First ephemerides of 25 variable stars

Oosterhoff, P.T.

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BULLETIN OF THE ASTRONOMICAL INSTITUTES
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COMMUNICATION FROM THE OBSERVATORY AT LEIDEN.

First ephemerides of 25 variable stars, by *P. Th. Oosterhoff*.

The material used in the present investigation consists of 155 plates, taken between 1924 Jan. 3 and 1926 March 11 with the Franklin-Adams instrument at Johannesburg. Of these 147 were taken by Prof. HERTZSPRUNG. With the exception of one plate, taken at J. D. 2424291·292, the star C. P. D. — 61°2829, $11^{h}\ 51^{m}\cdot4$ — 61°45′·1 (1875) was used for guiding. The size of the plates is 20 cm × 20 cm covering 10° × 10°. The ordinary exposuretime of 30 min. has never been materially surpassed and was only occasionally shortened. The J. D. of the plates are given in *B. A. N.* 147, p. 177, Table 1. The plates were taken during 78 nights, distributed in the following manner.

number of plates:	1	2	3	4	5	6	7	8	9	10
number of nights:	49	14	4	4	1	3	0	1	1	1

Of the 155 plates, 9 pairs have been compared in the blinkmicroscope, the intervals between the 2 plates compared being: 32, 2, 4, 2, 7, 3, 1, 33 and 3 days in the 9 cases. Of the stars thus found to be variable, the present paper will give only those, for which it has been possible to find the elements. With the exception of C. P. D. — 64°1725, all the variables, given in this note, are believed to be new. A number of other variables are retained for further investigation.

The stars have been estimated on the plates, using an eyepiece enlarging ten times, but for many reasons

TABLE 1.

Star	α (1875)	δ (1875)	C. P. D.		period	reciprocal period	approximate phgr. mag. at maximum	approximate phgr. mag. at minimum	number of plates	J. D. of the two plates, compared in the blink-microscope 2420000 +		Δ J.D.
	h m s	° ′	°	m	d	d⁻¹	m	m				d
a	11 16 11	— 64 45·2			3·53479	·282902	11·9	12·7	148	4260·350	4263·360	3
b	25 37·5	— 65 3·2	— 65 1675	8·6	·69359	1·4417777	7·4	8·5	143	4260·350	4263·360	3
c	30 28·5	— 60 46·4	— 60 3136	8·4	3·69378	·2707255	8·3	9·2	154	4260·350	4263·360	3
d	31 34·5	— 63 20·8			·743112	1·345693	11·8	12·6	146	4264·450	4297·392	33
e	33 20·5	— 62 43·7	— 62 2189	9·3	·791598	2·526535	10·1	11·1	147	4260·350	4263·360	3
f	36 50	— 65 46·6			·417961	4·7851359	12·0	12·4	146	4260·350	4263·360	3
g	39 49	— 58 41·2			·453183	2·2066152	10 8	12·5	151	3944·331	3946·330	2
h	41 9	— 64 42·6			·473226	2·113153	12·4	12·8	128	4294·385	4297·392	3
i	43 12	— 62 22·9	— 62 2320	9·8	3·1731	·3151508	9·7	10·6	151	4264·450	4297·392	33
k	43 56	— 65 5·9			173		11·9	< 14·5	148	4260·350	4292·295	32
l	44 52	— 64 26·7			4·9428	·2023152	11·5	12·4	148	4294·385	4297·392	3
m	46 10·5	— 64 42·5	— 64 1725	9·7	11·638	·0859224	9·8	11·1	149	4260·403	4264·375	4
n	47 58·5	— 65 30·5	— 65 1741	9·9	2·0030	·499259	10·2	11·4	153	3943·337	3944·331	1
o	51 37·5	— 61 56·9			7·0102	·14265	12·2	13·4	135	4294·385	4297.392	3
p	52 48	— 59 36·5			·327787	3·0507607	11·9	12·7	140	4260·350	4263.360	3
q	53 21	— 61 26·5			·901374	1·109418	12·5	13·6	153	4294·385	4297·392	3
r	12 0 5	— 64 22·7			6·2886	·159018	11·7	12·8	154	4260·403	4264·375	4
s	0 32	— 61 59·7			4·2013	·2380192	12.4	< 14·0	140	4294·385	4297·392	3
t	8 47·5	— 57 48·3	— 57 5356	9·9	1·9740	·5065792	10·9	11·6	151	4290·220	4297·348	7
u	10 45	— 65 3·5			7·137	·1401245	13·8	< 14·5	125	4294·385	4297·392	3
v	11 30	— 62 35·1			12·832	·077928	10·1	11·5	150	4264·450	4297·392	33
w	17 37·8	— 60 51·8	— 60 3948	9·9	2·9518	·3387798	10·1	11·0	147	4264·450	4297·392	33
x	21 50	— 63 43·6			3·1000	·3225839	11·0	11·9	154	3943·337	3944.331	1
y	23 39	— 65 20·6			·56244	1·7779517	11·7	13·0	147	4290·220	4297·348	7
z	24 54	— 65 26·2			2·4620	·4061656	12·0	13·7	148	4294·385	4297·392	3

not all 155 plates could be used for each star. After that the period was found and accurately computed by means of the method of least squares, except for the long-periodic variable star *k* in Table I. To form the mean lightcurve, the phases were calculated by the formula: phase = P^{-1} (J. D. Hel. M. T. Gr. — 2420000). The reductions to the sun, valid for the centre of the plates, have been applied. Then the estimates were arranged according to phase and divided into groups. To some extent such divisions into groups have been chosen, which gave the smoother lightcurves. Only in the case of star *d* in Table 1 a single observation was included in a group, following the one to which it really belonged according to its phase. The adopted mean values of the two groups: ${}^{\mathrm{P}}$·935, ${}^{\mathrm{m}}$·04 and ${}^{\mathrm{P}}$·981, — ${}^{\mathrm{m}}$·03 would have been: ${}^{\mathrm{P}}$·934, ${}^{\mathrm{m}}$·07, and ${}^{\mathrm{P}}$·982, — ${}^{\mathrm{m}}$·05 respectively, if the observation had been included in the first group.

