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PHOTOELECTRIC UBV PHOTOMETRY OF NORTHERN CEPHEIDS, III

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ABSTRACT

New UBV photoelectric observational data on 25 northern Cepheids with periods longer than 10 days are presented. The period changes and the variations in the light curve of the observed Cepheids are investigated.

Almost half of the programme stars show continuous period change (parabolic O-C curve). Among the Cepheids in binary systems YZ Aur, SV Per and perhaps AN Aur show a period jump and a subsequent rejump to the earlier value of the period. The apparent period changes due to orbital motion around the common centre of gravity can be seen in RW Cam, X Cyg, SZ Cyg and T Mon. The orbital period of RW Cam is about 6600 days. The only new case of secular light curve variation is observed in AN Aur.

INTRODUCTION

This paper is the third and last part of a series dealing with the new UBV photometry of northern Cepheids performed at the Konkoly Observatory, and it contains the observational data and O-C diagrams of Cepheids with periods longer than 10 days. The previous parts of this survey covered Cepheids with periods shorter than this limit (Szabados, 1977 and 1980; hereinafter these papers are referred to as Paper I and Paper II, respectively).

The main purposes of this survey have been outlined in the introductions to Papers I and II. With the long period Cepheids the most important factor is the knowledge of the period changes because the long period Cepheids tend to exhibit strong period changes. The investigation of the period changes of Cepheids in binary systems is also very important because the O-C diagrams of these variables may show two kinds of peculiarities, viz. a rejumping period and an apparent period change due to the orbital motion (see pp. 112-114 of Paper II).

During the course of this last part of the work 25 Cepheids were observed. Of these variables, 13 were observed in three colours of the UBV system, the other 12 in B and V lights only.

THE OBSERVATIONS

The stars dealt with in this programme were selected from the General Catalogue of Variable Stars (Kukarkin et al., 1969-1970) with the restrictions that their declination should be north of 0° and B magnitude (or m_{pg} for lack of photoelectric observations) at light minimum brighter than $12^{m}.5$. This sample contains Cepheids of both populations with a period greater than 10 days. Only the variable star RU Cam was omitted because of its well known photometric and spectroscopic peculiarities which raise doubts as to its belonging to CW variables. Moreover, RU Cam has been regularly observed since 1967 at Konkoly Observatory by the members of the Variable Star Department. A detailed analysis on this star will appear in due course.

Table 1 The programme

Star	N	Col.	Page obs.	Page rem.	Star	N	Col.	Page obs.	Page rem.
SZ Aql	20	UBV	7	66	VX Cyg	22	BV	13	70
TT Aql	23	UBV	7	47	BZ Cyg	21	BV	14	20
RX Aur	17	UBV	7	41	CD Cyg	21	UBV	14	64
SY Aur	19	UBV	8	21	AA Gem	13	BV	15	40
YZ Aur	20	BV	8	68	ζ Gem	16	UBV	15	24
AN Aur	17	BV	9	29	AP Her	32	BV	16	31
RW Cam	20	UBV	9	62	Z Lac	20	UBV	16	35
RW Cas	21	BV	10	51	T Mon	12	UBV	17	72
RY Cas	20	BV	10	43	SV Mon	17	UBV	17	56
SZ Cas	18	BV	11	45	SV Per	19	BV	18	38
X Cyg	24	UBV	11	58	VX Per	16	UBV	18	37
SZ Cyg	19	BV	13	54	SV Vul	23	UBV	18	76
TX Cyg	23	BV	13	49					

The stars investigated are listed in Table 1. The number of observations on each star, the colours, serial numbers of the pages where the individual observations and the O-C diagram with additional remarks on the given star can be found are indicated in the successive columns. The total number of observations is close on 500. The observations were made between 1977 and 1980 except for Z Lac. This latter star was observed several years earlier among the stars in the second group of the programme stars, because of the similarity of its coordinates with the shorter period Cepheid RR Lac.

Table 2

Variable	Comp.	V	B-V	U-B	Check	V	B-V	U-B	Remark
SZ Aql	+ 0° 4090	$8^m.94$	$1^m.42$	$1^m.42$	+ 0° 4088	$6^m.76$	$1^m.51$	$1^m.75$	
TT Aql	+ 1° 3905	7.56	0.48	-0.02	+ 1° 3911	8.89	0.74	0.47	
RX Aur	+39° 1159	8.13	1.15	1.02	+39° 1157	8.39	0.15	-0.43	
SY Aur	+42° 1190	8.81	1.63	2.04	+42° 1192	9.17	0.33	0.07	
YZ Aur	+39° 1221	9.66	1.21		+40° 1214	9.24	1.33		
AN Aur	+40° 1126	11.11	0.45		+40° 1132	10.35	0.51		
RW Cam	+58° 670	9.13	1.22	1.00	+57° 755	9.19	0.96	0.77	
RW Cas	+56° 311	9.70	1.31		+57° 362	8.99	0.17		
RY Cas	+57° 2824	9.79	1.41		+57° 2823	9.58	0.29		
SZ Cas	+58° 466	9.94	1.34		+58° 461	9.74	0.46		
X Cyg	+35° 4219	7.42	0.65	0.12	+35° 4282	6.64	1.61	2.10	
SZ Cyg	+46° 2971	9.80	1.29		+46° 2976	9.46	1.13		
TX Cyg	+41° 3958	10.25	1.20		see Fig.1	10.68	0.88		
VX Cyg	+39° 4380	9.78	1.19		+40° 4365	9.63	0.45		1
BZ Cyg	+44° 3578	9.90	0.65		+44° 3572	9.64	0.47		2
CD Cyg	+33° 3734	8.92	1.07	0.84	+33° 3730	9.38	0.32	0.08	
AA Gem	+26° 1083	9.89	1.39		+26° 1080	10.51	0.14		
ζ Gem	+22° 1645	3.52	0.34	0.04	+16° 1443	3.57	0.10	0.10	
AP Her	+15° 3592	9.60	1.17		+15° 3586	9.33	0.98		
Z Lac	+55° 2791	8.79	1.05	0.83	+55° 2792	8.71	0.24	-0.06	
T Mon SV Mon	}+6° 1253	7.74	1.03	0.49	+ 6° 1254	7.37	1.57	1.52	
SV Per	+41° 975	9.61	1.14		+41° 973	9.84	1.03		
VX Per	+57° 479	9.01	0.68	0.06	+58° 375	8.87	0.73	0.11	
SV Vul	+27° 3523	6.93	0.66	0.06	+27° 3516	6.85	0.69	0.12	

Remarks: 1 The comparison star has a faint companion

2 The check star is double

A full description of the observational technique, and the telescope and filters used can be found in Paper I (p. 6). During the course of the present part the observations were performed using the 24" telescope only.

The V magnitudes and colour indices of the comparison and check stars are listed in Table 2. The tie-in observations were made with the aid of UBV standard stars taken from the catalogue of Blanco et al. (1968). All the comparison and check stars are BD stars except for the check star for TX Cyg. This latter check star can be identified using the chart in Fig. 1. The size of this chart is 45'x45', north is at the top; the letter *a* denotes the comparison star and the star marked *b* is the check one.

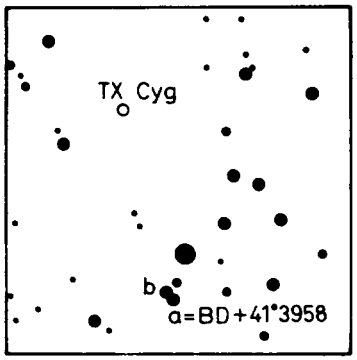

Figure 1 Identification chart for TX Cyg

Table 3 contains the observations in alphabetical order of the constellations. Some unpublished observations made by Prof. L. Detre in 1953 and by Dr. J. Abaffy in 1967 are also listed in Table 3. Unfortunately, since the comparison stars used by them are unknown in several cases these two sets of observations have not been transformed to the standard system, and only the magnitude differences are given in the instrumental system.

Table 3 The observations

SZ Aquilae

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3647.526	9.22	1.82		3761.289	8.65	1.57	1.43
3679.478	9.14	1.79		3763.315	8.88	1.69	1.44:
3693.440	8.69	1.65	1.48	3798.223	8.96	1.72:	1.61:
3701.422	9.04	1.62	1.28	3803.213	9.17	1.66	1.42
3703.518	8.77	1.46	1.03	3809.239	8.31	1.32	0.94:
3705.406	8.20	1.20		4049.529	8.34	1.32	1.19
3714.383	9.15	1.83	1.67	4050.470	8.41	1.35	1.21
3743.400	8.58	1.51	1.39	4102.330	8.47	1.45	
3747.311	9.00	1.76	1.71	4113.313	8.95	1.53	1.23
3749.405	9.25	1.85:		4150.264	8.04	1.07	1.04

TT Aquilae

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3647.546	6.77	1.13	0.82	3743.412	6.71	1.10	0.83
3679.456	7.28	1.47	1.33	3747.298	7.19	1.44	1.33
3690.414	6.93	1.28	1.07	3749.417	7.45	1.55	1.50
3701.407	6.65	0.98	0.76	3772.260	6.89	1.24	0.94
3703.506	6.85	1.24	1.06	3781.289	7.37	1.33	1.00
3705.394	7.10	1.39	1.18	3809.228	7.33	1.33	0.99
3707.443	7.32	1.47	1.36	4050.482	7.24	1.44	1.32
3714.371	6.67	1.00	0.63	4126.301	7.19	1.25	0.98
3722.411	7.52	1.60	1.52	4129.330	6.79	1.20	0.83
3724.437	7.56	1.50	1.60	4140.320	7.08	1.16	0.84
3737.322	7.55	1.65	1.61	4155.238	6.65	1.03	0.63
3739.405	7.40	1.42	1.08				

RX Aurigae

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3438.607	7.76	1.12	0.74	3607.296	7.73	0.93	0.56:
3483.653	7.60	0.97	0.72	3777.536	7.98	1.15	0.84
3490.524	7.81	0.95	0.53	3789.619	8.02	1.14	0.88
3599.311	7.55	0.96	0.57	3791.574	7.95	1.03	0.67

Table 3 (cont.)

