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COMMUNICATION FROM THE OBSERVATORY AT LEIDEN.

Provisional ephemerides of 25 variable stars in the constellations Norma and Ara,

by *W. E. Kruytbosch.*

The number of plates with the centre at 16^h4^m, $-54°45'$ (1875) covering $10° \times 10°$ and taken by Dr. H. VAN GENT with the Franklin-Adams instrument at Johannesburg amounts to 304 at present.

Selected pairs of plates of this region were compared in the blinkmicroscope. Of the 25 variable stars forming the subject of the present note 7 were found in this way by Dr. H. VAN GENT at Johannesburg, 10 by P. TH. OOSTERHOFF here in Leiden and 8 by the writer also in Leiden.

The total number of observations used here is 6285; the average number for each star is 251. The extreme dates of the plates used are J. D. 2425381 and 6476. The normal exposure-time of a plate is 30 min.

The 25 stars are listed in Table 1. Four of these occur in the *C. P. D.*, viz: *a*, *c*, *o* and *p* with the numbers $-51°8479$ ($10^m·0$), $-54°6718$ ($9^m·8$), $-53°7517$ ($10^m·2$) and $-53°7685$ ($9^m·6$) respectively.

For 24 periods a mean error has been given in Table 1. Owing to the small number of epochs these mean errors are in several cases rather uncertain.

The phases have in all cases been computed according to the formula:

$$\text{phase} = \text{recipr. period} \times (\text{J. D. hel. M. astr. T. Grw.} - 2420000)$$

The reciprocal periods actually used for this computation are given in Table 1.

For eclipsing variables the phase of minimum, for variables of δ Cep or RR Lyr type the phase of maximum has been given. The phases of maximum derived from a sine curve are marked with an asterisk in Table 1 and explained in the remarks below.

The normal epochs given in J. D. have been chosen near the mean date of the observations.

An attempt was made to estimate the magnitudes of the comparison stars by comparison with plates of the Crux region containing the Selected Area No. 193. The magnitudes thus found are given in Table 3. They are naturally rather uncertain.

The dates of the two plates, by the comparison of which the variability of the star was found in the blink microscope, are given in Table 2 together with the interval in days and the difference in steps between the two images of the variable as derived from the mean lightcurve. The last column of Table 2 contains the abbreviation of the name of the observer by whom the different variables were found: vG = Dr. H. VAN GENT, O = P. TH. OOSTERHOFF, K = the writer.

The surroundings of each variable with indication of the comparison stars are shown on the diagrams on page 240. The size of each square is indicated in the right hand bottom corner. The brightness assigned to each comparison star is given in Table 3.

For 15 variables the epochs of minimum and for 9 the epochs of maximum used for computing the period according to least squares are indicated in Table 4 together with the counting of epochs and the residuals *O—C*. For one variable (*m*) the number of epochs was too small to get reliable results by a least square solution.

For each variable the observations were arranged according to phase and divided into groups as indicated in Table 5, where mean values of phase and brightness are given for each group. The mean values are shown on the diagrams on the pages 239 and 240.

On all these diagrams vertical lines have been drawn for each tenth of the period except in the case of variable *d* as explained below. The phases have on the diagrams in case of eclipsing variables been counted from minimum and the brightness in steps from maximum light. For the eclipsing variable *m* a diagram of the complete period is given besides a diagram of the individual observations at or near the minimum.

The individual objects give rise to the following remarks:

d. This Algol star shows two different minima marked with vertical lines on the diagram at $^{ph}·342$ and $^{ph}·919$ respectively. The minima are practically of the same range, but show a somewhat different shape, the former being wider than the latter.

e. The mean light curve has an indication of a secondary minimum at $^{ph}\cdot76$.

g. A secondary minimum is indicated at $^{ph}\cdot315$.

h. A first trial to determine the period of this star giving insufficient results, the variable was estimated independently by Mr. OOSTERHOFF. The two series of observations are in good agreement. The period was deduced from the minima. A sine curve was determined by least squares from the mean values of phase and brightness for the two series of observations. The results are given in Table 6. The mean value of the phase of the maximum is $^{P}\cdot180 \pm {}^{P}\cdot015$ (m. e.) corresponding to the mean epoch of maximum J. D. $2425705^{d}\cdot96 \pm {}^{d}\cdot03$ (m. e.)

TABLE 6.

		O	O—C	K	O—C
	P	s	s	s	s
19	·0428	2·39	— ·18	1·53	— ·10
19	·1375	1·74	— ·38	1·47	+ ·01
19	·2038	2·31	+ ·28	1·45	— ·02
19	·2415	2·42	+ ·33	1·53	·0
19	·2862	2·19	— ·05	1·75	+ ·12
19	·3274	2·37	— ·08	1·56	— ·20
19	·4036	3·16	+ ·19	2·12	+ ·07
19	·5366	3·65	— ·34	2·69	+ ·15
19	·6386	4·29	— ·20	2·74	+ ·02
19	·6955	4·71	+ ·14	2·51	— ·21
19	·7478	4·15	— ·35	2·35	— ·30
19	·7924	5·06	+ ·72	2·85	+ ·31
19	·8437	4·56	+ ·50	2·52	+ ·15
19	·8793	3·46	— ·36	2·13	— ·11
19	·9525	3·04	— ·20	2·04	+ ·10