All the stars, except star *b* in Table 1, have been compared at maximum and at minimum with the stars for which Harvard magnitudes have been given in the Selected Area 193, which lies within the photographed region. Though the estimates are rather uncertain, they will give a fair idea of the range in brightness.

Table 1 gives the apparent places for the year 1875. The number of decimals given in the period and the reciprocal period will in many cases exceed the accuracy obtained. The computed mean errors of the periods often cannot be of much value, the number of epochs being too small. The reciprocal of the period indicates the number actually used in the calculation of the phases and since the computations have been made with the aid of a calculating machine, the use of fewer decimals would have given no saving of time. For the stars *e* and *f* the reciprocal of the apparent period is given, since in both cases the two minima are of equal depth. It may be of some statistical interest, to know the difference in magnitude on the two plates, by the comparison of which the variable was discovered. Therefore the Julian days of the pairs of plates, compared in the blinkmicroscope, are given in the table. The last column gives the intervals in days between the J. D. of these two plates.

In Figure 1 diagrams are given for 9 variables of the δ Cephei and cluster variable type. All these diagrams are on the same scale, one step in the abscissa representing one tenth of the period and one step in the ordinate, one approximate magnitude. In the accompanying Table 2 the mean values are given for each group of phases and brightness for the individual stars, expressed in fractions of the period, and in approximate magnitudes respectively. The diagrams are arranged according to the period.

TABLE 2.

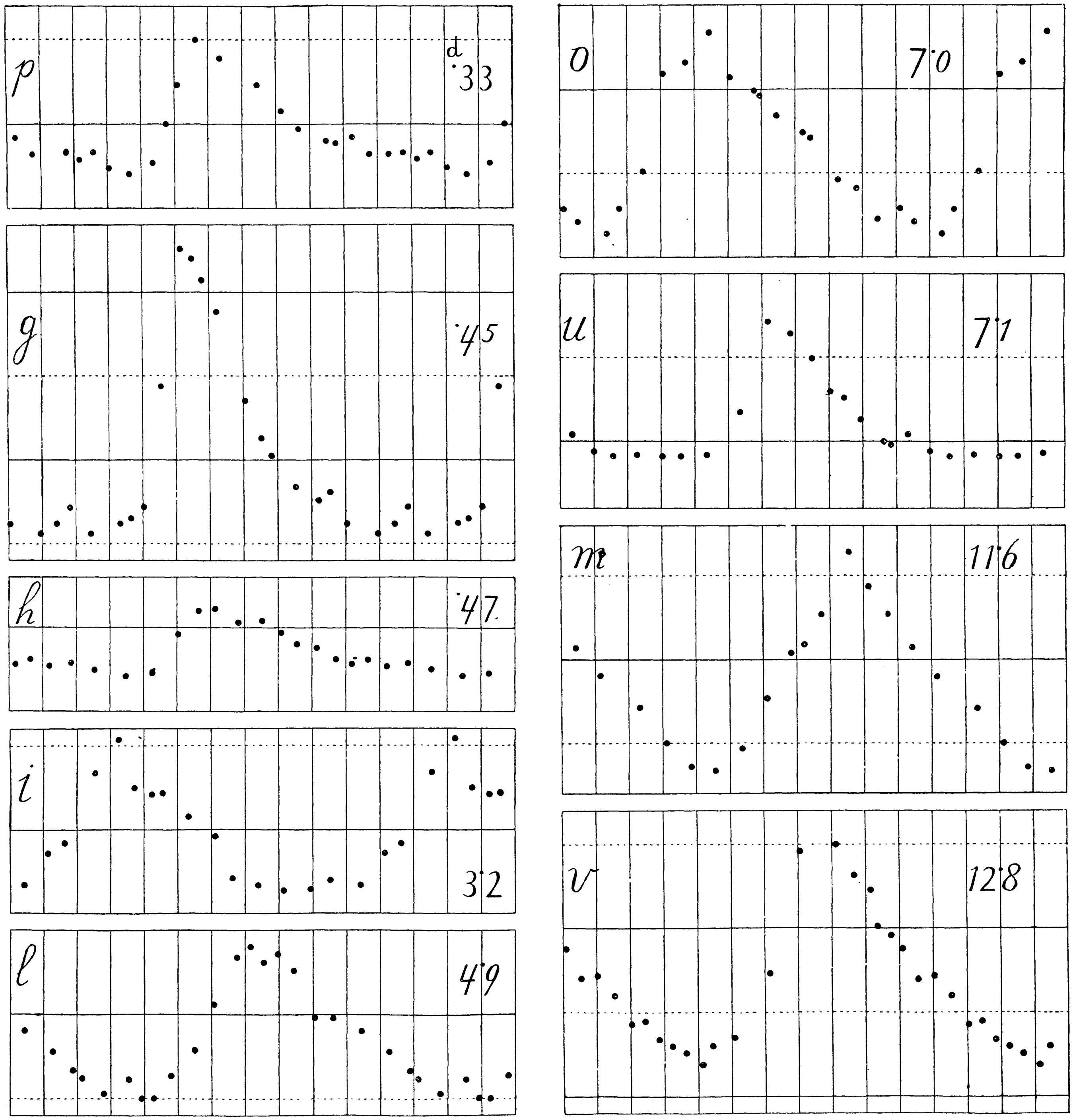
number of plates	phase	Δ m
	p	
n	P	m
8	·024	·08
8	·076	·18
8	·134	·18
8	·179	·17
8	·218	·21
8	·258	·17
8	·305	·26
8	·363	·30
8	·434	·23
8	·475	·00
8	·508	— ·23
8	·561	— ·50
8	·634	— ·39
8	·747	— ·23
8	·815	— ·08
7	·868	·03
7	·948	·10
6	·979	·11
	g	
n	P	m
8	·016	—1·26
8	·050	—1·20
8	·079	—1·07
8	·121	— ·88
8	·207	— ·35
8	·251	— ·13
8	·281	— ·03
8	·355	·16
8	·422	·24
10	·455	·19
8	·506	·38
8	·595	·44
8	·646	·38
8	·686	·28
8	·746	·44
8	·832	·38
8	·864	·35
8	·907	·28
5	·957	— ·44
	h	
n	P	m
8	·018	·22
8	·066	·19
8	·120	·23
8	·187	·21
8	·253	·25
8	·348	·29
8	·426	·27
8	·507	·04
8	·566	— ·10
8	·614	— ·11
8	·683	— ·03
8	·751	— ·04
8	·810	·03
8	·857	·10
8	·917	·12
8	·970	·19

