	·059	+ 6·5	
5711	P^1	Sept. 29	040·748	− 1·2	3	·163	+ 5·4	
5720	Y	Sept. 30	041·609	−19·8	3	·059	− 1·6	
5728	P	Oct. 1	042·635	− 8·4	1	·119	+19·4	Very weak.
5735	C	Oct. 3	044·644	+21·6	2	·004	+18·3	
5750	P^1	Oct. 6	047·608	−15·7	2	·072	+ 8·0	
5765	P	Oct. 8	049·587	−22·0	2	·119	+ 5·8	
5768	Y	Oct. 9	050·580	−22·4	2	·048	−10·8	
5775	C	Oct. 13	054·602	−25·2	3	·115	+ 3·9	
5787	C	Oct. 31	072·610	+ 4·4	2	·165	+10·5	
5792	G	Nov. 5	077·564	−31·6	2	·099	− 0·8	Exposed 105 min.
5800	Y	Nov. 6	078·500	−19·0	2	·070	+ 3·8	
5837	P^1	Dec. 22	.....	.....	.....	.....	.....	Prism under strain
		1914						
6139	H	June 30	314·834	− 1·1	2	·063	+20·0	
6164	P^1	July 8	322·785	−13·9	2	·097	+16·5	
6169	H–Y	July 9	323·725	−19·5	2	·072	+ 4·0	
6183	Y–H	July 14	328·748	−48·4	2	·074	−24·0	
6187	G–P^1	July 15	329·736	.....	.....	.....	.....	Temp. changed 3 degrees.

TABLE III.

OTTAWA OBSERVATIONS OF 12 LACERTÆ.—*Continued.*

Plate.	Observer*	Date.	Julian Day.	Velocity.	Weight.	Phase.	O–C.	Remarks.
		1914						
6198	P¹	July 17.....	2,420,331·810	−14·6	3	·047	− 3·3	
6216	H	July 21.....	335·774	− 3·1	1	·149	−10·5	
6220	H	July 23.....	337·675	−30·9	2	·129	−12·0	
6223	P¹	July 24.....	338·788	−25·2	2	·074	− 1·0	
6223	P¹	July 24.....	338·788	−25·3	.....	·074	.....	Remeasure.
6228	C	July 27.....	341·828	.....	.....	.....	.....	Exposed 135 min.
6233	P¹	July 29.....	343·849	−20·3	2	·114	+ 9·0	
6236	H	July 30.....	344·634	−20·2	3	·127	+ 4·8	
6244	P¹–C	Aug. 3.....	348·738	+ 0·8	3	·176	+ 1·8	
6262	H	Aug. 4.....	349·862	−31·8	3	·142	−14·0	
6266	P¹–C	Aug. 5.....	350·727	−20·1	2	·041	−12·5	
6270	H	Aug. 11.....	356·762	−21·7	2	·090	+ 7·8	
6276	P¹	Aug. 14.....	359·788	− 5·3	2	·027	− 4·5	
6281	Y–H	Aug. 18.....	363·736	−27·0	2	·113	+ 2·5	
6286	C	Aug. 19.....	364·757	−19·6	2	·169	−15·0	Epoch earlier?
6291	C	Aug. 21.....	366·654	−32·7	1	·134	−10·5	
6308	H	Aug. 25.....	370·722	−14·0	3	·148	0·0	
6314	G–C	Aug. 26.....	371·743	− 6·3	2	·011	− 9·5	
6318	H	Aug. 27.....	372·612	−21·1	0	·106	+ 9·5	Exposed 144 min.
6328	C	Aug. 31.....	376·767	− 7·3	2	·014	−10·0	
6335	H	Sept. 4.....	380·665	−19·8	2	·050	− 6·8	
6342	H	Sept. 8.....	384·555	−21·9	2	·079	+ 4·3	
6349	P	Sept. 9.....	385·669	+12·6	2	·034	+18·0	
6349	P	Sept. 9.....	385·669	+ 9·2	.....	·034	+14·8	Remeasure.
6356	P–H	Sept. 11.....	387·714	−15·7	3	·148	− 1·0	
6369	P¹	Sept. 14.....	390·656	− 1·3	3	·000	− 4·2	
6409	Y	Sept. 20.....	396·637	− 7·1	2	·189	− 9·0	
6409	Y	Sept. 20.....	396·637	− 5·5	.....	·189	− 7·4	Remeasure.
6426	P¹	Sept. 25.....	401·655	+ 1·6	2	·187	0·0	
6439	P¹	Sept. 28.....	404·655	−25·8	1	·097	+ 4·8	
6454	H	Oct. 1.....	407·598	+ 4·0	2	·144	+20·0	
6479	Y	Oct. 4.....	410·632	−30·1	3	·089	− 1·0	
6479	Y	Oct. 4.....	419·604	−33·1	3	·089	− 4·0	Remeasure.
6497	Y	Oct. 13.....	419·604	+ 3·3	3	·178	+ 3·7	
6504	P¹	Oct. 14.....	420·613	+ 7·0	3	·029	+ 9·0	
6512	C	Oct. 21.....	427·609	−30·4	3	·074	− 6·0	
6521	H	Oct. 22.....	428·695	+ 1·4	3	·001	− 1·8	
6531	G	Oct. 24.....	430·498	−19·9	3	·104	+11·0	
6542	P¹	Nov. 2.....	439·620	−24·3	3	·113	− 5·5	
6557	P¹	Nov. 16.....	453·608	+12·7	3	·006	+ 9·5	
6559	Y	Nov. 17.....	454·591	+ 4·2	2	·023	+ 4·0	
		1915						
6992	Y	May 13.....	631·858	−10·7	2	·035	− 5·5	
6998	C	May 14.....	632·852	−13·9	2	·063	+ 1·0	
7001	Y	May 15.....	633·847	−27·9	3	·093	+ 2·0	
7020	Y	May 27.....	645·849	−23·8	3	·123	+ 2·5	
7023	P	May 28.....	646·846	+ 1·3	3	·155	+12·0	
7026	P¹¹	May 29.....	647·839	−11·8	2	·182	−12·8	

TABLE III.