$$S_O = +\,3\cdot305 - 1\cdot196 \sin 2\pi P - \cdot426 \cos 2\pi P, \text{ max. at } {}^{P}\cdot196$$
$$\pm\,\cdot107 \qquad \pm\,\cdot107 \qquad \pm\,\cdot017 \text{ (m. e.)}$$
$$S_K = +\,2\cdot093 - \cdot550 \sin 2\pi P - \cdot324 \cos 2\pi P, \text{ max. at } {}^{P}\cdot165$$
$$\pm\,\cdot064 \qquad \pm\,\cdot064 \qquad \pm\,\cdot016 \text{ (m. e.)}$$

m. This Algol star with a period of $21^{d}\cdot249$ has a broad, constant minimum about $^{P}\cdot05$ wide. The descending branch of the lightcurve is steep, while no observations on the ascending branch are available. The individual observations of the minimum are given in Table 7 and on the diagram on page 240, where the two open circles represent the mean values of 5 observations at maximum. There is some indication of the brightness not being constant outside the primary minimum. More observations, especially on the ascending branch, are much wanted in order to get a complete lightcurve of this interesting star.

TABLE 7.

J. D. hel.	Phase	Brightness
2420000		s
5797·261	·831	4·5
97·283	·832	7·1
97·442	·839	7·2
97·464	·840	8·0
5415·244	·852	11·1
15·295	·855	11·4
15·318	·856	11·6
15·450	·862	11·7
15·496	·864	12·4
15·543	·866	11·2
6010·578	·870	13·0
10·600	·871	11·5
5798·258	·878	13·0
13·506	·889	13·2
13·528	·890	11·5
5437·448	·897	11·5
16·222	·898	11·3
16·244	·899	11·4
16·266	·900	13·2
16·288	·901	11·8

w. A secondary minimum is found at $^{ph}\cdot826$.

z. The lightcurve of this δ Cep variable has approximately the shape of a sinusoid, the maximum of which has been deduced by least squares. The residuals are given in Table 5. The formula is:

$$S = +\,3\cdot089 - \cdot324 \sin 2\pi P + 1\cdot452 \cos 2\pi P, \text{ max. at } {}^{P}\cdot4652$$
$$\pm\,\cdot089 \qquad \pm\,\cdot089 \qquad \pm\,{}^{P}\cdot0094 \text{ (m. e.)}$$

The following stars have meanwhile been published from Harvard as being variable (*H. B.* 884):

b = YY Nor, Algol type, Harvard period $1^{d}\cdot25333$

A possible relation between the periode of Harvard (H) and Leiden (L) is $^{1}/_{2\,H} + {}^{1}/_{L} = 1$.

l = BY Nor, RR Lyrae type, period unknown,
m = CE Nor, Algol type, period unknown.
n = CP Nor, Algol type, Harvard period $3^{d}\cdot90$.
u = VZ Arae, RR Lyrae type, Harvard period $^{d}\cdot38443$.

The reciprocals of the Harvard and Leiden periods differ by one unit.

I want to express my thanks to Professor HERTZSPRUNG for the help and advice he gave me in preparing this paper.

TABLE 1.

	α (1875)	δ (1875)	number of plates	period	m. e.	reciprocal period	phase of epoch	epoch 2420000+	fraction of period occupied by minimum	max.	min.	range	max.	min.
	h m s	° ′		d	d	d^{-1}	P	d	P	s	s	s	m	m
a	15 34 58·7	— 51 6·5	230	2·20889	± ·00004	·452717	·775	5824·333	·15	7·0	19·0	12·0	10·6	12·8
b	15 38 ·3	— 57 1·4	246	1·694903	± ·000047	·590004	·982	5649·084	·25	2·1	7·6	5·5	12·9	16·2
c	15 42 13·3	— 54 59·0	290	·942331	± ·00005	1·061198	·480	5726·057	·56	— 1·1	2·0	3·1	10·4	11·0
d	15 45 2·6	— 54 9·2	284	5·70386	± ·00785	·17532	{ ·342 / ·919	5772·170	{ ·15 / ·14	2·2	5·0	2·8	12·7	13·3
e	15 46 53·2	— 53 43·6	287	5·9569	± ·0042	·167873	·266	5738·060	·31	2·4	6·9	4·5	13·4	15·6
f	15 50 56·7	— 57 ·9	272	2·42711	± ·00013	·412012	·139	5611·824	·15	·4	2·1	1·7	13·8	14·6
g	15 53 24·2	— 51 1·2	258	·830755	± ·000015	1·203724	·797	5637·340	·21	1·4	3·6	2·2	13·6	14·8
h	15 57 48·9	— 58 36·7	285	1·9600	± ·0004	·5102	·180*	5705·960		1·5	2·9	1·4	13·0	13·5
i	15 58 42·9	— 57 53·1	280	1·454044	± ·000057	·687737	·291	5706·180	·22	·5	2·1	1·6	13·8	15·9
k	15 59 24·8	— 53 2·3	155	2·07116	± ·00016	·48282	·122	5577·901	·17	2·2	5·3	3·1	13·9	14·8
l	15 59 49·2	— 59 22·5	257	·660700	± ·000043	1·513546	·512	5720·680		1·5	3·1	1·6	13·7	14·7
m	16 0 37·8	— 59 42·1	282	21·248566		·047062	·880	5501·050	·10	1·5	12·0	10·5	11·0	13·9
n	16 3 42·6	— 57 58·8	282	2·46628	± ·00009	·40547	·866	5753·490	·29	·9	4·1	3·2	13·2	15·1
o	16 5 13·1	— 53 1·0	293	3·4535	± ·0006	·2896	·135	5756·680		2·0	5·1	3·1	11·5	12·0
p	16 8 52·2	— 53 41·1	177	2·97183	± ·00016	·3365	·953	5560·039	·11	2·7	8·0	5·3	10·9	11·8
q	16 13 54·8	— 52 49·0	198	·624999	± ·000020	1·600003	·021	5708·127		1·7	3·2	1·5	14·4	15·3
r	16 14 3·0	— 53 12·5	252	·134391	± ·000001	7·440974	·466	5694·210		1·3	3·7	2·4	14·0	15·0
s	16 16 47·5	— 52 56·1	257	3·093067	± ·00059	·323304	·675	5919·119	·16	1·4	4·1	2·7	14·2	15·2
t	16 21 47·9	— 55 16·3	291	35·734	± ·120	·028	·180	5827·860		1·1	3·5	2·4	12·5	13·8
u	16 26 55·0	— 58 8·1	177	·62563	± ·00001	1·59838	·120	5678·320		·5	3·8	3·3	13·2	14·8
v	16 27 4·0	— 51 9·4	250	1·79942	± ·00004	·55573	·347	5771·410	·23	·3	3·1	2·8	12·7	13·9
w	16 30 8·1	— 56 17·2	275	8·5207	± ·0033	·117361	·345	5822·590	·35	2·5	8·1	5·6	13·0	14·9
x	16 31 30·1	— 57 4·9	244	5·9594	± ·0024	·1678	·384	5765·000		·8	3·4	2·6	12·1	14·3
y	16 33 2·9	— 56 12·9	218	16·4370	± ·0074	·0608	·899	5623·330	·23	1·9	5·7	3·8	13·1	14·8
z	16 35 45·4	— 55 32·8	245	16·016	± ·022	·0624	·465*	5752·680		1·7	4·5	2·8	12·4	15·4

