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COMMUNICATIONS FROM THE OBSERVATORY AT LEIDEN.

Provisional Ephemerides of 33 variable stars in the constellations Norma and Ara, by *W. E. Kruytbosch*. †

IN R. PRAGER'S *Katalog und Ephemeriden veränderlicher Sterne für 1934* a considerable number of variable stars in the regions Norma and Ara appears with unknown period. Excluding the variables of long period and the irregular ones and taking into account only the variables of short period and the eclipsing binaries, which occur on the plates available in Leiden, the number of these variable stars of unknown period in PRAGER'S catalogue is 75.

Several of these stars are situated too near to the border of the plates taken by Dr. H. VAN GENT with the Franklin-Adams instrument at Johannesburg with the centre at $16^{\text{h}}4^{\text{m}}, -54^{\circ}45'$ (1875), covering $10^{\circ} \times 10^{\circ}$, to be successfully observed.

14 of these 75 stars have been found by Miss DORRIT HOFFLEIT at Harvard (*Harvard Bulletin* 884) on plates with the centre at $16^{\text{h}}01^{\text{m}}, -60^{\circ}5'$ (1900). The number of the Johannesburg plates is 304, that of the Harvard plates of these regions used by Miss HOFFLEIT is 42.

Of 7 other stars, viz. WX, AA, AC, BE, BH, CL and EX Nor, also found by Miss HOFFLEIT (*H.B.* 884), the period is redetermined by the writer.

The other 11 stars forming the subject of the present note were found by Dr. H. VAN GENT by comparing selected pairs of plates of this region in the blink-microscope at Groningen.

The period of the variable SY Nor, which was unknown, is determined by the writer.

The total number of observations used here is 9925. The average number for each star is 283.

The extreme dates of the Johannesburg plates used are J.D. 2425381 and 6476. The normal exposure time of these plates is 30 min.

The 33 stars are listed in Table I, *a-l* being the stars found by Dr. VAN GENT. Five of these stars occur in the *C.P.D.*, viz. *a, b, e, CL* Nor and SY Ara with the numbers $-51^{\circ}8448$ ($8^{\text{m}}.2$), $-56^{\circ}7083$ ($9^{\text{m}}.2$), $-53^{\circ}7149$ ($9^{\text{m}}.8$), $-57^{\circ}7678$ ($10^{\text{m}}.4$) and $-54^{\circ}7757$ ($9^{\text{m}}.4$) respectively.

For 27 periods a mean error has been given in Table I. Owing to the small number of epochs these mean errors are in some 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. The periods given in Table 1 do not always agree exactly with this reciprocal period, as the period has occasionally been slightly improved afterwards.

For eclipsing variables the phase of minimum, for variables of δ Cep or RR Lyr type the phase of maximum has been given.

The normal epochs given in Table 1 have been chosen near the mean date of the observations.

The dates of the two plates, by the comparison of which the variability of the star was found by Dr. VAN GENT in the blink-microscope, are given in Table 2 together with the interval in days and the

TABLE 2.

Star	Type	Variable found		Δd	Δs
		bright	faint		
<i>a</i>	Algol	2426126.534	2426118.501	8.03	2.6
<i>b</i>	"	6010.578	6015.595	5.02	3.5
<i>c</i>	"	6118.501	6126.534	8.03	4.8
<i>d</i>	"	6126.534	6118.501	8.03	4.8
<i>e</i>	"	5383.536	5393.493	9.96	9.3
<i>f</i>	"	6010.578	6015.595	5.02	4.7
<i>g</i>	"	5383.536	5393.493	9.96	5.1
<i>h</i>	SS Cyg (?)	5383.536	5393.493	9.96	4.6
<i>i</i>	Algol	6126.534	6118.501	8.03	5.0
<i>k</i>	"	6126.534	6118.501	8.03	4.1
<i>l</i>	"	5791.394	5774.482	16.91	(Krb) 4.5 (Oos) 4.7

difference in steps between the two images of the variable as derived from the mean lightcurve. All

these 11 variables but one (*h*) are Algol stars. The data of the variable *h* are given in Table 6.