(RX Aur)

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3830.399	7.37	0.83	0.54	4143.473	7.41	0.80	0.53
3911.445	7.35	0.78	0.56	4162.535	8.02	1.11	0.74
3926.434	7.73	1.06	0.74	4203.324	7.50	0.98	0.59
3957.302	7.43	0.80	0.47	4251.332	7.63	1.04	0.70
3966.312	7.86	1.04	0.59:				

SY Aurigae

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3424.635	9.12	1.00	0.68	3878.315	9.36	1.21	
3425.639	8.91	0.91	0.66	3928.355	9.27	1.22	0.81
3438.628	8.93	1.03		3931.279	9.29	1.09	0.71
3460.493	9.12	1.11		3956.290	8.98	1.05	0.79
3483.620	9.36	1.21	0.89	3957.315	9.09	1.15	0.78:
3599.328	8.76	0.92	0.72:	4132.622	9.38	1.22	0.75
3789.485	9.27	1.01		4157.507	8.74	0.91	0.59:
3791.601	8.84	0.93	0.64	4166.471	8.89	0.95	0.72:
3803.393	8.86	0.93	0.77:	4203.346	9.37	1.24	0.87
3849.454	9.33	1.14	0.78				

YZ Aurigae

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3420.620	10.25	1.43		3849.411	10.52	1.47	
3423.569	10.46	1.60		3928.385	10.14	1.33	
3424.584	10.52	1.67		3931.403	10.27	1.58	
3425.593	10.65	1.66		3956.275	10.75	1.56	
3483.602	10.76	1.47		4108.560	9.98	1.22	
3490.540	10.00	1.28		4132.604	10.41	1.53	
3598.349	9.93	1.20		4143.469	9.96	1.21	
3777.551	10.56	1.33		4167.460	10.28	1.56	
3791.586	10.72	1.68		4215.393	10.09	1.27	
3793.617	10.53	1.53		4251.315	10.27	1.25	

Table 3 (cont.)

AN Aurigae

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3424.603	10.73	1.34		3803.408	10.81	1.40	
3425.616	10.49	1.23:		3926.386	10.76	1.43	
3438.590	10.21	1.14		3928.369	10.79	1.36	
3483.569	10.68	1.40		3931.394	10.30	1.21	
3490.470	10.24	1.09		3935.298	10.50	1.36	
3524.252	10.57	1.40		4157.487	10.30	1.18	
3777.514	10.25	1.21		4167.445	10.29	1.18	
3789.513	10.25	1.27		4251.351	10.19	1.17	
3793.578	10.79	1.44					

RW Camelopardalis

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3438.520	8.88	1.47	0.91	3849.437	8.94	1.50	0.92:
3481.412	8.32	1.34	0.92	3878.332	8.58	1.42	0.98:
3483.674	8.52	1.44	1.02	3926.451	8.52	1.42	1.00
3560.320	8.47	1.24	0.82	3928.337	8.65	1.45	1.03
3777.441	8.39	1.35	1.03:	3935.328	8.84	1.41	0.83
3788.565	8.74	1.37	0.82	3956.303	8.20	1.27	0.91
3789.442	8.75	1.37	0.88	3966.325	9.00	1.46	0.96
3791.557	8.17	1.21	0.89:	4143.444	8.78	1.52	0.99
3803.376	8.92	1.44	0.90	4162.510	9.01	1.48	0.89:
3830.367	8.70	1.53	1.01	4167.413	8.55	1.34	0.85

Observations in 1967

J.D.hel. 2430000+	Δv	Δb	Δu	J.D.hel. 2430000+	Δv	Δb	Δu
9777.469	+0.203	1.070	1.929	9791.442	-0.021	0.832	1.634
9780.574	+0.392	1.234	1.755	9806.406	-0.112	0.684	1.265
9782.628	+0.180	1.003	1.410	9821.321	-0.240:	0.455:	0.810:
9786.528	-0.441	0.147	0.864	9833.334	+0.117:	0.820:	
9790.625	-0.072	0.754	1.575				

Table 3 (cont.)

RW Cassiopeiae

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3420.524	9.10	1.35		3830.246	8.60	0.92	
3424.488	9.59	1.59		3837.421	9.44	1.52	
3437.400	9.34	1.48		3873.362	9.41	1.32	
3438.471	9.48	1.55		3928.249	9.70	1.56	
3489.314	9.23	1.19		3931.265	9.49	1.41:	
3490.333	8.58	0.91		4108.500	9.50	1.51	
3560.272	9.69	1.52		4113.377	8.81	1.21:	
3788.522	8.90	1.17		4157.391	8.79	1.08	
3789.456	9.01	1.28		4166.370	9.73	1.62	
3791.529	9.24	1.44		4167.302	9.62	1.46	
3800.288	8.98	1.14					

Observations in 1967

J.D.hel. 2430000+	Δv	Δb	Δu	J.D.hel. 2430000+	Δv	Δb	Δu
9759.590	-0.091	+0.919	2.11	9781.553	-0.343	+0.699	2.13
9762.589	-0.855	-0.153		9783.424	-0.127	+1.043	2.08:
9763.491	-0.751	+0.022	0.928	9786.507	+0.278	+1.458	
9769.530	+0.006	+1.152	2.61	9787.500	+0.261	+1.440	
9770.435	+0.120	+1.346	2.82	9790.490	-0.108	+0.844	2.03
9776.515	-0.776	-0.089	0.761	9791.501	-0.957	-0.351	0.450
9780.518	-0.492	+0.475	1.648				

RY Cassiopeiae

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3420.505	10.31	1.62:		3777.572	9.48	1.13	
3424.469	9.71	1.22		3798.274	10.30	1.42:	
3438.456	9.38	1.13		3837.435	9.68	1.19	
3483.328	10.05	1.40		3878.242	9.82	1.45	
3489.295	9.77	1.33		3928.241	10.07	1.63	
3490.306	9.90	1.42		3931.254	10.35	1.57	
3524.261	9.55	1.22		4054.508	9.95	1.33	
3743.562	9.72	1.29		4066.470	10.05	1.42	

Table 3 (cont.)

(RY Cas)

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
4111.488	10.20	1.70:		4166.355	9.41	1.15	
4159.375	10.19	1.64		4251.267	9.39	1.17	

SZ Cassiopeiae

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3420.557	9.81	1.44		3849.423	9.87	1.49	
3423.624	9.61	1.36		3935.248	10.03	1.53:	
3424.524	9.68	1.41		4066.528	9.78	1.50	
3483.394	9.97	1.57		4100.541	9.93:	1.51:	
3489.394	9.75	1.35		4101.520	9.85:	1.43:	
3743.575	9.99	1.59		4162.438	9.88:	1.42:	
3777.381	9.61	1.33		4166.439	10.02	1.59	
3789.567	9.68	1.34		4167.509	10.03	1.52	
3793.566	9.74	1.47		4215.373	9.78:	1.37:	

X Cygni

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3679.429	6.64	1.21	1.00	3789.330	6.67	1.46	1.46
3693.487	6.88	1.47	1.40	3795.354	6.63	1.19	0.91
3704.367	6.35	1.30	1.15	3803.243	6.42	1.32	1.22
3705.462	6.43	1.36	1.27	3830.190	5.87	0.85	0.57
3714.514	6.10	0.99	0.67	4102.343	6.85	1.46	1.52:
3722.524	6.49	1.40	1.39	4108.358	5.91	0.88	0.54
3724.535	6.72	1.47	1.51	4113.535	6.29	1.25	1.08
3732.460	5.87	0.89	0.65	4126.325	5.96	0.92	0.70
3739.370	6.58	1.42	1.40	4129.356	6.24	1.22	1.12
3743.450	6.87	1.39	1.41	4143.361	6.01	1.00	0.77
3767.408	6.08	1.07	0.90	4155.281	6.60	1.19	0.94
3777.247	6.72	1.34	1.22	4160.371	6.07	1.07	0.89

Observations in 1953

J.D.hel. 2430000+	Δv	Δb	J.D.hel. 2430000+	Δv	Δb
4575.441	-0.567	-0.646	4576.421	-0.484	-0.450

Table 3 (cont.)