TABLE 2.

	type	variable found		Δ *d*	Δ *s*	found by
		bright	faint			
		d	d	d	s	
a	Algol	2425739·488	2425720·541	19	12·6	v G
b	Algol	5720·520	5713·506	7	5·1	K
c	Algol	6118·479	6129·421	11	1·6	O
d	Algol	5713·506	5720·520	7	2·8	K
e	Algol	6129·399	6125·461	4	4·5	K
f	Algol	5417·439	5420·376	3	1·1	K
g	Algol	5720·541	5739·488	19	1·7	v G
h	δ Cep	6129·421	6118·479	11	1·3	O
i	Algol	5390·439	5393·493	3	2·0	K
k	Algol	5720·541	5739·488	19	4·0 [1]	v G
l	RR Lyr	6118·479	6129·421	11	1·8	v G
m	Algol	5720·520	5713·506	7	10·4	K
n	Algol	6129·421	6118·479	11	3·5	O
o	δ Cep	5739·488	5720·541	19	3·1	v G
p	Algol	5739·488	5720·541	19	5·3	v G
q	δ Cep	6129·421	6118·479	11	2·0	O
r	WU Ma	6129·421	6118·479	11	2·5	O
s	Algol	6118·479	6129·421	11	3·3	O
t	δ Cep	5720·520	5713·506	7	2·8	K
u	RR Lyr	6129·421	6118·479	11	3·1	O
v	Algol	6118·479	6129·421	11	5·4	O
w	Algol	6118·479	6129·421	11	6·1	O
x	δ Cep	5390·439	5393·493	3	1·3	K
y	Algol	5720·541	5739·488	19	3·5	v G
z	δ Cep	6129·421	6118·479	11	2·5	O

[1]) The variable being invisible on plate 5102 of J. D. 2425739·488, the brightness of this minimum is assumed to equal that of the mean light-curve, viz: 5s·3.

TABLE 3.

a

	s	m
A	·00	9·3
a	5·00	10·2
b	7·89	10·8
c	12·34	11·4
d	16·67	12·1
e	19·52	13·0
f	20·82	13·4

b

	s	m
A	·00	11·7
a	1·53	12·0
b	3·12	13·0
c	4·31	13·9
d	5·45	15·1
e	6·08	15·7
f	7·16	16·1
g	7·82	16·5

c

	s	m
a	·00	10·4
b	3·43	11·0

d

	s	m
a	·00	12·2
b	2·81	12·8
c	5·32	13·4

e

	s	m
A	·00	12·2
a	2·73	13·1
b	3·61	13·6
c	4·63	14·0
d	5·79	15·4
e	7·10	15·7

f

	s	m
a	·00	13·6
b	1·04	13·9
c	2·44	15·1

g

	s	m
a	·00	12·9
b	1·64	13·5
c	3·43	15·0

h (K.)

	s	m
a	·00	12·5
b	1·68	12·9
c	3·15	13·4
d	4·86	14·4

h (O.)