number of plates	phase	Δ m
	i	
n	P	m
10	.042	·33
10	·114	·14
10	·164	·08
10	·257	— ·34
10	·323	— ·54
10	·373	— ·25
10	·425	— ·21
10	·458	— ·22
10	·532	— ·08
10	·611	·04
10	·662	·29
10	·740	·33
10	·814	·36
10	·894	·35
11	·952	·30
	l	
n	P	m
8	·042	·10
8	·128	·22
8	·189	·33
8	·215	·38
8	·279	·47
8	·353	·39
8	·391	·50
8	·428	·50
8	·480	·36
8	·550	·21
8	·609	— ·06
8	·676	— ·34
8	·716	— ·40
8	·753	— ·31
8	·798	— ·36
8	·843	— ·26
10	·905	·02
10	·960	·02
	o	
n	P	m
8	·012	·71
8	·053	·79
8	·139	·86
8	·177	·71
8	·248	·49
8	·309	— ·09
8	·374	— ·16
8	·447	— ·34
8	·507	— ·07
8	·580	·01
8	·596	·04
8	·643	·16
8	·722	·26
8	·745	·29
8	·827	·54
8	·882	·59
7	·946	·77

number of plates	phase	Δ m
	u	
n	P	m
8	·037	·96
8	·100	1·06
8	·158	1·09
8	·230	1·08
8	·304	1·09
8	·360	1·09
8	·435	1·08
8	·536	·83
8	·618	·29
8	·685	·36
8	·750	·51
8	·804	·70
8	·847	·74
8	·894	·87
7	·961	1·00
6	·985	1·02
	m	
n	P	m
10	·044	— ·07
12	·118	·10
11	·234	·29
10	·312	·50
10	·385	·64
11	·458	·66
10	·538	·53
10	·611	·23
11	·685	— ·04
8	·726	— ·09
14	·773	— ·27
8	·858	— ·64
9	·916	— ·44
15	·971	— ·27
	v	
n	P	m
8	·010	·12
8	·054	·30
8	·102	·28
8	·153	·40
8	·204	·57
8	·247	·55
8	·284	·66
8	·322	·70
8	·366	·74
8	·415	·81
8	·443	·70
8	·510	·65
8	·617	·27
8	·704	— ·46
8	·811	— ·50
8	·868	— ·32
8	·915	— ·23
7	·936	— ·01
7	·977	·04

The same has been done for 15 eclipsing variable stars in Figure 2 and Table 3. The diagrams show

FIGURE 1.



the total lightcurves for those variables, which have an obvious secondary minimum; in the other cases only the primary minimum has been given. The scale of the diagrams is rather different, but in all the figures, one step in the abscissa represents one tenth of the period and one step in the ordinate one approximate magnitude. In those diagrams, where only the primary minimum is plotted, the means represented are those marked with an arterisk in Table 3.

TABLE 3.

f

number of plates	phase	Δ m
n	P	m
10	·041	— ·38
10	·110	— ·31
10	·183	— ·21
10	·241	— ·17
10	·307	— ·03
10	·390	— ·07
10	·454	— ·14
10	·529	— ·26
10	·609	— ·33
10	·681	— ·42
10	·746	— ·43
10	·809	— ·40
10	·872	— ·38
9	·936	— ·43
7	·977	— ·38

e

number of plates	phase	Δ m
n	P	m
8	·036	·32
8	·090	·11
8	·152	— ·15
8	·248	— ·47
8	·303	— ·49
8	·356	— ·58
8	·400	— ·56
8	·435	— ·65
8	·468	— ·68
8	·521	— ·61
8	·587	— ·57
8	·643	— ·58
8	·703	— ·56
8	·768	— ·40
8	·832	— ·25
8	·877	·00
9	·934	·13
10	·978	·29

y

number of plates	phase	Δ m
n	P	m
8	·023	— ·52
8	·057	— ·61
8	·104	— ·66
8	·178	— ·74
8	·223	— ·74
8	·314	— ·70
7	·378	— ·58
5	·410	— ·17
5	·446	·52
5	·483	·48
5	·511	·31
5	·541	— ·11
8	·584	— ·60
8	·624	— ·64
8	·665	— ·66
8	·733	— ·78
8	·788	— ·70
10	·833	— ·61
9	·883	— ·64
8	·947	— ·54

d

number of plates	phase	Δ m
n	P	m
8	·024	— ·08
8	·064	·17
8	·126	·44
8	·183	·40
8	·232	·12
8	·299	·05
8	·347	— ·05
8	·425	— ·01
8	·535	— ·03
8	·592	·35
8	·628	·72
8	·663	·55
8	·707	·33
8	·752	·19
8	·807	·01
8	·877	— ·05
9	·935	·04
9	·981	— ·03

x

number of plates	phase	Δ m
n	P	m
7	·001	— ·18
4	·019	·02
4	·030	·23
4	·047	·42
4	·070	·51
4	·098	·39
4	·141	— ·03
4	·195	— ·29
10	·272	— ·39
10	·305	— ·39
10	·325	— ·34
10	·362	— ·31
10	·429	— ·28
4	·522	— ·12
4	·563	·14
4	·617	·07
4	·632	— ·01
4	·646	— ·21
10	·673	— ·18
10	·731	— ·26
8	·807	— ·28
7	·857	— ·27
7	·952	— ·18
7	·980	— ·14

c

number of plates	phase	Δ m
n	P	m
10	·039	— ·51
10	·110	— ·50
10	·165	— ·48
10	·227	— ·57
6	·282	— ·48
6	·336	— ·48
6	·368	— ·33
6	·380	— ·29
6	·400	— ·30
6	·427	— ·29
6	·464	— ·44
6	·495	— ·50
10	·573	— ·54
10	·654	— ·55
10	·709	— ·58
10	·772	— ·58
4	·812	— ·54
4	·837	— ·35
4	·877	— ·07
4	·915	·32
4	·943	·04
6	·975	— ·30