In Table 3 the magnitudes of the comparison stars are given as found by comparison with plates of the Crux region containing the Selected Area No. 193. These magnitudes are naturally rather uncertain.

The surroundings of each variable with indication of the comparison stars are shown on the diagrams on page 246. The size of each square is indicated in the right hand-bottom corner.

For 24 variables the epochs of minimum and for 3 the epochs of maximum used for computing the period according to least squares are indicated in Table 4, together with the countings of epochs and the residuals O-C. For six variables, viz. EM Nor, *b*, *f*, *h*, *i* and SY Ara, the number of epochs was too small to get reliable results by a least squares solution.

Excluding the variables *b*, *h* and *i*, the data of which are given in the remarks below, the observations of each variable 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 247 and 248.

On all these diagrams vertical lines have been drawn for each tenth of the period. The phases have on the diagrams in case of eclipsing variables been counted approximately from minimum and the brightness in steps from maximum light.

The individual objects give rise to the following remarks:

WX Nor. The Harvard period is $d.64$, the Leiden period is $1^d.271304$ or approximately double the Harvard one. A secondary minimum is observed at $ph.895$.

WZ Nor. A secondary minimum is found at $ph.982$.

AA Nor. The Harvard period of $12^d.253$ is confirmed by the present observations.

AC Nor. The period ($d.7845$) given in *H.B.* 884 is erroneous.

b. This Algol star *C.P.D.* $-56^{\circ}7083$ has an unusually long period. It was found in minimum on plates 6021 and 6221 of J.D. 2426015.57 and 6089.46, giving an interval of $73^d.89$. Dr. P. TH. OOSTERHOFF during his recent stay at Harvard estimated this star on 506 plates and found it decidedly in minimum on 2 plates only, viz. of J.D. 2418144.539 and 2425353.431. These 4 minima are satisfied by a period of $73^d.562$. The minimum seems to occupy an unusually small part of the period.

AT Nor. The epochs at which this Algol star was estimated to be $7^s.9$ or fainter were picked out. At 8 occasions two such observations fell on consecutive plates, of which the mean was taken as an epoch

of minimum. The six minima observed and kindly communicated by Miss HOFFLEIT of Harvard are

J. D. hel. 2423905.738
4299.724
4654.712
4670.651
6145.336
6481.415

The period deduced from these minima alone by means of a least squares solution is $1^d.44864 \pm d.00002$ (m.e.) or the same period as found from the Johannesburg material.

c. A secondary minimum is indicated at $ph.550$.

BE Nor. The mean lightcurve shows a secondary minimum at $ph.874$.

BH Nor. The formula derived from my own 11 minima is:

$$\text{min. at J.D. } 2425646.591 + 1^d.14445 \times (E - 210) \\ \pm .022 \pm .00016 \text{ m.e.}$$

Including the Harvard minimum at J.D. 2423992.546 (*H.B.* 884) and 7 others kindly communicated by Miss HOFFLEIT, the result is:

$$\text{min. at J.D. } 2425079.990 + 1^d.144634 \times (E - 1018) \\ \pm .016 \pm .000025 \text{ m.e.}$$

CL Nor. The period of this Algol star is given in *H.B.* 884 to be $d.61948$, while the one found here is $1^d.645749$, the difference between the two reciprocal periods being one unit.

CM Nor proves to be an Algol star.

CX Nor is a β Lyrae star of rather long period, viz. $19^d.62$. The density is likely to be 10^{-3} or even 10^{-4} that of our sun. The star is difficult to estimate owing to its faintness. The m.e. of a single observation is found to be $\pm 1^s.4$ or about $\pm m.36$.

f. The mean lightcurve shows a secondary minimum at $ph.923$. The number of minima found is too small to correct the period by means of a least squares solution.

DO Nor. A broad secondary minimum is found at $ph.060$.

g. There is an indication of a secondary minimum at $ph.861$.

h. The light-variation of the star is of an unusual character: broad as well as sharp minima occur, but they do not seem to alternate. It may be a variable of the SS Cyg type, but more observations are needed to establish its character. The observed data are given in Table 6, the second column of which gives the mean J.D., the third column the mean brightness in steps.