OTTAWA OBSERVATIONS OF 12 LACERTÆ—*Concluded.*

Plate.	Observer*	Date.	Julian Day.	Velocity.	Weight.	Phase.	O–C.	Remarks.
		1915						
7033	H	May 30.....	2,420,648·846	+ 8·6	3	·031	+11·0	
7043	H	June 1.....	650·812	−14·5	2	·066	− 3·5	
7046	P^{II}	June 2.....	651·835	−23·6	2	·123	+ 2·7	
7172	Y	Aug. 26.....	736·753	−49·9	3	·082	−22·5	
7176	Y	Aug.. 26.....	736·890	− 3·6	1	·026	− 3·0	
7177	Y	Aug. 27.....	737·538	−35·2	3	·095	− 5·0	
7178	Y	Aug. 27.....	737·582	−14·6	3	·141	+ 3·8	
7180	Y	Aug. 27.....	737·677	− 7·7	3	·041	0·0	
7181	Y	Aug. 27.....	737·722	−23·8	3	·086	+ 5·0	
7182	Y	Aug. 27.....	737·832	+ 2·3	3	·003	− 1·0	
7183	Y	Aug. 27.....	737·875	− 5·6	3	·045	+ 4·4	
7184	Y	Aug. 28.....	738·534	−32·9	3	·125	− 6·0	
7185	H	Aug. 28.....	738·666	− 1·0	2	·064	−19·0	
7200	P^{II}	Sept. 3.....	744·545	.....	.....	.....	.....	Slit set very wide.
7201	P^{II}	Sept. 3.....	744·593	+ 3·5	1	·006	0·0	" "
7202	P^{II}	Sept. 3.....	744·642	−23·8	1	·054	− 9·0	" "
7203	P^{II}	Sept. 3.....	744·674	−18·7	1	·087	+10·0	" "
7204	Y	Sept. 3.....	744·747	− 0·8	3	·160	+ 7·0	
7207	Y	Sept. 3.....	744·842	−16·3	3	·061	+ 2·5	
7208	Y	Sept. 3.....	744·889	−32·3	3	·108	− 1·7	
7209	Y	Sept. 4.....	745·528	−10·5	3	·168	− 6·0	
7210	H	Sept. 4.....	745·700	−15·6	3	·147	0·0	
7211	Y	Sept. 4.....	745·751	+11·3	3	·005	+ 8·0	
7214	Y	Sept. 4.....	745·846	−38·3	3	·100	− 7·4	
7215	Y	Sept. 4.....	745·889	−29·4	3	·143	−12·0	
7229	Y	Sept. 10.....	751·569	− 2·9	3	·030	− 0·5	
7231	Y	Sept. 10.....	751·658	−30·9	3	·121	− 3·7	
7239	Y	Sept. 14.....	755·545	−19·1	3	·145	− 3·0	
7240	Y	Sept. 14.....	755·587	+18·1	3	·187	+16·0	
7241	Y	Sept. 14.....	755·628	− 8·2	3	·034	− 4·0	
7242	Y	Sept. 14.....	755·672	−34·6	3	·078	− 8·0	
7243	Y	Sept. 14.....	755·712	−44·1	3	·118	−16·0	
7244	H	Sept. 14.....	755·750	−21·1	3	·157	−11·0	
7249	P	Sept. 15.....	756·599	− 5·2	2	·000	− 8·2	
7250	P	Sept. 15.....	756·642	−30·3	3	·043	−21·0	
7251	P	Sept. 15.....	756·690	−37·5	3	·083	−10·0	
7252	C	Sept. 15.....	756·750	− 7·6	1	·131	+15·0	Epoch very uncertain.
7256	H	Sept. 16.....	757·641	−41·0	3	·117	−12·0	
7266	Y	Sept. 19.....	760·516	−24·2	3	·095	+ 6·0	
7268	Y	Sept. 19.....	760·611	− 3·8	3	·190	− 6·0	
7270	Y	Sept. 19.....	760·713	−26·5	3	·099	+ 4·2	
7293	Y	Sept. 28.....	769·599	−24·3	3	·103	+ 6·8	
7296	Y	Sept. 28.....	769·699	− 2·9	3	·010	− 6·0	
7300	Y	Sept. 29.....	770·556	−18·5	3	·095	+12·0	
7302	Y	Sept. 29.....	770·667	− 7·5	3	·013	−10·0	
7303	C	Sept. 29.....	770·757	−26·5	3	·103	+ 4·5	
7310	H	Sept. 30.....	771·621	+ 8·2	3	·002	+ 5·0	
7313	Y–H	Sept. 30.....	771·721	−42·0	3	·102	−11·8	

*P=Plaskett; C=Cannon; H=Harper; P^{I}=Parker; Y=Young; G=Gibson; P^{II}=H. H. Plaskett.

MEASURES OF 12 LACERTÆ.

