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ORBIT OF THE SPECTROSCOPIC BINARY BOSS 3138

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Boss 3138 ($\alpha=11^h 55^m \cdot 8$, $\delta=-19^\circ 6'$, mag. 5.28, type B3) was announced a spectroscopic binary by Adams from four plates giving a range of 201 km. (*Astrophysical Journal*, Vol. XXXV, p. 176). The lines of the spectrum are very poor, and its declination being far south, it was difficult to secure good plates, and more difficult to secure plates when wanted. The determination of the orbit was based on 31 plates taken in the last two seasons. The period being almost exactly a day and a half had a tendency to bunch the observations at certain points in the orbit. It will be seen by the velocity curve, that the residuals of the normal places are high at points near the zero velocity line. This is due no doubt to the other component, as on several of the plates there was a suggestion of doubling in some of the lines although never distinctly enough seen to make the weaker component measurable. Plate residuals are high, but, considering that on some plates the velocities given by the different lines vary to the extent of as much as 70 km., high residuals are to be expected.

The observations follow; Table I gives Adams' observations, Table II, the Ottawa observations. The residuals are from the final curve.

TABLE I
ADAMS' OBSERVATIONS

Date	Julian Day	Velocity	Residual
1911, Feb. 7-941.....	2,419,075.940	+ 16	+15.0
Mar. 11-851.....	107.851	-116	+ 9.5
Mar. 24-843.....	120.844	+ 85	+ 8.0
April 12-789.....	139.789	- 21	-26.0

TABLE II

OTTAWA OBSERVATIONS

Plate	Observer*	Date	Julian Day	Phase	Weight	Velocity	Residual
		* 1916					
7523	H	Feb. 23-760	2,420,917.760	0.182	3	- 39.8	+32.2
7551	C	Mar. 17-719	940.719	0.595	7	+111.5	+12.5
7565	C	Mar. 22-713	945.713	1.080	8	+ 34.4	+12.4
7572	H	Mar. 23-687	946.687	0.551	4	+ 91.6	+ 4.6
7586	Y	Mar. 30-675	953.675	0.023	6	-124.0	- 1.0
7595	Y	April 2-672	956.672	0.014	9	-109.9	+14.1
7608	C	April 10-656	964.656	0.483	6	+ 80.0	+13.0
7611	C	April 14-658	968.658	1.479	5	-121.9	+ 4.0
7615	P	April 15-708	969.708	1.026	3	+ 58.9	+13.4
7618	P	April 19-680	973.680	0.488	2	+ 40.2	+27.8
7625	Y	May 2-606	986.606	1.390	6	-120.7	- 7.7
7633	H	May 4-608	988.608	0.386	4	+ 30.9	+ 4.9
7643	H	May 8-608	992.608	1.379	4	- 81.0	+29.0
7646	Y	May 9-635	993.635	0.904	1	+136.3	+49.3
7664	H	May 24-574	2,421,008.574	0.812	2	+125.9	+20.9
7677	P	May 31-611	015.611	0.333	3	- 74.0	-74.0
7962	C	Dec. 19-965	217.965	1.276	6	- 61.9	+ 9.1
7965	C	Dec. 25-964	223.964	1.263	6	- 65.1	± 0.0
7966	C	Dec. 28-963	226.963	1.256	2	- 66.1	- 4.1
		1917					
8015	C	Jan. 26-948	255.948	0.179	5	-101.3	-26.3
8028	Y	Feb. 1-823	261.823	0.042	3	- 98.8	+21.2
8093	C-H	Mar. 2-734	290.734	0.395	8	+ 57.1	+27.1
8109	C	Mar. 12-699	300.699	1.341	4	-110.7	-13.7
8132	C	Mar. 30-657	318.657	1.262	5	-107.9	-42.9
8137	C	April 3-688	322.688	0.784	7	+117.3	+ 9.3
8145	C	April 16-611	335.611	0.179	6	- 62.2	+12.8
8150	P	April 21-660	340.660	0.719	4	+ 89.8	-20.4
8153	Y	April 22-639	341.639	0.216	3	- 56.7	+ 0.8
8158	Y	April 24-616	343.616	0.712	7	+ 87.8	-22.4
8169	C	May 17-579	366.579	1.086	6	+ 35.1	+15.1
8171	C	May 18-597	367.597	0.601	3	+ 61.0	-37.0