EI and *EK Nor* are RR Lyr stars.

EM Nor. This variable gave some difficulties in determining the period because the lightcurve is nearly a sinusoid of small range. The star was therefore observed independently by Dr. P. TH. OOSTERHOFF, who deduced a period of $d^{\cdot}3692$ from the maxima. The two lightcurves (K and O) obtained with the same reciprocal period of $2^{d^{\cdot}17088}$ are in good agreement. The variable is possibly of the W UMa type.

EO Nor is an Algal star.

i is an Algal star with an unusually long period, apparently $90^d\cdot9$. Only 3 well defined minima were found, viz. on J.D. 2425390 \cdot 4, 5482 \cdot 3 and 6118 \cdot 5 respectively.

EX Nor. This Algal star was found faint on 4 plates only. 7 other epochs of minimum were kindly communicated by Miss HOFFLEIT. These 7 minima are marked with an asterisk in Table 4. The period is derived from the 11 minima together. The mean lightcurve shows a secondary minimum at $ph\cdot676$. The declination of this star as given in PRAGER's catalogue, viz. $-56^{\circ}48'6$ is erroneous: it is $-56^{\circ}50'2$.

FK Nor. The descending and the ascending branch of the mean lightcurve of this Algal star are insufficiently observed. In the accompanying table are given the observed data of these branches on two nights. The star has an indication of a secondary minimum at $ph\cdot641$.

FW Nor is an Algal star with a shallow secondary minimum at $ph\cdot794$.

SY Ara. Only 4 minima were found, this number being too small for a correction by means of least squares.

J.D. hel. 242....	Brightness of FK Nor	J.D. hel. 242....	Brightness of FK Nor
d	s	d	s
5453 \cdot 2100	4 \cdot 7	5445 \cdot 3570	8 \cdot 2
53 \cdot 2318	4 \cdot 7	45 \cdot 3792	8 \cdot 7
53 \cdot 3007	6 \cdot 2	45 \cdot 4013	7 \cdot 7
53 \cdot 3225	7 \cdot 7	45 \cdot 4234	4 \cdot 7
53 \cdot 3444	8 \cdot 7	45 \cdot 4462	4 \cdot 7
53 \cdot 3662	faint	45 \cdot 4684	4 \cdot 7
53 \cdot 3880	faint		

VW Ara proved to be an Algal star.

k. This Algal star shows a secondary minimum at $ph\cdot032$.

XX Ara is an Algal star with a pronounced secondary minimum at $ph\cdot073$.

l. The period could not be deduced from the estimates made by the writer. The star was observed independently by Dr. OOSTERHOFF, who found a period of $1^d\cdot00502$ from his observations on the ascending branch. The two lightcurves (K and O) are in good agreement.

Of the 60 variable stars found by Dr. VAN GENT in Groningen 37 were already known, of 10 the variability was found doubtful, 2 were longperiodical stars and of only 11 variables, 10 of which were eclipsing binaries, the period could be detected.

I want to express my thanks to Prof. HERTZSPRUNG for the help and advice he gave me in preparing this paper and for deducing the greater part of the periods.

TABLE I.