λ	5623		5630		5634		5642		5647		5664		5665	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	−35·7	½	−27·4	½	.....	....	−19·1	½	.....	....	.....	....	.....	....
4026·352	−34·6	½	−40·0	½	−23·4	¼	.....	....	−28·1	½	.....	....	.....	....
4101·890	−36·6	½	−30·8	½	.....	....	.....	....	.....	....	.....	....	.....	....
4143·928	−55·3	¼	−15·8	½	.....	....	− 7·0	½	−13·8	½	−26·7	½	.....	....
4267·301	.....	....	−27·4	½	.....	....	−17·2	½	−24·1	½	−51·5	½	.....	....
4340·634	−54·3	¼	−35·8	½	.....	....	.....	....	−20·8	½	−23·6	¼	−46·6	½
4388·100	−41·8	½	−33·5	½	−29·9	½	− 4·8	¼	−31·1	½	−27·5	½	.....	....
4471·676	−54·4	½	−15·2	½	−22·8	½	−16·5	½	−27·9	½	−40·5	½	−50·6	½
4552·750	.....	....	−33·3	½	.....	....	.....	....	−21·3	½	−28·0	½	−42·6	½
4567·950	.....	....	.....	....	− 7·0	¼	.....	....	.....	....	.....	....	.....	....
Weighted mean	−42·97		−28·80		−22·63		−14·68		−23·87		−33·82		−46·60	
V_a	+19·54		+18·48		+17·78		+16·76		+14·89		+ 5·91		+ 5·00	
V_d	0·00		0·00		+ 0·03		+ 0·01		− 0·07		− 0·05		− 0·18	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	−23·7		−10·6		− 5·1		+ 1·8		− 9·3		−28·2		−42·1	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	5670		5680		5685		5692		5704		5711		5720	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	− 5·0	¼	−14·1	½	.....	....	.....	....	.....	....	+ 2·9	½	−11·1	½
3964·875	.....	....	.....	....	.....	....	.....	....	.....	....	+ 5·1	¼	.....	....
4026·352	.....	....	−25·2	½	.....	....	−40·6	½	.....	....	+ 7·6	½	− 8·1	½
4101·890	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	− 5·8	½
4143·928	.....	....	− 5·9	¼	.....	....	−36·8	½	.....	....	+ 6·0	¼	−26·9	½
4267·301	.....	....	.....	....	.....	....	−24·2	½	− 8·8	½	−18·6	¼	−20·8	½
4340·634	+ 4·6	¼	−17·3	½	.....	....	−21·9	½	− 4·6	½	+ 5·8	½	− 9·2	½
4388·100	.....	....	−16·7	½	−14·3	½	−39·4	½	−16·1	½	+ 7·2	½	.....	....
4471·676	+21·5	¼	−17·7	½	+25·8	¼	−41·7	½	− 8·8	½	−26·6	½	−34·2	½
4552·750	.....	....	.....	....	.....	....	−33·4	½	.....	....	+16·0	½	.....	....
Weighted mean	+ 7·03		−17·07		+ 3·83		−34·00		− 9·57		+ 1·63		−16·60	
V_a	+ 2·56		+ 1·12		+ 0·02		− 0·72		− 1·48		− 2·54		− 2·89	
V_d	− 0·03		− 0·05		− 0·03		− 0·07		− 0·17		− 0·02		+ 0·03	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 9·3		−16·3		+ 3·5		−35·1		−11·5		− 1·2		−19·8	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	5728		5735		5750		5765		5768		5775		5787	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	+ 0·9	½	+ 3·4	½	.....	....	.....	....	.....	....	.....	....	+14·1	½
3964·875	.....	....	.....	....	.....	....	− 8·5	½	.....	....	.....	....	+11·0	½
4026·352	− 3·6	½	+27·1	½	+ 3·6	½	.....	....	−11·7	½	−19·8	½	+10·8	½
4101·890	− 2·4	¼	.....	....	.....	....	.....	....	−23·1	½	− 9·6	½	+24·0	½
4143·928	.....	....	+28·9	½	− 6·0	½	−10·9	½	− 5·0	½	−22·8	½	+23·8	½
4267·301	− 4·9	¼	+32·8	½	.....	....	−14·2	½	−11·0	½	−12·0	½	.....	....
4340·634	.....	....	+19·7	½	− 3·4	½	−15·0	½	−12·7	½	−27·8	½	+13·9	1
4388·100	−17·9	½	+26·3	½	−34·7	½	−16·7	½	−35·9	½	−15·5	½	+16·7	½
4471·676	0·0	½	+32·9	½	−11·3	½	−27·8	½	−11·4	½	−13·9	½	+35·4	½
4552·750	.....	....	+36·0	½	.....	....	−18·7	½	−17·2	½	.....	....	.....	....
Weighted mean	− 4·84		+ 25·90		− 10·36		− 15·95		− 16·00		− 17·34		+ 18·18	
V_a	− 3·27		− 3·99		− 5·07		− 5·77		− 6·12		− 7·55		− 13·41	
V_d	+ 0·02		− 0·03		0·00		+ 0·03		+ 0·03		− 0·02		− 0·10	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 8·4		+ 21·6		− 15·7		− 22·0		− 22·4		− 25·2		+ 4·4	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	5792		5800		6139		6164		6169		6183		6198	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	− 7·5	½	+ 3·3	½	.....	....	.....	....	.....	....	.....	....	−21·1	½
3964·875	−14·4	½	− 9·3	½	.....	....	.....	....	.....	....	.....	....	.....	....
4026·352	−25·2	½	+ 3·6	½	.....	....	.....	....	.....	....	−78·0	½	−21·7	½
4101·890	.....	....	.....	....	.....	....	.....	....	.....	....	−60·3	½	−47·2	½
4143·928	−21·8	½	+ 1·0	½	.....	....	−34·6	½	.....	....	−78·9	¼	.....	....
4267·301	.....	....	+ 1·1	½	.....	....	−33·0	½	.....	....	−56·6	½	.....	....
4340·634	−19·7	½	.....	....	−14·8	¼	−31·5	½	−45·0	½	−65·3	½	−45·0	½
4388·100	−19·1	½	− 8·3	½	−20·6	¼	−42·0	½	−31·5	½	−65·5	½	−31·5	½
4471·676	−11·4	½	−16·4	½	−30·0	¼	−28·5	½	−55·7	¼	−82·9	½	−34·7	½
4552·750	....	....	.....	....	.....	....	.....	....	−34·0	½	−55·0	½	.....	....
4567·950	.....	....	.....	....	.....	....	.....	....	.....	....	−74·0	½	.....	....
Weighted mean	− 16·44		− 3·57		− 21·80		− 34·00		− 39·53		− 67·88		− 33·50	
V$_o$	− 14·83		− 15·09		+ 20·86		+ 20·25		+ 20·14		+ 19·59		+ 19·16	
V$_d$	− 0·06		+ 0·04		+ 0·07		+ 0·11		+ 0·18		+ 0·13		+ 0·03	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 31·6		− 19·0		− 1·1		− 13·9		− 19·5		− 48·4		− 14·6	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	6216		6220		6223		6223*		6233		6236		6244	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	−17·9	½
4026·352	−23·4	½	.....	....	−33·8	½	−34·7	½	−13·9	½	−36·4	½	.....	....
4143·928	.....	....	.....	....	−27·9	¼	.....	....	.....	....	−23·1	½	−14·4	½
4267·301	.....	....	.....	....	.....	....	.....	....	−34·0	½	.....	....	−24·5	¼
4340·634	−23·6	½	.....	....	−49·0	1	−41·6	1	−46·1	¼	−45·0	1	+ 1·1	¼
4388·100	−26·8	½	−49·0	½	−51·3	1	−57·1	1	−66·4	½	−37·3	1	−12·8	½
4471·676	.....	....	.....	....	−37·0	1	−34·6	1	−23·5	½	−35·9	1	−17·3	½
4552·750	−12·0	½	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
Weighted mean	− 21·45		− 49·00		− 42·90		− 43·06		− 36·97		− 36·98		− 14·88	
V_a	+ 18·53		+ 18·20		+ 18·00		+ 18·00		+ 17·01		+ 16·84		+ 15·93	
V_d	+ 0·07		+ 0·19		+ 0·03		+ 0·03		− 0·08		+ 0·20		+ 0·07	
Curv.	− 0·28		− 0·28		+ 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 3·1		− 30·9		− 25·2		− 25·3		− 20·3		− 20·2		+ 0·8	

*Remeasure.

