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The Spectroscopic Binary θ^2 Tauri

BY

J. S. PLASKETT, D. Sc.

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THE SPECTROSCOPIC BINARY θ^2 TAURI.

BY J. S. PLASKETT, D.Sc.

The star θ^2 Tauri (α 4^h $22^m \cdot 9$, $\delta + 15° 39'$, magnitude 3·6, spectral type A5) was announced as a spectroscopic binary by Moore in the Lick Observatory Bulletin, No. 62, and by Frost in the Astrophysical Journal XXIX, page 238. Their published velocities with the date, Julian day, phase and residual (the two latter being obtained from the elements finally accepted) are given at the beginning of the table of measures below.

The star was placed under observation here on December 11, 1909, and between that date and March, 1912, 66 plates were obtained. Of these plates, 52 were selected and measured. The measures of the plates were discussed and a preliminary orbit obtained and published in the Journal of the Royal Astronomical Society of Canada VI, page 231, July-August, 1912. A summary of this work will be given later but, as it was felt desirable to have further observations, 16 more plates were obtained and measured making a total of 68 plates on which the present determination is based.

The spectrum is of type A5 containing numerous metallic lines, but unfortunately all these lines are wide and diffuse making the measurements more or less uncertain. This is shown by the poor agreement often present between different lines on the same plate and by the comparatively high probable error ± 3·6 km. per second of a single plate derived from the plate residuals from the final orbit. Four different dispersions were tried in the hope of getting more satisfactory measures with this type of spectrum, but no one showed very marked advantages over the others. This will be discussed more fully later.

The principal lines measured—all those used in the measures—with their chosen wave-lengths and source are given in the accompanying list. The titanium lines seem in general to be the best defined and most reliable in this spectrum.

LINES MEASURED IN θ^2 TAURI.

Wave-length.	Element.	Wave-length.	Element.
4584·018	*Fe*	4455·116	*Blend*
4572·156	*Ti*	4415·293	*Fe*
4563·939	*Ti*	4404·927	*Fe*
4549·766	*Ti-Fe*	4399·935	*Ti-Cr*
4534·139	*Ti*	4395·201	*Ti*
4515·508	*Ti*	4374·520	*Blend*
4508·455	*Ti*	4351·930	*Cr*
4501·448	*Ti*	4340·634	*H*
4494·738	*Fe*	4325·939	*Fe*
4481·400	*Mg*	4315·138	*Fe*
4468·663	*Ti*	4290·377	*Ti*

The summary of the measures of the early plates at the Lick and Yerkes observatories, of the 52 plates used in the first determination, and of the 16 plates obtained subsequently, with other data are given in the accompanying table and this is followed by tables containing the measured values of the individual lines, with the corrections required to reduce the velocities to the sun.

SUMMARY OF MEASURES.

Plate No.	Date	Julian Date	Spectrograph	Phase	Velocity	Residual O-C.	Remarks
Lick Plates—	Dec. 1, 1903....	2,416,450·70	....	139·10	+38	− 2·8	
	Jan. 3, 1905....	6,849·60	....	115·90	+50	+13·9	
	Oct. 4, 1906....	7,488·65	....	51·45	+74	− 7·8	
	Sept. 8, 1908....	8,193·90	....	53·20	+80	+ 0·6	
	Oct. 21, 1908....	8,236·85	....	96·15	+17	−14·8	
	Oct. 25, 1908....	8,240·85	....	100·15	+23	− 9·7	
Yerkes Plate.—	Aug. 31, 1906....	7,454·88	....	17·68	+42	− 5·9	
	Nov. 4, 1907....	884·77	....	25·47	+29	−22·4	
	Aug. 25, 1908....	8,179·94	....	39·24	+64	+ 2·6	
	Sept 8, 1908....	193·95	....	53·25	+88	+ 9·0	Secondary +40
	Sept. 18, 1908....	203·85	....	63·15	+10	−18·7	
	Oct 12, 1908....	227·85	....	87·15	+39	+ 9·9	Secondary +8
	Nov. 8, 1908....	254·78	....	114·08	+36	+ 0·3	
	Dec. 7, 1908....	283·63	....	2·23	+38	− 6·0	
	Dec. 11, 1908....	287·63	....	6·23	+31	−13·0	

