Photographic observations and period of RZ Tauri
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COMMUNICATION FROM THE OBSERVATORY AT LEIDEN.

Photographic observations and period of RZ Tauri, by *P. Th. Oosterhoff.*

This star was found to be variable by Miss LEAVITT. The lightvariation is of the W Urs. maj. type, as has been announced by HOFFMEISTER in *A. N.* 4985. The elements adopted by this author are:

J. D. $2420752^{d}\cdot565 + {}^{d}\cdot172067\,E$, but the lightcurve computed with these elements is rather unsymmetrical and also other irregular deviations from an ordinary lightcurve of this type seemed to be present.

In *B. A. N.* 83 SCHILT published an investigation on this star, the apparent period derived in this paper being ${}^{d}\cdot17200165$, but the representation of the observations by this period is not satisfactory and in many cases there are systematic deviations between the observations and the mean lightcurve.

Since during the last two years several stars of the W Urs. maj. type have been observed at this observatory with the special purpose to derive accurate epochs of minimum, I started a series of observations of RZ Tauri in Dec. 1929. From the first plate it appeared that SCHILT's elements did not satisfy the new observations. An investigation of SCHILT's observations learned that these observations can be represented as well by the reciprocal period $4^{d^{-1}}\cdot8115$ as by SCHILT's one viz: $5^{d^{-1}}\cdot81389771$. A larger number of observations has been necessary to decide which period would be the correct one.

The observations were made with the 34-cm. photographic refractor, without grating; the plates are Eastman 40, 16 cm × 16 cm and 9 cm × 12 cm, the time of exposure being $2^{min.}\,30^{sec.}$ with the exception of the plates 1874, 1888, exposure time $3^{min.}\,30^{sec.}$ and plate 1856 exposure time $1^{min.}$, $3^{min.}$ and $9^{min.}$

The comparison stars are:

a .... B. D. + 18°657 ($9^{m}\cdot5$)
b .... B. D. + 18°656 ($9\cdot2$)
c .... $\Delta\delta = +\ 3'\cdot3$ $\Delta\alpha\ \cos\delta = +\ 9'\cdot2$
(relative to the variable)

Usually it was not possible to make all observations of one minimum on the same plate, as was done in the case of AB And., since many of the plates were taken with moonlight.

The plates have been measured in the Schilt microphotometer. The reduction of these measurements to differences of magnitude was made in the following manner suggested by E. HERTZSPRUNG. A number of plates taken for other photometric purposes with a coarse grating placed in front of the objective and measured in the Schilt photometer showed a remarkable resemblance in the relation between galvanometer reading and magnitude. In fact making the galvanometer reading zero when all light is cut off, and say 25 for the fog on the plate, the different curves connecting reading and magnitude proved practically to differ by gradation only. Consequently a normal table was constructed by the aid of which the galvanometer readings could be immediately converted into provisional magnitudes, needing afterwards merely to be multiplied by a certain factor corresponding to the gradation of the plate. This factor can be found from the differences in provisional magnitude between the comparison stars, whenever these differences are known on the ordinary scale of magnitude. For this purpose three plates taken bv H. VAN GENT with a coarse grating in front of the objective have been measured in the Schilt photometer and the following values were deduced for the comparison stars:

$$m_b = m_a + {}^{m}\cdot25$$
$$m_c = m_a + \cdot79$$

The reciprocal gradations are given in Table 2 and it is seen that they may have values considerably different from 1. The mean value and the mean deviation are found to be: ·990 and ± ·226. The dispersion is rather large, but one of the main causes will be the fact that the time of development has been different for several plates. The plates taken with moonlight, which were developed only a short time, have a smaller gradation than the others.

In Table 1 the J. D. of each exposure is given, the phases in the second column have been calculated by the formula:

$$\text{phase} = 4^{d^{-1}}\cdot8115\ (\text{J. D.} - 2420000)$$

This reciprocal period will be discussed below. Δm in the third column gives the difference in magnitude between the variable and the mean of the three comparison stars. Here account is already taken of the gradation factors.

Dr. E. RYBKA, at present in Leiden, has been so kind as to take the plates 1921, 1922 and 1945 during my absence.

TABLE I.