*P=Plaskett; Y=Young; H=Harper; C=Cannon

MEASURES OF BOSS 3138

λ	7523		7551		7565		7572		7586		7595		7608	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481.400			+118.70	$\frac{1}{2}$										
4471.676	-70.00	$\frac{1}{2}$	+108.20	$\frac{1}{2}$			+60.95	$\frac{1}{2}$	-130.20	$\frac{1}{2}$	-99.10	$\frac{1}{2}$	+68.35	$\frac{1}{2}$
4388.100					+20.49	$\frac{1}{2}$					-124.40	$\frac{1}{2}$	+98.00	$\frac{1}{2}$
4340.634	-40.50	$\frac{1}{2}$	+83.30	$\frac{1}{2}$	+34.83	$\frac{1}{2}$	+85.90	$\frac{1}{2}$	-129.80	$\frac{1}{2}$	-110.60	$\frac{1}{2}$	+68.68	$\frac{1}{2}$
4271.760					+30.72	$\frac{1}{2}$							+117.70	$\frac{1}{2}$
4143.928											-86.00	$\frac{1}{2}$		
4101.890							+146.40	$\frac{1}{2}$	-108.10	$\frac{1}{2}$	-121.30	$\frac{1}{2}$	+80.25	$\frac{1}{2}$
4026.352			+116.10	$\frac{1}{2}$	+38.35	$\frac{1}{2}$	+64.80	$\frac{1}{2}$			-101.30	$\frac{1}{2}$		
Weighted														
mean	-55.25		+106.58		+31.85		+89.51		-122.70		-107.13		+86.60	
V_s	+15.68		+5.23		+2.80		+2.31		-1.09		-2.55		-6.36	
V_d	+ .02		\pm .00		- .01		+ .04		+ .02		+ .02		\pm .00	
Curv.	- .28		- .28		- .28		- .28		- .28		- .28		- .28	
Radial Velocity	-39.8		+111.5		+34.4		+91.6		-124.0		-109.9		+80.0	

MEASURES OF BOSS 3138—Continued

λ	7611		7615		7618		7625		7633		7643		7646	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4471.676	-153.90	$\frac{1}{2}$	+66.55	$\frac{1}{2}$	+81.62	$\frac{1}{2}$	-129.10	$\frac{1}{2}$	+28.82	$\frac{1}{4}$	-74.61	$\frac{1}{4}$	+208.50	$\frac{1}{4}$
4388.100	-92.90	$\frac{1}{2}$	.....	.....	.....	.....	-106.80	$\frac{1}{4}$	.....	.....	.....	.....	.....	.....
4340.634	-112.50	$\frac{1}{2}$	+68.64	$\frac{1}{2}$	+41.78	$\frac{1}{4}$	-59.20	$\frac{1}{4}$	+66.00	$\frac{1}{4}$	-50.30	$\frac{1}{4}$	+101.70	$\frac{1}{4}$
4143.928	.....	.....	.....	.....	+29.90	$\frac{1}{4}$	.....	.....	.....	.....	.....	.....	.....	.....
4101.890	-95.10	$\frac{1}{4}$	.....	.....	.....	.....	-97.90	$\frac{1}{4}$	+49.98	$\frac{1}{4}$	.....	.....	.....	.....
Weighted mean	-113.38		+67.94		+51.10		-104.42		+47.93		-62.45		+155.25	
V_a	-8.23		-8.70		-10.50		-15.95		-16.69		-18.17		-18.54	
V_d	-.04		-.11		-.09		-.02		-.04		-.06		-.11	
Curv.	-.28		-.28		-.28		-.28		-.28		-.28		-.28	
Radial Velocity	-121.9		+58.9		+40.2		-120.7		+30.9		-81.0		+136.3	