MEASURES OF 12 LACERTÆ—*Continued.*

λ	6262		6266		6270		6276		6281		6286		6291	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	−29·9	½	.....	....	−27·5	½	−18·7	½	−37·0	¼	.....	....	−24·3	½
3964·875	−43·4	½	.....	....	.....	....	.....	....	.....	....	.....	....	−58·1	¼
4026·352	−61·6	¼	.....	....	.....	....	−12·1	¼	−26·0	½	.....	....	−53·8	½
4143·928	−34·6	½	.....	....	.....	....	.....	....	−48·1	½	−30·2	½	.....	....
4267·301	.....	....	.....	....	.....	....	−13·8	¼	.....	....	−41·2	½	.....	....
4340·634	−48·4	½	−23·6	½	.....	....	.....	....	−51·7	¼	.....	....	−41·7	½
4388·100	−64·1	½	−42·8	½	−48·9	½	−21·0	½	−35·0	½	−26·8	½	−52·8	½
4471·676	−54·5	½	−39·7	½	−29·7	½	−18·6	½	−51·9	¼	−27·2	1	−38·4	½
4481·400	.....	....	.....	....	.....	....	.....	....	.....	....	−32·4	1	.....	....
Weighted mean	− 47·05		− 35·36		− 35·37		− 17·82		−. 38·75		− 30·90		− 43·67	
V_a	+ 15·66		+ 15·46		+ 13·92		+ 13·10		+ 11·96		+ 11·65		+ 11·17	
V_d	− 0·12		− 0·07		0·00		− 0·06		+ 0·01		− 0·02		+ 0·12	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 31·8		− 20·1		− 21·7		− 5·3		− 27·0		− 19·6		− 32·7	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	6308		6314		6318		6328		6335		6342		6349	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	−26·1	1	−26·5	½	.....	....	−18·7	½	−12·4	½	−18·3	½	.....	....
3964·875	−25·4	½	− 9·0	½	.....	....	.....	....	.....	....	−38·5	½	.....	....
4026·352	.....	....	+ 6·1	½	.....	....	−12·1	½	−37·3	½	−22·6	½	.....	....
4101·890	.....	....	.....	....	−39·9	½	.....	....	.....	....	.....	....	+17·3	½
4143·928	.....	....	−10·5	½	−13·5	½	−11·5	½	−20·2	½	−19·2	½	+12·0	½
4267·301	.....	....	−22·3	½	−31·9	½	.....	....	.....	....	−35·0	½	.....	....
4340·634	−19·1	¼	−16·9	½	−22·5	¼	.....	....	−25·9	½	−28·2	1	+13·5	½
4388·100	−15·1	½	−17·5	½	−26·8	½	−16·3	½	.....	....	−31·5	½	− 1·2	½
4471·676	−27·3	½	−27·2	½	−42·1	½	−16·1	½	−34·7	½	−21·0	½	− 1·2	½
Weighted mean	− 23·56		− 15·48		− 30·10		− 14·76		− 26·10		− 26·94		+ 8·08	
V_a	+ 9·83		+ 9·50		+ 9·17		+ 7·86		+ 6·53		+ 5·18		+ 4·80	
V_d	0·00		− 0·03		+ 0·15		− 0·08		+ 0·05		+ 0·18		+ 0·03	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 14·0		− 6·3		− 21·1		− 7·3		− 19·8		− 21·9		+ 12·6	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	6349*		6356		6369		6409		6409*		6426		6439	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	−11·6	½	− 8·4	½	+ 1·2	½	− 9·2	½	−24·3	½	− 1·3	½	.....	....
3964·875	.....	....	.....	....	.....	....	.....	....	.....	....	+13·9	¼	.....	....
4026·352	0·0	½	−27·7	½	+ 0·9	½	− 9·5	¼	− 4·3	½	− 3·5	¼	−23·4	½
4101·890	+11·1	¼	−19·5	½	.....	....	.....	....	.....	....	.....	....	.....	....
4143·928	+17·3	½	−13·5	½	− 1·9	¼	− 5·8	½	− 2·0	½	+10·6	½	−17·7	½
4267·301	.....	....	.....	....	.....	....	− 8·5	¼	− 9·6	¼	.....	....	.....	....
4340·634	+12·4	½	.....	....	0·0	½	−10·1	1	− 5·6	½	.....	....	−28·1	1
4388·100	− 4·6	½	−32·7	½	−17·5	½	− 5·8	½	− 4·6	½	+ 7·3	½	.....	....
4471·676	+ 2·5	¼	−14·8	½	− 6·1	½	− 3·7	½	+ 6·1	½	−12·4	½	−19·8	½
4552·750	+20·0	¼	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
Weighted mean	+ 4·65		− 19·43		− 4·09		− 7·67		− 6·07		+ 2·92		− 23·42	
V_a	+ 4·80		+ 4·07		+ 3·01		+ 0·85		+ 0·85		− 0·99		− 2·08	
V_d	+ 0·03		− 0·06		+ 0·02		+ 0·02		+ 0·02		− 0·02		− 0·03	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 9·2		− 15·7		− 1·3		− 7·1		− 5·5		+ 1·6		− 25·8	

*Remeasure.

MEASURES OF 12 LACERTÆ—*Continued.*

λ	6454		6479		6479*		6497		6504		6512		6521	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	+ 2·0	½	.....	....	.....	....	+ 8·7	¼	+12·3	½	.....	....	+25·0	½
3964·875	.....	....	−26·2	½	−27·0	½	.....	....	.....	....	.....	....	.....	....
4026·352	+13·0	½	.....	....	.....	....	+20·8	½	+ 7·8	½	−16·5	½	+ 4·3	½
4101·890	.....	....	.....	....	.....	....	.....	....	+29·7	¼	.....	....	+ 3·8	½
4143·928	+ 1·9	½	.....	....	.....	....	+ 2·9	½	+22·1	¼	−21·2	½	+10·5	½
4267·301	+ 9·5	½	.....	....	.....	....	+16·0	¼	+11·7	¼	.....	....	.....	....
4340·634	+ 7·8	½	−19·1	½	−23·6	½	+ 7·9	½	+13·5	½	−10·1	½	+16·9	1
4388·100	+16·2	½	−26·8	½	−29·1	½	0·0	½	+13·3	½	−25·6	½	+ 7·0	½
4471·676	+ 1·2	½	−34·7	½	−34·6	½	+ 9·8	1	+19·9	½	−26·0	½	+14·8	½
4552·750	.....	....	.....	....	.....	....	+25·3	½	.....	....	.....	....	.....	....
Weighted mean	+ 7·37		− 25·50		− 28·58		+ 11·09		+ 15·16		− 19·88		+ 12·40	
V_a	− 3·16		− 4·36		− 4·26		− 7·46		− 7·81		− 10·19		− 10·55	
V_d	+ 0·04		− 0·02		− 0·02		− 0·02		− 0·03		− 0·07		− 0·18	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 4·0		− 30·1		− 33·1		+ 3·3		+ 7·0		− 30·4		+ 1·4	

*Remeasure.