SUMMARY OF MEASURES—*Continued.*

Plate No.	Date	Julian Date	Spectrograph	Phase	Velocity	Residual O-C.	Remarks
Ottawa Plates—							
3030	Dec. 11, 1909....	2,418,652·73	III S	89·93	+28·2	− 2·3	
3041	Dec. 16, 1909....	657·74	III S	94·94	+30·9	− 0·6	
3044	Dec. 18, 1909....	659·66	III S	96·86	+34·7	+ 2·7	
3056	Dec. 28, 1909....	669·78	III S	106·98	+34·9	+ 0·8	
3068	Dec. 30, 1909....	671·51	III S	108·71	+22·8	−11·7	
3076	Dec. 30, 1909....	671·65	I	108·85	+22·1	−12·4	
3085	Jan. 7, 1910....	679·52	III S	116·72	+31·4	− 4·8	
3108	Jan. 14, 1910....	686·66	III S	123·86	+29·2	− 8·6	
3116	Jan. 15, 1910....	687·53	III S	124·73	+38·9	+ 0·8	
3133	Jan. 19, 1910....	691·56	III S	128·76	+37·4	− 1·6	
3169	Feb. 3, 1910....	706·70	III S	3·20	+46·0	+ 2·9	
3201	Feb. 21, 1910....	724·55	I	21·05	+42·6	− 5·6	
3208	Feb. 23, 1910....	726·55	I	23·05	+57·0	+ 6·8	
3222	Feb. 24, 1910....	727·56	III S	24·06	+46·7	− 4·0	
3255	Mar. 2, 1910....	733·63	I	30·13	+60·6	+ 6·5	
3268	Mar. 3, 1910....	734·59	III R	31·09	+54·0	− 0·7	
3308	Mar. 10, 1910....	741·61	III R	38·11	+58·6	− 1·6	
3334	Mar. 17, 1910....	748·55	III R	45·05	+71·8	+ 2·5	Pr. +107 Sec. + 43
3623	Sept. 7, 1910....	922·89	I	78·69	+31·9	+ 3·9	
3651	Sept. 14, 1910....	929·86	I	85·66	+37·3	+ 7·7	
3658	Sept. 15, 1910....	930·87	I	86·67	+42·5	+12·8	
3668	Sept. 16, 1910....	931·79	I	87·59	+27·3	− 2·7	
3687	Sept. 21, 1910....	936·88	I	92·68	+36·0	+ 5·0	
3730	Oct. 10, 1910....	955·90	I	111·70	+25·8	− 9·3	
3741	Oct. 12, 1910....	957·88	I	113·68	+37·6	+ 2·0	
3784	Oct. 31, 1910....	976·73	I	132·53	+38·7	− 1·3	
3793	Nov. 2, 1910....	978·82	I	134·62	+37·8	− 2·7	
3802	Nov. 8, 1910....	984·81	I	140·61	+44·3	+ 2·3	
3818	Dec. 5, 1910....	9,011·67	I	26·77	+56·7	+ 4·6	Pr. +112 Sec.+ 11
3843	Dec. 9, 1910....	015·67	I	30·77	+56·2	+ 1·7	Pr. +66 Sec. − 37
3859	Dec. 12, 1910....	018·60	I	33·70	+61·2	+ 4·6	
3871	Dec. 15, 1910....	021·65	I	36·75	+55·1	− 3·9	
3888	Dec. 21, 1910....	027·66	I	42·76	+67·0	+ 1·4	
3916	Jan. 5, 1911....	042·57	I	57·67	+42·7	− 1·4	
3922	Jan. 9, 1911....	046·61	I	61·71	+27·0	− 3·4	
3930	Jan. 12, 1911....	049·61	I	64·71	+32·3	+ 4·6	
3938	Jan. 16, 1911....	053·67	I	68·77	+25·8	− 1·0	
3958	Jan. 18, 1911....	055·59	I	70·69	+28·0	+ 1·0	
3973	Jan. 30, 1911....	067·59	III L	82·69	+35·1	+ 6·1	
4627	Oct. 10, 1911....	320·79	I	54·49	+70·7	− 1·3	
4636	Oct. 12, 1911....	322·86	I	56·56	+62·1	+10·0	
4672	Oct. 28, 1911....	338·75	III L	72·45	+26·9	− 0·2	
4716	Dec. 6, 1911....	377·77	I	111·47	+34·2	− 0·9	
4733	Dec. 19, 1911....	390·82	III L	124·52	+26·7	−11·3	
4739	Dec. 25, 1911....	396·75	I	130·45	+35·4	− 4·1	
4746	Jan. 1, 1912....	403·71	III L	137·41	....	....	Pr. +54 Sec. +2
4760	Jan. 10, 1912....	412·63	III L	5·63	+41·4	− 2·4	
4780	Jan. 12, 1912....	414·67	I	7·67	+45·3	+ 0·9	
4788	Jan. 13, 1912....	415·50	III L	8·50	+39·1	− 5·6	
4792	Jan. 16, 1912....	418·60	I	11·60	+40·7	− 5·0	

SUMMARY OF MEASURES.—*Concluded.*

Plate No.	Date	Julian Date	Spectrograph	Phase	Velocity	Residual O-C.	Remarks
4832	Feb. 10, 1912....	2,419,443·66	I	36·66	+60·9	+ 2·0	
4835	Feb. 12, 1912....	445·65	I	38·65	+58·9	− 1·8	
4880	Mar. 11, 1912....	473·52	I	66·52	+25·8	− 1·4	
5218	Oct 4, 1912....	680·78	I	133·08	+41·6	+ 1·5	
5236	Oct. 7, 1912....	683·79	I	136·09	+48·7	+ 7·8	
5243	Oct. 16, 1912....	692·80	I	4·40	+50·8	+ 7·3	
5244	Oct. 16, 1912....	692·85	I	4·45	+44·4	+ 0·9	
5250	Oct. 17, 1912....	693·82	I	5·42	+41·4	− 2·3	
5251	Oct. 17, 1912....	693·85	I	5·45	+48·0	+ 4·3	
5253	Oct. 20, 1912....	696·64	I	8·24	+45·5	+ 0·9	
5254	Oct. 20, 1912....	696·69	I	8·29	+46·9	+ 2·3	
5259	Oct. 25, 1912....	701·71	I	13·31	+56·7	+10·0	
5260	Oct. 25, 1912....	701·75	I	13·35	+43·9	− 2·8	
5892	Jan. 21, 1914....	20,154·56	I	44·06	+63·4	− 4·6	
5902	Jan. 25, 1914....	158·55	III L	48·05	+74·2	− 0·7	
5903	Jan. 30, 1914....	163·62	III L	53·12	+76·1	− 3·2	
5904	Feb. 2, 1914....	166·53	III L	56·03	+63·2	+ 6·2	
5905	Feb. 4, 1914....	168·50	III L	58·0	+37·6	− 4·4	
5914	Feb. 5, 1914....	169·60	I	59·10	+33·4	− 3·9	

MEASURES OF θ^2 TAURI.

λ	3030		3041		3044		3056		3068		3076		3085	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·018	+ 30·53	½	+ 31·73	½			+ 49·89	½	+ 37·42	1	+ 46·35	2		
4572·156	+ 35·41	1	+ 32·72	1	+ 36·31	¼	+ 49·71	1					+ 51·11	1
4563·939			+ 48·78	½					+ 44·85	1				
4549·766	+ 43·01	¾	+ 35·02	1½	+ 40·33	1½	+ 51·27	½	+ 37·45	½			+ 42·46	1
4534·139			+ 53·88	1	+ 43·58	1			+ 34·92	¼			+ 47·01	½
4481·400	+ 32·94	1	+ 50·21	1½	+ 42·15	1½			+ 37·24	1	+ 40·56	2	+ 59·33	2
4468·663			+ 53·11	¼	+ 54·83	2					+ 54·00	¼		
4395·201											+ 26·70	1	+ 48·26	½
4374·520			+ 47·19	½	+ 48·36	½	+ 51·97	½						
4351·930			+ 24·80	1	+ 38·45	½					+ 30·80	1		
4325·939											+ 29·11	½		
4315·138													+ 41·56	½
Weighted mean	+ 35·47		+ 38·35		+ 45·44		+ 50·51		+ 39·19		+ 38·43		+ 51·03	
V_a	− 6·87		− 9·50		− 10·48		− 15·06		− 15·97		− 16·03		− 19·38	
V_d	− 0·09		− 0·13		− 0·02		− 0·26		− 0·18		− 0·05		+ 0·08	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 28·2		+ 28·4		+ 34·7		+ 34·9		+ 22·8		+ 22·1		+ 31·4	