MEASURES OF BOSS 3138—Continued

λ	7664		7677		7962		7965		7966		8015		8028	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481·400					- 76·77	$\frac{1}{2}$								
4471·676	+126·40	$\frac{1}{2}$	-42·96	$\frac{1}{2}$	-109·70	$\frac{1}{2}$	-98·00	$\frac{1}{2}$	-112·80	$\frac{1}{2}$	-158·50	$\frac{1}{2}$	-137·20	$\frac{1}{2}$
4338·100			-47·78	$\frac{1}{2}$			-93·00	$\frac{1}{2}$	+ 76·40	$\frac{1}{2}$	-111·60	$\frac{1}{2}$		
4340·634	+195·60	$\frac{1}{2}$			- 50·01	$\frac{1}{2}$	-89·60	$\frac{1}{2}$			-108·90	$\frac{1}{2}$	-106·80	$\frac{1}{2}$
4143·928					-123·90	$\frac{1}{2}$								
4101·890			-61·18	$\frac{1}{2}$										
Weighted														
mean	+149·47		-48·72		-90·10		-93·53		-94·60		-126·33		-122·00	
V_s	- 23·16		-24·83		+28·47		+28·77		+28·79		+ 25·42		+ 23·39	
V_d	- .09		- .15		\pm .00		- .04		- .04		- .14		+ .04	
Curv.	- .28		- .28		- .28		- .28		- .28		- .28		- .28	
Radial Velocity	+125·9		-74·0		-61·9		-65·1		-66·1		-101·3		- 98·8	

MEASURES OF BOSS 3138—Continued

λ	8093		8109		8132		8137		8145		8150		8153	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481.400					-120.70	$\frac{1}{2}$								
4471.676	+31.70	$\frac{1}{2}$	-122.30	$\frac{1}{2}$			+99.42	$\frac{1}{2}$	-59.95	$\frac{1}{2}$	+120.40	$\frac{1}{2}$	-63.45	$\frac{1}{2}$
4388.100	+43.68	$\frac{1}{2}$					+119.60	$\frac{1}{2}$			+89.35	$\frac{1}{2}$	-45.80	$\frac{1}{2}$
4340.634	+52.02	$\frac{1}{2}$	-114.20	$\frac{1}{2}$	-94.22	$\frac{1}{2}$	+127.30	$\frac{1}{2}$	-51.68	$\frac{1}{2}$	+94.62	$\frac{1}{2}$		
4143.928	+45.32	$\frac{1}{2}$			-105.40	$\frac{1}{2}$	+135.70	$\frac{1}{2}$	-70.25	$\frac{1}{2}$			-24.84	$\frac{1}{2}$
3933.825									-31.22	$\frac{1}{2}$				
Weighted														
mean	+44.95		-118.25		-106.74		+120.50		-52.96		+101.46		-44.70	
V_s	+12.38		+7.76		-0.96		-2.92		-9.01		-11.26		-11.69	
V_d	+ .06		+ .07		+ .06		- .04		+ .03		- .09		- .03	
Curv.	- .28		- .28		- .28		- .28		- .28		- .28		- .28	
Radial Velocity	+57.1		-110.7		-107.9		+117.3		-62.2		+89.8		-56.7	

The 31 observations were grouped into nine normal places as follows:—

NORMAL PLACES

No.	Julian Day	Phase	Velocity	Weight	Residual
1.....	2,421,104.371	1.073	+ 38.3	1.0	+12.4
2.....	247.304	1.266	- 75.5	2.0	- 8.2
3.....	078.062	1.373	-106.5	1.4	+ 2.1
4.....	2,420,958.769	0.007	-117.1	2.0	+ 7.7
5.....	2,421,291.348	0.150	- 84.0	1.7	+ 4.5
6.....	091.670	0.244	- 56.8	2.0	-11.8
7.....	100.780	0.429	+ 57.0	1.5	+12.7
8.....	026.750	0.584	+ 95.0	2.0	- 0.2
9.....	287.502	0.756	+104.0	1.4	- 6.2

By using the Mount Wilson observations in conjunction with our own, the period was determined with considerable accuracy, viz., 1.50307 days. The other elements of the orbit were obtained by Dr. King's method. They were:—

$$\begin{aligned}
 K &= 115 \text{ km.} \\
 e &= .05 \\
 \omega &= 195^\circ \\
 T &= \text{J. D. } 2,420,917.601 \\
 \gamma &= -1.45 \text{ km.}
 \end{aligned}$$

