Provisional ephemerides of three δ Cephei variables of small range (Errata: 10 146)

Hertzsprung, E.

Table 2 contains the minima actually used for both solutions and the corresponding residuals $O-C$.

The difference between the two periods as derived separately from the primary or the secondary minima is about 3 times its mean error. I therefore decided to form mean lightcurves separately for the two years, during which the great majority of the plates were taken. The formula

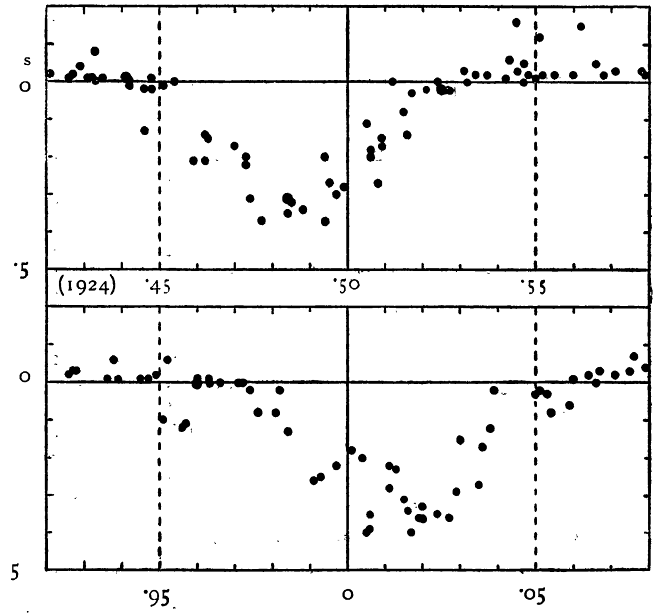
$$\text{phase} = {}^{d-1}{\cdot}41283\ (\text{J. D. hel. M. astr. T. Grw.} - 2420000)\ ^{1})$$

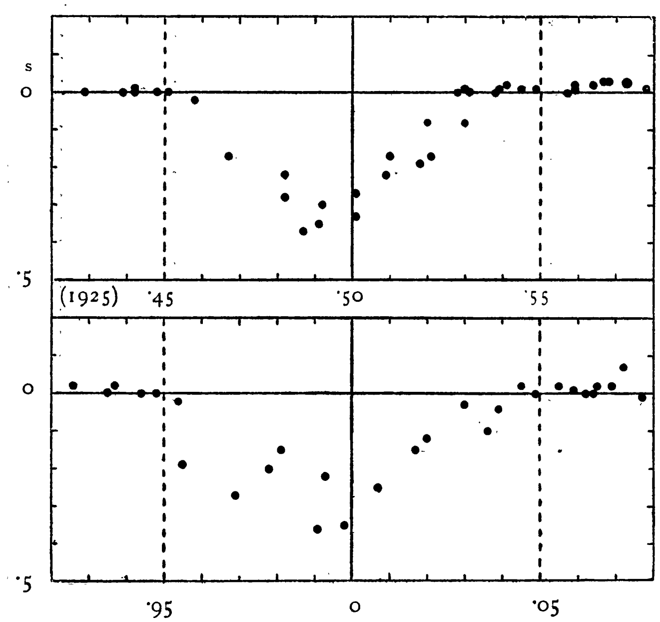
has been used throughout.

The 218 individual estimates made near the primary[2]) minimum between the phases ·42 and ·58 and near the secondary minimum between the phases ·92 and ·08 are given in Table 3[3]) and represented graphically in the diagram separately for the two years 1924 and 1925.

It seems irreconcilable with the observations to assume a separation of exactly half a period between primary and secondary minimum in 1924, but in the following year no shift between the two minima is perceptible, though it should be noted that the material from 1925 is weaker than that from the year before.

At any rate the variable appears to be of more than usual interest and to deserve special attention. If a suitable grating before the objective is used, the single comparison star C. P. D. — 60°2730 is sufficient for accurate photometry.





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[1]) It is only accidental that according to this formula the primary minimum falls at the phase about ·5 and the secondary at about ·o.

[2]) It should be noted that the terms primary and secondary minimum are arbitrary, there being no sensible difference in depth between the two.

[3]) The calculation of the phases has been carried out with one decimal more in the J. D. than given in Table 3.