J.D.H.M.T. Gr. — 242 0000	phase	Δ m
plate **1856**		
		m
5966·4259	7·458	—·16
·4276	·466	—·19
·4325	·490	—·11
plate **1867**		
5972·4618	6·500	—·16
·4639	·510	—·05
·4660	·520	—·04
·4680	·530	—·03
·4701	·540	—·03
·4722	·550	+·03
·4743	·560	+·06
·4763	·570	+·04
·4784	·580	+·09
·4805	·590	+·09
·4826	·600	+·09
·4846	·610	+·19
·4867	·620	+·11
·4888	·630	+.09
·4909	·640	+·12
·4930	·650	+·15
·4950	·660	+·17
·4971	·670	+·12
·4992	·680	+·15
·5013	·690	+·11
·5033	·700	+·11
·5054	·710	+·10
·5075	·720	+·05
·5096	·730	+·06
·5117	·740	·00
·5137	·750	+·04
·5158	·760	—·02
·5179	·770	—·03
·5200	·780	—·07
·5220	·790	—·07
·5241	·800	—·11
·5262	·810	—·08
·5283	·820	—·15
·5304	·830	—·18
·5324	·840	—·18
·5345	·850	—·18
·5366	·860	—·22
·5387	·870	—·23
·5407	·880	—·22
·5428	·890	—·26
plate **1874**		
		m
5983·3934	9·097	—·33
·3962	·111	—·35
·3990	·124	—·34
·4017	·137	—·34
·4045	·151	—·36
·4073	·164	—·33
·4100	·177	—·30
·4128	·191	—·34
·4156	·204	—·33
·4184	·218	—·29
·4211	·231	—·35
·4239	·244	—·33

J.D.H.M.T. Gr. — 242 0000	phase	Δ m
		m
5983·4267	9·258	—·34
·4378	·311	—·33
·4405	·324	—·28
·4433	·337	—·28
·4461	·351	—·28
·4488	·364	—·25
·4516	·377	—·25
·4544	·391	—·27
·4571	·404	—·26
·4599	·417	—·18
·4627	·431	—·24
·4655	·444	—·21
plate **1876**		
5995·2625	6.206	—·31
·2646	·216	—·28
·2667	·226	—.36
·2688	·236	—·33
·2709	·246	—·30
·2729	·256	—·26
·2750	·266	—·31
·2771	·276	—·27
plate **1880**		
5996·2909	1·154	—·46
·2930	·164	—·46
·2951	·174	—·43
·2971	·183	—·39
·2992	·194	—·39
·3013	·204	—·40
·3034	·214	—·38
·3054	·223	—·37
·3075	·234	—·39
·3096	·244	—·36
·3117	·254	—·38
·3138	·264	—·36
·3158	·273	—·36
·3179	·284	—·35
·3200	·294	—·34
·3221	·304	—·33
·3241	·313	—·33
·3262	·324	—·29
·3283	·334	—·28
·3304	·344	—·31
·3325	·354	—·26
·3345	·363	—·25
·3366	·374	—·27
·3387	·384	—·22
·3408	·394	—·24
·3428	·403	—·26
·3449	·413	—·23
·3470	·424	—·22
·3491	·434	—·21
·3511	·443	—·19
·3532	·453	—·15
·3553	·464	—·15
·3574	·474	—·15
·3595	·484	—·13
·3615	·493	—·08
·3636	·503	—·09
·3657	·514	—·10

J.D.H.M.T. Gr. — 242 0000	phase	Δ m
		m
5996·3678	1·524	—·05
·3698	·533	—·05
·3719	·543	+·01
·3740	·554	+·02
plate **1884**		
6004·4138	0·237	—·37
·4159	·247	—·39
·4180	·257	—·37
·4201	·267	—·34
·4221	·277	—·33
·4242	·287	—·35
·4263	·297	—·34
·4284	·307	—·33
·4304	·317	—·30
·4325	·327	—·30
·4346	·337	—·27
·4367	·347	—·30
·4388	·357	—·32
·4408	·367	—·31
·4429	·377	—·31
·4450	·387	—·23
·4471	·397	—·28
·4491	·407	—·27
·4512	·417	—·28
·4533	·427	—·17
·4554	·437	—·18
·4574	·447	—·17
·4595	·457	—·17
·4616	·467	—·13
·4637	·477	—·11
·4658	·487	—·12
·4678	·497	—·06
·4699	·507	—·05
·4720	·517	—·06
·4741	·527	—·01
·4761	·537	—·01
·4803	·557	+·04
·4824	·567	+·08
·4845	·577	+·17
·4865	·587	+·13
·4886	·597	+·17
·4907	·607	+·22
·4928	·617	+·15
·4948	·627	+·21
plate **1885**		
6011·2403	3·083	—·31
·2424	·093	—·23
·2445	·103	—·32
·2466	·113	—·27
·2487	·123	—·30
·2507	·133	—·23
plate **1886**		
6011·2577	3·166	—·36
·2597	·176	—·38
·2618	·186	—·39
·2639	·196	—·36
·2660	·266	—·36
·2680	·216	—·38