	α (1875)			number of plates	period		m.e.	reciprocal period	phase of epoch	epoch 2420000 +	max. min. range			max. min.		Star
	h	m	s		d	d					d $^{-1}$	P	d	s	s	
1	15	30	38 \cdot 6	—58 $^{\circ}$ 7 $'$ 8	291	1 \cdot 271304	\pm 0 \cdot 000018	7866	426	5745 \cdot 520	1 \cdot 1	5 \cdot 5	4 \cdot 4	12 \cdot 0	13 \cdot 0	WX Nor
2	15	31	47 \cdot 2	—58 43 \cdot 6	267	1 \cdot 049018	\pm 0 \cdot 000017	95327	511	5756 \cdot 513	3 \cdot 5	8 \cdot 8	5 \cdot 3	12 \cdot 8	14 \cdot 0	WZ Nor
3	15	34	13 \cdot 2	—51 26 \cdot 4	273	8 \cdot 58023	\pm 0 \cdot 00018	11655	107	5792 \cdot 421	0	3 \cdot 9	3 \cdot 9	8 \cdot 0	11 \cdot 2	a
4	15	39	18 \cdot 9	—57 17 \cdot 0	287	12 \cdot 2537	\pm 0 \cdot 0026	08161	775	5805 \cdot 350	1 \cdot 3	10 \cdot 5	9 \cdot 2	13 \cdot 6	15 \cdot 3	AA Nor
5	15	41	10 \cdot 9	—59 2 \cdot 9	293	1 \cdot 29338	\pm 0 \cdot 00009	77317	888	5716 \cdot 580	7	4 \cdot 8	4 \cdot 1	11 \cdot 7	13 \cdot 1	AC Nor
6	15	47	31 \cdot 6	—56 12 \cdot 8	301	73 \cdot 562				5353 \cdot 6	2 \cdot 6	4 \cdot 4	1 \cdot 8	10 \cdot 1	11 \cdot 2	b
7	15	47	59 \cdot 2	—57 10 \cdot 2	290	1 \cdot 44864	\pm 0 \cdot 00003	690322	266	5835 \cdot 343	4 \cdot 0	8 \cdot 5	4 \cdot 5	14 \cdot 0	14 \cdot 7	AT Nor
8	15	49	31 \cdot 5	—51 20 \cdot 1	282	706717	\pm 0 \cdot 000012	1415	033	5771 \cdot 048	1 \cdot 2	6 \cdot 8	5 \cdot 6	12 \cdot 6	15 \cdot 2	c
9	15	52	2 \cdot 9	—57 39 \cdot 1	290	1 \cdot 338325	\pm 0 \cdot 000041	747203	522	5758 \cdot 170	1 \cdot 5	5 \cdot 6	4 \cdot 1	13 \cdot 6	14 \cdot 4	BE Nor
10	15	52	46 \cdot 4	—58 2 \cdot 0	296	1 \cdot 144634	\pm 0 \cdot 000025	87364	077	5079 \cdot 984	1 \cdot 0	3 \cdot 2	2 \cdot 2	12 \cdot 7	13 \cdot 1	BH Nor
11	15	58	48 \cdot 7	—58 37 \cdot 3	273	1 \cdot 873417	\pm 0 \cdot 000055	533784	974	5764 \cdot 455	3 \cdot 1	8 \cdot 3	5 \cdot 2	13 \cdot 6	14 \cdot 9	d
12	15	58	58 \cdot 4	—53 41 \cdot 0	299	4 \cdot 426460	\pm 0 \cdot 000204	225915	471	5738 \cdot 756	1 \cdot 6	11 \cdot 0	9 \cdot 4	11 \cdot 8	13 \cdot 7	e
13	16	2	21 \cdot 4	—57 38 \cdot 5	295	1 \cdot 645749	\pm 0 \cdot 000065	607626	577	5714 \cdot 991	2 \cdot 3	6 \cdot 7	4 \cdot 4	12 \cdot 3	13 \cdot 3	CL Nor
14	16	2	29 \cdot 0	—58 4 \cdot 9	298	5 \cdot 56362	\pm 0 \cdot 00050	179714	596	5762 \cdot 264	2	4 \cdot 4	4 \cdot 2	11 \cdot 7	12 \cdot 8	CM Nor
15	16	5	28 \cdot 0	—57 3 \cdot 3	267	19 \cdot 62	\pm 0 \cdot 01	050969	119	5613 \cdot 589	7	5 \cdot 0	4 \cdot 3	14 \cdot 1	15 \cdot 2	CX Nor
16	16	6	1 \cdot 6	—53 20 \cdot 4	294	5 \cdot 302621		188586	457	5729 \cdot 254	1 \cdot 7	4 \cdot 7	3 \cdot 0	13 \cdot 2	14 \cdot 4	f
17	16	7	53 \cdot 8	—57 16 \cdot 2	285	622240	\pm 0 \cdot 000012	1607099	542	5767 \cdot 250	3 \cdot 8	9 \cdot 0	5 \cdot 2	13 \cdot 9	14 \cdot 8	DO Nor
18	16	10	43 \cdot 7	—59 7	291	4 \cdot 01499	\pm 0 \cdot 00051	2491	308	6079 \cdot 117	1 \cdot 8	4 \cdot 8	3 \cdot 0	12 \cdot 9	14 \cdot 1	DY Nor
19	16	10	53 \cdot 7	—53 11 \cdot 2	292	2 \cdot 12317	\pm 0 \cdot 00015	471	327	5705 \cdot 578	—1	4 \cdot 7	4 \cdot 8	13 \cdot 1	15 \cdot 2	g
20	16	10	54 \cdot 8	—54 34 \cdot 0	245						1 \cdot 0	9 \cdot 0	8 \cdot 0	12 \cdot 9	15 \cdot 3	h