Provisional ephemerides of three δ Cephei variables of small range,

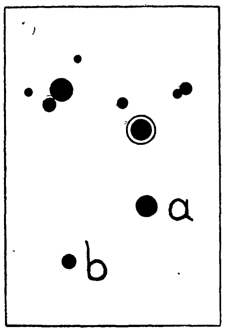
by *Ejnar Hertzsprung*.

In extending our knowledge to new variable stars different policies may be followed. The easiest thing to do is merely to confine one self to the discovery and listing of new variables by expiditious methods. In fact, this has been done to a great extent. Thousands of stars are now known to be variable without further information as to the character of the variation. Many of them have been in this backward position for several years and their number is still increasing.

Before the introduction of photography in astronomy the situation was different. At that time it was necessary to discover the variability of a star, before it could be observed to some extent. Now we know that every star above a certain brightness, known as variable or not, is present on hundreds of old plates, on which it may be examined whenever wanted.

The policy of this observatory is on the other hand not to let the number of discoveries materially surpass what can be more closely examined within a reasonable time, in order to determine at least provisional elements.

The variables, which in the first place come into consideration when plates covering few years only are available, are eclipsing variables and stars of the δ Cep and RR Lyr type. In order to find merely variables of these kinds, pairs of plates are examined in the blinkmicroscope, differing by one or a few days only in time. Care is taken to compare plates of good gradation and as similar to each other in all respects as can be found. In doing so the blinkmicroscope is used to its best advantage and differences of a few tenths of a magnitude may occasionally be detected. This point is of importance, as certain kinds of variables, e.g. those of the eclipsing type, consisting of two nearly equal components, may easily escape discovery, when a less sensitive procedure is used. Among the brighter stars certainly still many variables of small range are waiting for discovery followed by examination and these objects are of special interest, because they are within reach of the spectroscope for determination of their radial velocities. Two of the 3 δ Cep variables, forming the subject of the present note, are of about the 9th and 10th magnitude.



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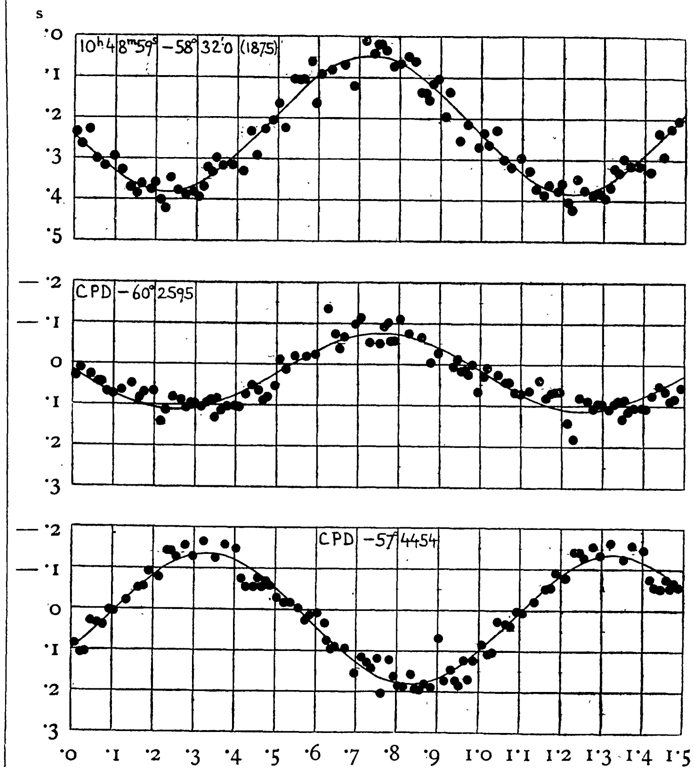

TABLE 1.