MEASURES OF 12 LACERTÆ—*Continued.*

λ	6531		6542		6557		6559		6992		6998		7001	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	− 2·4	½	−14·4	½	+31·1	½	.....	....	−29·1	½	−26·7	¼	−30·0	¼
3964·875	.....	....	.....	....	+19·8	½	.....	....	.....	....	.....	....	.....	....
4026·352	− 7·8	½	−25·2	½	+26·1	½	+34·9	¼	−16·0	¼	−18·7	¼	−56·3	¼
4101·890	.....	....	0·0	½	.....	....	.....	....	.....	....	.....	....	.....	....
4143·928	− 7·7	½	.....	....	+39·7	½	+ 5·8	¼	.....	....	.....	....	.....	....
4267·301	.....	....	−25·5	½	+28·9	¼	+35·3	¼	.....	....	.....	....	.....	....
4340·634	−11·3	½	0·0	½	+21·5	¼	.....	....	−21·4	¼	−29·3	½	−36·0	½
4388·100	−16·3	½	+ 8·1	½	+39·8	½	+12·9	¼	−14·0	½	−39·6	½	−46·6	¼
4471·676	− 5·6	½	−14·9	½	+28·6	½	+38·6	¼	−37·9	½	−30·3	¼	−54·4	½
4481·400	.....	....	.....	....	.....	....	.....	....	−44·3	¼	.....	....	.....	....
4552·750	.....	....	.....	....	+35·0	½	+ 6·5	¼	.....	....	.....	....	.....	....
Weighted mean	− 8·50		− 10·27		+ 30·67		+ 22·33		− 27·08		− 30·54		− 44·82	
V_a	− 11·14		− 13·63		− 17·53		− 17·73		+ 16·50		+ 16·73		+ 16·95	
V_d	.....		− 0·13		− 0·15		− 0·12		+ 0·19		+ 0·20		+ 0·20	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 19·9		− 24·3		+ 12·7		+ 4·2		− 10·7		− 13·9		− 27·9	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	7020		7023		7026		7033		7043		7046		7172	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	−29·1	½	−25·9	¼	−33·0	½	−20·2	¼	−22·3	½	.....	....	.....	....
3964·875	−50·8	½	−16·6	½	.....	....	− 8·2	¼	.....	....	.....	....	.....	....
4026·352	−62·3	½	−13·0	½	−33·0	½	− 3·4	¼	.....	....	.....	....	−69·4	½
4101·890	−30·6	¼	−14·8	¼	−47·3	¼	− 3·7	¼	.....	....	.....	....	.....	....
4143·928	−30·3	½	−17·8	½	−30·8	½	−23·0	¼	−31·2	½	−43·3	½	−35·8	¼
4267·301	−47·9	½	− 1·6	¼	−44·1	¼	.....	....	.....	....	.....	....	.....	....
4340·634	−37·1	½	−28·1	½	−27·0	¼	− 9·0	½	−30·4	½	−38·3	½	−52·9	½
4388·100	−37·3	½	− 7·0	¼	−12·8	¼	+ 6·9	¼	−45·5	½	.....	....	−60·6	½
4471·676	−50·1	½	−24·8	½	−30·3	1	−19·2	½	−41·5	½	−48·9	½	−74·9	¼
4481·400	−58·5	¼	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4552·750	.....	....	.....	....	−21·0	¼	.....	....	.....	....	.....	....	−53·7	¼
Weighted mean	− 43·27		− 17·84		− 31·13		− 10·80		− 34·18		− 43·50		− 59·01	
V_a	+ 19·47		+ 19·25		+ 19·40		+ 19·53		+ 19·78		+ 19·92		+ 9·57	
V_d	+ 0·18		+ 0·18		+ 0·18		+ 0·18		+ 0·20		+ 0·12		− 0·21	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 23·8		+ 1·3		− 11·8		+ 8·6		− 14·5		− 23·6		− 49·9	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	7176		7177		7178		7180		7181		7182		7183	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	−26·1	½	−22·0	½	−23·5	½	.....	....	.....	....	− 5·2	½	− 4·4	½
3964·875	.....	....	.....	....	.....	....	.....	....	.....	....	−12·2	¼	−19·7	½
4026·352	−22·5	¼	−39·0	½	−30·3	½	− 6·1	½	−42·5	¼	− 2·6	¼	−22·5	½
4101·890	−31·5	¼	−40·8	½	−27·8	½	− 7·4	¼	−36·2	½	.....	....	− 6·5	½
4143·928	− 5·8	¼	−38·0	¼	−24·5	½	−24·0	½	−35·6	½	− 4·8	½	−26·0	½
4267·301	.....	....	.....	....	−30·8	½	− 7·4	½	−28·7	¼	− 6·4	¼	−30·8	¼
4340·634	−86·0 +37·0		−64·2	½	−14·6	½	−12·4	½	−25·9	½	− 5·6	½	−23·6	½
4388·100	+ 4·6	½	−51·3	½	−19·8	½	−25·6	¼	−53·6	½	−11·7	½	− 1·2	½
4471·676	0·0	¼	−54·5	½	−30·3	½	−24·1	½	−14·9	½	− 4·0	½	−10·5	1
4481·400	.....	....	−45·5	½	.....	....	−28·6	¼	−23·1	¼	.....	....	.....	....
4552·750	.....	....	−39·2	¼	−13·1	½	.....	....	.....	....	.....	....	− 1·3	¼
4567·950	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	−18·5	¼
Weighted mean	− 12·85		− 44·49		− 23·84		− 16·83		− 32·83		− 6·45		− 14·30	
V_a	+ 9·53		+ 9·32		+ 9·30		+ 9·28		+ 9·26		+ 9·22		+ 9·21	
V_d	− 0·03		+ 0·22		+ 0·21		+ 0·07		0·00		− 0·15		− 0·20	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 3·6		− 35·2		− 14·6		− 7·7		− 23·8		+ 2·3		− 5·6	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	7184		7185		7201		7202		7203		7204		7207	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	.....	....	.....	....	−15·5	½	.....	....	.....	....	.....	....	.....	....
3964·875	.....	....	.....	....	− 0·8	¼	.....	....	.....	....	.....	....	.....	....
4026·352	.....	....	.....	....	− 5·2	½	−33·8	¼	−26·9	½	.....	....	−31·2	½
4101·890	.....	....	.....	....	+12·1	½	−26·9	¼	−30·6	¼	− 5·5	½	.....	....
4143·928	−41·8	½	.....	....	−12·5	½	−36·1	½	−37·0	½	+ 2·4	½	−15·9	½
4267·301	−55·3	½	.....	....	.....	....	.....	....	−37·2	¼	.....	....	.....	....
4340·634	−41·7	¼	−12·4	½	−10·1	½	−23·6	½	−20·3	½	−19·0	½	−11·3	½
4388·100	−33·8	½	− 7·0	½	+ 2·3	½	−30·3	½	−12·8	½	− 3·5	½	−29·2	½
4471·676	−35·3	½	.....	....	+ 4·3	¼	−32·8	½	−17·3	¼	− 9·3	½	−26·0	½
4552·750	−44·6	¼	.....	....	.....	....	.....	....	.....	....	− 9·2	½	.....	....
Weighted mean	− 41·86		− 9·70		− 3·33		− 30·59		− 25·37		− 7·35		− 22·72	
V_a	+ 8·98		+ 8·95		+ 6·98		+ 6·96		+ 6·95		+ 6·93		+ 6·90	
V_d	+ 0·21		+ 0·04		+ 0·15		+ 0·10		+ 0·03		− 0·07		− 0·19	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 32·9		− 1·0		+ 3·5		− 23·8		− 18·7		− 0·8		− 16·3	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	7208		7209		7210		7211		7214		7215		7229	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	.....	....	.....	....	− 6·0	½	− 4·8	½	−27·5	½	.....	....	−11·6	½
3964·875	.....	....	.....	....	− 9·0	½	+ 2·5	½	.....	....	.....	....	.....	....
4026·352	−20·8	½	−17·3	¼	−13·0	½	+ 4·3	¼	−32·1	½	.....	....	− 3·4	½
4101·890	.....	....	−24·1	¼	−28·7	½	− 1·9	½	−47·3	¼	.....	....	− 9·3	½
4143·928	−36·1	¼	−11·5	½	−25·0	½	− 1·4	1	−44·7	½	−45·7	½	− 7·2	½
4267·301	−33·0	¼	− 6·4	¼	−30·3	½	+10·6	½	−39·4	¼	.....	....	.....	....
4340·634	.....	....	− 4·5	¼	−29·3	½	+16·9	1	−25·9	½	−23·6	½	−10·1	½
4388·100	−38·5	1	−23·3	½	−35·0	½	−17·5	½	−59·5	1	−21·0	½	− 5·8	½
4471·676	−34·0	¼	−30·9	½	−18·6	½	+15·5	1	−53·8	1	−40·8	1	− 3·7	½
4481·400	−24·3	¼	.....	....	.....	....	− 2·5	¼	.....	....	.....	....	.....	....
4552·750	.....	....	− 3·9	¼	−25·6	¼	+19·0	½	−47·0	½	−44·6	½	− 7·9	½
4567·950	.....	....	.....	....	−23·8	¼	− 6·0	¼	−37·1	¼	−33·1	¼	.....	....
Weighted mean	− 32·30		− 17·06		− 21·96		+ 5·02		− 44·35		− 35·85		− 7·37	
V_a	+ 6·88		+ 6·67		+ 6·61		+ 6·60		+ 6·56		+ 6·54		+ 4·56	
V_d	− 0·22		+ 0·21		0·00		− 0·08		− 0·19		− 0·22		+ 0·15	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 25·9		− 10·5		− 15·6		+ 11·3		− 38·3		− 29·4		− 2·9	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	7231		7239		7240		7241		7242		7243		7244	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	.....	....	.....	....	.....	....	.....	....	.....	....	−41·8	¼	−28·2	¼
4026·352	.....	....	−26·0	¼	+ 1·7	¼	.....	....	.....	....	−41·6	½	.....	....
4143·928	−20·7	½	−22·6	½	+22·0	½	−13·0	¼	.....	....	−46·7	1	.....	....
4267·301	.....	....	.....	....	+ 5·3	½	−20·3	¼	.....	....	.....	....	.....	....
4340·634	.....	....	−19·1	1	+10·1	½	−16·9	½	−21·2	½	−49·5	1	.....	....
4388·100	−38·5	½	−23·3	½	+25·5	½	− 1·2	¼	−40·8	½	−53·6	½	−30·3	¼
4471·676	−36·5	½	−28·5	½	+15·5	½	−19·2	½	−50·0	½	−43·9	½	−23·5	¼
4552·750	.....	....	.....	....	.....	....	+ 1·3	¼	.....	....	.....	....	−13·1	¼
4567·950	.....	....	.....	....	.....	....	+ 5·2	¼	.....	....	.....	....	.....	....
Weighted mean	− 35·20		− 22·18		+ 15·10		− 11·13		− 37·35		− 46·99		− 23·80	
V_a	+ 4·54		+ 3·14		+ 3·13		+ 3·11		+ 3·09		+ 3·08		+ 3·06	
V_d	+ 0·05		+ 0·18		+ 0·12		+ 0·07		0·00		− 0·07		− 0·12	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 30·9		− 19·1		+ 18·1		− 8·2		− 34·6		− 44·1		− 21·1	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	7249		7250		7251		7252		7256		7266		7268	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	−10·0	¼	.....	....	−29·9	½	.....	....	.....	....	−18·7	½	− 0·8	½
4026·352	+12·1	¼	.....	....	−20·0	¼	−13·0	½	.....	....	−21·7	½	−11·3	¼
4143·928	−17·8	¼	−29·3	½	−37·0	1	− 2·4	½	−40·4	½	−20·7	½	− 1·4	½
4267·301	.....	....	−30·0	¼	−46·8	¼	.....	....	.....	....	−25·5	½	− 9·0	¼
4340·634	− 6·7	½	−36·0	½	−42·8	½	− 5·8	½	−51·7	¼	−33·8	½	− 7·9	½
4388·100	−15·8	½	−44·3	½	−57·1	1	−18·6	½	−41·4	½	−31·5	½	− 4·7	½
4471·676	−14·2	½	−22·3	½	−39·0	1	.....	....	.....	....	−24·1	½	− 5·6	½
4481·400	.....	....	.....	....	−43·0	½	.....	....	.....	....	−27·6	½	− 3·3	¼
4552·750	.....	....	.....	....	−43·8	½	.....	....	.....	....	.....	....	.....	....
4567·950	.....	....	.....	....	−18·5	½	.....	....	.....	....	.....	....	.....	....
Weighted mean	− 7·70		− 32·65		− 39·80		− 9·95		− 43·00		− 25·42		− 4·94	
V_a	+ 2·62		+ 2·61		+ 2·60		+ 2·58		+ 2·20		+ 1·33		+ 1·31	
V_d	+ 0·11		+ 0·04		− 0·03		.....		.....		+ 0·19		+ 0·08	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 5·2		− 30·3		− 37·5		− 7·6		− 41·0		− 24·2		− 3·8	