TABLE I (continued).

	<i>a</i> (1875)	<i>d</i> (1875)	number of plates	period	m.e.	reciprocal period	phase of epoch	epoch 2420000 +	max. min. range	max. min.	Star
21	^h 16 ^m 11 ^s 32.2	^o —59 ['] 18.2	286	^d 3590709	± '0000050	^d 2.784965	^P .794	^d 5929.265	^s —3 ^s 6.4 ^s 6.7	^m 12.6 ^m 13.9	EI Nor
22	^h 16 ^m 11 ^s 46.2	^o —58 ['] 50.7	277	^d 548862	± '000018	^d 1.821952	^P .023	^d 5740.010	^s 3.2 ^s 7.0 ^s 3.8	^m 13.5 ^m 14.3	EK Nor
23	^h 16 ^m 12 ^s 18.9	^o —56 ['] 2.7	296 296 1289	^d 3692		^d 2.7088	{.932 {.940	{5736.094 {5736.097	{1.7 ^s 3.5 ^s 1.8 {2.6 ^s 3.5 ^s 0.9	{12.9 ^m 13.5 {13.4 ^m 13.7	EM Nor
24	^h 16 ^m 13 ^s 40.4	^o —56 ['] 30.1	296	^d 8523065	± '0000141	^d 1.173287	^P .193	^d 5939.035	^s 2.0 ^s 7.5 ^s 5.5	^m 13.1 ^m 13.8	EO Nor
25	^h 16 ^m 13 ^s 59.0	^o —51 ['] 33.7	294	^d 90.9					^s 2.6 ^s 6.6 ^s 4.0	^m 12.6 ^m 13.5	
26	^h 16 ^m 16 ^s 40.4	^o —56 ['] 51.9	289	^d 716284	± '000006	^d 1.396094	^P .226	^d 5415.266	^s .4 ^s 3.1 ^s 2.7	^m 12.8 ^m 13.5	EX Nor
27	^h 16 ^m 18 ^s 24.3	^o —59 ['] 31.9	215	^d 8.400	± '001	^d .119	^P .961	^d 5764.378	^s 2.6 ^s 7.4 ^s 4.8	^m 14.4 ^m 15.2	FK Nor
28	^h 16 ^m 22 ^s 17.7	^o —56 ['] 42.6	289	^d 6.46073	± '00059	^d 1.54781	^P .279	^d 5926.305	^s 1.4 ^s 8.1 ^s 6.7	^m 13.6 ^m 15.2	FW Nor
29	^h 16 ^m 25 ^s 19.8	^o —54 ['] 29.2	302	^d 1.856632		^d .538605	^P .093	^d 5631.377	^s .0 ^s 11.4 ^s 11.4	^m 10.1 ^m 12.2	SY Ara
30	^h 16 ^m 25 ^s 41.1	^o —56 ['] 21.1	280	^d 3.71955	± '00036	^d .2689	^P .400	^d 5776.869	^s .7 ^s 5.8 ^s 5.1	^m 13.4 ^m 15.1	VW Ara
31	^h 16 ^m 27 ^s 8.1	^o —55 ['] 28.5	251	^d 844688	± '000024	^d 1.18387	^P .517	^d 5765.428	^s 1.1 ^s 5.8 ^s 4.7	^m 13.6 ^m 14.7	XX Ara
32	^h 16 ^m 28 ^s 39.3	^o —59 ['] 16.5	270	^d 9.8442	± '0016	^d .10158	^P .572	^d 5744.950	^s 1.8 ^s 7.1 ^s 5.3	^m 13.6 ^m 15.2	XX Ara
33	^h 16 ^m 32 ^s 4.2	^o —53 ['] 37.1	290 292	^d 1.00502	± '00005	^d .99500	^P .643	^d 5889.088	{1.4 ^s 5.3 ^s 3.9 {3.1 ^s 8.4 ^s 5.3	{13.0 ^m 14.5 {13.1 ^m 14.4	l (Krb) (Oos)