r

number of plates	phase	Δ m
n	P	m
8	·041	— ·16
8	·086	— ·17
8	·135	— ·26
8	·190	— ·19
8	·247	— ·28
8	:307	— ·16
8	·343	— ·24
8	·380	— ·13
4	·404	— ·14
4	·435	·52
4	·454	·75
4	·464	·81
4	·474	·78
4	·511	·33
8	·549	— ·10
8	·606	— ·20
8	·679	— ·26
8	.745	— ·30
8	·781	— ·23
8	·853	— ·18
9	·913	— ·17
9	·963	— ·06

b

number of plates	phase	Δ m
n	P	m
8	·035	— ·09
8	·085	— ·11
8	·128	— ·04
8	·186	— ·09
8	·249	— ·04
8	·299*	— ·02
8	·362*	·15
8	·421*	·47
8	·479*	·85
8	·532*	·85
8	·575*	·60
8	·646*	·34
8	·745*	·00
8	·803	·00
8	·857	— ·04
8	·892	— ·11
7	·937	— ·15
8	·979	— ·09

q

number of plates	phase	Δ m
n	P	m
10	·063	— ·03
10	·187	·00
10	·264	— ·05
10	·318	— ·08
10	·373	— ·03
10	·401	— ·05
10	·444	·00
10	·493*	·00
8	·531*	·38
5	·567*	·90
5	·594*	1·10
5	·631*	·87
5	·654*	·18
10	·703*	·00
10	·800	·03
9	·856	— ·13
8	·918	— ·20
8	·967	·00

TABLE 3 (*continued*).

t

number of plates	phase	Δ m
n	P	m
12	·131	— ·01
12	·197	·00
6	·243*	·00
6	·278*	·04
6	·305*	·20
6	·334*	·70
6	·355*	·67
6	·380*	·55
6	·409*	·24
6	·437*	·04
10	·587	— ·02
10	·692	— ·03
10	·733	— ·02
10	·768	— ·02
10	·831	— ·02
10	·872	·03
9	·908	— ·03
10	·947	— ·02

n

number of plates	phase	Δ m
n	P	m
10	·014	— ·01
10	·063	— ·01
10	·161	·04
10	·222	·05
10	·316	·00
10	·438	— ·01
10	·479	·03
10	·499	— ·01
10	·523	— ·04
10	·592	— ·01
8	·665*	·05
4	·690*	·15
4	·703*	·29
1	·722*	·87
1	·744*	1·20
1	·747*	1·20
1	·747*	1·20
1	·750*	1.20
10	·892	·03
11	·950	·00
11	·982	·00

z

number of plates	phase	Δ m
n	P	m
8	·019	·00
9	·060	— .06
10	·151	— ·03
10	·237	— ·09
10	·333	— ·10
10	·377	·00
3	·402*	·00
3	·426*	·68
3	·444*	1·09
3	·464*	1·70
1	·498*	·93
1	·508*	·46
3	·540*	·00
10	·571	— ·05
10	·656	— ·07
10	·733	— ·07
10	·792	— ·05
11	·868	— ·02
11	·932	— ·05
12	·982	— ·02

w

number of plates	phase	Δ m
n	P	m
10	·030	— ·01
10	·112	·03
10	·153	·09
10	·264	·04
10	·353	·07
10	·430	·07
10	·489	·09
10	·560	·02
4	·644*	·07
4	·665*	·28
4	·696*	·65
4	·729*	·90
4	·753*	·56
4	·780*	·26
4	·794*	·12
10	·815*	·02
10	·846	·01
10	·920	·10
9	·977	·00

a

number of plates	phase	Δ m
n	P	m
10	·028	·04
10	·117	·04
9	·161*	·02
4	·202*	·21
4	·238*	·80
4	·259*	·82
4	·276*	·53
4	·301*	·36
10	·378*	·04
10	·440	·02
10	·500	·06
10	·581	·00
10	·662	·04
10	·745	·02
10	·826	·02
10	·882	·00
10	·915	·04
9	·979	·02

s

number of plates	phase	Δ m
n	P	m
7	·012	— ·01
7	·037	— ·03
3	·059*	·00
1	·115*	1·65
1	·127*	2·00
1	·146*	2·00
1	·147*	2·00
1	·151*	2·00
1	·155*	2·00
1	·160*	2·00
1	·174*	2·00
1	·182*	·95
4	·194*	·01
10	·231	·03
10	·274	·01
10	·373	— ·06
10	·436	·02
10	·497	— ·02
10	·580	— ·01
10	·688	·05
10	·767	·01
10	·809	— ·03
10	·888	— ·02
10	·970	— ·02

