PERIODS AND PHOTOGRAPHIC MEAN LIGHT CURVES

OF 17 LONG PERIOD VARIABLES IN A FIELD AROUND

$$\alpha = 17^h, \quad \delta = -70°$$

This bulletin summarizes the results of an investigation of 17 long period variables situated in Apus, Ara, and Triangulum Australe. Six out of these stars were already known to be variable (CF Aps, EF Tr A, FS Tr A, CQ Aps, DN Aps, and XX Aps), but up to now no periods or mean light curves have been determined for these stars. The remaining eleven variables have been discovered with a blink microscope. The light variability of the present 17 long period variables has been measured on 401 photographic plates that were taken with the 10-inch telescope of the Boyden Observatory. The observations span 11 years. The apparent magnitudes of the variables were estimated with Pogson's method using at least six comparison stars for each variable star. When a variable becomes fainter the the limiting magnitude of the photographic plates, which is about $16^m.1$, it is given the apparent magnitude $16^m.1$. The apparent magnitudes of the comparison stars have been derived from stars counts on one square degree around each variable and from interpolations in the tables of the Groningen Publication Nr. 43. The periods and the mean light curves have been determined by means of computer analysis using the Phase Dispersion Minimization (PDM) method (Stellingwerf, 1978), which is extremely adequate for the determination of the periods and the mean light curves of long period variables. The PDM method has been used with a bin structure $N_b = 20$, $N_c = 2$.

The variables are indicated on identification charts 1 - 17. These identification charts cover a field of about 30 minutes of arc square and have North on top. On Table 1 we have listed for each variable the program number, the provisional coordinates, the period, the apparent magnitude of maximum light of the mean photographic light curve, the number of

observed moments of maximum light, and the epoch. No amplitude is given
for stars that become fainter than the limiting amplitude of the photogra-
phic plates. Note that the maximum of the mean light curves underestimates
the true maximum by an amount of about $A/N_b \simeq 0^m.2$ which is about the accu-
racy of the magnitude determination of the comparison stars. On Table 2
we have summarized the basic quantities of the PDM analysis of the light
curves. θ_{min} is typically of the order of 0.1 or smaller so that generally
90% or more of the initial variance has been removed by the mean light curve
at the indicated period. The signal to noise ratio is typically 4 to 5.

We have also given a list of remarks on individual variables. In this
list we have identified the six variables which were already known in the
literature, and we have also indicated the stars that are invisible during
a considerable fraction of the total phase intervals.

Light curves are shown in Figures 1 - 17. Individual observations are
indicated by an asterisk *, bin means by +, the spline fit to the bin means,
which is used to remove the oscillation from the data and to calculate the
residuals,by ×; when two of or all three symbols coincide, the symbol Q is
used.

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Reference:

Stellingwerf, R.J. : 1978, Ap. J. 224, 953.

Table I

Nr	α 1900	δ 1900	P	V_{max}	A	NE	Nm	JD 2438000+
1	$16^h08^m03^s$	$- 68°18.7$	206.3	12.4		219	3	729
2	16 21 08	$- 72$ 22.0	233.9	11.6		295	4	769
3	16 27 51	$- 69$ 04.0	265.5	14.45		326	1	644
4	16 30 12	$- 68$ 03.1	224.7	10.9	3.25	316	4	796
5	16 30 50	$- 66$ 22.2	271.6	12.95		321	2	717
6	16 32 22	$- 69$ 49.3	202.0	14.5		289	2	760
7	16 35 01	$- 71$ 49.7	249.6	13.0	1.5	302	5	781
8	16 36 00	$- 64$ 58.2	206.8	13.05		225	1	826
9	16 44 03	$- 66$ 43.2	253.6	14.8		334	1	806
10	16 47 42	$- 71$ 19.5	137.0	10.8	2.15	314	4	700
11	16 55 17	$- 72$ 17.2	390.5	12.8		350	4	696
12	16 56 25	$- 65$ 08.1	279.2	12.15		229	1	710
13	16 59 19	$- 72$ 04.5	209.9	13.95		329	1	765
14	17 11 13	$- 66$ 57.9	204.9	13.8		319	1	737
15	17 13 52	$- 66$ 11.8	178.6	14.1		284	2	713
16	17 14 23	$- 69$ 12.8	170.0	12.3	2.95	322	5	720
17	17 26 24	$- 66$ 49.9	225.8	11.65		322	4	687

Nr : program number which refers to the identification chart;
α δ: provisional coordinates for 1900; P : period in days;
V_{max}:apparent magnitude of maximum light of the mean photographic
    light curve; A : total variation of the mean photographic
    light curve; NE : number of estimates; Nm : number of ob-
    served moments of maximum light; JD : mean epoch.