	s	m
a1	·00	11·9
b	3·10	12·4
c1	8·56	13·1

i

	s	m
a	·00	13·2
b	·85	14·2
c	1·30	15·0
d	2·05	15·9

k

	s	m
a	·00	13·2
b	3·18	14·0
c	4·97	15·0

l

	s	m
a	·00	12·8
b	1·92	13·7
c	2·87	14·9

m

	s	m
a	·00	10·6
b	2·77	11·2
c	7·94	12·6
d	12·17	14·1
e	13·25	14·3

n

	s	m
a	·00	12·7
b	1·44	13·2
c	3·11	14·5
d	4·24	15·6

o

	s	m
A	·00	11·2
a	3·07	11·7
b	5·96	12·1

p

	s	m
A	·00	10·5
a	3·51	11·2
b	6·27	11·5
c	8·63	11·6

q

	s	m
A	·00	13·3
a	2·27	14·8
b	2·98	15·2

r

	s	m
a	·00	13·5
b	2·07	14·4
c	2·91	14·6
d	3·91	15·2

s

	s	m
a	·00	13·7
b	1·83	14·2
c	3·28	14·7
d	4·64	15·7

t

	s	m
a	·00	11·9
b	1·31	12·9
c	2·54	13·1
d	3·69	14·0
e	4·50	14·3

u

	s	m
a	·00	13·0
b	1·16	13·4
c	2·86	14·3
d	3·61	14·9

v

	s	m
a	·00	12·6
b	·66	13·0
c	1·92	13·5
d	3·25	13·8
e	4·91	14·5

w

	s	m
a	·00	12·2
b	2·30	12·7
c	4·02	13·6
d	6·02	13·7
e	7·56	14·7

x

	s	m
a	·00	11·4
b	·63	11·6
c	3·02	13·7
d	4·09	15·7

y

	s	m
A	·00	12·3
a	1·73	12·7
b	3·04	13·6
c	3·71	14·0
d	4·49	14·3
e	5·02	15·2

z

	s	m
a	·00	11·8
b	2·67	14·2
c	4·18	14·9

TABLE 4.

a

d	*E*	d
2425411·265	0	+ ·001
44·403	15	— ·002
53·232	19	+ ·004
5720·520	140	— ·009
5824·333	187	— ·005
35·362	192	+ ·011

b

d	*E*	d
2425391·458	0	— ·007
5415·190	14	— ·004
42·343	30	+ ·031
52·464	36	— ·018
5713·506	190	+ ·009
40·598	206	— ·017
74·504	226	— ·009
91·450	236	— ·012
98·258	240	+ ·016
5803·326	243	·000
25·370	256	+ ·010

c

d	*E*	d
2425411·35	0	+ ·03
23·50	13	— ·07
43·39	34	+ ·03
44·33	35	+ ·03
76·31	69	— ·03
5651·61	255	·00
52·59	256	+ ·03
5719·41	327	— ·05
20·52	328	+ ·12
37·41	346	+ ·04
5803·31	416	— ·02
35·34	450	— ·03
36·26	451	— ·05
51·33	467	— ·06
54·27	470	+ ·05
6010·60	636	— ·04
2426076·58	706	— ·03
6126·52	759	— ·03

d

d	*E*	d
2425420·40	0	+ ·92
35·30	3	—1·31
43·35	4	+1·03
52·40	6	—1.34
75·27	10	—1·31
5720·53	53	—1·57
74·53	62	+1·04
91·39	65	+ ·77
98·26	67	—3·78
5808·31	68	+ ·56
31·28	72	+ ·69
6013·60	104	+ ·30
36·54	108	+ ·40
76·57	115	+ ·46
93·63	118	+ ·39
6125·47	124	—2·03

e

d	*E*	d
2425410·41	0	+ ·03
16.22	1	— ·12
46·31	6	+ ·19
52·26	7	+ ·18
5791·37	64	— ·25
97·44	65	— ·14
5803·30	66	— ·23
21·25	69	— ·16
33·32	71	·00
51·33	74	+ ·14
6089·48	114	+ ·02
6125·48	120	+ ·27

f

d	*E*	d
2425415·518	0	— ·49
·543	0	— ·24
·565	0	— ·02
2425420·432	2	+ ·11
37·448	9	+ ·38
5716·527	124	+ ·06
·549	124	+ ·28
89·308	154	— ·24
·381	154	+ ·49
6012·586	246	— ·35

g

d	*E*	d
2425381·46	0	+ ·01
91·43	12	+ ·01
5411·36	36	·00
15·52	41	+ ·01
45·42	77	·00
51·24	84	+ ·01
5655·61	330	+ ·01
5824·22	533	— ·02
58·28	574	— ·02
6088·45	851	+ ·03
93·42	857	+ ·01

h

d	*E*	d
2425452·35	0	+ ·04
5850·22	203	+ ·03
6014·55	287	— ·28
36·55	298	+ ·16
67·52	314	— ·23
87·44	324	+ ·09
89·48	325	+ ·17
91·39	326	+ ·22
93·42	327	+ ·19
6118·48	340	— ·23
20·54	341	— ·13
22·53	342	— ·10
26·53	344	— ·02
6475·49	522	+ .06

i

d	*E*	d
2425393·47	0	+ ·01
2425415·27	15	·00
18·20	17	+ ·02
41·50	33	+ ·06
44·35	35	·00
76·32	57	— ·02
5646·51	174	+ ·05
5745·38	242	+ ·04
64·26	255	+ ·02
74·46	262	+ ·04
90·48	273	+ ·07
5825·34	297	+ ·03
60·26	321	+ ·05
6088·47	478	— ·02
91·39	480	— ·01
6120·52	500	+ ·04

k

d	*E*	d
2425391·458	0	— ·029
93·493	1	— ·065
5418·481	13	+ ·069
20·432	14	— ·051
43·313	25	+ ·047
45·379	26	+ ·042
5685·588	142	— .003
5714·576	156	— ·012
37·376	167	+ ·005
39·477	168	+ ·035
64·271	180	— ·025
93·283	194	— ·009

l

d	*E*	d
2425411·47	0	·00
15·45	6	+ ·02
17·44	9	+ ·02
35·28	36	+ ·02
48·46	56	— ·01
52·43	62	·00
5652·61	365	— ·02
5738·51	495	— ·01