TABLE 3.

WX Nor	AC Nor	^s ^m	^e	^f	^s ^m	EM Nor (I)	^s ^m	^s ^m
a ^s 00 ^m 11.8	a ^s 00 ^m 11.5	c 4.52 13.7	a ^s 00 ^m 11.5	a ^s 00 ^m 12.5	b 2.88 14.3	a ^s 00 ^m 12.5	b 2.31 13.4	c 3.44 14.1
b 2.68 12.3	b 1.37 12.3	d 5.96 14.3	b 3.81 12.1	b 1.85 13.2	c 4.76 15.2	b 2.45 13.2	c 3.94 13.6	d 5.02 14.8
c 5.52 13.0	c 3.03 12.5	e 7.23 15.8	c 8.88 13.1	c 3.61 13.8	d 5.96 15.8	c 4.66 13.8		k
WZ Nor	d 5.37 13.1	BE Nor	d 11.81 14.0	d 5.02 14.8				
A ^s 00 ^m 12.8	e 7.01 13.6			e 6.42 15.3	h			
a 4.04 13.0		CL Nor			a ^s 00 ^m 12.6	a ^s 00 ^m 12.7	a ^s 00 ^m 14.0	a ^s 00 ^m 13.3
b 6.34 13.3	b	a ^s 00 ^m 11.7		a ^s 00 ^m 13.2	b 2.99 13.6	b 3.10 13.6	b 4.68 14.7	b 2.54 13.8
c 8.20 13.9	a ^s 00 ^m 9.4	b 2.07 12.3		b 3.34 13.6	c 4.33 13.9	c 4.81 13.9	c 6.16 15.0	c 4.25 14.1
	b 2.54 10.3	c 4.65 12.8		c 6.20 14.1	d 6.60 14.4			d 6.21 14.9
	c 4.74 11.1	d 7.19 13.3		d 8.64 14.7	e 8.42 15.1			
	d 6.84 12.1			e 10.47 15.2				
a		BH Nor			EI Nor			
a ^s 00 ^m 8.0		a ^s 00 ^m 12.5			a ^s 00 ^m 12.7	a ^s 00 ^m 11.8	a ^s 00 ^m 13.3	a ^s 00 ^m 13.1
b 2.67 10.3	AT Nor	b 2.87 13.0			b 2.37 13.1	b 2.60 12.8	b 3.15 14.1	b 2.37 14.0
c 4.62 11.6	a ^s 00 ^m 13.3	c 5.34 13.6			c 5.00 13.7	c 4.03 12.9	c 6.26 14.7	c 4.41 14.2
	a 3.38 13.7				d 6.98 14.0	d 7.49 14.1	d 7.77 15.2	d 7.39 15.0
	b 6.14 14.1							
AA Nor	c 9.15 14.9							
a ^s 00 ^m 13.4								
b 3.68 13.9								
c 6.61 14.5								
d 9.81 15.5								

TABLE 4.