MEASURES OF 12 LACERTÆ—*Continued.*

λ	7270		7293		7296		7300		7302		7303		7310	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	−12·4	½	−24·3	½	.....	....	− 6·1	½	− 7·2	½	.....	....	− 5·6	½
3964·875	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....	+ 9·0	¼
4026·352	−36·4	½	−25·1	½	− 5·6	¼	−33·0	¼	−13·9	½	.....	....	+ 7·8	½
4101·890	.....	....	.....	....	.....	....	.....	....	−17·6	¼	.....	....	+18·6	¼
4143·928	−23·1	½	−18·7	½	− 7·7	½	−32·0	¼	− 2·4	½	−11·1	½	+10·1	½
4267·301	−40·4	¼	−27·1	½	.....	....	− 8·5	¼	+15·8	½	−12·8	¼	+12·7	¼
4340·634	−21·4	¼	−22·5	½	+ 1·1	½	− 2·3	½	− 1·7	½	−31·5	1	+16·9	½
4388·100	−23·3	¼	−14·0	½	.....	....	−18·7	½	−13·6	½	−29·2	1	+28·0	½
4471·676	−37·1	1	−38·3	½	− 4·9	½	−19·2	1	.....	....	−26·6	1	+14·2	½
4552·750	−17·1	½	−15·8	¼	+12·6	½	−18·3	½	.....	....	−22·3	¼	− 4·5	¼
4567·950	.....	....	+ 2·6	¼	− 1·3	½	.....	....	− 2·0	¼	+ 3·9	¼	.....	....
Weighted mean	− 27·43		− 22·09		− 0·55		− 16·06		− 4·79		− 23·68		+ 11·16	
V_a	+ 1·29		− 1·96		− 1·95		− 2·32		− 2·36		− 2·40		− 2·72	
V_d	− 0·08		+ 0·06		− 0·12		+ 0·12		− 0·06		− 0·18		+ 0·01	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 26·5		− 24·3		− 2·9		− 18·5		− 7·5		− 26·5		+ 8·2	

MEASURES OF 12 LACERTÆ—*Concluded.*

λ	7313													
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
3933·727	−10·4	¼	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4026·352	−55·5	½	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4101·890	−36·2	¼	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4143·928	−26·5	¼	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4340·634	−34·9	½	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4388·100	−33·9	½	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
4471·676	−52·6	½	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
Weighted mean	− 38·80		.....		.....		.....		.....		.....		.....	....
V_c	− 2·75		.....		.....		.....		.....		.....		.....	....
V_d	− 0·13		.....		.....		.....		.....		.....		.....	....
Curv.	− 0·28		.....		.....		.....		.....		.....		.....	....
Radial Velocity	− 42·0		.....		.....		.....		.....		.....		.....	....