Table II

Characteristic quantities of the PDM analysis of the light curves

Nr	σ^2	σ_N^2	σ_0^2	θ_{min}	ε
1	1.523	0.042	1.481	0.035	5.9
2	1.807	0.193	1.614	0.118	2.9
3	0.132	0.005	0.127	0.064	5.0
4	1.279	0.053	1.226	0.053	4.8
5	1.206	0.063	1.143	0.074	4.3
6	0.439	0.008	0.431	0.022	7.4
7	0.314	0.003	0.311	0.100	3.3
8	1.438	0.048	1.390	0.043	5.4
9	0.250	0.009	0.241	0.052	5.1
10	0.426	0.025	0.401	0.069	4.0
11	1.475	0.025	1.450	0.024	7.6
12	1.781	0.051	1.730	0.038	5.9
13	0.577	0.040	0.537	0.091	3.6
14	0.696	0.031	0.665	0.059	4.6
15	0.437	0.039	0.398	0.106	3.2
16	1.121	0.047	1.074	0.062	4.8
17	2.926	0.072	2.854	0.033	6.3

Individual remarks
Var. 2. = CF Aps. Var. 3. = Invisible during about 2/3 of the
total phase interval. Var. 4. = EF Tr A. Var. 5. = FS Tr A. In-
visible during about 1/2 of the total phase interval. Var. 7.=
CQ Aps. Var. 9. = Invisible during about 7/10 of the total
phase interval. Var. 13. = DN Aps. Var. 15. = Invisible during
about 3/5 of the total phase interval. Var. 16.= XX Aps. Semi-
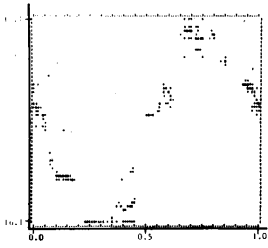regular variable, brightness at minimum light is variable.
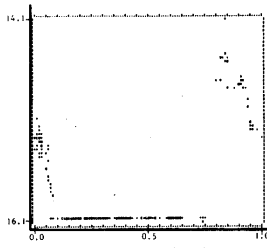
5

6

7

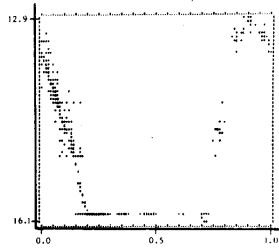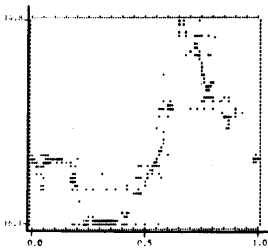FIG. 1   Variable 1

FIG. 3   Variable 3
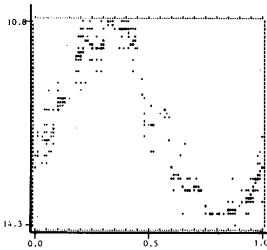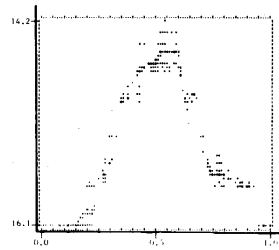
FIG. 5   Variable 5
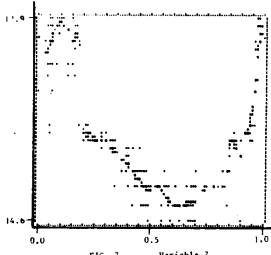
FIG. 2   Variable 2

FIG. 4   Variable 4

FIG. 6   Variable 6

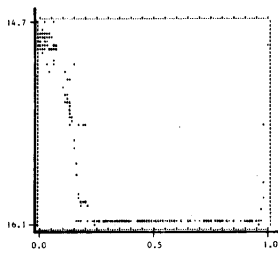8   9   10

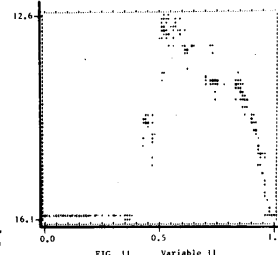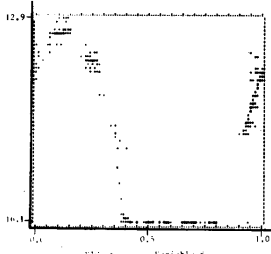FIG. 7   Variable 7   FIG. 9   Variable 9   FIG. 11   Variable 11

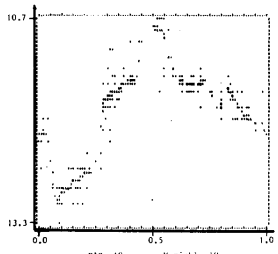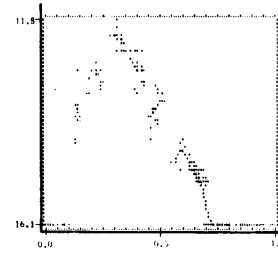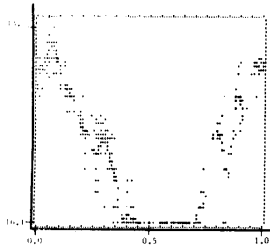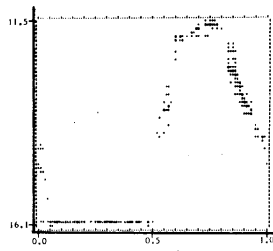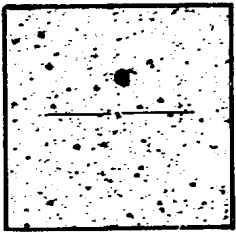FIG. 8   Variable 8   FIG. 10   Variable 10   FIG. 12   Variable 12