	Anonyma	C. P. D. −60°2595	C. P. D. −57°4454
found by	OOSTERHOFF	OOSTERHOFF	VAN GENT
R. A. (1875)	10h 48m 59s	11h 5m 26s	11h 8m 32s
Decl. (1875)	−58° 32′0	−60° 4′5	−57° 13′8
number of plates	610	639	638
period	3d·5782	5d·7277	4d·4313
reciprocal period	·27947 d⁻¹	·17459 d⁻¹	·225667 d⁻¹
range in steps	·333s	·188s	·313s
mean error of one plate	± ·103s	± ·079s	± ·081s
terms of sinusoid	+ ·2145s + ·1645 sin 2πP + ·0255 cos 2πP	+ ·0198s + ·0942 sin 2πP − ·0331 cos 2πP	+ ·2396s − ·1363 sin 2πP + ·0770 cos 2πP
maximum of sinusoid: phase	·7256P	·7556P	·3318P
maximum of sinusoid: mean epoch	2424038d·808	2424036d·632	2424038d·392
maximum of sinusoid: m. e.	± ·020	± ·050	± ·022
approximate magnitude: max.	12m·0	9m·9	8m·8
approximate magnitude: min.	12·6	10·3	9·5

The general data of the 3 variables are given in Table 1.

The comparison stars used for the first star, $10^h 49^m{\cdot}0$, $-58°32'$ (1875), are indicated on the accompanying diagram. The adopted brightnesses in steps are *a* $^s{\cdot}000$ and *b* $^s{\cdot}546$.

For C. P. D. $-60°2595$ the comparison stars used were *a*: C. P. D. $-60°2574$, $^s{\cdot}000$ and *b*: C. P. D. $-60°2590$, $^s{\cdot}30$, while for C. P. D. $-57°4454$ ($9^m{\cdot}1$, Sp. F8) they were *a*: C. P. D. $-56°4351$ ($8^m{\cdot}8$, Sp. K0), ·000 and *b*: C. P. D. $-57°4463$ ($9^m{\cdot}2$, Sp. A0), $^s{\cdot}298$.

In the latter case the difference in magnitude between the two comparison stars was determined by the aid of 6 plates taken with a coarse grating in front of the objective and found to be $^m{\cdot}65$.

The phases have been computed from the formula

phase = reciprocal period (J. D. hel. M. astr. T. Grw. — 2420000).

The observations were then arranged according to phase and divided into groups of 10, or exceptionally 9, estimates each. The mean values of phase and brightness thus obtained are given in the Tables 2, 3 and 4 and represented graphically in the figures. It is seen that all 3 curves are nearly sinusoids. The constants found by least square solutions for these sinusoids are given in Table 1 and the residuals *O—C* in Tables 2, 3 and 4.

TABLE 2. $10^h\,48^m\,59^s - 58°\,32'{\cdot}0$

n	P	s	O—C (s)	n	P	s	O—C (s)
10	·006	·235	—·010	10	·504	·162	—·024
10	·020	·263	+ 4	10	·518	·224	+ 53
10	·037	·227	— 50	10	·540	·104	— 45
10	·054	·300	+ 7	10	·556	·107	— 28
10	·071	·318	+ 10	10	·568	·104	— 20
10	·098	·295	— 36	10	·582	·061	— 51
10	·118	·329	— 16	10	·593	·161	+ 58
10	·136	·370	+ 14	10	·609	·090	— 1
10	·155	·384	+ 19	10	·633	·081	+ 5
10	·166	·361	— 8	10	·662	·069	+ 8
10	·178	·299	— 75	10	·687	·120	+ 67
10	·190	·377	0	10	·719	·009	— 39
10	·200	·359	— 20	10	·737	·040	— 8
10	·212	·402	+ 22	10	·748	·017	— 33
10	·223	·421	+ 40	10	·756	·017	— 34
10	·235	·347	— 35	10	·767	·032	— 22
10	·253	·377	— 1	10	·784	·072	+ 13
10	·273	·389	+ 15	10	·801	·064	— 2
10	·292	·381	+ 14	10	·820	·049	— 28
10	·306	·393	+ 33	10	·839	·060	— 28
10	·317	·368	+ 14	10	·851	·136	+ 38
10	·328	·321	— 26	10	·862	·137	+ 31
10	·337	·332	— 9	10	·871	·154	+ 42
10	·349	·298	— 35	10	·882	·113	— 8
10	·365	·317	— 4	10	·895	·102	— 32
10	·389	·316	+ 16	10	·910	·195	+ 46
10	·415	·330	+ 54	10	·926	·133	— 30
10	·434	·232	— 25	10	·950	·254	+ 66
10	·449	·291	+ 48	10	·968	·213	+ 6
10	·468	·226	+ 4	10	·992	·270	+ 38
10	·486	·203	— 1				