The observations were grouped into normal places on the assumption of a period ·193089 day, the initial epoch being taken at Julian Day 2,420,761·0. Each normal place covers one-twelfth the period.

NORMAL PLACES.

	Julian Day.	Phase from T.	Observed Velocity.	Computed Velocity Preliminary.	Computed Velocity Final.	O–C Preliminary.	O–C Final.
1.....	2,420,761·0056	·0487	+ 2·5	+ 4·0	+ 3·2	−1·5	−0·7
2.....	·0283	·0714	+ 2·3	− 0·6	− 1·8	+2·9	+4·1
3.....	·0407	·0838	−10·8	− 6·1	− 7·5	−4·7	−3·3
4.....	·0580	·1011	−16·5	−15·5	−16·9	−1·0	−0·4
5.....	·0726	·1157	−23·9	−22·9	−24·1	−1·0	+0·2
6.....	·0902	·1333	−29·6	−28·8	−29·7	−0·8	+0·1
7.....	·1014	·1445	−29·7	−30·0	−30·7	+0·3	+1·0
8.....	·1195	·1626	−28·0	−27·2	−27·4	−0·8	−0·4
9.....	·1385	·1816	−21·7	−19·2	−19·3	−2·5	−2·4
10.....	·1494	·1925	−11·8	−13·3	−13·4	+1·5	+1·6
11.....	·1647	·0147	− 5·2	− 5·2	− 5·4	−0·0	+0·2
12.....	·1844	·0344	+ 2·0	+ 2·3	+ 1·8	−0·3	+0·2

The following preliminary elements were estimated to be sufficiently close to serve as a basis for correction.

$$P = 0{\cdot}193089 \text{ day}$$
$$e = 0{\cdot}0$$
$$T = \text{Julian Day } 2{,}420{,}761{\cdot}150$$
$$K = 17{\cdot}00 \text{ km.}$$
$$\gamma = -13{\cdot}00 \text{ km.}$$

T is taken as the point where the radial velocity curve cuts the axis of velocity of the system while changing from negative to positive, *i.e.*, at the instant the primary member of the system is nearest the sun. This instant may conveniently be designated *perihelion*.

The observation equations resulting from these initial elements are:—

	x	y	z	$-n$
1	1	+1·000	+ ·014	+1·5
2	1	+ ·730	+ ·684	−2·9
3	1	+ ·403	+ ·915	+4·7
4	1	− ·148	+ ·989	+1·0
5	1	− ·583	+ ·812	+1·0
6	1	− ·931	+ ·366	+0·8
7	1	−1·000	+ ·010	−0·3
8	1	− ·837	− ·546	+0·8
9	1	− ·365	− ·931	+2·5
10	1	− ·019	−1·000	−1·5
11	1	+ ·460	− ·888	0·0
12	1	+ ·900	− ·436	+0·3

Where $x = d\gamma$
$y = dK$
$z = K\mu dT$

These give normal equations,

$$\begin{aligned} 9{\cdot}300x \; -0{\cdot}890y \; +0{\cdot}119z \; +6{\cdot}989 &= 0 \\ +5{\cdot}141y \; +0{\cdot}166z \; -0{\cdot}162 &= 0 \\ +4{\cdot}157z \; +2{\cdot}733 &= 0 \end{aligned}$$

$$\begin{aligned} x &= -0{\cdot}750 \\ y &= -0{\cdot}078 \\ z &= -0{\cdot}633 \end{aligned}$$

$$\begin{aligned} \text{or } d\gamma &= -0{\cdot}75 \text{ km.} \\ dK &= -0{\cdot}08 \text{ km.} \\ dT &= -0{\cdot}0012 \text{ day} \end{aligned}$$

The final elements become,

$$\begin{aligned} P &= 0{\cdot}193089 \text{ day} \\ e &= 0{\cdot}0 \\ T &= \text{Julian Day } 2{,}420{,}761{\cdot}1488 \pm {\cdot}001 \\ K &= 16{\cdot}92 \text{ km.} \pm 0{\cdot}50 \\ \gamma &= -13{\cdot}75 \text{ km.} \pm 0{\cdot}37 \\ a \sin i &= 45{,}000 \text{ km.} \\ \frac{m_1^3 \sin^3 i}{(m+m_1)^2} &= {\cdot}0001 \odot \end{aligned}$$

No attempt was made to determine eccentricity. The residuals which the individual observations give when represented by these elements are tabulated in Table III. They were obtained graphically and though given to a tenth of a kilometre are not in general so accurately determined. The probable error of a single observation is 5·8 km.

It seems to the writer that this is larger than the character of the spectrum would lead one to expect. Part of it may be due to the length of the exposure time, which in 1913 was often one-third and sometimes one-half the period. The 1915 plates on the average were exposed less than one-fourth the period but, even so, the epoch becomes uncertain. The phases were not reduced to the sun which would alter the residuals a little though not much.

There seems to be a peculiar feature indicated by the measures so far made, which may go a long way toward explaining the large probable error. If a high velocity is obtained at positive maximum, the velocity at the following minimum is very low, and *vice versa*; that is the amplitude varies from cycle to cycle.

In figure 1 are plotted the results of some individual nights' observations. The velocities obtained on one night are designated alike, and there seems to be a distinct tendency for the residuals at maximum and minimum to have opposite signs. It would be interesting to take series of plates with an instrument which would permit of a shorter exposure, so that more plates could be obtained covering one revolution.

Dominion Observatory,
Ottawa,
October, 1915.