MEASURES OF θ^2 TAURI—*Continued.*

λ	3108		3118		3133		3169		3201		3208		3222	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·018	+ 43·34	¼	....	....	+ 35·76	½	+ 66·47	½	+ 61·36	1	....	....	+ 61·49	½
4572·156	+ 40·98	1	+ 49·55	1½	+ 52·67	1	+ 86·48	1	+ 96·96	½	+ 78·34	¼	....	....
4563·939	....	....	....	....	+ 78·58	½	+ 73·18	½	+ 90·89	½	....	....	....	....
4549·766	+ 59·32	1	+ 61·98	1	+ 48·31	1	+ 75·29	1½	+ 60·65	1	+ 67·37	1	+ 88·19	1
4534·139	+ 51·04	1	+ 66·26	1	+ 66·41	1½	+ 72·31	1	+ 78·42	1	....	....	+ 73·43	1½
4508·455	....	....	....	....	....	....	....	....	+ 70·53	1	+ 97·17	½	....	....
4494·738	....	....	+ 55·07	½	....	....	....	....	+ 72·23	1	....	....	....	....
4481·400	+ 60·73	1½	+ 63·19	1½	+ 64·59	2	+ 73·01	1½	+ 57·16	1½	+ 92·25	2	+ 82·12	1
4468·663	....	....	+ 77·62	½	+ 68·65	½	....	....	+ 86·33	1	....	....	....	....
4395·201	+ 49·53	½	....	....	+ 52·68	½	....	....	+ 76·51	½	+ 82·41	1	+ 76·62	½
4340·634	....	....	....	....	+ 72·26	½	+ 62·51	½	+ 71·16	1½	+ 80·41	½	+ 77·57	½
4325·939	+ 44·21	½	....	....	....	....	....	....	+ 65·38	1	....	....	+ 74·10	½
4290·377	+ 49·00	1	+ 60·38	1	+ 76·78	½	....	....	+ 81·35	1½	+ 75·00	½	....	....
Weighted mean	+ 51·72		+ 60·58		+ 61·44		+ 74·40		+ 72·24		+ 87·60		+ 77·36	
V_a	− 22·09		− 22·40		− 23·74		− 27·70		− 29·89		− 29·87		− 29·88	
V_d	− 0·14		− 0·03		+ 0·01		− 0·27		− 0·14		− 0·14		− 0·14	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 29·2		+ 38·9		+ 37·4		+ 46·2		+ 42·9		+ 57·3		+ 47·0	

MEASURES OF θ_2 TAURI—*Continued*

λ	3255		3268		3308		3334		3623		3651		3658	
	Vel.	Wt	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·018	…		…		+ 87·86	½	…		…		…		…	
4572·156	…		…		+ 87·26	½	+109·32	½	+ 7·04	½	+ 1·62	½	…	
4563·939	+114·28	½	+105·18	1	+ 73·94	½	+ 92·34	½	…		…		…	
4549·766	+ 90·71	½	+ 66·55	½	+ 85·63	1	+ 96·19	1½	− 21·34	½	− 1·33	½	+ 25·35	½
4534·139	+ 98·28	½	…		+ 95·35	½	…		…		…		…	
4515·508	…		+ 60·55	½	…		…		…		…		…	
4481·400	+ 86·51	1	+ 71·46	½	+ 89·06	1½	+ 98·48	1	+ 18·88	1	+ 13·78	1	+ 9·70	1
4468·663	…		+ 95·03	½	+103·75	½	…		…		+ 13·68	1	…	
4395·201	+108·27	½	…		+ 95·21	1	…		+ 10·35	1	− 4·09	½	+ 20·47	½
4351·930	+ 85·66	½	+ 75·19	½	+ 92·86	½	+110·56	½	…		…		…	
4340·634	+ 84·46	1	…		+ 80·80	½	…		− 9·83	1	+ 21·98	½	+ 20·25	½
4325·939	+ 81·93	½	+ 94·50	½	+ 84·85	½	…		…		…		…	
4290·377	+ 79·04	½	…		+ 76·60	½	+105·91	1	…		…		+ 4·79	½
Weighted mean	+ 91·22		+ 84·50		+ 88·56		+100·70		+ 3·06		+ 9·14		+ 14·55	
V_a	− 29·78		− 29·73		− 29·13		− 28·12		+ 29·03		+ 28·33		+ 28·19	
V_d	− 0·28		− 0·21		− 0·28		− 0·21		+ 0·08		+ 0·08		+ 0·06	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		0·28		− 0·28	
Radial Velocity	+ 60·9		+ 55·3		+ 58·8		+ 72·1		+ 31·9		+ 37·3		+ 42·5	

MEASURES OF θ^2 TAURI—*Continued.*

λ	3668		3687		3730		3741		3784		3793		3802	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·018	− 0·68	½	− 17·44	½	− 7·90	1	− 7·22	½	+ 32·98	1			+ 19·35	½
4572·156	− 4·87	½			+ 11·91	1			+ 22·32	1	+ 20·57	½	+ 15·15	½
4563·939			+ 20·59	½					+ 29·48	½	+ 42·93	½		
4549·766	+ 5·33	½	+ 10·68	1	+ 1·33	2	+ 26·68	1	+ 16·01	1½	+ 20·67	1½	+ 22·68	1½
4534·139	− 22·97	½	− 10·04	1	+ 8·45	1			+ 49·64	½	+ 30·90	½	+ 40·14	½
4515·508													+ 30·26	½
4508·455									+ 10·01	1			+ 48·50	½
4501·448									+ 28·17	1			+ 33·34	1
4481·400	+ 13·47	1	+ 27·32	2	+ 1·03	2	+ 26·04	1½	+ 36·31	1	+ 24·76	2	+ 50·42	2
4468·663					+ 4·68	1	+ 19·86	½						
4404·927	+ 8·83	1	+ 2·78	½					+ 14·88	½				
4399·935	− 18·48	1												
4395·201			+ 2·29	1	+ 5·52	½	+ 12·14	½			+ 24·78	½	+ 29·58	1
4374·520			+ 12·95	½										
4351·930	− 5·37	1			+ 2·81	1	+ 16·00	1			+ 30·20	½	+ 38·95	½
4340·634	+ 14·11	1½	+ 0·58	½	+ 24·87	½	+ 18·52	1			+ 28·93	½	+ 33·55	½
4325·939	− 12·48	1					− 12·15	½			+ 12·27	½		
Weighted mean	− 0·72		+ 9·04		+ 3·99		+ 16·40		+ 25·10		+ 25·11		+ 34·52	
V_a	+ 28·06		+ 27·21		+ 22·24		+ 21·56		+ 13·97		+ 13·02		+ 10·17	
V_d	+ 0·20		+ 0·04		− 0·13		− 0·08		− 0·13		− 0·08		− 0·10	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 27·3		+ 36·0		+ 25·8		+ 37·6		+ 38·7		+ 37·8		+ 44·3	