5

11

12

13

14.0

11.5

16.1

16.1

16.1

0.0   0.5   1.0   0.0   0.5   1.0   0.0   0.5   1.0

FIG. 13   Variable 13   FIG. 15   Variable 15   FIG. 17   Variable 17

9

13.6   12.3

16.1   15.3

0.0   0.5   1.0   0.0   0.5   1.0
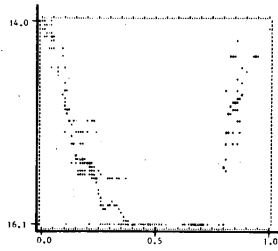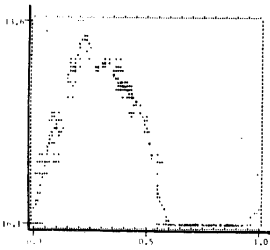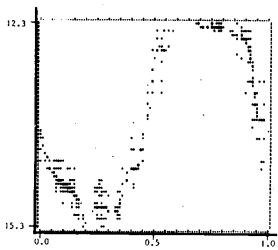
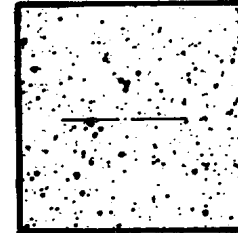FIG. 14   Variable 14   FIG. 16   Variable 16
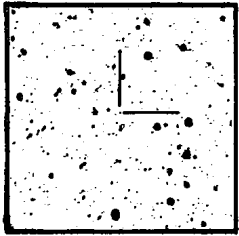
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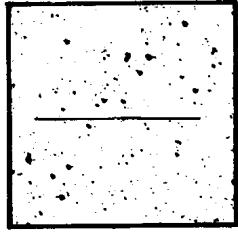
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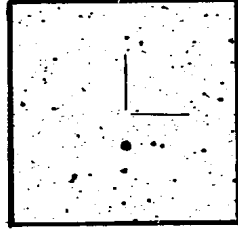
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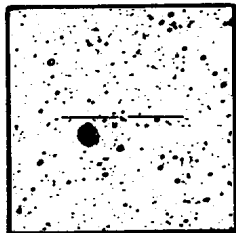
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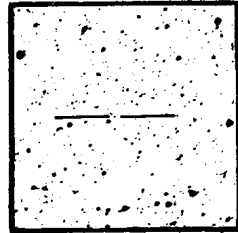
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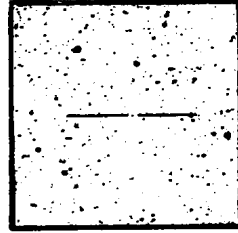
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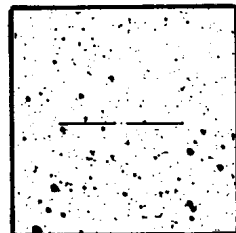
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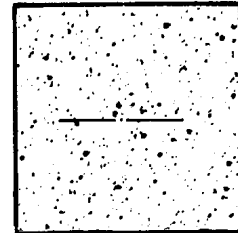
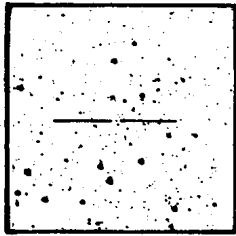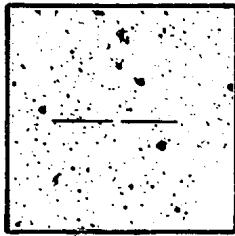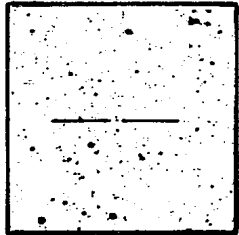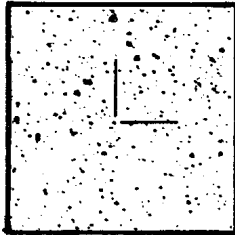Var. 8
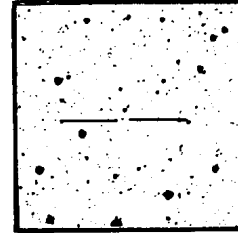
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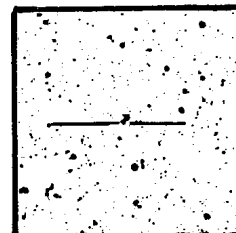
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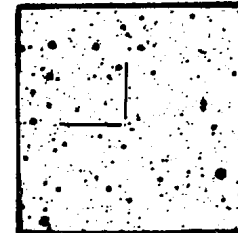
Var. 11

Var. 12

Var. 13   Var. 14   Var. 15

Var. 16   Var. 17