(X Cyg)

J.D.hel. 2430000+	Δv	Δb	J.D.hel. 2430000+	Δv	Δb
4577.415	-0.319	-0.127	4606.332	-0.691	-0.909
4579.432	-0.063	+0.252	4607.510	-0.552	-0.700
4580.410	+0.094	+0.453	4608.495	-0.479	-0.495
4581.427	+0.226	+0.535	4609.549	-0.331	-0.309
4583.448	+0.314	+0.620	4610.421	-0.259	-0.140
4584.551	+0.194	+0.458	4611.397	-0.178	+0.050
4585.375	+0.025	+0.102	4614.419	+0.180	+0.539
4587.527	-0.509	-0.686	4618.483	+0.012	+0.019
4588.377	-0.825	-1.105	4619.394	+0.040	+0.022
4589.360	-0.863	-1.114	4619.570	-0.002	-0.050
4590.425	-0.656	-0.836	4620.539	-0.579	-0.874
4591.419	-0.552	-0.590	4621.622	-0.839	-1.170
4592.454	-0.442	-0.427	4622.508	-0.693	-1.020
4595.376	-0.078	+0.120	4623.545	-0.542	-0.791
4596.398	+0.028	+0.234:	4624.546	-0.534	-0.542
4597.412	+0.149	+0.518	4625.473	-0.373	-0.376
4598.402	+0.256	+0.540	4627.548	-0.131	-0.014
4599.392	+0.241	+0.582	4628.538	-0.018	+0.284
4600.514	+0.252	+0.625	4629.546	+0.182	+0.389
4601.438	+0.080	+0.228	4636.583	-0.318:	-0.531:
4602.422	-0.008	+0.020	4649.387	+0.250	+0.561
4604.402	-0.703	-0.945	4652.372	-0.044	-0.025
4605.336	-0.788	-1.138	4652.545	-0.096	-0.119

Observations in 1967

J.D.hel. 2430000+	Δv	Δb	Δu	J.D.hel. 2430000+	Δv	Δb	Δu
9769.446	-0.395	0.626	2.07	9788.278	-0.145	1.075	
9770.397	-0.293	0.796	2.38	9791.390	+0.216	1.473	
9776.469	+0.319	1.651	3.53:	9795.247	+0.285	1.506	
9777.379	+0.368	1.713	3.37	9796.262	+0.123	1.286	
9782.481	-0.636	0.189	1.279	9799.281	-0.648	0.179	1.255
9783.402	-0.645	0.180	1.290	9814.271	-0.098	0.922	2.26:
9787.342	-0.253	0.904					

Table 3 (cont.)

SZ Cygni

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3298.469	9.61	1.66		3772.407	9.54	1.52	
3337.481	8.93	1.30:		3777.279	9.06	1.36	
3437.263	9.83	1.79		3789.425	9.31	1.39	
3483.295	9.81	1.73		3791.364	8.97	1.31:	
3693.523	9.81	1.76		3795.367	9.36	1.59	
3714.501	9.02	1.26		3803.270	9.56	1.52	
3720.541	9.49	1.70:		4054.395	9.66	1.73	
3722.537	9.69	1.73		4066.408	9.26	1.59	
3743.518	9.55	1.37		4174.228	9.46:	1.68:	
3763.438	9.19	1.59					

TX Cygni

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3437.281	10.01	2.11		3800.271	9.49	2.11	
3483.310	9.84	1.98		3803.330	9.90	2.15	
3705.540	9.62	1.93		3830.329	9.55	2.12	
3722.494	9.09	1.73		4049.446	9.39	1.98	
3724.519	9.33	1.91		4054.441	10.00	2.08	
3761.409	9.95	2.10		4100.437	9.86	2.03	
3763.464	9.72	1.99		4111.417	9.77	2.17	
3765.370	8.90	1.62		4147.322	9.44	1.73	
3772.364	9.68	2.13		4150.282	9.19	1.77	
3789.345	9.99	2.09		4162.362	9.06	1.60	
3791.350	9.92	2.03		4166.293	9.34	1.90	
3795.381	8.88:	1.71:					

VX Cygni

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3693.470	10.41	1.94		3720.380	10.31	1.79	
3703.534	9.58	1.43		3722.482	9.68	1.49	
3705.521	9.73	1.59		3724.484	9.61	1.52	
3714.468	10.47	1.97		3761.398	10.25	1.77	

Table 3 (cont.)

(VX Cyg)

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3765.380	9.69	1.55		3803.344	9.61	1.46	
3772.318	10.16	1.96:		3830.311	9.99	1.88	
3777.289	10.54	2.02		4049.430	9.84	1.68	
3788.487	9.90	1.74		4100.414	10.55	1.96	
3789.358	9.95	1.86		4101.465	10.36	1.85	
3791.336	10.09	1.92		4155.269	10.27	1.96	
3800.261	10.33	1.75:		4203.229	10.30	1.81	

BZ Cygni

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3437.246	10.12	1.56		3777.411	10.33	1.80	
3647.502	10.53	1.67:		3788.472	10.50	1.72	
3679.517	10.28	1.68		3795.336	10.06	1.65	
3693.506	10.08	1.54		3803.254	10.09	1.56	
3714.449	10.11	1.61		3868.223	10.32	1.70	
3720.550	10.20	1.60:		4049.413	10.08	1.63	
3722.467	10.06	1.63:		4050.451	10.22	1.71	
3739.383	10.52	1.66		4100.460	10.15	1.70	
3743.529	10.05	1.51:		4102.354	10.40	1.74:	
3763.446	10.05	1.60		4113.345	10.49	1.76	
3772.393	10.06	1.52					

CD Cygni

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3630.489	8.68	1.31	1.03	3772.419	9.36	1.60	1.55
3705.500	9.45	1.68	1.46	3798.238	8.48	1.04	0.81
3714.428	8.57	1.21	1.00	3803.283	8.97	1.46	1.28
3720.524	9.21	1.58	1.53	3809.253	9.51	1.62	1.39
3724.561	9.54	1.63		3830.295	9.14	1.34	1.06
3743.497	9.27	1.40		4049.401	9.44	1.62	
3761.300	9.23	1.46	1.18	4101.451	9.34	1.43	1.23
3763.423	8.41	0.99	0.65	4111.402	9.01	1.57	1.37:

Table 3 (cont.)

(CD Cyg)

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
4126.342	8.80	1.38	1.13	4155.253	8.58	1.07	0.79
4129.343	9.12	1.57	1.44	4159.330	8.67	1.32	1.07
4140.332	8.54	1.17					

AA Geminorum

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3460.516	9.94	1.29		3789.580	9.97	1.24	
3481.439	9.77	1.14		3793.590	9.47	0.92	
3483.430	10.00	1.29		3928.405	9.69	1.02	
3489.411	9.40	0.95		3931.412	9.49	1.03	
3572.314	9.81	1.18		3957.343	9.89	1.26	
3598.318	9.86:	1.16:		3966.301	9.59	1.12:	
3599.352	9.76	1.09:					

ζ Geminorum

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3481.505	3.65	0.71	0.51	3791.614	4.14	0.90	0.69
3483.492	3.87	0.84	0.68	3793.606	3.84	0.72	0.58
3489.463	3.80	0.73	0.51	3849.494	3.94	0.87	0.81
3572.329	3.67	0.68	0.49	3926.403	3.75	0.71	0.56
3598.336	4.16	0.90	0.87:	3928.420	3.68	0.67	0.56
3599.340	4.03	0.82	0.65	3935.345	3.85	0.77	0.55
3607.327	4.14	0.94	0.84	3957.331	3.70	0.69	0.57
3789.594	4.06	1.00	0.86	4203.461	3.76	0.82	0.75

Observations in 1967

J.D.hel. 2430000+	Δv	Δb	Δu	J.D.hel. 2430000+	Δv	Δb	Δu
9776.554	0.140:	0.416:	0.863:	9796.536	0.164	0.444	0.873
9777.550	0.232	0.592	1.063	9810.591	0.627	1.120	
9782.569	0.595	1.045	1.599	9814.631	0.376	0.745	1.197
9784.553	0.314	0.647	1.074	9825.138	0.314:	0.632:	1.104:
9786.551	0.169	0.444	0.875	9864.303	0.473	0.929	1.414
9791.583	0.676	1.184	1.919				

Table 3 (cont.)

AP Herculis

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3298.450	10.74	0.80		3749.425	10.50	0.62	
3304.495	10.95	0.70		3753.289	10.94	0.84	
3337.439	10.50	0.60		3761.278	10.52	0.62	
3647.457	10.49	0.56		3772.269	10.62	0.69	
3690.395	10.75	0.79		3777.256	11.13	0.93	
3705.422	11.08	0.84		3789.294	10.95	0.71	
3714.413	11.12:	0.82:		3791.228	10.43	0.65	
3716.355	11.10	0.77:		3800.239	10.75	0.68	
3720.355	10.56	0.66		4049.364	10.38	0.67	
3722.436	11.01	0.80		4054.424	11.16:	0.81:	
3724.448	11.13	0.89		4108.343	11.17	0.90	
3730.319	10.54	0.64		4111.386	10.46	0.63	
3732.433	10.87	0.81		4113.324	10.55	0.67	
3739.325	10.46	0.59		4157.268	10.95	0.92	
3743.308	10.96	0.88		4159.250	11.08	0.99	
3747.320	11.03	0.78		4167.241	11.05	0.83	

Z Lacertae

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
2318.465	8.38	1.15	0.87	2728.302	8.24	1.00	
2642.405	7.92	0.90	0.55	2738.355	8.37	1.08	0.66
2645.490	8.45	1.25	1.02	2756.331	8.73	1.33	1.14
2646.388	8.58	1.31	1.08	2770.213	8.50	1.15	0.79
2672.546	8.48	1.09	0.69:	3481.329	8.13	1.01	0.70
2675.429	8.05	0.95	0.61	3489.262	8.42	1.06	0.75
2676.452	8.21	1.06	0.74	3705.479	8.71	1.23	0.97
2685.497	7.92	0.81	0.62	3798.285	8.32	1.06	0.74:
2714.359	8.82	1.25	1.06	3878.274	8.80	1.38	
2715.399	8.55	1.16	1.00:	3931.238	8.65	1.29	1.21

Observations in 1967

J.D.hel. 2430000+	Δv	Δb	Δu	J.D.hel. 2430000+	Δv	Δb	Δu
9732.477	+0.051	+0.761	1.496	9759.390	-0.331	+0.319	0.941

Table 3 (cont.)