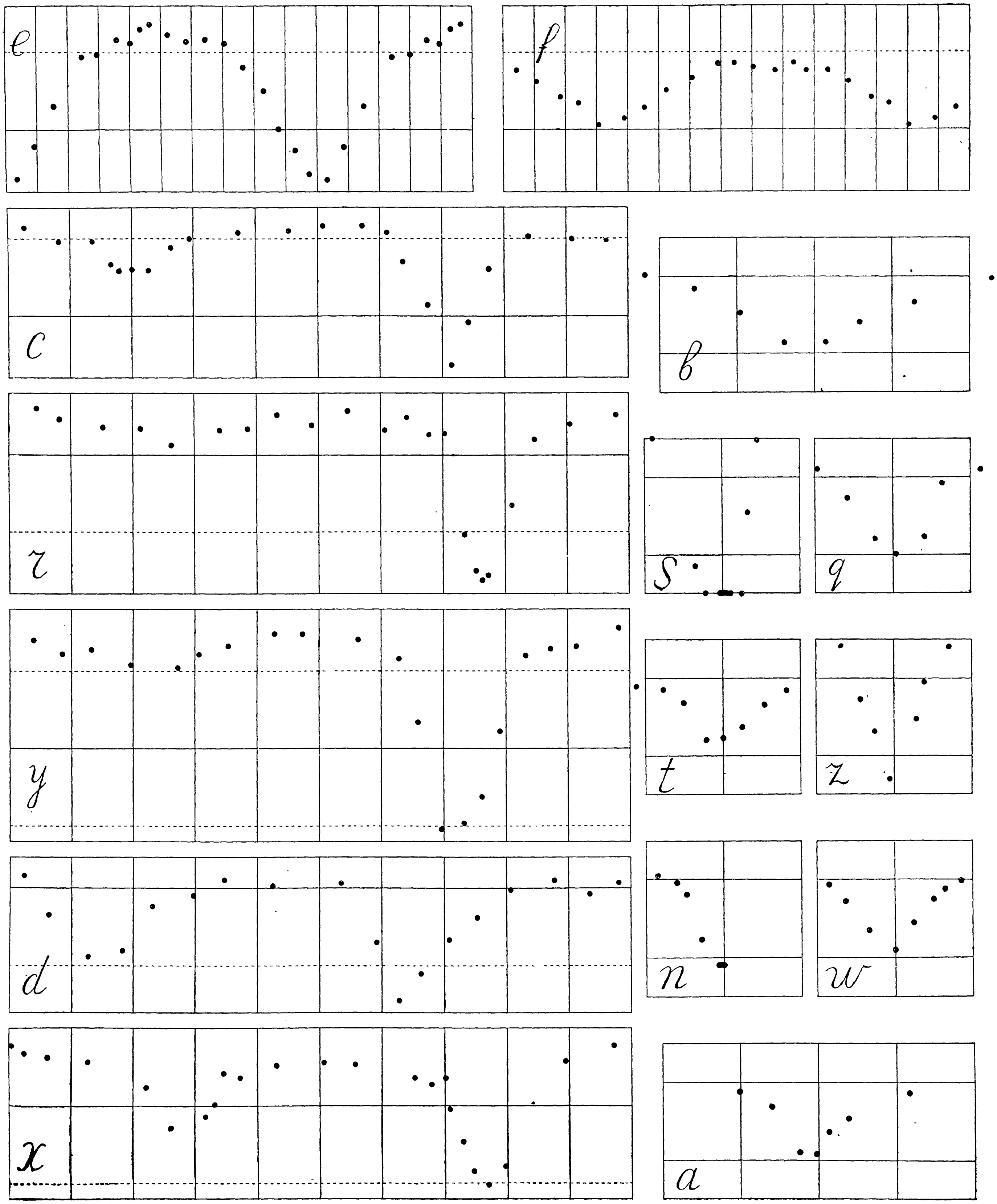
In all ephemerides, given below, the epoch coincides with an observed minimum or maximum. For each star the J. D. of the minima and maxima observed and used in the least square solution, are given in a table. The epoch used in the elements and that given in this table, have the same zeropoint, except for the stars *l* and *m*.

a. This star is of the eclipsing type, the fraction of the period occupied by the minimum being ·17.

Elements of minimum:

J. D. 2423995·242 + 3·53479 (*E*—15).

FIGURE 2.



J. D. Hel. M. T. Gr. — 2420000	Epoch	$O-C$
3942·280	0	+ ·060
3963·343	6	— ·086
3988·230	13	+ ·058
3995·212	15	— ·030
4260.314	90	— ·037
4292·201	99	+ ·037

b. The star is an eclipsing variable and is H. D. 100213 spectrum B3. It is probable that the period must be doubled, the minimum occupying the fraction ·4 of the period. If this is so, a doubling of the lines of the order of 300 km/sec may be expected. There is but a slight indication of ellipticity and the minima seem to be of equal depth.

The comparison stars are:

C. P. D. — 65° 1680 $7^{m}{\cdot}8$ H.D. 100431 spectrum B 9
and
C. P. D. — 64° 1668 $8^{m}{\cdot}3$ H. D. 100264 spectrum A 0

At maximum the variable is a little brighter than the first and at minimum fainter than the second comparison star. The magnitudes in Table 1 have been reduced to the international scale.

Elements of minimum:

J. D. 2424260·378 + ·69359 ($E-496$).

Mean error of the period: ± ·00004.

J. D. Hel. M. T. Gr. — 2420000	Epoch	$O-C$
3916·417	0	+ ·054
3941·341	36	+ ·009
3966·284	72	— ·018
3973·251	82	+ ·014
3991·212	108	— ·059
4260·373	496	— ·010
4281·226	526	+ ·035
4285·338	532	— ·014
4287·414	535	— ·019
4290·220	539	+ ·011
4292·295	542	+ ·007
4294·385	545	+ ·016

c. This variable is H. D. 100915 spectrum B 8. It is of the eclipsing type and shows a secondary minimum, the magnitude at maximum and at the two minima being: $M = 8^{m}{\cdot}3$ $m_1 = 9^{m}{\cdot}2$ $m_2 = 8^{m}{\cdot}6$.

The fraction of the period occupied by the minimum is ·23.

Elements of minimum:

J. D. 2424262·318 + 3·69378 ($E-78$).

J. D. Hel. M. T. Gr. — 2420000	Epoch	$O-C$
3974·257	0	+ ·054
3985·231	3	— ·053
4262·292	78	— ·026
4288·200	85	+ ·026

d. The star is an eclipsing variable and has two minima.

Elements of minimum:

J. D. 2423990·237 + ·743112 ($E-43$).

$M = 11^{m}{\cdot}8$ $m_1 = 12^{m}{\cdot}6$ $m_2 = 12^{m}{\cdot}3$.

J. D. Hel. M. T. Gr. — 2420000	Epoch	$O-C$
3958·281	0	— ·002
3990·238	43	+ ·001
4259·260	405	+ ·017
4282·272	436	— ·008
4296·392	455	— ·007

e. The star is of the β Lyrae type and it seems that the minima are of equal depth. Therefore the mean lightcurve has been computed with the apparent period.