J.D.H.M.T. Gr. — 242 0000	phase	Δ m
		m
6011·2701	3·226	—·35
·2722	·236	—·34
·2743	·246	—·37
·2763	·256	—·31
·2784	·266	—·32
plate **1887**		
6011·3186	3·459	—·12
·3207	·470	—·16
·3227	·479	—·17
·3248	·489	—·14
·3269	·499	—·15
·3290	·509	—·11
·3311	·520	—·07
·3331	·529	—·03
·3352	·539	—·07
·3373	·549	—·02
·3394	·560	+·03
·3414	·569	+·05
·3435	·579	+·03
·3456	·589	+·10
·3477	·599	+·04
·3498	·610	+·c6
·3518	·619	+·05
·3539	·629	+·07
·3560	·639	+·03
·3581	·649	+·07
·3601	·659	+·07
·3622	·669	+·12
·3643	·679	+·16
·3664	·689	+·17
·3685	·700	+·11
·3705	·709	+·10
·3726	·719	+·10
·3747	·729	+·07
·3768	·739	+·06
·3788	·749	+·04
·3809	·759	—·02
·3830	·769	—·03
·3851	·779	—·08
·3871	·789	—·05
·3892	·799	—·07
·3913	·809	—·10
·3934	·819	—·13
·3955	·829	—·16
·3975	·839	—·20
·3996	·849	—·19
·4017	·859	—·18
·4038	·869	—·22
·4058	·879	—·28
plate **1888**		
6013·4185	3·563	+·07
·4212	·576	+·08
·4240	·590	+·11
·4268	·603	+·14
·4295	·616	+·12
·4323	·630	+·11
·4351	·643	+·11

TABLE 1. (Continued).

J.D.H.M.T. Gr. — 242 0000	phase	Δ *m*
plate **1889**		m
6016·2864	7·362	— ·25
·2884	·372	— ·21
·2905	·382	— ·31
·2926	·392	— ·26
·2947	·402	— ·30
·2967	·412	— ·28
·2988	·422	— ·23
plate **1890**		
6016·3050	7·452	— ·17
·3071	·462	— ·07
·3092	·472	— ·08
·3113	·482	+ ·02
·3134	·492	— ·17
·3154	·502	— ·04
plate **1891**		
6016·3217	7·532	— ·04
·3237	·541	+ ·04
·3258	·552	+ ·03
·3279	·562	+ ·03
·3300	·572	+ ·16
·3321	·582	+ ·07
plate **1892**		
6016·3383	7·612	+ ·19
·3404	·622	+ ·08
·3424	·631	+ ·13
·3445	·642	+ ·10
·3466	·652	+ ·28
·3487	·662	+ ·18
plate **1893**		
6016·3549	7·692	+ ·11
·3570	·702	+ ·20
·3591	·712	+ ·18
·3611	·721	+ ·06
·3632	·732	+ ·03
·3653	·742	— ·03
plate **1894**		
6016·3715	7·771	+ ·01
·3736	·782	+ ·07

J.D.H.M.T. Gr. — 242 0000	phase	Δ *m*
		m
6016·3757	7·792	— ·09
·3778	·802	— ·09
·3798	·811	— ·12
·3819	·822	— ·13
plate **1895**		
6016·3882	7·852	— ·19
·3902	·861	— ·24
·3923	·872	— ·21
·3944	·882	— ·23
plate **1903**		
6017·3410	2·436	— ·19
·3431	·446	— ·20
·3452	·456	— ·14
·3473	·467	— ·21
·3493	·476	— ·08
plate **1904**		
6017·3556	2·506	— ·06
·3576	·516	— ·10
·3597	·526	— ·05
·3618	·536	+ ·01
·3639	·546	+ ·09
plate **1905**		
6017·3701	2·576	+ ·11
·3722	·586	+ ·16
·3743	·596	+ ·19
·3763	·606	+ ·17
·3784	·616	+ ·17
plate **1906**		
6017·3846	2·646	+ ·22
·3867	·656	+ ·20
·3888	·666	+ ·23
·3909	·676	+ ·15
·3930	·686	+ ·22
plate **1907**		
6017·3992	2·716	+ ·14
·4013	·726	+ ·12
·4033	·736	+ ·12
·4054	·746	+ ·05
·4075	·756	+ ·12