(Z Lac)

J.D.hel. 2430000+	Δv	Δb	Δu	J.D.hel. 2430000+	Δv	Δb	Δu
9760.524	-0.152	+0.576	1.340	9769.513	-0.392	+0.175	0.755
9762.557	+0.192	+1.040	2.03	9789.356	-0.350	+0.111	0.687
9763.540	+0.295	+1.144	2.05	9790.469	-0.593	-0.114	0.355:
9766.562	-0.182:	+0.432:					

T Monocerotis

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3481.462	6.54	1.43	1.01	3789.632	5.85	1.31	0.84
3483.452	6.37	1.26	0.68	3791.624	6.01	1.39	0.96
3489.429	5.73	1.07	0.60	3793.636	6.11	1.42	1.07
3490.454	5.77	1.19	0.70	3849.484	6.23	1.45	1.17
3560.360	6.59	1.46	1.05	3935.280	6.50	1.53	1.23
3777.607	6.52:	1.45:	0.96:	4203.483	6.41	1.49	1.20

Observations in 1967

J.D.hel. 2430000+	Δv	Δb	Δu	J.D.hel. 2430000+	Δv	Δb	Δu
9784.630	-0.992	-0.255	0.512:	9808.546	-0.107	+0.958	2.21
9786.592	-0.973	-0.176	0.671	9810.544	-0.794	+0.027	0.865
9787.572	-0.869	-0.027	0.929	9812.572	-1.018	-0.260	0.500
9790.589	-0.688	+0.307	1.461	9814.603	-0.904	-0.024	0.833
9791.571	-0.622	+0.403	1.680	9825.564	-0.166	+0.956:	
9796.522	-0.351	+0.837	2.50:				

SV Monocerotis

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3481.486	8.41	1.36	0.98	3777.624	8.46	1.17	0.63
3483.473	8.67	1.40	1.12	3791.639	8.43	1.22	0.55
3489.444	7.66	0.81	0.37	3793.626	7.98	0.95	0.41
3490.436	7.70:	0.90:	0.32:	3928.280	8.61	1.21	0.58
3560.383	8.75	1.42	1.08	3935.267	8.04	1.14	0.69
3572.293	8.30	1.34	0.90	3957.274	8.78	1.42	1.06
3599.282	7.95	1.08	0.56	3966.282	8.14	1.16	0.67:

Table 3 (cont.)

(SV Mon)

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
4167.530	8.47	1.39	1.00	4251.370	7.69:	0.87:	0.23:
4203.511	8.41	1.14	0.51				

SV Persei

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3438.569	8.49	0.91		3931.292	8.93	1.10	
3490.506	9.35	1.14		3935.313	9.35	1.18	
3560.338	8.85:	0.91:		3957.287	9.35	1.17	
3599.298	9.14	1.24		4132.588	9.02	1.18	
3607.281	8.76	1.08		4143.456	8.97	1.19	
3789.529	9.23	1.27		4162.416	8.59	0.94	
3791.542	9.22	1.14		4166.421	9.05	1.22	
3830.385	8.85	1.08		4167.430	9.20	1.18	
3837.477	9.03	1.05		4215.417	9.05	1.12	
3878.297	9.23	1.26					

VX Persei

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3438.488	9.61	1.44	0.91	3789.549	9.08	1.09	0.76:
3483.371	9.38	1.23	0.83	3873.343	9.69	1.39	1.03:
3489.378	9.31	1.31	1.03	3878.261	9.03	1.16	0.82
3490.405	9.45	1.38	1.04	3928.260	9.62	1.45	1.02
3560.303	9.20	1.17	0.84	4101.501	9.65	1.35	1.11
3572.275	9.08	1.15	0.85	4108.514	9.11	1.19	0.88
3737.505	8.99	1.12	0.83	4132.571	9.42	1.36	0.98
3739.413	9.29	1.19	0.97	4166.404	9.59	1.42	1.11:

SV Vulpeculae

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3298.489	7.75	1.72		3647.477	7.39	1.72	1.63
3304.462	7.64	1.61	1.48	3679.408	6.96	1.44	1.12
3337.457	7.51	1.71	1.64	3701.388	7.65	1.78	1.76

Table 3 (cont.)

(SV Vul)

J.D.hel. 2440000+	V	B-V	U-B	J.D.hel. 2440000+	V	B-V	U-B
3705.440	7.77	1.78	1.65	3772.293	7.07	1.54	1.31
3714.353	6.75	1.13	0.78	3781.299	7.33	1.73	1.62
3720.338	6.88	1.28	0.97	3789.318	7.58	1.78	1.63:
3722.452	6.92	1.37	1.06	3803.229	6.92	1.24	0.84
3732.449	7.22	1.64	1.55	4049.469	7.31	1.70	1.60
3739.354	7.40	1.77	1.65	4066.440	7.75	1.74	1.65
3753.280	7.68	1.75	1.58	4101.490	7.53	1.70	
3761.269	6.75	1.15	0.88	4150.327	7.63	1.78	1.68
3763.415	6.78	1.24	0.94				

THE LIGHT CURVES AND PERIOD CHANGES OF THE INDIVIDUAL VARIABLES

This section contains the light curves, the tables and the graphs of the O-C values representing the period variation. Some remarks on the observed Cepheids are also noted on the individual Cepheids. As in Papers I and II, it was not my intention to give the full history of the variables which would have increased considerably the volume of the paper. The variables were arranged according to the length of their period as in the previous papers.

A detailed description of the construction of the O-C diagrams can be found in Paper I (p. 32). The O-C values determined on the basis of visual, photographic and photoelectric observations are marked with open circles, filled circles and triangles, respectively. The size of these marks denotes the weight of the O-C values to be found in the figures of this section.

The columns in the tables of the O-C residuals for each variable contain the following data:

1. The moment of normal maximum (or that of median brightness)
2. The corresponding epoch
3. The O-C residual in days
4. The type of observation (vis for visual, pg for photographic and pe for photoelectric observations)
5. The weight of the O-C residual depending on the type, number

and quality of the observations.

6. The source of the observational data. When the name of the observer is not identical with the name (or one of the names) given in the reference the observer's name is indicated in the footnote to the table.

The determination of the O-C curves was by a weighted least squares fitting procedure. The O-C residuals with zero weight are not plotted in the diagrams, those with 0.5 weight are plotted but were always omitted in the curve fitting procedure.

The formula by which the O-C residuals have been calculated is indicated at each variable. These formulae usually refer to maximum light. If O-C diagrams for both maximum and median brightnesses are presented, the two different calculated ephemerides are marked with C_{max} and C_{med}, respectively.

BZ Cygni

The B light and the B-V colour curves of this small amplitude Cepheid are shown in Fig. 2. The O-C residuals have been computed by the formula:

$$C = 2443774.037 + 10^{d}.141932 \times E \quad .$$

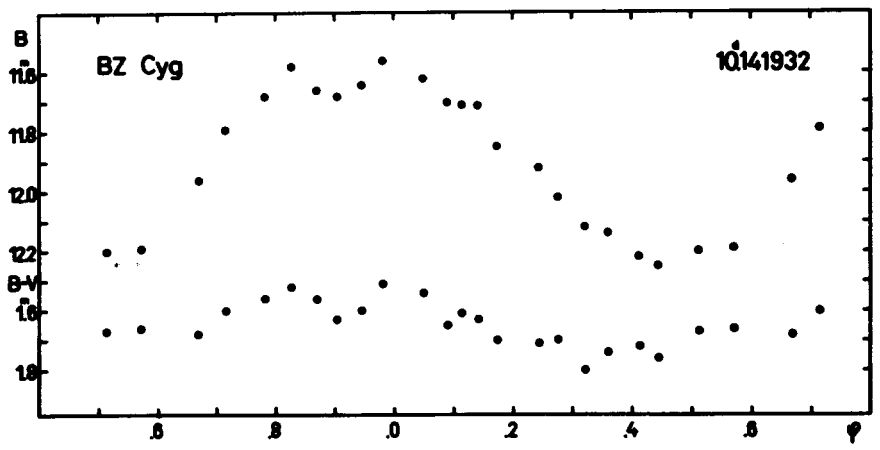

Figure 2 B and B-V curves of BZ Cyg

The period of this Cepheid has remained constant since the discovery of its light variation (see Fig. 3). The O-C value of the points with 0.5 weight is systematically smaller than that of

Table 4 O-C residuals for BZ Cyg

Obs.Max.J.D.	E	O-C	Type	w	Reference
		d			
2418571.266	-2485	-0.070	pg	1	Furuhjelm (1921)
2423631.4	-1986	-0.8	pg	0.5	Rügemer (1933)
2425943.45	-1758	-1.07	pg	0.5	Beyer[1] (1934a)
2426673.97	-1686	-0.77	pg	0.5	Beyer[1] (1934a)
2426674.10	-1686	-0.64	pg	0.5	Lur'ye (1946)
2426826.18	-1671	-0.69	pg	0.5	Rügemer (1933)
2427161.806	-1638	+0.254	vis	1	Beyer (1934a)
2428043.35	-1551	-0.55	pg	0.5	Perova (1956)
2430649.47	-1294	-0.91	pg	0.5	Solov'yov (1945)
2431349.85	-1225	-0.32	pg	0.5	Perova (1956)
2433073.92	-1055	-0.38	pg	0.5	Perova (1956)
2433306.66	-1032	-0.90	pg	0.5	Perova (1956)
2433560.64	-1007	-0.47	pg	0.5	Perova (1956)
2433976.20	-966	-0.73	pg	0.5	Perova (1956)
2434159.608	-948	+0.123	pg	1	Nikulina (1970)
2436085.580	-758	-0.873	pg	0.5	Korovkina (1958)
2436441.64	-723	+0.22	pg	0	Korovkina (1959)
2436786.104	-689	-0.142	pe	3	Weaver et al. (1960)
2436796.408	-688	+0.020	pe	3	Oosterhoff (1960)
2437191.22	-649	-0.70	vis	0.5	Häussler (1965)
2437273.217	-641	+0.158	pe	1	Mitchell et al. (1964)
2437922.037	-577	-0.105	pg	1	Girnyak (1971)
2438986.726	-472	-0.319	pg	1	Girnyak (1971)
2443774.144	0	+0.107	pe	3	present paper

Remark: [1] Observer: Plaut

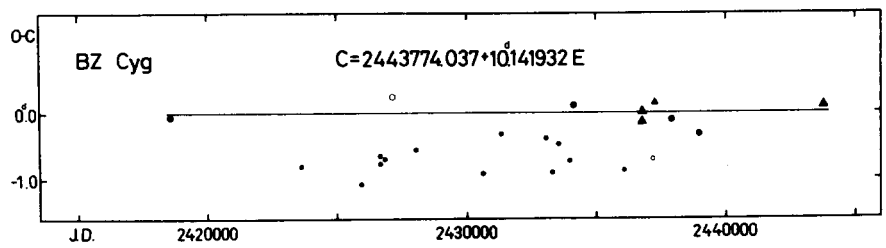

Figure 3 O-C diagram of BZ Cyg

the reliable points. This difference is caused by the fact that the phase of the normal maxima that are published without listing the original observational data is thought to be earlier than the phase of the true normal maximum determined from the photoelectric normal curve.