MEASURES OF θ_2 TAURI—*Continued.*

λ	3818		3843		3859		3871		3888		3916		3922	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·018	....	....	+ 71·83	1	....	....	+ 48·66	½	+ 52·06	½	+ 51·66	1	+ 34·35	½
4572·156	....	....	+ 67·24	1	....	....	+ 46·27	½	+ 69·27	½	+ 64·67	1½	+ 29·36	1
4563·939	+ 89·37	½	+ 38·90	½	+ 53·03	1	+ 79·95	½	− 72·55	½	+ 71·34	½	....	....
4549·766	+ 50·69	1	+ 61·36	1½	+ 70·03	1	+ 67·37	1½	+ 69·37	1	+ 57·50	1½	+ 38·55	1
4534·139	+ 62·62	½	+ 69·88	1	+ 81·37	1	....	....	+100·92	½	+ 74·50	½	+ 48·08	1½
4501·448	....	....	+ 55·99	1	....	....	....	....	....	....	+ 55·08	1	+ 59·87	½
4481·400	+ 63·54	1½	+ 71·20	2	+ 69·92	1½	+ 67·37	1½	+ 90·34	1	+ 58·44	1½	+ 53·97	1½
4468·663	....	....	....	....	+ 84·38	½	....	....	+100·82	1	+ 80·58	1	....	....
4404·927	+ 46·27	½	+ 64·55	1	+ 42·14	1	+ 61·82	1	....	....	+ 50·01	1	+ 52·44	½
4399·935	....	....	....	....	....	....	....	....	....	....	....	....	+ 33·80	½
4395·201	....	....	+ 53·65	1	+ 86·13	1	+ 57·38	1	+ 62·20	1	+ 62·28	1	+ 44·03	½
4351·930	+ 54·73	½	....	....	....	....	+ 67·22	1	+ 77·49	½	....	....	+ 55·90	½
4340·634	....	....	+ 56·11	1	....	....	+ 68·84	1	+ 83·88	1	+ 73·05	1	+ 63·63	½
Weighted mean	+ 60·55		+ 62·13		+ 68·54		+ 64·08		+ 79·03		+ 61·43		+ 47·41	
V_a	− 3·62		− 5·69		− 7·20		− 8·74		− 11·72		− 18·48		− 20·11	
V_d	+ 0·04		0·00		+ 0·14		0·00		− 0·04		+ 0·06		− 0·04	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 56·7		+ 56·2		+ 61·2		+ 55·1		+ 67·0		+ 42·7		+ 27·0	

MEASURES OF θ^2 TAURI.—*Continued.*

λ	3930		3938		3958		3973		4627		4636		4672	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·018	+ 53·04	½	+ 50·02	½									− 7·73	¼
4572·156			+ 42·21	½	+ 65·21	½	+ 61·27	½	+ 47·63	½	+ 39·89	1	+ 16·82	¼
4563·939	+ 49·89	1	+ 38·23	½										
4549·766			+ 55·36	1	+ 49·36	1½	+ 58·88	1	+ 24·68	½			+ 7·03	½
4534·139	+ 49·41	1	+ 42·80	½	+ 49·41	½			+ 38·84	½	+ 49·41	½	+ 3·22	½
4501·448	+ 66·33	½					+ 48·18	½						
4481·400	+ 46·96	1½	+ 48·87	1½	+ 50·78	2	+ 73·25	1	+ 50·78	1	+ 48·23	1	+ 21·93	1
4468·663	+ 79·32	½									+ 21·19	½		
4404·927			+ 57·28	½	+ 55·46	½								
4399·935			+ 33·80	½	+ 44·06	½								
4395·201	+ 46·07	½	+ 45·23	½	+ 59·67	1					+ 30·32	½		
4351·930	+ 51·23	½	+ 63·48	½	+ 48·31	½			+ 52·98	1½	+ 48·31	½		
4340·634	+ 55·53	½	+ 52·07	1					+ 57·27	2	+ 41·07	1½		
Weighted mean	+ 53·92		+ 48·97		+ 52·35		+ 62·28		+ 48·48		+ 40·79		+ 11·73	
V_a	− 21·25		− 22·70		− 23·99		− 26·75		+ 22·36		+ 21·67		+ 15·42	
V_d	− 0·06		− 0·17		− 0·06		− 0·11		+ 0·10		− 0·03		+ 0·07	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 32·3		+ 25·8		+ 28·0		+ 35·1		+ 70·7		+ 62·1		+ 26·9	

MEASURES OF θ^2 TAURI.—*Continued.*

λ	4716		4733		4739		4760		4780		4788		4792	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·018	+ 8·45	½			+ 30·26	½			+ 44·98	¼			+ 66·38	½
4572·156	+ 21·92	¼	+ 32·92	½			+ 48·61	¼	+ 78·07	½				
4563·939											+ 50·48	¼	+ 72·28	¼
4549·766	+ 35·88	1	+ 40·28	1	+ 45·09	½	+ 57·20	½	+ 58·69	½	+ 56·31	½	+ 61·36	1
4534·139			+ 53·10	¼	+ 41·48	¼	+ 50·88	½	+ 71·86	½	+ 73·09	½	+ 73·05	½
4481·400	+ 53·34	1½	+ 46·51	1	+ 48·49	1½	+ 69·40	½	+ 65·46	½	+ 74·59	¼	+ 76·94	1
4455·116			+ 35·84	¼					+ 73·86	½	+ 58·60	¼		
4415·293			+ 26·48	1	+ 51·36	½	+ 77·91	½			+ 43·21	¼	+ 41·96	½
4395·201	+ 32·12	1												
4351·930	+ 54·73	1			+ 59·98	1			+ 71·65	½			+ 56·48	1
4340·634	+ 37·83	1			+ 59·59	1			+ 69·42	1			+ 73·47	½
4325·939	+ 29·52	1							+ 56·45	½			+ 51·87	½
Weighted mean	+ 38·59		+ 37·99		+ 49·35		+ 62·15		+ 66·88		+ 60·71		+ 63·67	
V_a	− 4·03		− 10·70		− 13·54		− 20·41		− 21·18		− 21·49		− 22·60	
V_d	+ 0·07		− 0·27		− 0·17		− 0·07		− 0·14		+ 0·11		− 0·05	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 34·2		+ 26·7		+ 35·4		+ 41·4		+ 45·3		+ 39·1		+ 40·7	