Elements of minimum:

J. D. 2424260·377 + ·395799 ($E-801$)
± ·005 ± ·000011 m. e.

J. D. Hel. M. T. Gr. — 2420000	Epoch	$O-C$
3943·337	0	— ·005
3945·335	5	+ ·014
3966·284	58	— ·014
3968·265	63	— ·012
3970·263	68	+ ·007
3989·240	116	— ·015
3991·236	121	+ ·002
3995·212	131	+ ·020
4259·213	798	+ ·023
4260·373	801	— ·004
4262·315	806	— ·041
4264·375	811	+ ·040
4285·338	864	+ ·026
4287·297	869	+ ·006
4289·237	874	— ·033
4294·408	887	— ·008
4296·392	892	— ·003
4586·514	1625	— ·001

f. The star is of the same type as the preceding one. There is no difference between the two minima and the apparent period has been used for the calculation of the mean lightcurve. The range in brightness is only small.

Elements of minimum:

J. D. 2424260·346 + ·2089805 (*E* — 1703)
± ·004 ± ·000005 m. e.

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3904·438	0	— ·014
3974·257	334	+ ·006
3992·232	420	+ ·008
2997·218	444	— ·021
4259·307	1698	+ ·006
4260·338	1703	— 008
4286 273	1827	+ ·014
4287·308	1832	+ ·004
4289·402	1842	+ ·008
4290·232	1846	+ ·002
4293·387	1861	+ ·022
4566·504	3168	+ ·002
4586·537	3264	— ·027

g. This variable of the RR Lyrae type has a rather large range in brightness.

Elements of maximum:

J. D. 2424264·46 + ·453183 (*E* — 713)
± ·000009 m. e.

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3941·341	0	— ·009
3966·284	55	+ ·009
3976·254	77	+ ·009
4260·373	704	— ·017
4261·288	706	— ·009
4264·473	713	+ ·005
4281·226	750	— ·011
4289·402	768	+ ·009
4291·204	772	— ·003
4294·385	779	+ ·007
4559·499	1364	+ ·009

h. This star is also of the RR Lyrae type.

Elements of maximum:

J. D. 2424260·264 + ·473226 (*E* — 691)
± ·005 ± ·000016 m. e.

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3933·273	0	+ ·008
3959·281	55	— ·011
3996·207	133	+ ·003
4258·351	687	— ·021
4260·279	691	+ ·015
4285·338	744	— ·007
4288·200	750	+ ·015
4293·387	761	— ·003

i. The star is of the δ Cephei type.

Elements of maximum:

J. D. 2424259·47 + 3·1731 (E — 145)

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3799·530	0	+ ·159
4259·240	145	— ·228
4297·370	157	— ·175
4586·540	248	+ ·244

k. This is the only long-periodic variable among the 25 variables contained in this paper. There may be many unknown long-periodic variables in the investigated region, but in most cases the intervals in time between the plates compared in the blink-microscope were on purpose chosen too short to find them. In the minimum the star is too faint to make accurate estimates. In this case the number of plates is too small to give a reliable lightcurve. The plates taken between J. D. 2423900 and J. D. 2424000 give a maximum with ascending and descending branch. It seems that the maximum is rather sharp. Only two more maxima have been observed. From these data the period has been estimated to be about 173 days.

Elements of maximum: J. D. 2423950 + 173 E.

l. The star is of the δ Cephei type. A provisional period has been computed by means of 12 observed maxima, but since the dispersion of the points in the mean lightcurve, thus obtained, was rather large, the period has been corrected, using 4 observations of the ascending branch, where the variable has the same brightness, as one of the comparison stars. These four observations are given in the table.

Elements of maximum: J. D. 2424259·26 + 4·9428 E.

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3942·350	0	+ ·013
4263·460	65	— ·158
4288·350	70	+ ·018
4293·401	71	+ ·126

m. This variable is also of the δ Cephei type and it is H. D. 103137 spectrum Go. The D. C. gives the following data:

103137. — Muscae. Variable. Max. 9·.4 Min. 10·3. Class and period, unknown. The class of spectrum indicates variability in short period.

The median spectral class, belonging to the period of 11·6 days is G4 according to H. C. 313.

The period has been computed from 6 observed maxima and also from 6 minima, the periods found being: $11^{d}6410$ and $11^{d}6154$ respectively. Two tables are given, showing the observed maxima, resp. minima.

maxima

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3885·25	0	·00
3943·34	5	— ·11
3990·22	9	+ ·20
4281·23	34	+ ·19
4292·30	35	— ·38
4560·52	58	+ ·10

minima

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3799·53	0	— ·71
3916·42	10	+ ·03
3940·34	12	+ ·72
3998·21	17	+ ·51
4264·40	40	— ·45
4288·20	42	+ ·12

From these data the period of 11·638 days has been adopted.

Elements of maximum: J. D. 2424281·30 + 11·638 E.

n. This variable of the eclipsing type has the rather awkward period of 2·0030 days. Only 4 minima have been observed and no observation was made on the ascending branch of the lightcurve.

Elements of minimum:
J. D. 2423943·34 + 2·0030 (E — 29).

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3885·251	0	·000
3941·341	28	+ ·007
3943·337	29	·000
3945·335	30	— ·005

o. The star is of the δ Cephei type.
Elements of maximum:
J. D. 2424286·32 + 7·0102 (E — 71)

J. D. Hel M. T. Gr. — 2420000	Epoch	*O—C*
3788·564	0	+ ·232
3963·273	25	— ·313
4258·351	67	+ ·338
4264·450	68	— ·573
4286·321	71	+ ·268
4566·504	111	+ ·044

p. The star is of the cluster variable type.

Elements of maximum:
J. D. 2424263·382 + ·327787 (E — 812)

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3997·218	0	— ·001
4259·445	800	— ·004
4263·383	812	+ ·001
4264·375	815	+ ·010
4285·338	879	— ·006
4292·225	900	— ·002

q. The star is eclipsing variable, the fraction of the period occupied by the minimum being ·21.

Elements of minimum:
J. D. 2423988·21 + ·901374 (E — 52)
± ·00004 m. e.