SY Aurigae

Its light and colour curves are plotted in Fig. 4. According to Janot Pacheco (1976) this variable has a faint blue compan-

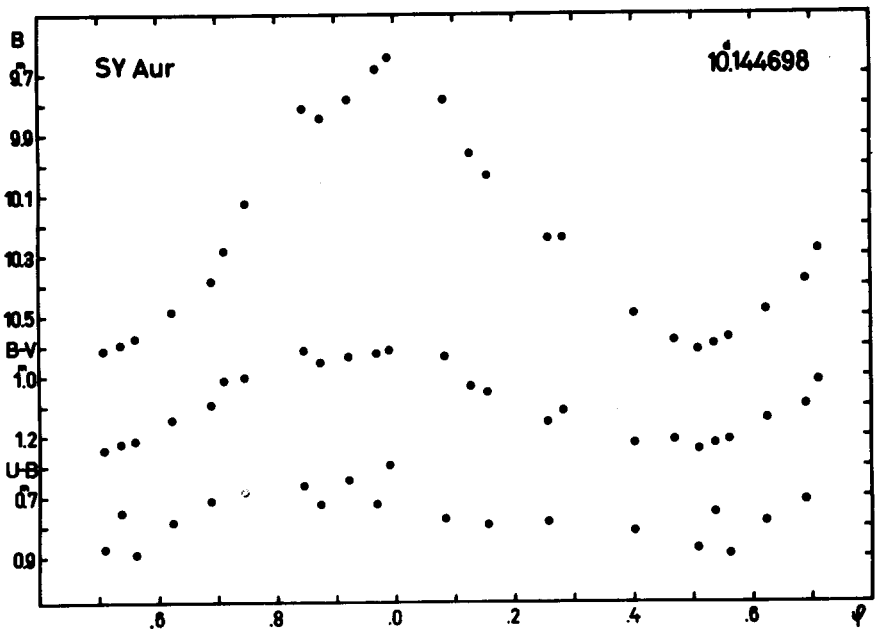

Figure 4 B, B-V and U-B curves of SY Aur

ion. The spectral classification of SY Aur (F5 III in the G.C.V.S. - Kukarkin et al., 1969-1970) may be in error since it suggests much lower luminosity than Cepheids with a period of 10 days usually have.

The O-C residuals for this star have been obtained with the formulae:

$$C_{max} = 2443832.919 + 10^{d}.144698 \times E$$

$$C_{med} = 2443830.379 + 10^{d}.144698 \times E$$

for the maximum and median brightnesses, respectively. As can be seen in Fig. 5, the O-C diagram can well be approximated by a parabola. The equation of the best fitting parabola is as follows:

$$(O-C)_{par} = 1.73 \times 10^{-7} \times E^{2} \quad .$$

Table 5 O-C residuals for SY Aur

(maximum brightness)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2416504.146	-2694	$+1^{d}.043$	pg	1	Florya, Kukarkin (1931)
2418036.203	-2543	+1.251	vis	1	Enebo (1909)
2418776.770	-2470	+1.255	vis	1	Enebo (1911)

Table 5 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2419172.122	-2431	+0^d.964	pg	0.5	Robinson (1933)
2419800.992	-2369	+0.863	vis	1	Enebo (1914)
2421961.887	-2156	+0.937	pg	1	Jordan (1929)
2424071.542	-1948	+0.495	vis	1	Nielsen[1] (1928)
2425674.508	-1790	+0.598	pg	1	Rybka (1930)
2426212.158	-1737	+0.579	vis	1	Zakharov (1951)
2426221.88	-1736	+0.16	pg	0.5	Kiehl, Hopp (1977)
2426252.969	-1733	+0.812	vis	1	Kukarkin (1940)
2426759.901	-1683	+0.509	pg	1	Mashnauskas (1961)
2427368.30	-1623	+0.23	pg	0.5	Kiehl, Hopp (1977)
2427916.205	-1569	+0.317	vis	0.5	Nielsen[2] (1937b)
2428129.02	-1548	+0.09	pg	0.5	Fu De-Lian (1964)
2428586.053	-1503	+0.615	pg	1	Sokolov (1969)
2429245.098	-1438	+0.255	vis	0.5	Nielsen[2] (1941a)
2429265.733	-1436	+0.600	pg	1	Sokolov (1969)
2430695.700	-1295	+0.165	vis	0.5	Nielsen[2] (1952)
2432298.488	-1137	+0.091	vis	0.5	Nielsen[2] (1955)
2436214.295	-751	+0.044	pe	3	Bahner et al. (1977)
2436538.771	-719	-0.110	pg	1	Makarenko (1969)
2436833.104	-690	+0.027	pe	2	Oosterhoff (1960)
2436833.140	-690	+0.063	pe	3	Weaver et al. (1960)
2438293.771	-546	-0.143	pg	1	Makarenko (1969)
2439075.158	-469	+0.102	pe	2	Takase (1969)
2439348.913	-442	-0.049	pe	2	Wamsteker (1972)
2443832.981	0	+0.062	pe	3	present paper

Remarks: [1] Observer: Thorrud; [2] Observer: Arthur Nielsen

Table 6 O-C residuals for SY Aur

(median brightness)

Obs.Med.J.D.	E	O-C	Type	w	Reference
2425671.922	-1790	+0^d.552	pg	1	Rybka (1930)
2436211.820	-751	+0.109	pe	3	Bahner et al. (1977)
2436830.664	-690	+0.127	pe	3	Weaver et al. (1960)
2443830.333	0	-0.046	pe	3	present paper

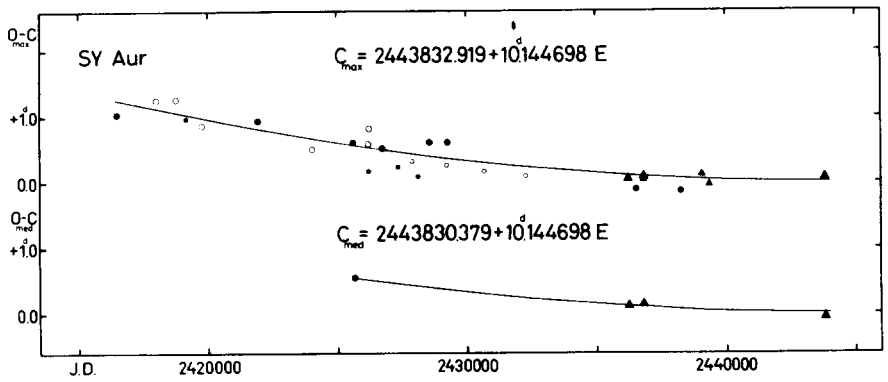

Figure 5 O-C diagram of SY Aur

ζ Geminorum

This star is one of the brightest Cepheids and is the prototype of the small amplitude Cepheids (see Fig. 6).

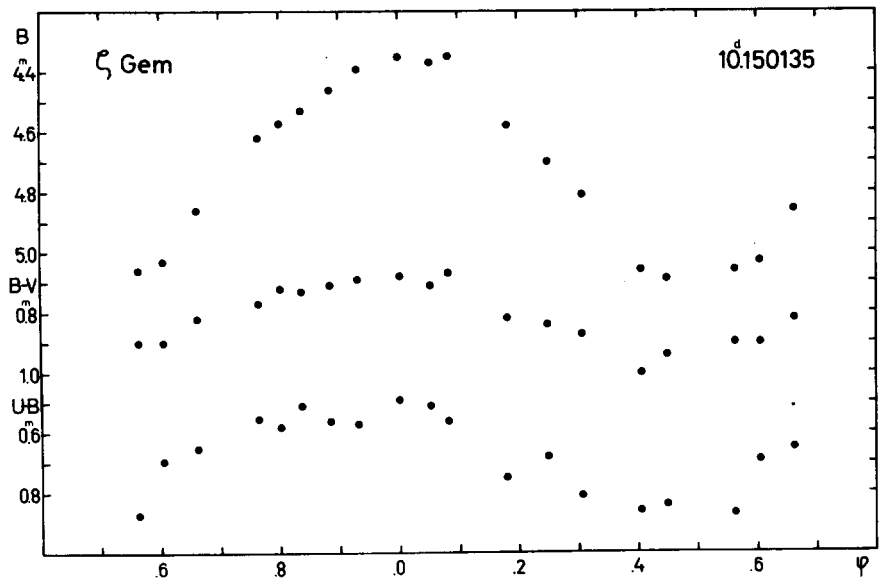

Figure 6 B, B-V and U-B curves of ζ Gem

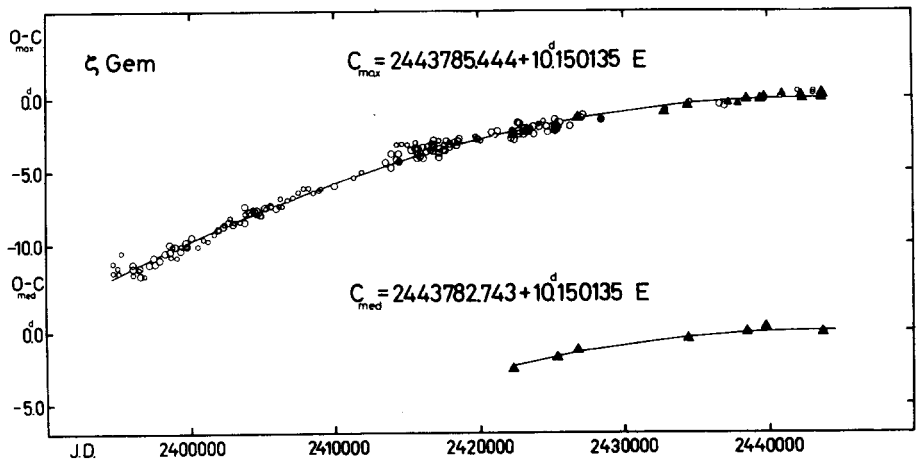

Figure 7 O-C diagram of ζ Gem

The O-C residuals have been computed with the formulae:

$C_{max} = 2443785.444 + 10^d.150135 \times E$

$C_{med} = 2443782.743 + 10^d.150135 \times E$

for the maximum and median brightnesses, respectively. The O-C diagram in Fig. 7 shows a continuous period decrease. The equation of the best fitting parabola is

$$(O-C)_{par} = -5^{d}.24\times10^{-7}\times E^{2} \quad .$$

The deviations of the photoelectric and the reliable photographic O-C values from the above parabola (for maximum brightness) are plotted in Fig. 8. Some systematic trend in these deviations

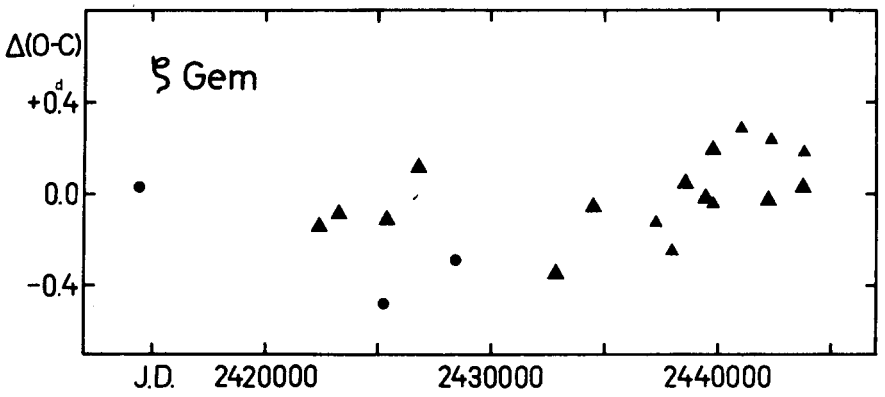

Figure 8 Deviations from the mean O-C curve

can be seen. If the parabolic O-C diagram is interpreted as a result of the stellar evolution, the small deviations from this parabola may be caused by the period noise. The explanation of the Δ(O-C) values in terms of the light-time effect is not satisfactory because the radial velocity measurements (Abt and Levy, 1974; Campbell, 1901; Evans, 1976; Hase, 1929; Henroteau, 1925; Jacobsen, 1926; Scarfe, 1976) do not show any variation in the average value of the radial velocity as would be expected in the case of the component in a binary system. The only deviating average radial velocity value is that of Rufus (1932).

According to Abt and Levy (1974) the rate of the period decrease of ζ Gem is four times greater than that predicted by the evolutionary calculations. Therefore they suggested that the period variation was due to a light-time effect in a long period binary ($P_{orb} > 225$ years) having a low mass secondary. Fernie and Turner (1978) remarked that the closest star to the Cepheid might be a physical companion to ζ Gem. In this case they must have an orbital period in excess of 10^{6} years. In view of the above

facts, there is no unambiguous answer as to the binary nature of ζ Gem.

Table 7 O-C residuals for ζ Gem
(maximum brightness)

Obs.Max.J.D.	E	O-C	Type	w	Reference
		d			
2394667.81	-4838	-11.28	vis	0.5	Argelander (1848)
2394677.33	-4837	-11.91	vis	0.5	Schmidt (1857)
2394982.19	-4807	-11.55	vis	0.5	Argelander (1848)
2395002.05	-4805	-11.99	vis	0.5	Schmidt (1857)
2395267.43	-4779	-10.52	vis	0.5	Argelander (1848)
2396027.855	-4704	-11.354	vis	1	Hagen[1] (1903)
2396077.93	-4699	-12.03	vis	0.5	Schmidt (1857)
2396088.465	-4698	-11.645	vis	1	Argelander (1869)
2396423.37	-4665	-11.69	vis	0.5	Schmidt (1857)
2396474.176	-4660	-11.639	vis	1	Argelander (1869)
2396565.026	-4651	-12.140	vis	1	Hagen[1] (1903)
2396818.76	-4626	-12.159	vis	0.5	Schmidt (1857)
2397154.525	-4593	-11.349	vis	1	Argelander (1869)
2397459.537	-4563	-10.841	vis	1	Hagen[1] (1903)
2397519.975	-4557	-11.304	vis	1	Argelander (1869)
2397875.456	-4522	-11.077	vis	1	Argelander (1869)
2398241.363	-4486	-10.575	vis	1	Argelander (1869)
2398536.305	-4457	-9.987	vis	1	Hagen[1] (1903)
2398586.501	-4452	-10.542	vis	1	Argelander (1869)
2398657.28	-4445	-10.81	vis	0.5	Schmidt (1857)
2398769.61	-4434	-10.13	vis	0.5	Nielsen[2] (1930b)
2398982.738	-4413	-10.160	vis	1	Argelander (1869)
2399022.66	-4409	-10.84	vis	0.5	Schmidt (1858)
2399317.451	-4380	-10.402	vis	1	Argelander (1869)
2399358.34	-4376	-10.11	vis	0.5	Schmidt (1858)
2399632.685	-4349	-9.822	vis	1	Zinner, Wachmann[3] (1931)
2399723.768	-4340	-10.090	vis	1	Argelander (1869)
2399744.06	-4338	-10.10	vis	0.5	Schmidt (1859)
2400099.937	-4303	-9.476	vis	1	Argelander (1869)
2400525.58	-4261	-10.14	vis	0.5	Schmidt (1861)
2400901.66	-4224	-9.61	vis	0.5	Schmidt (1861)
2401226.35	-4192	-9.73	vis	0.5	Schmidt (1863)
2401632.85	-4152	-9.23	vis	0.5	Schmidt (1864)
2401927.501	-4123	-8.936	vis	1	Argelander (1869)
2401998.52	-4116	-8.97	vis	0.5	Schmidt (1865)
2402313.385	-4085	-8.758	vis	1	Valentiner[4] (1900)
2402384.62	-4078	-8.57	vis	0.5	Schmidt (1866)
2402648.656	-4052	-8.441	vis	1	Valentiner[4] (1900)
2402719.98	-4045	-8.17	vis	0.5	Schmidt (1867)
2402993.591	-4018	-8.611	vis	1	Valentiner[4] (1900)
2403095.22	-4008	-8.48	vis	0.5	Schmidt (1868)
2403470.82	-3971	-8.44	vis	0.5	Schmidt (1869)
2403785.426	-3940	-8.486	vis	1	Valentiner[4] (1900)
2403786.076	-3940	-7.836	vis	0.5	Schmidt (1870)
2403786.543	-3940	-7.369	vis	1	Zinner, Wachmann[3] (1931)
2404090.631	-3910	-7.785	vis	1	Valentiner[4] (1900)
2404192.05	-3900	-7.87	vis	0.5	Schmidt (1871)
2404344.61	-3885	-7.56	vis	0.5	Guthnick[5] (1920)
2404466.252	-3873	-7.719	vis	1	Valentiner[4] (1900)