MEASURES OF θ^2 TAURI.—*Continued.*

λ	4832		4835		4880		5218		5236		5243		5244	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·018	......	......	......	......	......	......	......	......	+ 18·00	½	......	......	......	......
4572·156	......	......	+ 92·74	½	+ 44·92	½	......	......	+ 25·44	½	......	......	......	......
4549·766	+ 80·04	½	+ 83·24	½	+ 52·56	1	+ 5·87	1	+ 12·67	1	+ 26·14	1	+ 18·84	1
4534·139	+ 94·32	¾	+ 86·39	¾	+ 57·33	½	+ 17·04	½	+ 26·01	¾	+ 37·50	½	+ 30·38	½
4481·400	+ 95·44	½	+ 91·69	1	+ 59·72	½	+ 35·49	1	+ 38·68	2	+ 33·45	1½	+ 29·11	2
4468·663	......	......	......	......	......	......	......	......	+ 39·59	1	......	......	......	......
4415·293	......	......	......	......	......	......	......	......	......	......	+ 35·50	½	......	......
4395·201	+102·98	½	+ 78·07	½	+ 53·65	½	+ 23·23	½	......	......	......	......	+ 18·90	¾
4351·930	+ 80·99	1	+ 92·08	1	+ 59·98	1	+ 8·29	½	+ 19·15	¾	+ 27·80	½	+ 24·29	¾
4340·634	+ 94·30	½	+ 89·67	½	+ 56·11	½	+ 19·10	1	+ 23·85	½	+ 27·79	1	+ 23·14	1
Weighted mean	+ 90·16		+ 88·50		+ 55·20		+ 17·72		+ 25·75		+ 30·90		+ 24·63	
V_c	− 28·79		− 29·05		− 28·96		+ 24·06		+ 23·16		+ 20·07		+ 20·06	
V_d	− 0·23		− 0·24		− 0·18		+ 0·12		+ 0·10		+ 0·12		+ 0·04	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 60·9		+ 58·9		+ 25·8		+ 41·6		+ 48·7		+ 50·8		+ 44·4	

MEASURES OF θ^2 TAURI.—*Continued.*

λ	5250		5251		5253		5254		5259		5260		5892	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549·766	+ 32·01	½	+ 24·93	½	+ 32·01	1	+ 20·69	1	+ 31·22	1	+ 19·34	1	+ 92·10	1
4534·939	....	....	+ 46·76	½	+ 34·34	1	+ 19·81	1	+ 39·70	½	+ 30·39	½	+111·00	½
4501·448	+ 8·70	½	+ 13·31	1	+ 20·81	½	+ 44·49	½	+ 41·76	½	....	....	+ 88·84	½
4481·400	+ 30·39	1	+ 43·78	1	+ 36·76	1½	+ 33·43	2	+ 45·69	1	+ 32·93	1½	+ 91·78	1
4404·927	+ 21·30	½	+ 27·13	1	+ 8·84	½	....	....	+ 39·38	½	+ 24·59	½	....	....
4395·201	....	....	....	....	+ 17·33	1	....	....	+ 46·70	1	+ 26·85	½	....	....
4351·930	+ 16·80	½	....	....	+ 32·69	½	....	....	+ 36·53	½	+ 20·90	½	....	....
4340·634	+ 35·30	½	+ 23·72	1	+ 20·25	½	+ 32·76	½	+ 38·79	½	+ 35·30	½	+ 85·38	2
4325·939	....	....	....	....	....	....	....	....	....	....	....	....	+ 79·75	1
Weighted mean	+ 22·13		+ 28·76		+ 27·72		+ 29·20		+ 40·31		+ 27·55		+ 88·20	
V_a	+ 19·68		+ 19·67		+ 17·75		+ 17·74		+ 16·51		+ 16·50		− 24·40	
V_d	− 0·10		− 0·15		+ 0·28		+ 0·21		+ 0·14		+ 0·07		− 0·08	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 41·4		+ 48·0		+ 45·5		+ 46·9		+ 56·7		+ 43·9		+ 63·4	

MEASURES OF θ^2 TAURI.—*Concluded.*

λ	5902		5903		5904		5905		5914					
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·018	+ 82·38	¼	...	...	+ 83·95	¼	+ 68·57	¼	+ 49·38	½	...	...	...	...
4572·156	+ 82·70	¼	...	...	+ 62·84	¼	+ 53·41	¼	...	...	...	...	...	...
4563·939	+102·95	¼	+ 88·72	¼	+104·82	¼	+ 65·30	¼	+ 67·00	½	...	...	...	...
4549·766	+104·55	1	+ 99·00	¼	+ 98·66	½	+ 66·13	½	+ 73·42	½	...	...	...	...
4534·139	...	...	+115·05	¼	...	...	+ 67·82	¼	+ 51·45	½	...	...	...	...
4481·400	+105·90	1	+107·80	½	+ 94·38	½	+ 73·08	¼	+ 64·60	1	...	...	...	...
4468·663	+113·83	½	...	...	...	...	...	...	...	...	...	...	...	...
4340·634	...	...	...	...	...	...	...	...	+ 83·75	½	...	...	...	...
4325·939	+ 64·40	¼	...	...	...	...	...	...	+ 41·22	½	...	...	...	...
Weighted mean	+100·14		+103·67		+ 91·10		+ 65·77		+ 61·93		...		...	
V_a	− 25·53		− 27·04		− 27·47		− 27·85		− 28·05		...		...	
V_d	− 0·14		− 0·21		− 0·14		− 0·04		− 0·18		...		...	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		...		...	
Radial Velocity	+ 74·2		+ 76·1		+ 63·2		+ 37·6		+ 33·4		...		...	

A summary of the previous work on the orbit, which has considerable bearing on this later determination will now be given. It was found necessary to carry through three least-squares solutions of the orbit. In the first one of these, a correction for the period was introduced but when this correction was carried forward to the Lick and Yerkes observations it was found to be quite inapplicable. Consequently the period was determined as closely as possible from a comparison of the early with the Ottawa values and the coefficient for this correction omitted from the later solutions.