J.D.H.M.T. Gr. — 242 0000	phase	Δ *m*
plate **1908**		m
6017·4137	2·786	— ·03
·4158	·796	— ·03
·4179	·806	— ·04
·4200	·816	— ·10
·4220	·826	— ·12
plate **1909**		
6017·4283	2·856	— ·20
·4304	·866	— ·22
·4324	·876	— ·18
·4345	·886	— ·22
·4366	·896	— ·24
plate **1912**		
6018·2434	6·778	— ·03
·2455	·788	— ·03
·2476	·798	— ·09
plate **1913**		
6018·3867	7·468	— ·11
·3888	·478	— ·12
·3909	·488	— ·17
·3930	·498	— ·16
·3950	·508	— ·09
plate **1914**		
6018·4013	7·538	— ·01
·4034	·548	— ·02
·4054	·558	— ·01
·4075	·568	+ ·02
·4096	·578	+ ·07
plate **1916**		
6021·2882	1·428	— ·15
·2903	·438	— ·13
·2924	·448	— ·14
·2945	·458	— ·14
·2965	·468	— ·13
plate **1917**		
6021·3028	1·498	— ·10
·3049	·509	— ·10
·3069	·518	— ·07

J.D.H.M.T. Gr. — 242 0000	phase	Δ *m*
		m
·3090	·528	— ·04
·3111	·538	— ·05
plate **1921**		
6027·3306	0·516	— ·03
·3357	·526	— ·06
·3377	·535	— ·03
·3398	·545	+ ·03
·3419	·556	+ ·07
·3440	·566	+ ·03
·3460	·575	+ ·08
plate **1922**		
6027·3544	0·616	+ ·14
·3564	·625	+ ·11
·3585	·635	+ ·17
·3606	·646	+ ·13
·3627	·656	+ ·14
·3647	·665	+ ·19
·3668	·675	+ ·19
·3689	·685	+ ·15
·3710	·696	+ ·13
·3731	·706	+ ·16
plate **1945**		
6037·3032	8·484	— ·11
·3053	·494	— ·08
·3074	·505	— ·07
·3094	·514	— ·05
·3115	·524	— ·01
·3136	·534	+ ·04
·3157	·544	+ ·03
·3177	·554	+ ·05
·3198	·564	+ ·08
·3219	·574	+ ·08
·3240	·584	+ ·17
·3261	·595	+ ·18
·3281	·604	+ ·22
·3302	·614	+ ·19
·3323	·624	+ ·22
·3344	·634	+ ·26
·3364	·644	+ ·22
·3385	·654	+ ·20

TABLE 2.

plate	number of exposures	reciprocal gradation	plate	number of exposures	reciprocal gradation
1856	3	1·035	1895	4	1·302
1867	40	·660	1903	5	1·029
1874	24	·692	1904	5	·995
1876	8	·684	1905	5	1·110
1880	41	·694	1906	5	1·079
1884	39	·709	1907	5	1·092
1885	6	·884	1908	5	1·109
1886	11	·893	1909	5	·917
1887	43	·803	1912	3	1·028
1888	7	·766	1913	5	·965
1889	7	1·290	1914	5	·962
1890	6	1·204	1916	5	·897
1891	6	1·260	1917	5	1·019
1892	6	1·331	1921	7	·902
1893	6	1·222	1922	10	·805
1894	6	1·597	1945	18	·733

In four cases we can compute an epoch of minimum from observations which cover as well the descending as the ascending branch of the same minimum. This is done in the manner indicated in *B. A. N.* 147, page 179 and *B. A. N.* 166. If only an ascending or descending branch has been observed we may derive other epochs of minimum by comparing graphically this branch with the corresponding branch of the four minima mentioned above. Eight epochs of mimum were derived, which are given in Table 3.

TABLE 3.