Table 7 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2404567.59	-3863	-7.88[d]	vis	0.5	Schmidt (1872)
2404608.424	-3859	-7.649	vis	1	Zinner, Wachmann[3] (1931)
2404831.417	-3837	-7.959	vis	1	Valentiner[4] (1900)
2404932.84	-3827	-8.04	vis	0.5	Schmidt (1873)
2405166.882	-3804	-7.448	vis	1	Valentiner[4] (1900)
2405288.64	-3792	-7.49	vis	0.5	Schmidt (1874)
2405552.714	-3766	-7.322	vis	1	Valentiner[4] (1900)
2405603.46	-3761	-7.33	vis	0.5	Schmidt (1875)
2405928.082	-3729	-7.509	vis	1	Valentiner[4] (1900)
2406121.08	-3710	-7.36	vis	0.5	Schmidt (1876)
2406263.759	-3696	-6.786	vis	0.5	Belyavsky[6] (1910)
2406395.10	-3683	-7.40	vis	0.5	Schmidt (1877)
2406750.83	-3648	-6.92	vis	0.5	Schmidt (1878)
2407157.01	-3608	-6.75	vis	0.5	Schmidt (1879)
2407492.32	-3575	-6.39	vis	0.5	Schmidt (1880)
2407857.98	-3539	-6.14	vis	0.5	Schmidt (1881)
2408233.54	-3502	-6.13	vis	0.5	Schmidt (1882)
2408578.36	-3468	-6.42	vis	0.5	Schmidt (1883)
2408913.44	-3435	-6.29	vis	0.5	Schmidt (1884)
2409015.04	-3425	-6.19	vis	0.5	Nielsen[7] (1930b)
2410009.990	-3327	-5.955	vis	1	Hagen (1891)
2410354.144	-3293	-6.905	vis	0	Reed (1888)
2411360.45	-3194	-5.46	vis	0.5	Nielsen[7] (1930b)
2411908.99	-3140	-5.03	vis	0.5	Nielsen[8] (1930b)
2412851.996	-3047	-5.987	vis	0	Markwick (1892, 1894)
2413564.137	-2977	-4.355	vis	1	Plassmann (1900)
2413950.417	-2939	-3.780	vis	1	Plassmann (1900)
2413979.885	-2936	-4.763	vis	1	Pickering (1904)
2414316.42	-2903	-3.18	vis	0.5	Luizet (1902b)
2414335.691	-2901	-4.211	vis	1	Pickering (1904)
2414478.219	-2887	-3.785	vis	1	Plassmann (1900)
2414487.821	-2886	-4.333	pg	1	Wirtz (1901)
2414712.31	-2864	-3.15	vis	0.5	Luizet (1902b)
2415087.80	-2827	-3.21	vis	0.5	Luizet (1902b)
2415320.879	-2804	-3.586	vis	1	Plassmann (1900,1901,1908)
2415605.224	-2776	-3.445	vis	1	Tass (1925)
2415666.56	-2770	-3.01	vis	0.5	Luizet (1902b)
2415777.453	-2759	-3.769	vis	0.5	Yendell (1902b)
2415787.268	-2758	-4.104	vis	1	Plassmann (1908)
2415787.949	-2758	-3.423	vis	1	Nijland (1923)
2415797.704	-2757	-3.818	vis	1	Kopff (1902)
2415858.58	-2751	-3.84	vis	0.5	McDermott (1902)
2415970.085	-2740	-3.989	vis	1	Bilt (1926a)
2416143.288	-2723	-3.338	vis	1	Plassmann (1908)
2416172.918	-2720	-4.159	vis	1	Lau (1904)
2416406.864	-2697	-3.666	vis	1	Götz (1906)
2416508.718	-2687	-3.313	vis	1	Plassmann (1908)
2416711.866	-2667	-3.168	vis	1	Olivier (1952)
2416721.611	-2666	-3.573	vis	1	Bilt (1926a)
2416874.025	-2651	-3.411	vis	1	Tass[9] (1925)
2416874.320	-2651	-3.116	vis	1	Tass[10] (1925)
2416883.963	-2650	-3.623	vis	1	Plassmann (1908)
2416894.896	-2649	-2.840	vis	1	Schiller (1906)
2417228.908	-2616	-3.783	vis	1	Bilt (1926a)

Table 7 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
		d			
2417238.785	-2615	-4.056	vis	1	Plassmann (1908)
2417270.4	-2612	-2.9	vis	0.5	Furness[11] (1913b)
2417310.450	-2608	-3.442	vis	1	Lohnert (1909)
2417594.592	-2580	-3.504	vis	1	Olivier (1952)
2417604.986	-2579	-3.260	vis	1	Nijland (1923)
2417614.853	-2578	-3.543	vis	1	Bilt (1926a)
2417777.885	-2562	-2.913	vis	1	Plassmann (1908)
2417848.56	-2555	-3.29	vis	0.5	Nielsen[12] (1930b)
2417939.841	-2546	-3.359	vis	1	Nijland (1923)
2417950.165	-2545	-3.185	vis	1	Bilt (1926a)
2418315.716	-2509	-3.039	vis	1	Nijland (1923)
2418417.041	-2499	-3.216	vis	1	Mündler (1911a)
2418437.485	-2497	-3.072	vis	0.5	Scheller (1912)
2418559.427	-2485	-2.932	vis	1	Olivier (1952)
2418640.796	-2477	-2.764	vis	1	Nijland (1923)
2419250.821	-2417	-1.747	vis	0	Hornig (1915)
2419816.565	-2361	-4.410	vis	0	Breson (1913)
2419828.452	-2360	-2.673	vis	0.5	Hoffmeister (1916a)
2419899.406	-2353	-2.770	vis	1	Kaiser (1915)
2419939.979	-2349	-2.798	vis	0.5	Olivier (1952)
2420132.75	-2330	-2.879	vis	0.5	Nielsen[7] (1930b)
2420904.713	-2254	-2.327	vis	1	Luyten (1922)
2421127.79	-2232	-2.55	vis	0.5	Nielsen[13] (1930b)
2421320.897	-2213	-2.298	vis	1	Luyten (1922)
2422244.104	-2122	-2.754	vis	1	Rabe (1923)
2422315.70	-2115	-2.21	vis	0.5	Nielsen[7] (1930b)
2422366.187	-2110	-2.472	pe	3	Guthnick (1921)
2422375.973	-2109	-2.836	vis	1	Bellemin (1922)
2422721.639	-2075	-2.275	vis	1	Leiner (1922)
2422731.566	-2074	-2.498	vis	1	Rabe (1923)
2422732.368	-2074	-1.696	vis	1	Gallisot (1923)
2422803.383	-2067	-1.732	vis	1	Bellemin (1922)
2423056.382	-2042	-2.486	vis	1	Rabe (1923)
2423137.772	-2034	-2.297	vis	1	Nielsen[14] (1927a)
2423168.397	-2031	-2.123	vis	1	Zverev (1936)
2423269.793	-2021	-2.228	pe	3	Bottlinger (1928)
2423432.08	-2005	-2.34	vis	0.5	Nijland (1935)
2423442.428	-2004	-2.145	vis	1	Leiner (1928)
2423543.967	-1994	-2.108	vis	1	Parenago (1938)
2423736.995	-1975	-1.932	vis	1	Hopmann (1926)
2423797.392	-1969	-2.436	vis	1	Leiner (1928)
2424193.90	-1930	-1.78	vis	0.5	Nielsen[15] (1930b)
2424203.841	-1929	-1.993	vis	1	Leiner (1928)
2424529.05	-1897	-1.59	vis	0.5	Nijland (1935)
2424711.413	-1879	-1.927	vis	1	Leiner (1928)
2424761.751	-1874	-2.340	vis	1	Kukarkin (1940)
2425228.769	-1828	-2.228	pg	1	Hellerich (1935)
2425280.295	-1823	-1.453	vis	1	Leiner (1928)
2425310.362	-1820	-1.836	vis	1	Collmann (1930)
2425340.804	-1817	-1.845	pe	3	Güssow (1930)
2425411.71	-1810	-1.99	vis	0.5	Nijland (1935)
2425462.360	-1805	-2.090	vis	1	Kukarkin (1940)
2425625.169	-1789	-1.683	vis	1	Zverev (1936)
2426325.312	-1720	-1.900	vis	1	Zverev (1936)

Table 7 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2426802.918	-1673	-1^d.350	pe	3	Hall (1934)
2427056.638	-1648	-1.384	vis	1	Florya, Kukarkina (1953)
2427198.938	-1634	-1.185	vis	1	Nielsen[16] (1941b)
2428436.956	-1512	-1.484	pg	1	Günther (1939)
2432883.249	-1074	-0.950	pe	3	Eggen (1951)
2432884.25	-1074	+0.05	vis	0	Ahnert (1949)
2432954.5	-1067	-0.7	vis	0.5	Pohl[17] (1951)
2434416.368	-923	-0.501	pe	3	Harris (1953)
2434609.43	-904	-0.29	vis	0.5	Marks[18] (1959)
2434711.76	-894	+0.54	vis	0	Marks (1959)
2435948.00	-772	-1.54	vis	0	Rudolph[19] (1960)
2436639.347	-704	-0.402	vis	1	Azarnova (1960)
2437004.583	-668	-0.571	vis	1	Mayall[20] (1964)
2437258.567	-643	-0.340	pe	1	Mitchell et al. (1964)
2437979.154	-572	-0.413	pe	2	Williams (1966)
2438527.582	-518	-0.092	pe	3	Wisniewski, Johnson (1968)
2439420.773	-430	-0.113	pe	3	Takase (1969)
2439765.870	-396	-0.121	pe	2	Sudzius (1969)
2439796.556	-393	+0.115	pe	3	present paper[21]
2440984.10	-276	+0.09	vis	0.5	Braune et al.[22] (1972)
2441004.565	-274	+0.258	pe	2	Evans (1976)
2442111.17	-165	+0.50	vis	0.5	Busch[23] (1980)
2442354.51	-141	+0.235	pe	1	Scarfe[24] (1976)
2442465.897	-130	-0.029	pe	3	Depenchuk (1980)
2443217.388	-56	+0.352	vis	0.5	Busch[25] (1980)
2443258.14	-52	+0.50	vis	0.5	Braune et al.[26] (1978)
2443785.473	0	+0.029	pe	3	present paper
2443805.927	+2	+0.183	pe	2	Depenchuk (1980)

Remarks: (observers) [1] Heis; [2] Oudemans; [3] Winnecke; [4] Schönfeld; [5] Argelander; [6] Glasenapp; [7] Plassmann; [8] Knopf; [9] Terkán; [10] Fejes; [11] Whitney; [12] Luizet; [13] Vogelenzang; [14] Johansson; [15] Cecchini; [16] Loreta; [17] Händel; [18] Wroblewski; [19] Masuch; [20] Orchiston; [21] Abaffy; [22] Bischof; [23] Tietz; [24] Winzer; [25] Branzke; [26] Steinbach

Table 8 O-C residuals for ζ Gem

(median brightness)

Obs.Med.J.D.	E	O-C	Type	w	Reference
2422363.426	-2110	-2^d.532	pe	3	Guthnick (1921)
2425338.134	-1817	-1.814	pe	3	Güssow (1930)
2426800.309	-1673	-1.258	pe	3	Hall (1934)
2434413.637	-923	-0.531	pe	3	Harris (1953)
2438524.912	-518	-0.061	pe	3	Wisniewski, Johnson (1968)
2439793.968	-393	+0.228	pe	3	present paper[1]
2443782.611	0	-0.132	pe	3	present paper

Remark: [1] Observer: Abaffy

AN Aurigae

This variable has a faint companion within the edge of the diaphragm. The amplitude of the light variation is smaller than

that given by Schaltenbrand and Tammann (1971); this is explainable by the effect of the visual companion (see Fig. 9). According to Madore (1977) AN Aur has a B5 photometric companion.