The second solution resulted in such a large increase of *K* and consequent rise of the positive maximum velocity above any observed values as again to be inadmissible. This was undoubtedly due to the absence of any Ottawa observations near the peak of the curve, which is of course very sharp when the eccentricity is 0·7. For the third solution, therefore, one Lick observation of +80 km., and one Yerkes of +88 km., taken on the same day, Sept. 8, 1908, very near the maximum, were combined into an additional normal place and incorporated into the observation equations, and the resulting solution was satisfactory. These different solutions are given here:—

Element.	1st Preliminary.	1st Solution.	2nd Preliminary.	2nd Solution.	3rd Preliminary.	3rd Solution (without Lick and Yerkes Observations)	3rd Solution (with Lick and Yerkes Observations)
Period	141·0	141·487	140·50	140·50	140·50	140·50	140·50
e	0·65	0·699	0·65	0·758	0·70	0·772	0·694
K	25·0	26·59	27·0	33·76	32·0	37·99	29·128
ω	45°·0	47°·43	50°·0	39°·09	45°·0	38°·22	48°·57
T	51·0	51·075	56·33	54·876	55·74	55·207	56·12
γ	+41·51	+42·17	+42·72	+43·60	+43·16	+ 43·713	+ 42·90
Max. Vel.	+78·0	+81·34	+81·0	+97·22	+91·0	+104·7	+ 85·40
Min. Vel.	+28·0	+28·16	+27·0	+29·70	+27·0	+ 28·7	+ 27·14

The curious behaviour of these elements in the successive solutions is due to the preliminary elements in each case being not sufficiently close approximations to allow the second order differentials to be neglected, and also to the fact, and this also influenced the choice of the preliminary values, that there were no observations near the peak of the curve while the others were so situated as to abnormally influence the least-squares solutions. However it was not felt desirable, as was done in the 3rd solution, to combine the Ottawa measures with those from other observatories, especially in view of the high residuals given by some of the latter; and it was decided to secure further observations here, around the peak and on the descending branch of the curve, to enable a more accurate period and more consistent and homogeneous elements to be determined. Further, the question of a second spectrum shown by two of the Yerkes and also possibly on some Ottawa plates should, if possible, be settled.

The first series of additional plates in October, 1912, was, through an oversight, unfortunately taken at the wrong time, and it was not until January, 1914, that plates at the proper epoch were obtained. When these measures were combined with the earlier ones, it was at once seen that the previous period of 140·50 days obtained from comparison of the Ottawa and earlier observations was not exact, but that it would have to be increased about 0·2 day. Observations 7 periods apart, at approximately the same place on the very steep descending branch, enabled the period to be determined quite accurately as 140·70 days. With this period all the observations were combined into 18 normal places, each plate being arbitrarily weighted according to its general quality and the number of lines measured. The weighted velocities and phases of these normal places are given in the accompanying table, the initial epoch T_0 being taken as Julian Day 2,418,000.

The number and position of these normal places were so chosen and, at the same time, the extreme range of phase in any one of them was relatively so small, that they satisfactorily represent all the observations. Their weights are submultiples of the sums of the weight of the plates therein, so taken for convenience of the least-squares solutions, that the maximum weight is unity. The residuals are those determined from the final elements.

NORMAL PLACES.

No.	Wt.	Phase	Velocity	Residual O-C.	No.	Wt.	Phase	Velocity	Residual O-C.
1	1	5·37	+ 44·84	+ 1·26	10	½	58·05	+ 37·87	− 4·00
2	¼	12·75	47·10	+ 1·12	11	⅖	64·35	28·76	+ 0·88
3	½	23·24	50·15	− 0·07	12	¼	70·12	26·90	+ 0·01
4	1	34·81	58·20	+ 0·93	13	⅙	80·69	33·50	+ 4·99
5	½	44·15	68·20	+ 0·57	14	⅖	87·20	35·04	+ 5·17
6	⅙	48·05	74·20	− 0·54	15	⅜	94·83	33·87	+ 2·36
7	⅙	53·12	76·10	− 3·33	16	¾	111·28	29·98	− 5·04
8	1/12	54·49	70·70	− 1·07	17	½	125·55	33·63	− 4·58
9	¼	56·26	62·70	+ 7·26	18	½	133·39	40·08	− 0·04

When the normal places were plotted on cross-section paper, preliminary elements suiting the velocity curve fairly well were, with the experience gained in the previous determination, soon obtained by the aid of Dr. King's graphical method.*

*Report of Chief Astronomer 1908, p. 329 and Astrophysical Journal XXVII p. 125.

The values adopted were:

$$
\begin{aligned}
\text{Period} &= 140{\cdot}70 \text{ days}\\
e &= 0{\cdot}7\\
\omega &= 55^\circ\\
K &= 26{\cdot}25 \text{ km.}\\
T &= \text{J. D. } 2{,}418{,}054{\cdot}80\\
\gamma &= +42{\cdot}21 \text{ km.}
\end{aligned}
$$

Observation equations for each of the 18 normal places were formed from these elements by Schlesinger's convenient method.* In these observation equations the numbering begins from the time of periastron instead of from T_0 as in the normal places, or No. 1 here is No. 9 in the normal places.

OBSERVATION EQUATIONS.

No.	Weight	r	κ	π	ϵ	τ	δV
1	$\frac{1}{4}$	1·000	+ ·110	+ ·994	+ ·562	+ ·895	+ 7·06
2	$\frac{1}{2}$	1·000	− ·376	+ ·927	+ ·837	+ ·611	− 4·88
3	$\frac{2}{5}$	1·000	− ·948	+ ·317	+ ·248	+ ·010	+ 1·01
4	$\frac{1}{4}$	1·000	−1·000	− ·010	− ·006	− ·001	+ 0·40
5	$\frac{1}{6}$	1·000	− ·944	− ·330	− ·125	− ·021	+ 5·62
6	$\frac{2}{5}$	1·000	− ·893	− ·451	− ·133	− ·023	+ 5·81
7	$\frac{3}{8}$	1·000	− ·830	− ·558	− ·122	− ·023	+ 3·01
8	$\frac{3}{4}$	1·000	− ·694	− ·720	− ·066	− ·024	− 4·49
9	$\frac{1}{2}$	1·000	− ·570	− ·822	+ ·002	− ·025	− 4·10
10	$\frac{1}{2}$	1·000	− ·496	− ·868	+ ·045	− ·028	+ 0·41
11	1	1·000	− ·361	− ·932	+ ·139	− ·034	+ 1·61
12	$\frac{1}{4}$	1·000	− ·268	− ·963	+ ·195	− ·039	+ 1·42
13	$\frac{1}{2}$	1·000	− ·103	− ·995	+ ·303	− ·052	+ 0·10
14	1	1·000	+ ·168	− ·986	+ ·471	− ·086	+ 1·03
15	$\frac{1}{2}$	1·000	+ ·558	− ·830	+ ·612	− ·160	+ 0·75
16	$\frac{1}{6}$	1·000	+ ·810	− ·586	+ ·526	− ·198	+ 0·13
17	$\frac{1}{6}$	1·000	+ ·925	+ ·379	− ·240	+ ·332	− 1·03
18	$\frac{1}{12}$	1·000	+ ·659	+ ·752	− ·099	+ ·747	+ 0·57