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3941·341	0	+ ·003
3969·273	31	— ·008
3988·218	52	+ ·009
4260·403	354	— ·021
4261·311	355	— ·015
4288·388	385	+ ·021
4297·392	395	+ ·011

r. The variable is also of the eclipsing type and has two minima. The minimum occupies the fraction ·14 of the period.
$M = 11^{m}{\cdot}7 \quad m_1 = 12^{m}{\cdot}8, \quad m_2 = 11^{m}{\cdot}9.$

Elements of minimum:
J. D. 2423977·27 + 6·2886 (E — 30)

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3788·564	0	— ·048
3933·273	23	+ ·023
3977·248	30	— ·022
3996·207	33	+ ·071
4260·303	75	+ ·046
4285·338	79	— ·073

s. The star is an eclipsing variable. The descending and ascending branches of the lightcurve, on both of which falls only a single observation, appear to be rather steep. The star being very faint in the minimum, it cannot be said, whether a constant brighness in the minimum is present.

Elements of minimum:
J. D. 2424290·20 + 4·2013 (*E* — 89)

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3916·42	0	+ ·14
3941·34	6	— ·15
3958·28	10	— ·01
3996·21	19	+ ·10
4000·21	20	— ·10
4290·22	89	+ ·02
4294·39	90	— ·01

t. The star is an eclipsing variable.
Elements of minimum:
J. D. 2424288·28 + 1·9740 (*E*—203)
± ·0002 m. e.

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3887·483	0	— ·067
3988·218	51	— ·007
3990·238	52	+ ·039
3992·232	53	+ ·058
4286·297	202	— ·007
4288·294	203	+ ·016
4290·232	204	— ·020
4292·212	205	— ·014

u. The star is of the δ Cephei type. The lightcurve is flat in the minimum, since the variable becomes there too faint, to make accurate estimates.

Elements of maximum:
J. D. 2424286·01 + 7·137 (*E*—68)

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3801·51	0	+ ·23
3965·28	23	— ·14
4258·28	64	+ ·27
4286·39	68	— ·16
4293·41	69	— ·28
4586·51	110	+ ·22

v. The star is of the same type as the preceding one. A provisional period of 12·871 days has been calculated from 4 maxima, given in the table.

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3884·355	0	+ ·028
3987·223	8	— ·073
4000·210	9	+ ·042
4566·504	53	+ ·004

The dispersion of the points of the lightcurve, thus obtained, was rather large and therefore the period has been corrected, using some observations of the ascending branch of the lightcurve.

Elements of maximum:
J. D. 2423987·70 + 12·832 (*E*—8)

w. The variable is of the eclipsing type, the minimum occupying the fraction ·17 of the period.

Elements of minimum:
J. D. 2424264·51 + 2·9518 (*E*—99)

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3972·260	0	— ·022
3975·257	1	+ ·023
4264·473	99	— ·034
4282·249	105	+ ·031

x. The star is eclipsing variable and has two minima.

$$M = 11^{\mathrm{m}}{\cdot}0 \quad m_1 = 11^{\mathrm{m}}{\cdot}9 \quad m_2 = 11^{\mathrm{m}}{\cdot}5.$$

Elements of minimum:
J. D. 2423971·27 + 3·1000 (*E*—58)
± ·0003 *m. e.*

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3791·539	0	+ ·064
3887·483	31	— ·091
3940·342	48	+ ·068
3943·337	49	— ·036
3971·253	58	— ·020
3999·210	67	+ ·037
4287·414	160	— ·056
4566·504	250	+ ·037

y. The star is an eclipsing variable and it is probable, that a secondary minimum is present.

Elements of minimum:
J. D. 2424293·41 + ·56244 (*E* — 587)

J. D. Hel. M. T. Gr. — 2420000	Epoch	*O—C*
3963·273	0	+ ·017
3990·238	48	— ·015
4287·214	576	— ·010
4292·295	585	+ ·009
4293·410	587	— ·001
4297·348	594	·000
4559·451	1060	+ ·003

FIGURE 3.