TABLE 4 (*continued*).

d	*E*	d
2425740·50	498	·00
64·26	534	— ·02
89·38	572	— ·01
91·37	575	·00
95·30	581	— ·04
5834·33	640	+ ·01
6036·52	946	+ ·03
67·55	993	+ ·01
87·41	1023	+ ·04
94·61	1034	— ·02
	n	
2425383·54	0	— ·02
93·44	4	+ ·01
5415·59	13	— ·03
5716·53	135	+ ·02
90·49	165	— ·01
5805·35	171	+ ·06
6076·56	281	— ·02
91·39	287	+ ·01
6118·49	298	— ·02
	o	
2425383·56	0	— ·06
90·44	2	— ·09
5411·36	8	+ ·11
42·46	17	+ ·13
53·32	20	— ·37
5739·47	103	+ ·14
94·47	119	— ·12
5808·31	123	— ·09
36·25	131	+ ·22
50·21	135	+ ·37
53·30	136	·00
6067·52	198	+ ·11
91·39	205	— ·20
6122·53	214	— ·14
29·42	216	— ·16
	p	
2425411·43	0	— ·04
17·43	2	+ ·02
20·37	3	— ·01
35·28	8	+ ·04
38·21	9	·00
5714·58	102	— ·01
20·53	104	— ·01
41·34	111	·00
44·33	112	+ ·02
	q	
2425406·32	0	+ ·05
11·31	8	+ ·04
18·24	19	+ ·09
42·48	58	— ·04
44·36	61	— ·04
51·24	72	— ·03
52·46	74	— ·06
76·32	112	+ ·05
5719·39	501	— ·01
40·60	535	— ·04
5821·24	664	— ·03
31·28	680	+ ·01
6012·58	970	+ ·06
67·50	1058	— ·02
90·64	1095	·00
6122·54	1146	+ ·02
29·41	1157	+ ·01
	r	
2425383·54	0	+ ·04
91·43	59	·00
5406·33	170	— ·02
11·31	207	— ·01
11·45	208	·00
15·50	238	+ ·01
38·21	407	+ ·01
42·48	439	— ·02
43.29	445	— ·01
43·44	446	·00
44·36	453	— .02
45·45	461	·00
48·29	482	+ ·01
48·42	483	+ ·01
51·24	504	+ ·01
52·33	512	+ ·02
52·44	513	·00
53·25	519	— ·02
53·37	520	— ·01
82·29	735	+ ·01
5716·53	2478	+ ·01
19·48	2500	·00
20·54	2508	— ·01
37·34	2633	— ·01
39·63	2650	— ·01
40·58	2657	·00
44·33	2685	— ·01
90·28	3027	— ·02
94·45	3058	— ·02
97·28	3079	— ·01
5808·31	3161	·00
2425835·32	3362	·00
50·24	3473	·00
54·27	3503	·00
64·24	3577	+ ·02
6010·58	4666	+ ·01
14·60	4696	·00
76·56	5157	+ ·01
87·44	5238	·00
89·46	5253	·00
90·39	5260	— ·01
93·62	5284	·00
6118·49	5469	+ ·01
22·53	5499	+ ·01
26·53	5529	— ·02
	s	
2425764·46	0	— ·03
89·30	8	+ ·07
92·40	9	+ ·07
95·30	10	+ ·12
6067·63	98	+ ·02
92·40	106	+ ·04
6129·41	118	— ·06
	t	
2425406	0	+ 4
37	1	0
5652	7	0
5719	9	— 4
93	11	— 2
5863	13	— 3
6012	17	+ 3
6475	30	+ 1
	u	
2425415·565	0	— ·002
16·244	1	+ ·052
17·439	3	— ·005
37·448	35	— ·016
42·462	43	— ·007
44·342	46	— ·004
51·244	57	+ ·016
52·465	59	— ·014
5714·587	478	— ·033
92·222	602	+ ·024
95·304	607	— ·023
5822·210	650	— ·019
25·336	655	— ·021
52·278	698	+ ·019
6010·578	951	+ ·033
6122·547	1130	+ ·014
29·399	1141	— ·016
	v	
2425420·42	0	— ·02
38·44	10	+ ·01
5652·58	129	+ ·01
5744·33	180	— ·02
5834·32	230	+ ·01
52·29	240	— ·01
6093·42	374	·00
6129·41	394	·00
	w	
2425413·40	0	— ·15
5720·52	36	+ ·22
37·34	38	·00
97·27	45	+ ·29
5805·35	46	— ·15
22·21	48	— ·33
31·28	49	+ ·21
6120·54	83	— ·23
29·40	84	+ ·11
	x	
2425437·45	0	+ ·09
43·38	1	+ ·06
5651·60	36	— ·30
5741·34	51	+ ·05
65·37	55	+ ·25
89·31	59	+ ·35
5836·29	67	— ·35
54·27	70	— ·24
60·26	71	— ·21
6009·60	96	+ ·14
15·58	97	+ ·16
	y	
2425442·4845	0	+ ·0120
75·2809	2	— ·0657
5738·5115	18	+ ·1725
5853·2794	25	— ·1188
	z	
2425383·5	0	— ·79
5415·8	2	— ·52
49·5	4	+1·14
5655·6	17	— ·97
5719·9	21	— ·73
37·9	22	+1·25
5834·3	28	+1·55
64·2	30	— ·58
6010·1	39	+1·17
89·0	44	— ·01
6119·5	46	—1·54