In these observation equations according to Schlesinger's notation,

$$
\begin{aligned}
\Gamma &= \delta\gamma + e\cdot\cos\omega\cdot\delta K + K\cdot\cos\omega\cdot\delta e - K\cdot e\cdot\sin\omega\cdot\delta\omega\\
\kappa &= \delta K\\
\pi &= -K\cdot\delta\omega = -26{\cdot}25\ \delta\omega\\
\epsilon &= -\ K\cdot\frac{2{\cdot}21}{1-e^2}\delta e = -113{\cdot}75\,\delta e\\
\tau &= K\cdot\mu\ \sqrt{\frac{1+e}{1-e}}\cdot\frac{1}{1-e}\cdot\ \delta T = 9{\cdot}302\,\delta T
\end{aligned}
$$

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*Publications Allegheny Observatory I, p. 33

The resulting normal equations are:

$$\begin{array}{rrrrrcr}
7\cdot759\,\mathrm{r} - & 2\cdot356\kappa & - 4\cdot036\pi & + 1\cdot659\,\epsilon & + \cdot316\tau & = & + 2\cdot329 \\
 & + 2\cdot682\kappa & + 1\cdot019\pi & + \cdot094\,\epsilon & - \cdot027\tau & = & - \cdot276 \\
 & & + 5\cdot078\pi & - \cdot480\,\epsilon & + \cdot856\tau & = & - 1\cdot709 \\
 & & & + 1\cdot013\,\epsilon & + \cdot245\tau & = & - \cdot227 \\
 & & & & + \cdot481\tau & = & - \cdot127
\end{array}$$

The solution of these equations gives the following values of the unknowns:

$$\begin{array}{lcrcl}
\kappa = + \cdot8711 & \text{whence} & \delta K & = & + \cdot87 \\
\pi = + \cdot3865 & \text{``} & \delta\omega & = & - \cdot844 \\
\epsilon = - 1\cdot927 & \text{``} & \delta e & = & + \cdot0169 \\
\tau = - \cdot7156 & \text{``} & \delta T & = & - \cdot0769 \\
\mathrm{r} = + 1\cdot207 & \text{``} & \delta\gamma & = & + \cdot381
\end{array}$$

These corrections result in the following values for the elements with the derived values of the probable errors. Σpvv is reduced from 75·04 to 72·87, showing that the preliminary values were very close to the final ones. This is also indicated by the smallness of the differences between the values obtained by substituting in the observation equations and those obtained from the ephemeris from the corrected elements.

FINAL ELEMENTS

Period, $P = 140\cdot70$ days
Eccentricity, $e = 0\cdot717 \pm \cdot022$
Longitude of Apse, $\omega = 54^\circ\cdot16 \pm 4^\circ\cdot35$
Semi-Amplitude, $K = 27\cdot12$ km. ± 1·44 km.
Periastron Passage, $T =$ J. D. 2,418,054·723 ± 0·520 day
Velocity of System, $\gamma = + 42\cdot59$ km.
Maximum Velocity = + 81·10
Minimum Velocity = + 26·86
Projected length semi-axis major, $a \sin i =$ 37,471,000.

The comparatively high values of the probable error of the elements is due principally to the abnormal deviations between phases 70 and 134 from the velocity curve drawn from these elements and shown in full line in the accompanying figure. These deviations, which will be more fully discussed later, make the probable error of a normal place of unit weight and consequently the probable errors of the elements nearly double what they would otherwise be.

From a carefully drawn curve on a large scale, the residuals from the observations were obtained and are given in the last column but one of the table of observations. From these residuals, the probable error of a single Ottawa plate comes out as ±3·6 km. per second. It will be of interest to compare the probable errors for the different dispersions used and these are given herewith.

Spectrograph	Å per mm. at H_γ	No. of Plates	Probable Error Single Plate
I..	33·4	45	3·7
III R.	20·2	3	3·2
III S.	17·6	11	
III L.	10·1	9	3·9

There is very little difference in the accuracy of measurement with the different dispersions, the advantage seeming to lie with the three-prism dispersion and short camera. The advantage of increased linear scale is offset evidently by increased diffuseness of the lines. Considering the character of the spectrum and the presence of some abnormal effect the accuracy may be considered satisfactory.

In the velocity curve drawn from these elements the normal places are represented by circles. It will be seen that, considering the diffuse character of the spectrum lines, the agreement is quite satisfactory excepting between phases 70 and 134 where there is a marked double hump. As the five normal places in this region have on the average four plates each it is evident that this deviation must be considered to have a probable objective existence. It is impossible to give a definite cause for this abnormal effect. As its period is approximately half the main period and as there seems to be a continuance of this effect further along the velocity curve, one apparent explanation would be a secondary disturbance of half the period of the binary. Although such an effect does not admit of any probable physical explanation, it was thought worth while to determine the elements of the orbit on this supposition. Assuming suitable preliminary elements and carrying through a least-squares solution, adding terms for the amplitude and phase of a simple sine curve superposed on the velocity curve, the following elements were obtained.

Periods, 140·70 days and 70·35 days
Eccentricity, $e=0\cdot711$
Longitude of Apse, $\omega=50°\cdot80$
Semi-Amplitude Primary, $K=29\cdot03$ km.
Periastron Passage, $T=$J. D. 2,418,054·641
Velocity of System, $\gamma=+42\cdot63$ km.
Semi-Amplitude Secondary, $K=3\cdot57$ km.
Phase Ascending Node Secondary = J. D. 2,418,067·42
Maximum Velocity Primary 84·71 Combined 81·1
Minimum Velocity Primary 26·65 Combined 27·0.