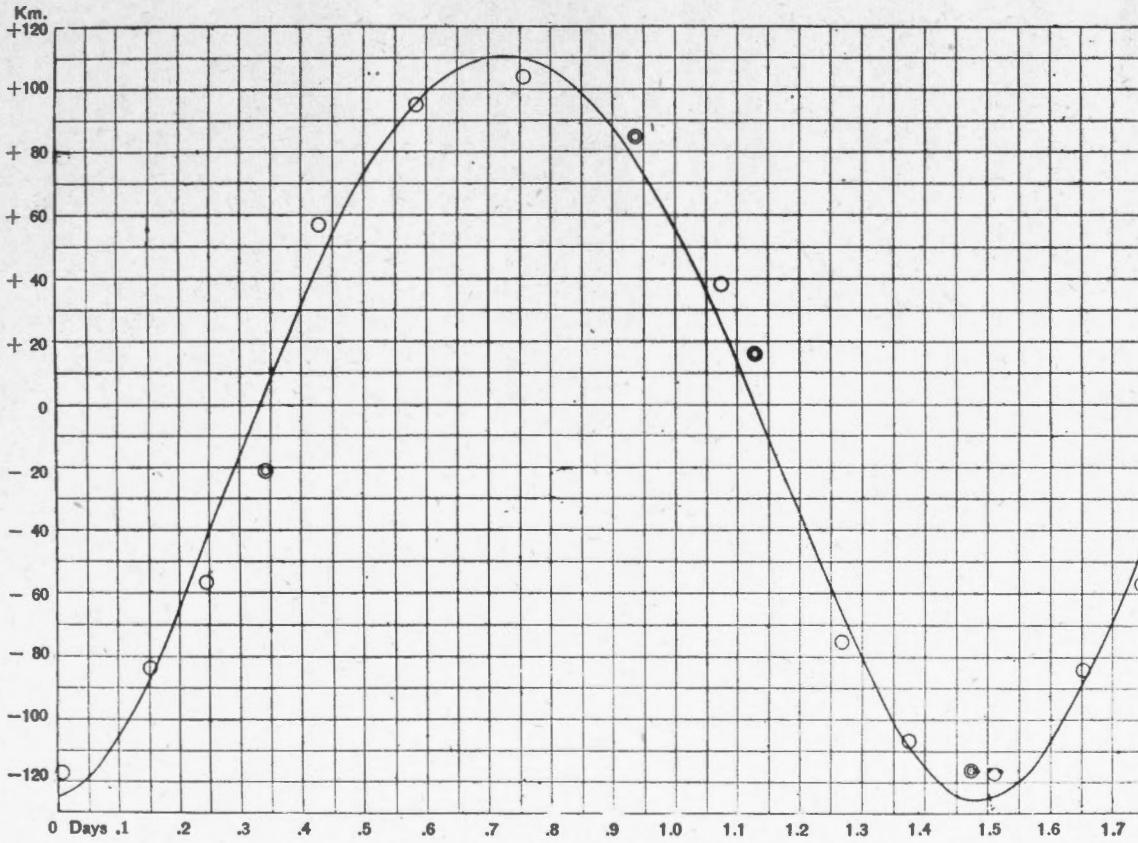
One least-squares solution was carried through, the value of the period being taken as fixed and omitted from the solution. The resulting corrections are small, but the value of Σpvv was reduced about 30 per cent. The corrected values of the elements are given below with the probable errors appended.

$$\begin{aligned}
 K &= 118.19 \text{ km.} & \pm .80 \text{ km.} \\
 e &= .078 & \pm .0082 \\
 \omega &= 185^\circ.08 & \pm 9^\circ.54 \\
 T &= \text{J. D. } 2,420,917.573 & \pm .038 \text{ day} \\
 \gamma &= + 1.70 \text{ km.} & \pm .72 \text{ km.} \\
 P &= 1.50307 \text{ days} \\
 a \sin i &= 2,435,000 \text{ km.} \\
 \frac{m_1^3 \sin^3 i}{(m + m_1)^2} &= 0.25 \odot
 \end{aligned}$$

Probable error of single plate = ± 13 km.

Dominion Observatory
Ottawa

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Radial Velocity Curve of Boss 3138

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ORBITS OF THE SIXTY THREE OPTIC COMPONENTS OF α -CASSIOPEIA

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This star ($\alpha = 0^{\text{h}} 37^{\text{m}} 3.4^{\text{s}}$, $\delta = +46^{\circ} 29'$) was discovered as a spectral double binary by Director Frost of the Dominion Observatory in *Report of Astronomy*, vol. 22, page 19. It is an absolute photographic magnitude of 2 and type B. The six spectra of both components showing

Thirty five quadrants of the orbit have been obtained by the Dominion Observatory with the aid of the Dominion Observatory's spectrograph. The results are given in per centum and the orbits are plotted in the accompanying diagrams.

The star is a double binary of the type known as a "spectroscopic binary". It is a double binary of the type known as a "spectroscopic binary". It is a double binary of the type known as a "spectroscopic binary".