TABLE 5.

n	phase	brightness
	a	
	P	s
10	·025	6·6
10	·084	6·7
10	·199	7·2
10	·266	7·3
10	·260	7·5
10	·291	7·7
10	·322	7·1
10	·354	6·4
10	·379	7·1
10	·409	7·6
10	·482	7·2
10	·548	7·2
10	·594	7·5
10	·639	8·3
10	·691	7·6
5	·727	10·9
5	·746	15·5
5	·765	19·1
5	·786	18·2
5	·802	15·1
5	·817	11·8
10	·836	9·5
10	·860	7·3
10	·895	7·6
10	·924	7·7
10	·964	6·9
	b	
10	·023	4·4
10	·049	2·8
10	·076	2·4
10	·144	1·9
10	·184	2·1
10	·245	2·1
10	·286	2·1
10	·329	2·2
10	·402	1·8
10	·424	2·4
10	·459	2·2
10	·487	2·2
10	·520	2·1
10	·556	2·1
10	·592	2·0
10	·620	2·2
10	·658	2·0
10	·698	1·9
10	·749	2·0
10	·784	2·0
10	·837	2·1
10	·891	2·1
10	·929	3·3
8	·961	6·3
8	·982	7·6
	c	
10	·023	—1·0
10	·055	—1·5
10	·084	—1·2
10	·112	—1·2
10	·155	—1·0
10	·209	— ·7
10	·250	— ·9
10	·306	— ·1
10	·349	— ·2
10	·390	+ ·3
10	·423	+1·4
10	·446	+1·9

TABLE 5 (*continued*).

n	phase	brightness
	P	s
10	·470	+2·0
10	·500	+1·5
10	·523	+1·7
10	·541	+1·6
10	·571	+ ·9
10	·606	+ ·5
10	·631	— ·6
10	·664	— ·6
10	·689	— ·4
10	·712	—1·1
10	·747	— ·8
10	·789	— ·8
10	·832	—1·1
10	·876	—1·1
10	·907	—1·3
10	·946	— ·7
10	·975	—1·3

d

n	phase	brightness
10	·031	2·1
20	·078	2·2
20	·145	2·1
20	·226	2·2
10	·294	2·7
10	·321	4·6
10	·341	4·9
10	·382	3·2
20	·430	2·4
20	·494	2·2
30	·594	2·2
20	·694	2·0
30	·747	2·3
20	·838	2·2
10	·897	3·4
10	·921	5·0
7	·942	3·2
7	·979	2·3

e

n	phase	brightness
10	·049	2·0
10	·083	2·6
10	·106	2·5
10	·125	2·6
10	·138	2·8
10	·154	2·8
10	·225	5·1
10	·260	6·9
10	·299	4·9
10	·323	2·7
10	·353	2·6
10	·393	2·5
10	·416	2·4
10	·432	2·6
10	·446	2·5
10	·464	2·3
10	·487	2·3
10	·544	2·4
10	·591	2·2
10	·625	2·0
10	·670	2·2

n	phase	brightness
	P	s
10	·727	2·9
10	·762	3·1
10	·796	2·7
10	·830	2·7
10	·882	2·4
10	·918	2·5
9	·947	2·3
8	·971	2·3

f

n	phase	brightness
10	·012	·4
10	·026	·5
10	·048	·4
10	·067	·5
10	·082	·8
10	·104	·7
10	·127	2·1
10	·149	1·9
10	·174	·5
10	·190	·5
10	·201	·8
10	·216	·8
10	·231	·6
10	·246	·2
10	·263	·1
10	·275	·1
10	·284	·5
10	·306	·2
10	·332	·7
10	·359	·6
10	·371	·5
10	·384	·6
10	·403	·7
10	·429	·6
10	·446	·4
11	·467	·3
12	·484	·7

g

n	phase	brightness
10	·024	1·1
10	·063	1·2
10	·098	1·5
10	·135	1·3
10	·167	1·3
10	·215	1·5
10	·248	1·7
10	·288	1·6
10	·342	1·8
10	·396	1·5
10	·446	1·0
10	·494	1·6
10	·542	1·2
10	·583	1·6
10	·613	1·4
10	·667	1·6
10	·707	2·1
10	·735	2·5
10	·762	3·2
10	·797	3·6
10	·822	3·1

n	phase	brightness
	P	s
10	·850	2·1
10	·880	1·6
10	·907	1·0
10	·936	1·6
8	·972	1·5

h (K.)

n	phase	brightness
19	·043	1·5
19	·138	1·5
19	·204	1·4
19	·242	1·5
19	·286	1·8
19	·327	1·6
19	·404	2·1
19	·537	2·7
19	·639	2·7
19	·696	2·5
19	·748	2·4
19	·792	2·8
19	·844	2·5
19	·879	2·1
19	·952	2·0

h (O.)