J. D. H. M. T. Gr. — 2420000	phase reciprocal period being: $4^{d-1}{\cdot}8115$	deviation from mean value	phase reciprocal period being $5^{d-1}{\cdot}81389771$	deviation from mean value
	p		p′	
* 5972·49268	·649	—·003	·462	+·001
5996·39543	·657	+·005	·430	—·031
6004·49761	·640	—·012	·535	+·074
* 6011·35996	·658	+·006	·432	—·029
* 6016·34539	·646	—·006	·417	—·044
* 6017·38645	·655	+·003	·469	+·008
6027·36473	·665	+·013	·482	+·021
6037·33681	·646	—·006	·459	—·002

Those epochs which are marked with an asterisk have been deduced from observations covering the total minimum. Now it will be seen that the reciprocal period $4^{d-1}{\cdot}8115$ gives a much better representation of the new observations than the reciprocal period of SCHILT, viz. $5^{d-1}{\cdot}81389771$. With both reciprocal periods phases of minimum were calculated, which are given in the second and fourth columns of Table 3, the deviations from the mean value of phase are shown in columns three and five.

The new period is also in good agreement with SCHILT's observations as stated above. Though the dispersion as given in the first column of Table 2 (*B. A. N.* 83) remains unaltered, when calculated with the reciprocal period $4^{d-1}{\cdot}8115$, the new observations prove sufficiently that the new period is correct.

Therefore SCHILT's observations have been treated anew and a mean lightcurve was computed with the reciprocal period $4^{d-1}{\cdot}8115$. SCHILT made his observations with a coarse grating in front of the objective, so that it was sufficient to use only one comparison star. This comparison star was supposed by SCHILT to be variable and corresponding corrections were applied to the observed differences in magnitude. However, as the evidence of variability does not appear convincing to the present writer, these corrections have been disregarded and the original differences in magnitude found by SCHILT used.

The mean epoch deduced from the mean lightcurve by the method explained in *B. A. N.* 147 page 179 is:

J. D. 2424031·93505.

From this old epoch and the epochs marked with an asterisk in Table 3 the period was computed by least squares giving the following elements:

$$\text{J. D. } 2424031^{d}{\cdot}935 + {}^{d}{\cdot}20783532\, E$$
$$\pm{\cdot}002 \pm {\cdot}00000014 \quad \text{m. e.}$$

Using these elements we find the following $(O-C)$'s:

J. D.	epoch	$O-C$
2424031·93505	0	$+{}^{d}{\cdot}00001$
5972·49268	9337	$-\ {\cdot}00072$
6011·35996	9524	$+\ {\cdot}00135$
6016·34539	9548	$-\ {\cdot}00127$
6017·38645	9553	$+\ {\cdot}00062$

The large interval between SCHILT's and my observations gave some difficulty regarding the counting of the number of periods within this interval. Therefore two other solutions of the period were made, the first from SCHILT's observations alone, the second from the eight epochs given in Table 3. The corresponding values of the period and its mean error are:

$${}^{d}{\cdot}207841 \pm {}^{d}{\cdot}000004$$
$${\cdot}207838 \pm {\cdot}000007.$$

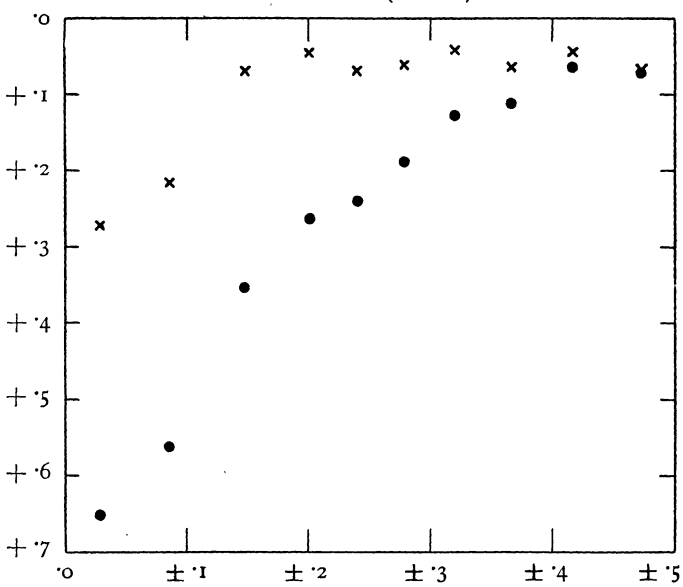
These values make it very probable that the counting of the number of periods as given above is right.