TABLE 3. C. P. D. $60° - 2595$

n	P	s	O—C (s)	n	P	s	O—C (s)
10	·008	·030	+·009	10	·466	·089	+·046
10	·020	·009	— 19	10	·477	·082	+ 45
10	·043	·026	— 16	10	·491	·055	+ 26
10	·061	·044	— 8	10	·510	—·011	— 28
10	·069	·043	— 13	10	·523	·013	+ 3
10	·082	·069	+ 6	10	·542	—·019	— 17
10	·100	·072	— 1	10	·571	—·019	— 1
10	·118	·063	— 17	10	·596	—·022	+ 9
10	·143	·049	— 42	10	·626	—·136	— 91
10	·161	·082	— 16	10	·641	—·071	— 19
10	·172	·070	— 31	10	·654	—·038	+ 18
10	·182	·068	— 36	10	·668	—·065	— 4
10	·195	·067	— 40	10	·692	—·098	— 31
10	·214	·141	+ 30	10	·707	—·112	— 42
10	·230	·182	+ 69	10	·729	—·052	+ 21
10	·242	·080	— 34	10	·754	—·050	+ 24
10	·264	·089	— 25	10	·765	—·091	— 16
10	·277	·108	— 6	10	·774	—·101	— 27
10	·288	·096	— 16	10	·779	—·054	+ 20
10	·300	·096	— 14	10	·790	—·056	+ 16
10	·315	·108	0	10	·801	—·112	— 41
10	·327	·096	— 9	10	·824	—·074	— 8
10	·338	·087	— 15	10	·855	—·066	— 9
10	·347	·131	+ 32	10	·879	—·003	+ 45
10	·354	·086	— 11	10	·895	—·028	+ 13
10	·361	·115	+ 21	10	·931	+·007	+ 30
10	·378	·104	+ 17	10	·943	—·013	+ 3
10	·396	·103	+ 23	10	·952	·017	+ 29
10	·407	·107	+ 33	10	·960	·016	+ 23
10	·420	·074	+ 6	10	·970	·026	+ 27
10	·440	·051	— 7	10	·980	·001	— 3
10	·454	·066	+ 16	9	·992	·069	+ 57

TABLE 4. C. P. D. $-57°\,4454$

n	P	s	O—C (s)	n	P	s	O—C (s)
10	·010	·085	—·008	10	·557	—·002	—·001
10	·020	·108	+ 26	10	·571	·028	+ 15
10	·033	·104	+ 32	10	·585	·016	— 11
10	·048	·029	— 29	10	·604	·009	— 37
10	·065	·035	— 5	10	·620	·033	— 29
10	·078	·039	+ 11	10	·629	·076	+ 6
10	·091	·003	— 12	10	·639	·098	+ 18
10	·105	·007	+ 5	10	·650	·088	— 1
10	·135	—·021	+ 6	10	·672	·094	— 14
10	·162	—·052	— 0	10	·695	·156	+ 30
10	·176	—·055	+ 8	10	·716	·115	— 26
10	·190	—·091	— 17	10	·727	·129	— 19
10	·215	—·079	+ 14	10	·738	·143	— 12
10	·234	—·142	— 37	10	·751	·119	— 42
10	·245	—·141	— 31	10	·761	·204	+ 38
10	·258	—·128	— 12	10	·782	·122	— 51
10	·280	—·154	— 30	10	·792	·163	— 12
10	·300	—·132	— 3	10	·805	·187	+ 9
10	·322	—·165	— 32	10	·818	·189	+ 9
10	·354	—·124	+ 7	10	·834	·159	— 21
10	·377	—·159	— 33	10	·847	·194	+ 14
10	·401	—·148	— 31	10	·859	·196	+ 17
10	·419	—·075	+ 35	10	·870	·180	+ 4
10	·429	—·053	+ 51	10	·884	·190	+ 18
10	·445	—·052	+ 43	10	·901	·070	— 95
10	·459	—·076	+ 10	10	·918	·173	+ 15
10	·467	—·053	+ 27	10	·931	·149	— 2
10	·476	—·069	+ 4	10	·942	·172	+ 27
10	·489	—·058	+ 5	10	·951	·186	+ 48
10	·503	—·028	+ 22	10	·967	·122	— 6
10	·520	—·014	+ 20	9	·976	·170	+ 49
10	·538	—·016	+ 2	9	·988	·124	+ 14