n	phase	brightness
19	·043	2·4
19	·138	1·7
19	·204	2·3
19	·242	2·4
19	·286	2·2
19	·327	2·4
19	·404	3·2
19	·537	3·6
19	·639	4·3
19	·696	4·7
19	·748	4·2
19	·792	5·1
19	·844	4·6
19	·879	3·5
19	·952	3·0

i

n	phase	brightness
10	·011	·4
10	·042	·5
10	·069	·4
10	·104	·5
10	·144	·5
10	·184	·4
10	·222	·8
10	·266	2·0
10	·301	2·1
10	·324	1·7
10	·361	·8
10	·407	·5
10	·437	·5
10	·462	·6
10	·486	·5
10	·510	·4
10	·532	·4
10	·554	·5

n	phase	brightness
	P	s
10	·580	·4
10	·616	·3
10	·659	·5
10	·713	·5
10	·776	·5
10	·819	·6
10	·868	·4
10	·935	·5
10	·956	·6
10	·984	·4

k

n	phase	brightness
10	·035	2·2
1	·059	2·2
5	·067	2·8
3	·079	3·6
3	·090	4·6
1	·104	5·2
1	·129	5·3
1	·140	5·3
2	·150	5·2
1	·159	4·0
2	·171	2·8
6	·182	2·6
10	·202	2·3

l

n	phase	brightness
10	·043	2·9
10	·117	3·1
10	·169	3·1
10	·203	3·1
30	·264	2·9
10	·330	3·2
10	·412	3·0
10	·432	2·2
10	·464	1·6
10	·489	1·5
10	·528	1·5
10	·578	1·5
10	·625	2·0
20	·682	2·3
30	·732	2·5
20	·800	2·6
10	·859	2·8
19	·924	2·8
8	·981	2·8

m

n	phase	brightness
10	·010	1·8
10	·048	1·2
10	·093	·9
10	·121	1·2
10	·159	1·2
10	·174	1·2
10	·204	1·8
10	·251	1·4
10	·280	1·4
10	·326	1·7
10	·367	1·8

n	phase	brightness
	P	s
10	·413	2·2
10	·458	1·7
10	·498	2·0
10	·538	1·8
10	·557	2·0
10	·592	1·3
10	·612	1·2
10	·642	1·3
10	·663	1·2
10	·675	1·1
10	·712	1·8
10	·753	1·0
5	·789	1·4
5	·822	2·1
5	·832	4·4
5	·853	10·8
5	·870	12·2
7	·896	12·0
10	·946	1·9
10	·976	1·6

n

n	phase	brightness
10	·036	1·0
10	·072	1·2
10	·092	·7
10	·105	1·1
10	·120	·9
10	·135	1·0
10	·159	·9
10	·179	·8
10	·209	·7
10	·243	·7
10	·286	·8
10	·308	1·0
10	·380	·9
10	·466	·8
10	·512	·8
10	·570	1·0
10	·620	·8
10	·655	1·1
10	·693	1·0
10	·717	·8
10	·741	1·0
10	·770	1·0
10	·797	1·3
10	·831	2·5
10	·866	4·1
10	·898	3·2
10	·930	1·8
6	·958	1·1
6	·981	1·0

o

n	phase	brightness
30	·050	2·4
30	·133	2·0
30	·229	3·0
30	·323	3·9
30	·429	4·0
30	·569	4·9
30	·675	5·2

n	phase	brightness
	P	s
30	·774	5·2
27	·880	4·9
26	·961	3·6

p

n	phase	brightness
10	·006	2·6
10	·035	2·8
10	·070	2·8
10	·133	2·2
10	·236	2·8
10	·316	3·3
10	·342	3·2
10	·376	2·3
10	·409	3·2
10	·571	3·1
10	·608	2·4
10	·665	2·8
10	·697	2·7
10	·730	2·6
10	·814	2·6
7	·902	2·9
2	·926	5·1
4	·946	8·2
4	·957	7·8
4	·960	7·9
4	·968	7·9
2	·978	5·6

q

n	phase	brightness
10	·021	1·7
10	·072	1·8
10	·125	1·9
10	·161	2·2
10	·186	2·4
10	·228	2·5
10	·297	2·9
10	·342	2·9
10	·389	2·8
10	·442	3·2
10	·481	3·0
10	·525	3·0
10	·583	3·1
10	·625	3·2
10	·684	3·2
10	·756	3·3
10	·843	3·3
10	·894	3·1
9	·943	2·3
9	·977	2·1

r

n	phase	brightness
10	·021	1·3
15	·080	1·3
10	·121	1·3
25	·200	1·6
20	·278	2·0
25	·375	3·3
20	·488	4·6
10	·571	3·3
5	·604	2·9
15	·633	2·2

n	phase	brightness
	P	s
15	·692	1·5
20	·755	1·5
20	·831	1·4
25	.907	1·0
17	·976	1·3

s

n	phase	brightness
30	·080	1·7
30	·204	1·4
30	·349	1·3
30	·456	1·5
40	·545	1·4
10	·643	3·0
10	·692	4·1
10	·731	2·1
30	·794	1·5
40	·918	1·4

t

n	phase	brightness
10	·020	2·2
20	·109	1·2
30	·211	·9
40	·336	1·5
50	·434	1·9
40	·544	2·1
30	·638	2·5
40	·695	3·1
20	·834	3·6
11	·952	3·4

u

n	phase	brightness
10	·035	2·7
10	·089	1·1
10	·120	·5
10	·152	·9
10	·181	1·5
10	·221	1·9
10	·278	2·3
10	·318	2·5
10	·363	2·7
10	·436	3·2
50	·615	3·4
27	·889	3·5

v

n	phase	brightness
80	·144	·0
10	·314	1·0
10	·347	3·1
10	·364	2·8
10	·413	·5
10	·462	·5
10	·495	·2
110	·731	·3

w

n	phase	brightness
30	·050	2·5
30	·162	2·5
10	·277	3·7
10	·329	8·1
10	·386	4·1
10	·414	2·9
10	4·58	2·8