WX Nor	d	E	d	AA Nor	d	E	d
2424710.66 *)	53.366	57	+ '005	(ascending branch)	2425423.504		I — .13
5416.27	5713.506	59	+ '019		48.212		3 + .25
45.47	14.565	307	+ '002		.233		3 + .26
5852.30	93.216	308	+ '012	2425411.243	.255		3 — .10
6087.51	5858.277	383	— '013		.292		3 + .83
6120.54	6014.564	445	+ '009		.313		3 + .34
29.42	6120.523	594	— '008		.423		3 + .33
6476.51		695	'000		.448		3 — .01
					5742.376		27 + .8c
*) Harvard Bulletin 884	2425423.481		o + '010		91.372		31 — .64
	5646.550	26	— '007		.394		31 + .27
	5792.410	43	— '011		5803.304		32 + .31
2425391.446	5835.322	48	'000		.326		32 + .41
5415.565	6118.478	81	+ '008		52.278		36 + .31
					.300		36 — .31

TABLE 4 (continued).

k			d			E			d			XX Ara			l (Oos)		
d	E	d	2425451	2221	47	+027	2425390	451	E	d	2425764	35	d	E	d		
2425411	0	-048	5655	584	289	-024	5646	538	26	+062	65	37	0	0	+00		
467	0	-027	5744	330	394	+030	5774	493	39	+043	92	47	28	28	-02		
17417	7	+011	5853	279	523	+014	5853	290	47	+086	6009	58	244	244	+01		
439	7	+033	6036	547	740	-015	6010	589	63	-122	12	58	247	247	-01		
44444	39	+008	6118	501	837	+004	89	469	71	+004	13	60	248	248	+01		
											14	60	249	249	+00		

TABLE 5.