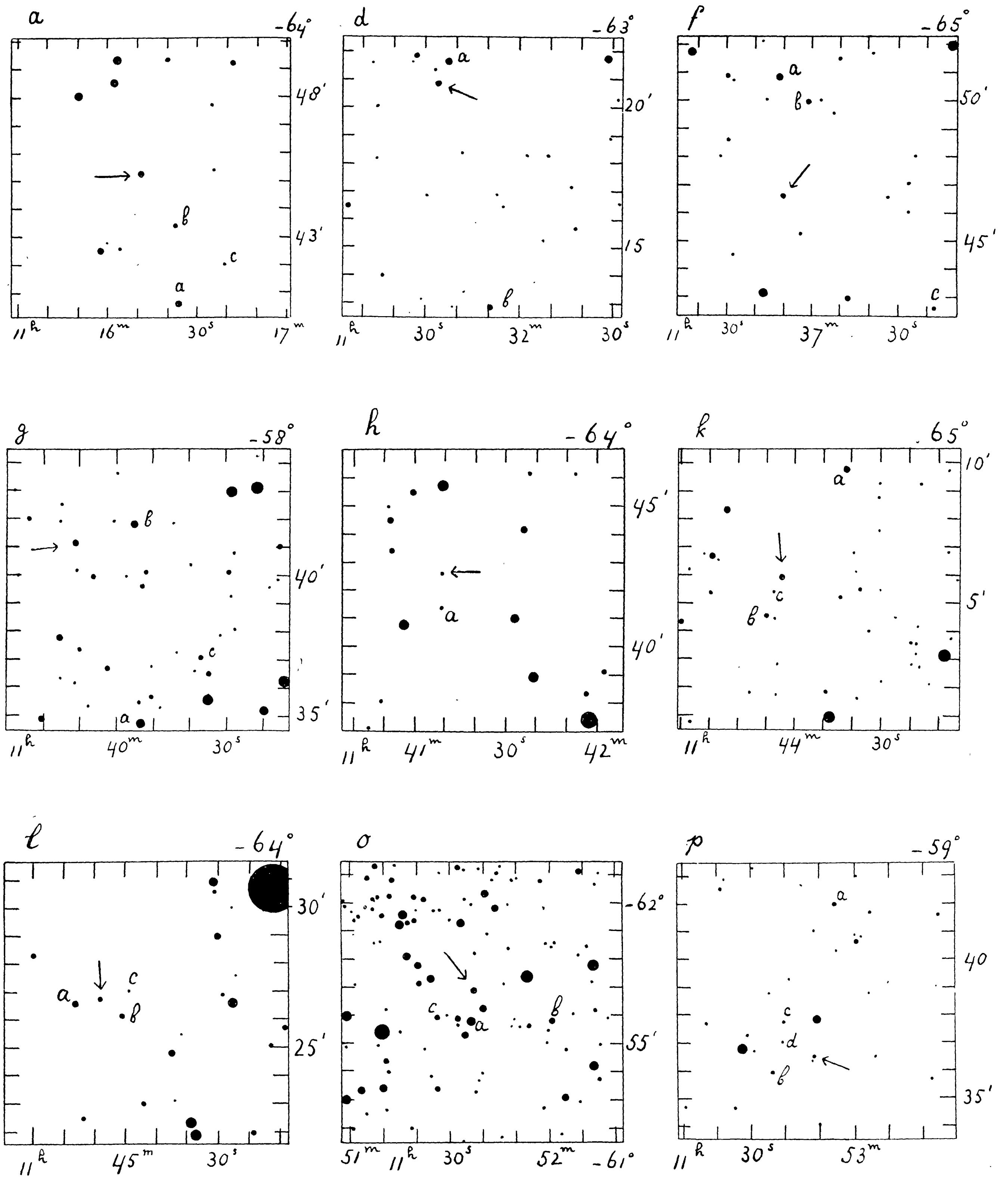

a
-64°
48'
43'
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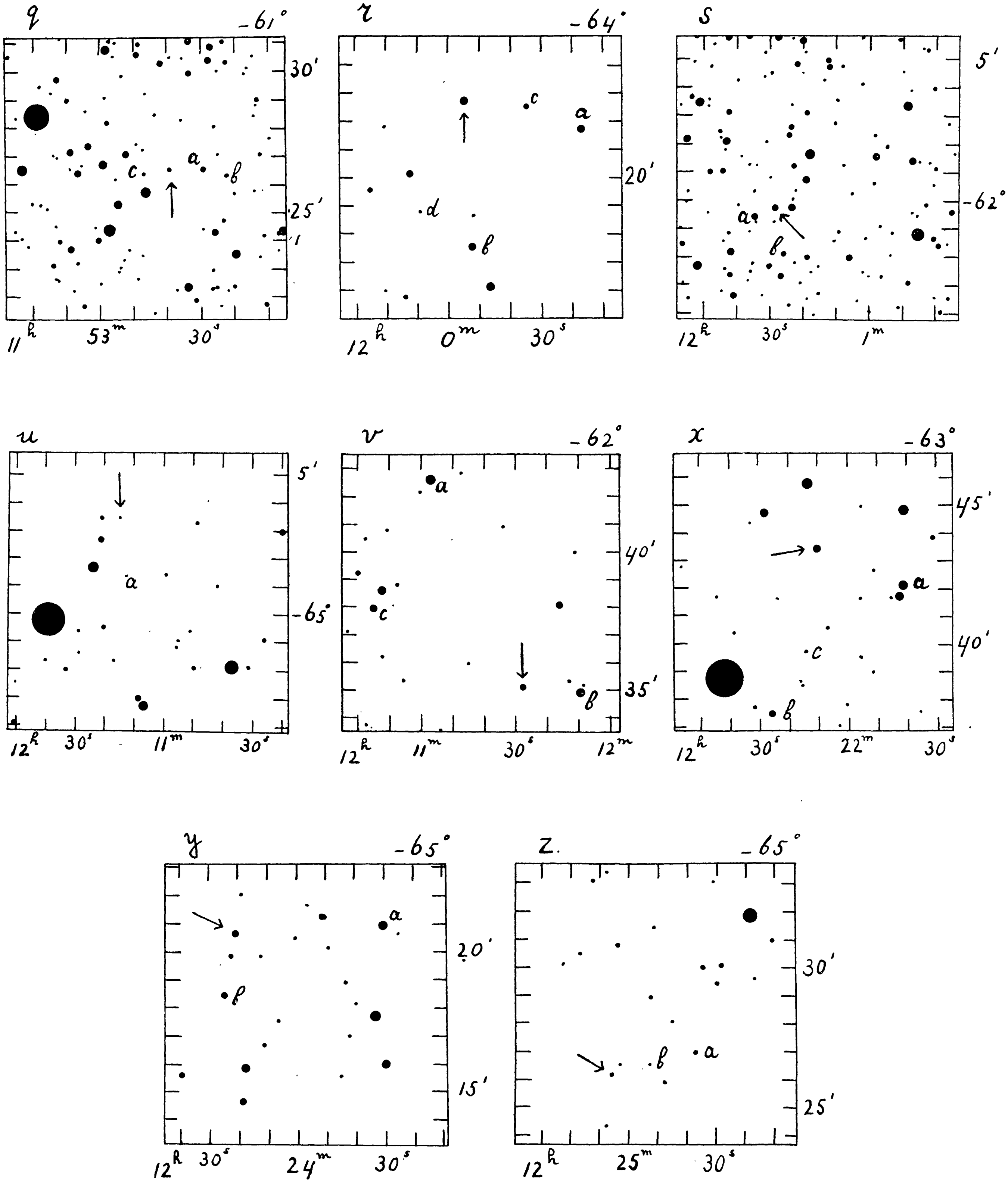
FIGURE 3 (*continued*).



z. The variable is of the eclipsing type, the minimum occupying the fraction ·14 of the period.

Elements of minimum:

J. D. 2423945·32 + 2·4620 (E — 24)

J. D. Hel. M. T. Gr. — 2420000	Epoch	$O—C$
3886·242	0	+ ·007
3940·342	22	— ·058
3945·335	24	+ ·011
3987·223	41	+ ·044
4297·392	167	— ·005

Figure 3 gives charts, each covering 10′ × 10′ with the aid of which it will be easy to identify those variable stars, contained in this paper, which are not included in the C. P. D. The variables are marked with an arrow and the comparison stars with letters.

The present investigation was begun in November 1927 and the total number of estimates is 3963.

I want to thank Prof. HERTZSPRUNG for the interest, he has shown in my work and for his valuable advice in so many cases.