The mean error of a single of SCHILT's observations was found from the differences in magnitude between observations following each other in phase, the result being $\pm{}^{m}{\cdot}099$ and the corresponding total weight of all observations $403/(\pm{\cdot}099)^2 = 41118\ \text{m}^{-2}$. Then the observations were arranged according to phase counted from minimum and divided in groups of 40 or 41 observations each. The mean results are given in the first three columns of Table 4 and are shown by the black dots in Figure 1. In Figures 1 and 2 ordinates are magnitudes, abscissae are phases counted from minimum. The total range of the lightvariation is found to be ${}^{m}{\cdot}60$.

TABLE 4.

number of observations	mean phase	mean magnitude	$\cos^2 \vartheta$	l^2 observed	l^2 computed	$O-C$	"rectified" magnitude
	p	m					m
40	·0288	·652	·992	·3330	·4967	−·1637	·272
40	·0860	·562	·929	·3930	·5286	−·1356	·216
40	·1476	·353	·800	·5776	·5941	−·0165	·070
40	·2013	·264	·651	·6805	·6697	+·0108	·046
40	·2406	·240	·530	·7112	·7311	−·0199	·070
40	·2785	·189	·411	·7813	·7915	−·0102	·062
40	·3200	·128	·287	·8742	·8544	+·0198	·043
41	·3664	·112	·166	·9003	·9158	−·0155	·064
41	·4163	·064	·068	·9836	·9655	+·0181	·045
41	·4726	·072	·007	·9692	·9964	−·0272	·070

FIGURE 1. (SCHILT)



My own observations have been treated in the same way. Phases were calculated by the formula:

$$\text{phase} = 4^{d^{-1}}\cdot 8115\ (\text{J. D.} - 2420000);$$

then the observations were arranged according to phase and divided in groups of 10 and 9 observations each. The mean epoch of minimum derived from this mean lightcurve is:

J. D. 2426005·33098.

A final mean epoch was computed from this epoch and the mean epoch of SCHILT's observations giving them the relative weights 4 and 1.

The best elements are now:

$$\text{J. D. } 2425610^{d}\cdot 6518 + {}^{d}\cdot 20783530\ (E - 7596)$$
$$\pm\cdot 0005 \pm \cdot 00000014 \quad \text{m. e.}$$

The mean error of a single of my observations calculated in the same way as above is $\pm\,{}^{m}\cdot 040$ and the corresponding total weight of all observations accordingly $356/(\pm\,{}^{m}\cdot 040)^2 = 222500\ \text{m}^{-2}$. The observations do not cover the whole lightcurve, between phase ·9 and phase ·1 there is not a single observation. But since the phase of the minimum is ·65, a well determined mean lightcurve could be deduced by arranging the observations according to phase counted from minimum. In this way the lightcurve is sufficiently covered by observations though the part near maximum will have a smaller weight than the remaining part of the lightcurve. This having been done the observations were divided into groups of 30 or 29 observations each. The mean results are given in the first three columns of Table 5 and shown by the black dots in Figure 2. The total range of light-variation is here found to be ${}^{m}\cdot 52$, or about a tenth of a magnitude smaller than the value deduced from Schilt's observations.

In Table 1 the last figure of the number of epochs calculated by the above formula has been indicated in order to distinguish the even and the odd minima. The even minima seem to be deeper than the odd ones by ${}^{m}\cdot 05$, but a larger number of observations will be needed to decide whether this difference is real or not. In this paper it was neglected.

Since this mean lightcurve has a rather large weight, I computed the ellipticity of the stars, following the method given by H. N. RUSSELL. (*Ap. J.* **36**, 60, 1912). The change in brightness caused by the ellipticity is given by the formula:

$$l^2 = 1 - \varepsilon^2 \sin^2 i \cos^2 \vartheta;$$

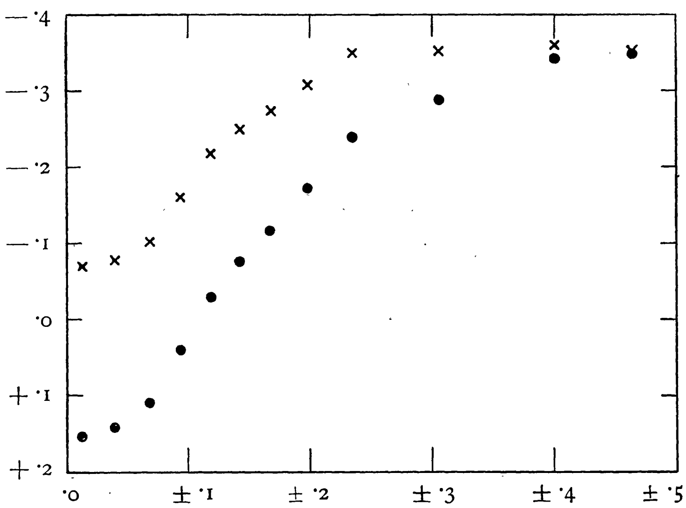
l is the intensity of the light received, the maximum value being unity, ε the eccentricity of the equatorial section of the stars, i the inclination of the orbital plane and ϑ the phase angle counted from minimum.