n	phase	brightness	n	phase	brightness	n	phase	brightness	n	phase	brightness	n	phase	brightness	n	phase	brightness						
WX Nor			AA Nor			c			P			s			P			s					
20	058	1.4	21	046	8.7	6	977	2.6	68	502	3.8	2	588	4.0	10	489	6.0	20	594	6.1	20	819	2.7
20	127	1.5	28	145	9.3	11	000	4.0	20	751	3.6	2	590	4.2	10	522	8.2	10	644	5.5	20	894	2.6
20	208	1.3	21	224	9.4	5	026	6.5	5	884	3.2	2	594	4.4	5	547	9.0	20	692	4.6	29	986	2.6
20	301	1.6	14	280	9.5	5	044	6.8	5	932	6.7	2	600	3.5	10	574	7.0	10	739	1.6			
15	358	2.2	21	348	10.1	5	063	6.2	5	951	7.4	3	619	2.3	10	608	5.3	5	760	1.5			
5	398	3.4	28	436	10.2	5	087	4.4	5	957	8.2	10	653	1.0	10	634	4.5	10	794	1.3			
5	410	4.9	28	540	9.3	5	112	2.5	5	968	8.3	10	685	1.0	10	668	4.0	10	852	1.2	20	044	2.4
5	426	5.5	28	624	6.3	10	144	1.7	5	986	8.0	10	727	6.1	10	708	3.9	14	892	0.9	20	108	3.1
5	453	3.6	28	728	2.0	10	184	1.5	30	086	2.0	30	791	8.1	10	751	4.0	18	956	2.3	5	175	6.9
15	497	1.6	14	813	2.0	20	241	1.5	30	210	1.9	30	872	5.2	20	808	4.0				5	188	7.5
20	501	1.1	14	871	3.8	20	320	1.3	30	329	1.7	CX Nor			20	878	3.8	EK Nor			5	211	6.6
20	626	1.2	14	904	6.6	20	408	1.5	10	402	2.0	22	034	2.1	DY Nor			10	023	3.2	20	276	3.3
20	678	1.5	14	954	7.5	20	475	1.8	10	446	6.6	20	117	4.1	30	064	1.8	10	062	3.4	20	354	2.2
20	743	1.4	14	978	8.4	30	550	2.2	5	467	10.9	20	117	4.1	30	150	2.0	10	105	3.5	20	437	2.2
20	806	1.8				20	642	1.7	5	480	10.2	20	206	2.1	30	211	2.2	30	312	5.3	20	577	2.3
20	853	1.9				30	721	1.2	10	501	5.6	20	271	1.3	26	211	2.2	30	312	5.3	20	624	2.4
10	895	2.4	AC Nor			30	827	1.4	10	522	2.5	20	337	1.1	15	304	4.7	10	373	5.8	20	700	2.5
10	925	2.2	10	028	1.0	30	932	1.5	10	541	1.7	20	402	6.3	30	406	2.1	20	439	6.4	20	778	2.5
21	971	2.0	20	081	7.8	BE Nor			30	606	1.6	20	454	8.3	30	498	2.2	20	512	6.8	20	860	2.6
			30	166	7.7	20	038	2.2	30	723	1.8	20	517	1.8	30	663	2.2	20	602	6.9	20	938	2.0
			30	267	7.7	30	132	1.7	30	788	1.8	20	579	1.6	30	780	2.2	30	692	7.0	21	980	2.2
			30	380	7.7	30	265	1.5	30	880	2.0	20	697	2.0	30	895	2.1	10	754	7.4			
			31	448	7.3	30	342	1.7	29	980	1.9	20	794	1.0	40	966	1.8	10	778	7.5	EX Nor		
			30	568	6.6	30	419	2.0	CL Nor			23	843	8.8				10	822	7.5	19	000	6.6
			30	679	8.8	20	419	2.0	31	010	2.6							10	856	7.6	10	054	4.4
			20	753	8.1	10	485	4.4	30	103	2.6							10	890	7.2	10	100	8.8
			10	805	1.5	10	516	5.6	30	211	2.4	30	043	1.7	10	227	1.2	10	930	6.2	10	164	2.3
			10	841	3.4	10	552	5.1	30	302	2.5	40	205	2.0	5	273	9.9	17	978	4.6	10	210	3.1
			10	874	4.8	10	604	2.7	30	302	2.5	30	284	1.9	5	295	2.9				10	245	2.9
			10	915	4.2	30	666	2.1	30	420	2.7	30	392	2.0	5	319	4.7	EM Nor (I)			10	286	1.8
			10	946	3.4	30	765	1.5	10	488	2.7	40	392	2.0	5	334	4.6	30	054	1.9	10	326	1.3
			10	980	2.2	30	864	2.0	10	509	3.3	5	453	4.7	5	334	4.6	30	168	2.3	20	370	9.9
						30	948	2.2	10	528	4.5	5	462	4.3	5	355	3.1	30	287	2.8	20	434	9.9
									10	558	6.0	10	484	2.4	5	367	2.3	30	390	3.4	20	486	5.5
									10	584	6.7	30	531	1.8	10	389	1.0	30	497	3.4	20	548	6.6
									10	605	5.3	30	617	1.7	30	472	1.1	30	602	3.0	20	604	8.8
									10	622	4.4	20	758	1.8	30	559	1.1	10	662	2.8	20	676	1.6
									10	640	3.3	20	830	1.7	30	658	1.1	10	716	2.4	20	742	1.4
									31	722	2.7	10	888	2.0	30	760	1.1	30	802	2.1	20	804	1.4
									33	885	2.6	10	923	2.2	30	831	1.2	20	894	1.8	20	861	1.2
												14	974	2.1	32	935	1.1	19	969	1.8	20	944	6.6
									CM Nor			DO Nor			EI Nor			EM Nor (II)			FK Nor		
									30	047	5.5	20	000	5.0	29	027	3.0	20	071	2.7	10	020	2.8
									30	134	8.8	20	060	5.2	20	128	4.5	20	142	2.8	20	082	2.6
									30	233	6.6	20	111	5.1	20	204	5.2	30	252	3.1	20	181	2.7
									30	335	7.7	20	206	4.3	20	266	5.7	30	354	3.3	20	312	2.6
									30	461	7.7	20	288	4.0	20	319	6.0	30	463	3.5	20	437	2.6
									10	525	7.7	20	348	4.3	20	373	6.0	30	568	3.3	20	560	2.8
									3	547	5.2	10	408	4.8	20	440	6.1	30	662	3.0	20	641	3.2
									2	570	1.2	10	449	5.4	20	526	6.4	30	742	2.8	20	717	2.8
									2	578	2.2												