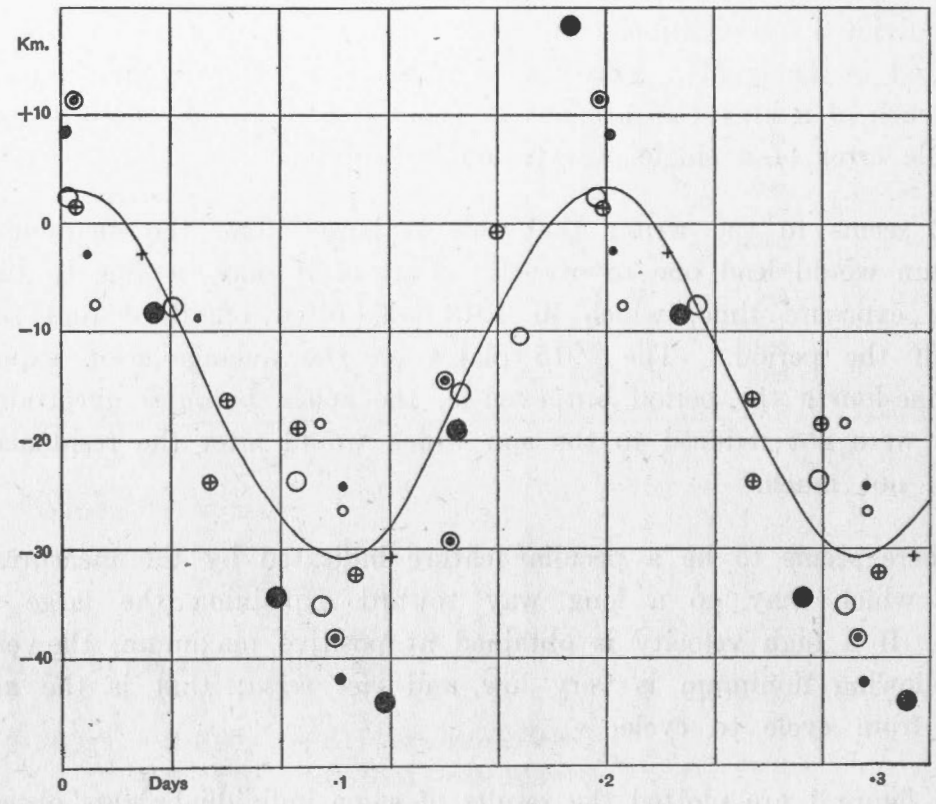
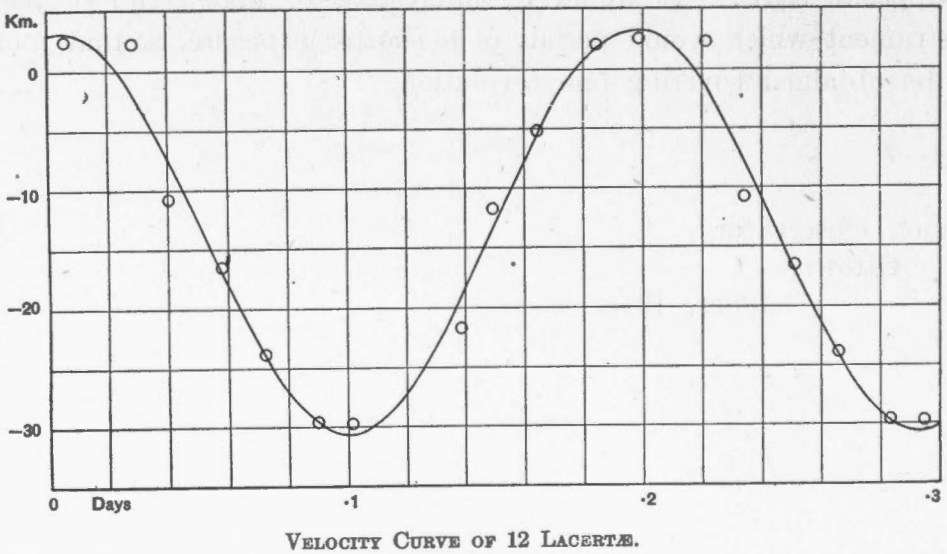
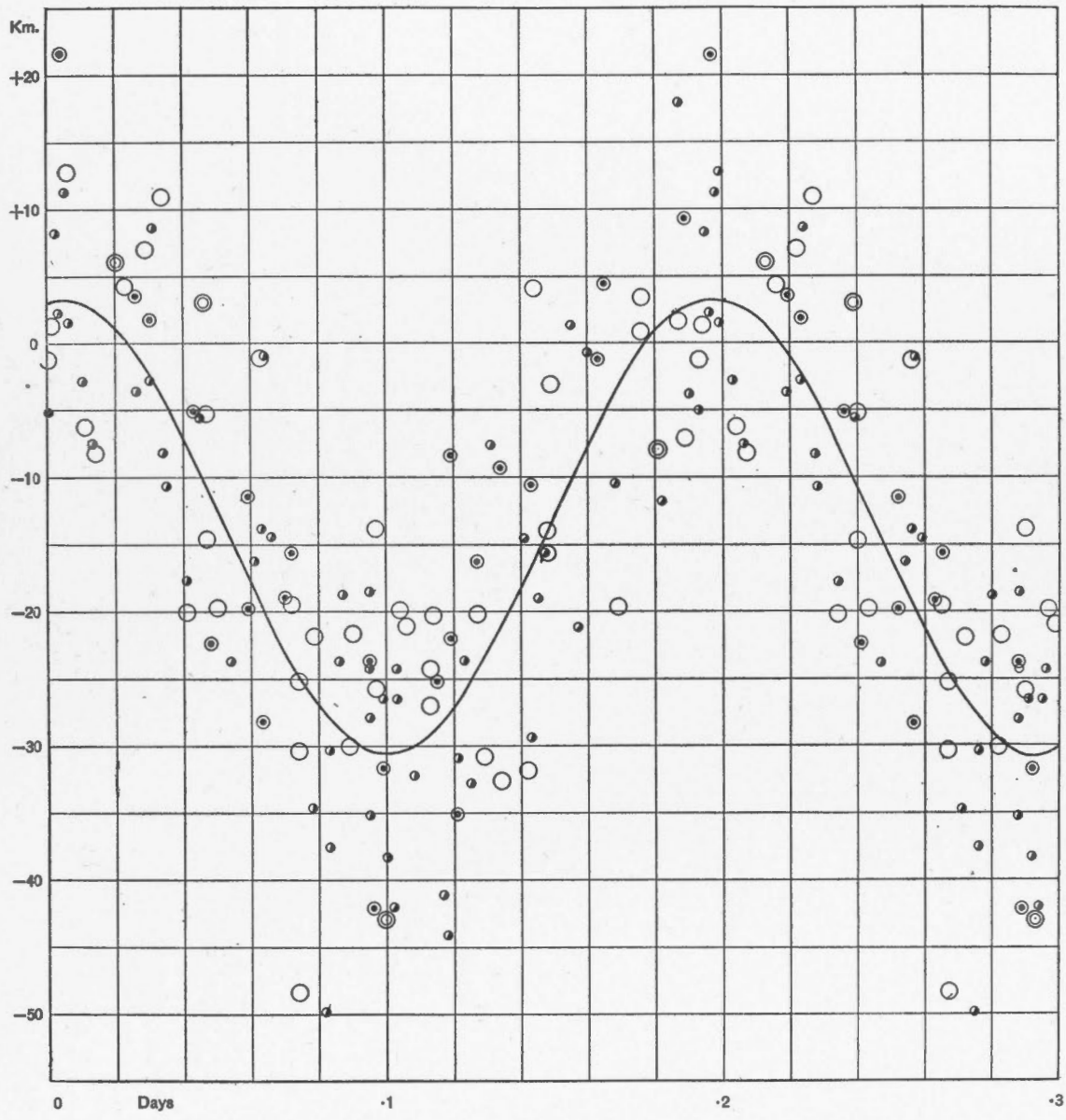


FIGURE I.



VELOCITY CURVE OF 12 LACERTÆ.



OBSERVATIONS OF 12 LACERTÆ.

Mount Wilson observations are represented by two concentric circles.
Ottawa, 1913, " " " two circles, the centre one filled.
Ottawa, 1914, " " " one open circle.
Ottawa, 1915, " " " one half filled circle.