n	phase	brightness
	P	s
10	·506	2·9
30	·559	2·4
30	·645	2·5
20	·724	2·6
20	·782	2·6
10	·826	3·3
10	·860	2·8
20	·896	2·4
15	·970	2·4

x

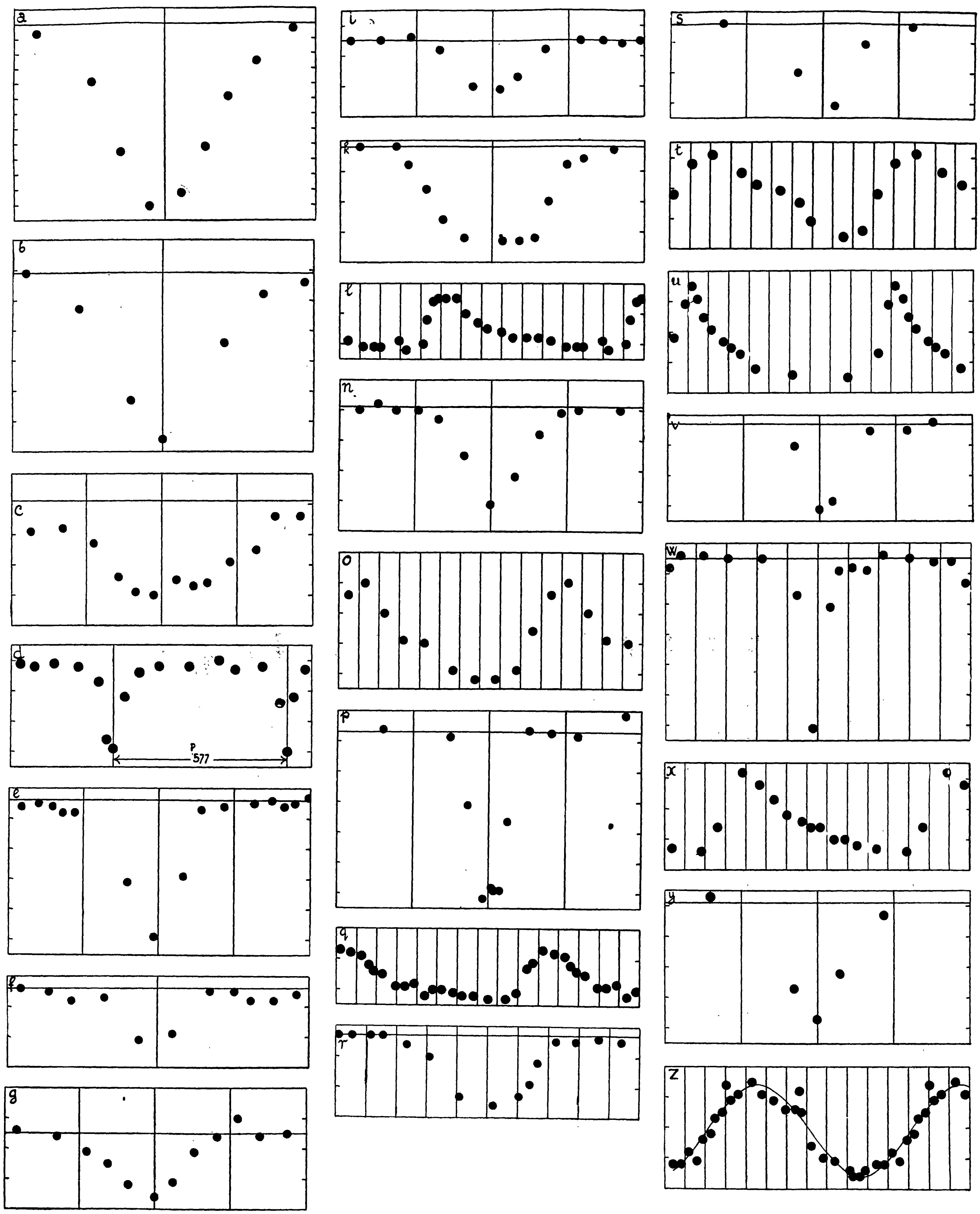
n	phase	brightness
50	·044	3·3
20	·185	3·4
20	·265	2·6
30	·384	·8
10	·468	1·2
10	·535	1·7
10	·600	2·2
10	·672	2·4
20	·722	2·6
20	·763	2·6
10	·835	3·0
10	·890	3·0
24	·942	3·2

y

n	phase	brightness
41	·145	1·7
41	·338	2·1
41	·528	2·2
41	·756	1·7
4	·870	4·7
5	·899	5·7
4	·928	4·2
41	·986	2·3

z

n	phase	brightness	O—C
10	·042	4·2	— ·2
10	·084	4·2	0
10	·121	3·8	— ·1
10	·161	4·1	+ ·5
10	·193	3·4	+ ·1
10	·231	3·2	+ ·3
10	·249	2·7	— ·1
10	·287	2·5	+ ·1
10	·306	1·6	— ·7
10	·329	2·1	0
10	·366	1·9	0
10	·433	1·5	— ·1
10	·480	1·9	+ ·3
10	·540	2·1	+ ·3
10	·598	2·4	+ ·3
10	·648	2·4	— ·1
10	·667	1·8	— ·8
10	·678	2·5	— ·2
10	·725	3·6	+ ·4
10	·785	4·0	+ ·3
10	·840	4·1	0
10	·917	4·4	— ·1
10	·930	4·6	+ ·1
8	·967	4·6	c
7	·992	4·4	— ·2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