The value of $\varepsilon^2 \sin^2 i$ has been found by least squares from the four points nearest to maximum, the result being ·3386. Making the solution from the three last points, this value remains practically unaltered. The minimum value of ε is thus found to be ·58, which is about the same as was found by H. VAN GENT in

TABLE 5.

number of observations	mean phase	mean magnitude	$\cos^2 \vartheta$	l^2 observed	l^2 computed	$O-C$	"rectified" magnitude
	p	m					m
30	·0125	+·154	·998	·3937	·6621	—·2684	—·070
30	·0396	+·142	·985	·4025	·6665	—·2640	—·078
30	·0682	+·110	·955	·4270	·6766	—·2496	—·102
30	·0934	+·041	·916	·4848	·6898	—·2050	—·161
30	·1191	—·029	·866	·5516	·7068	—·1552	—·217
30	·1427	—·076	·812	·6015	·7251	—·1236	—·251
30	·1676	—·116	·747	·6474	·7471	—·0997	—·274
30	·1983	—·172	·659	·7178	·7769	—·0591	—·309
29	·2347	—·239	·548	·8121	·8144	—·0023	—·350
29	·3057	—·288	·328	·8888	·8889	—·0001	—·352
29	·4001	—·342	·095	·9818	·9678	+·0140	—·360
29	·4637	—·349	·013	·9945	·9956	—·0011	—·351

FIGURE 2.



the case of V W Cep. Adopting this value a "rectified" lightcurve was computed. This represents the remaining lightvariation after subtracting the change in brightness caused by the ellipticity of the two components from the observed lightcurve. The rectified curve is given in the last column of Table 5 and is shown by the crosses in Figure 2. The range in magnitude of this rectified lightcurve is about ^{m}·30. The same computation was made for SCHILT's mean lightcurve. The value of $\varepsilon^2 \sin^2 i$ was found to be ·5074 corresponding to a minimum value of ε of ·71. A rectified lightcurve was computed with this value, which is given in the last column of Table 4 and shown by the crosses in Figure 1. The difference between the results of Schilt's and of my own observations is rather large. It proves that in order to get a set of re liable elements of such a system, the observed lightcurve must be very accurate.

From the mean lightcurve of my observations I computed also the remaining elements of this system, assuming the two components identical and the orbit circular. The method given by H. N. RUSSELL (*Ap. J.* **35**, 315 and **36**, 54) was used.

Denoting the stars by the indices 1 and 2, the elements are:

fraction of disc eclipsed at minimum	$\alpha_0 = ·483$
value of $\cos^2 \vartheta$ at beginning of eclipse	$\cos^2 \vartheta' = ·407$
eccentricity of equatorial section of stars	$\varepsilon = ·608$
semi-major axis of stars	$a_1 = a_2 = ·426$
semi-minor axis of stars	$b_1 = b_2 = ·338$
lightintensity of stars	$L_1 = L_2 = ·500$
inclination of the orbit plane	$i = 73°·2$
mean density ($\rho_\odot = 1$)	$\rho = ·80$

a and b are given in fractions of the radius of the relative orbit of the two components.

In Table 6 the observed and computed rectified curves are given, Δm being counted in this case from constant light. The agreement is satisfactory, since the largest absolute value of $(O - C)$ is ^{m}·019. No better representation could be expected since no account was taken of reflexion and darkening at the limb.

TABLE 6.

Δm observed	Δm computed	$O-C$
m	m	m
+·282	+·296	—·014
+·274	+·275	—·001
+·250	+·231	+·019
+·191	+·188	+·003
+·135	+·144	—·009
+·101	+·107	—·006
+·078	+·074	+·004
+·043	+·039	+·004
+·002	+·013	—·011
·000	·000	±·000
—·008	·000	—·008
+·001	·000	+·001

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