The compound curve is shown in dotted lines in the figure, and it is quite evident that it does not represent the observations much, if any, more satisfactorily than the simple curve for, while the agreement is better between phases 80 and 130, it is poorer at other parts. The average plate residual is only reduced about 5 per cent. by the introduction of the secondary. One possible explanation of the deviations is the presence of the spectrum of the companion to the principal star and the displacement of the measured velocities towards the γ line by the blend effect of the two spectra. It is difficult to see how such a blend effect can cause deviations of the peculiar character shown here, as the curve goes through a complete cycle below the γ line and exhibits no evidence of blending above this line. Yet Harper's orbit of θ Aquilae*, a binary whose elements are quite similar to those of θ^2 Tauri, shows similar deviations below the γ line though not so strongly marked as here. In the case of θ Aquilae

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*Journal R.A.S.C. III p. 87, Mar–Apr., 1909.

it was later shown that this was probably due to the presence of a second spectrum with the resultant blend effect. The inference is that the second spectrum is present in θ^2 Tauri, but as yet no reasonable evidence to that effect has been secured. On two of the early plates obtained at Yerkes, the second spectrum was measured, and on four obtained here some apparent doubling was observed. The results at Yerkes and the attempted measures here, given in the last column of the table of measures, all bring the secondary spectrum in impossible positions. For example, the secondary velocity in one plate and the primary velocity in the other plate at Yerkes fall within two or three kilometres of the γ line, while the velocities of primary and secondary in every suspected case here are in equally impossible relative positions. Furthermore, later trials on these suspected plates found me unable to repeat my measures and I strongly doubt the reality of the doubling. As previously stated, plates have been especially secured here, with three different dispersions, near the maximum positive velocity when the doubling should be most pronounced but in no case can doubled lines be definitely seen and while there is possibly a second spectrum present the lines are so broad, diffuse, and lacking in contrast, that I doubt whether positive evidence either way can be obtained.

Other reasons may be cited for suspecting abnormal conditions in this star. The large residuals from the orbit of some of the plates obtained at the Lick and Yerkes observatories, the average residual being 8·4 as compared with 4·1 km. at Ottawa, are much greater than can be explained by the poor character of the spectrum or by the choice of different lines with different wave-lengths for measurements. Another reason is to be found in the difference between the velocity of the system obtained here +42·6 km. per second and that obtained from its stream motion +39·2. θ_2 Tauri is of special interest as being one of the moving stream in Taurus described by Prof. Boss.* His computed radial velocity for θ_2 Tauri is 40·5 km. per second, 2·1 km. less than the Ottawa value. His velocity is based on Kustner's determination of the radial motion of three other stars of the group. In a later discussion of the Taurus stream by Wilson†,

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* Astronomical Journal XXVI, p. 31.

† Popular Astronomy XX, p. 359.

in which the computed values are based on the radial velocities of 8 stars of the stream determined by Campbell and hence of much greater weight, the velocity of θ^2 Tauri comes out at 39·2 or 3·4 km. smaller than the Ottawa value.

It seems to me probable, therefore, that the Ottawa value is over 3 km. too high and though it is possible to explain this systematic difference by incorrect identifications or wave-lengths it is more likely due to some cause which may be also operative in producing the curious humps in the curve and causing the early observations to have such unreasonably large residuals.

It is of interest to interpolate here that if Boss's value of the proper motion and of the distance of the convergent be accepted, the value of the parallax of θ^2 Tauri is $0''\cdot023$ equivalent to a light journey of about 140 years.

The similarity between the velocity curve of θ^2 Tauri and that of the Cepheid variable W Sagitarii* is quite marked, the deviations from simple elliptic motion occurring in exactly the same relative positions in the orbits and being of approximately equal relative magnitudes. Moreover, except in the longer period and higher eccentricity, the elements are quite similar and it may be that the abnormal effects are produced by the same causes. Although the variation must be small it is possible that accurate photometric observations might show θ^2 Tauri to be a variable star and it would be of interest to have this tested. Although it is possible that a better orbit would be obtained if a considerable number of additional spectra were secured, the character of the spectrum lines is such as to render this additional work of doubtful value.

Dominion Observatory,
Ottawa,
February, 1915.

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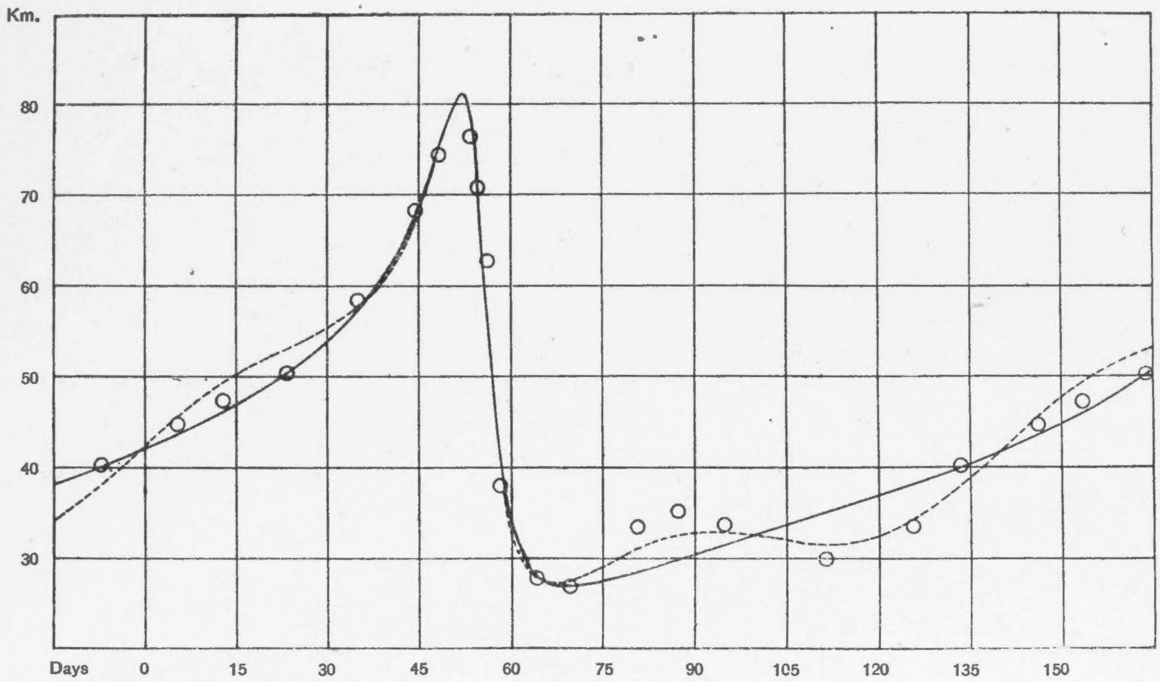
* Astrophysical Journal XX, p. 172.



Velocity Curve of θ^2 Tauri.