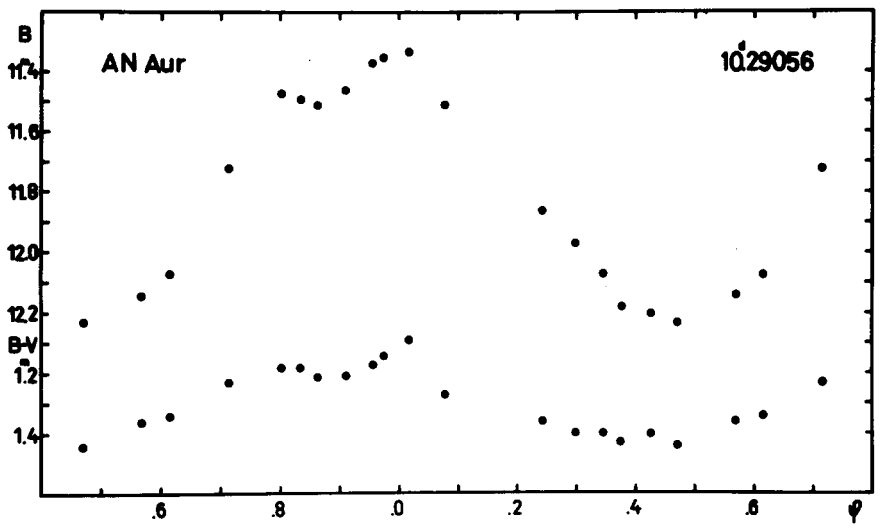

Figure 9 B and B-V curves of AN Aur

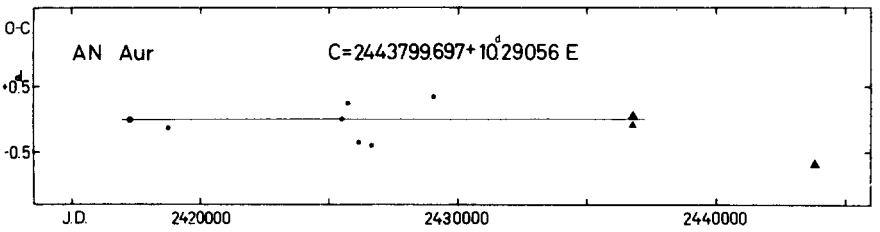

Figure 10 O-C diagram of AN Aur

The O-C residuals have been derived using the formula:

$$C = 2443799.697 + 10^{d}.29056 \times E \quad .$$

The O-C diagram in Fig. 10 shows a constant period before J.D. 2437000. After this epoch the behaviour of the period is not known. The existence of a jump in the period followed by a rejump cannot be excluded since the shape of the light curve has changed compared with the photoelectric light curve of Weaver et al. (1960) observed at about J.D. 2437000. Earlier evidence for such a change in the light curve was the case of SU Cyg published in Paper I (p. 77). With AN Aur the ascending branch of the light

curve became considerably shorter, the difference between the maximum and median brightnesses being about $0^d.4$ smaller at J.D. 2443800 than about 7000 days earlier. A new series of photoelectric observations is urgently needed to prove or reject the existence of the rejump in AN Aur's period.

Table 9 O-C residuals for AN Aur

Obs.Max.J.D.	E	O-C	Type	w	Reference
2417260.340	-2579	$-0^d.003$	pg	1	Parenago (1933)
2418742.05	-2435	-0.13	pg	0.5	Oosterhoff (1935)
2421262.44	-2190	-0.93	pg	0	Oosterhoff (1935)
2425513.34	-1777	-0.03	pg	0.5	Kukarkin (1932a)
2425524.18	-1776	+0.52	pg	0	Guthnick (1928)
2425729.72	-1756	+0.25	pg	0.5	Oosterhoff (1935)
2426181.91	-1712	-0.35	pg	0.5	Schneller (1932)
2426655.22	-1666	-0.40	pg	0.5	Oosterhoff (1935)
2429043.38	-1434	+0.35	pg	0.5	Frolov (1949)
2436832.907	-677	-0.081	pe	2	Oosterhoff (1960)
2436833.041	-677	+0.053	pe	3	Weaver et al. (1960)
2443799.026	0	-0.671	pe	3	present paper

AP Herculis

The light and colour curves of this Population II Cepheid are plotted in Fig. 11 (the observations made in 1977 are omit-

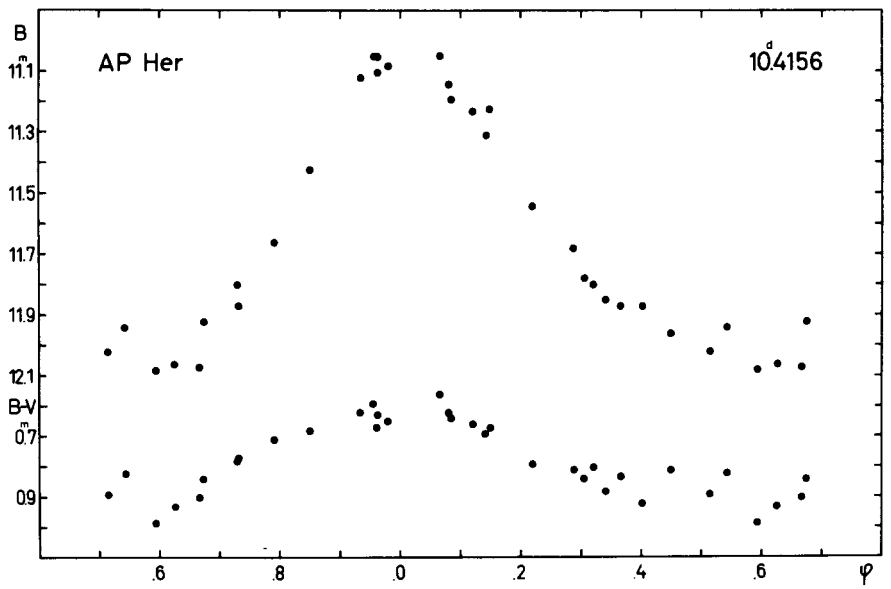

Figure 11 B and B-V curves of AP Her

ted because of their phase difference). The existence of a blue photometric companion cannot be excluded (Madore, 1977).

The O-C residuals have been computed with the formula:

$$C = 2443745.347 + 10^{d}.4156 \times E \quad .$$

This is the Population II Cepheid showing the strongest period variations (see Fig. 12), the difference between the longest and the shortest values of the period being about 6 per cent of the

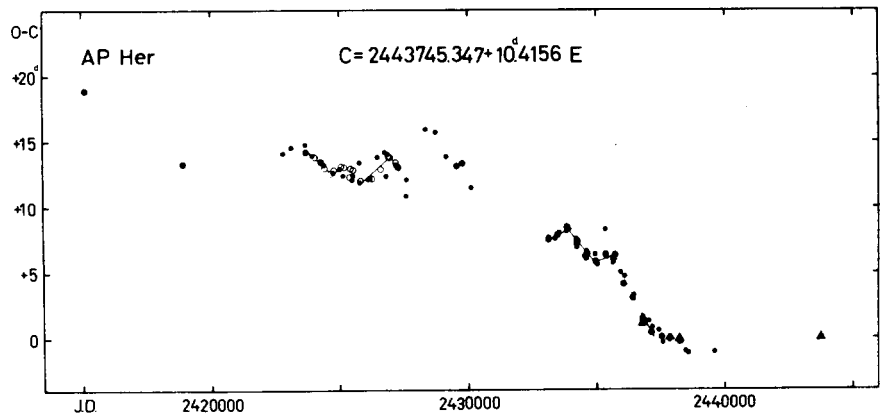

Figure 12 O-C diagram of AP Her

period. There are several intervals when the value of the period cannot be determined with any certainty. The reliable periods are as follows:

between J.D. 2415000 and J.D. 2419000 $P = 10^{d}.400$
between J.D. 2423700 and J.D. 2424700 $P = 10^{d}.3970$
between J.D. 2424700 and J.D. 2425300 $P = 10^{d}.4260$
between J.D. 2425800 and J.D. 2427000 $P = 10^{d}.4338$
between J.D. 2427000 and J.D. 2427400 $P = 10^{d}.3945$
between J.D. 2433000 and J.D. 2433850 $P = 10^{d}.4277$
between J.D. 2433850 and J.D. 2434850 $P = 10^{d}.3898$
between J.D. 2434850 and J.D. 2435600 $P = 10^{d}.4209$
between J.D. 2435600 and J.D. 2437200 $P = 10^{d}.3715$
between J.D. 2437200 and J.D. 2443800 $P = 10^{d}.4156$

but three observations made in 1977 show that the period in that year might have been smaller than reported here.

Bogdanov (1973) found the period variation to be periodic with $P = 8840^{d}$. Several pronounced cycles can be seen in Fig. 12

but the period variation is not periodic at all. Nevertheless, AP Her deserves to be subjected to regular photoelectric monitoring because of its extremely strong period changes.

Table 10 O-C residuals for AP Her

Obs.Max.J.D.	E	O-C	Type	w	Reference
2415163.011	-2746	+18^{d}.902	pg	1	Parenago[1] (1951)
2418959.142	-2381	+13.339	pg	1	Parenago[1] (1951)
2422855.43	-2007	+14.19	pg	0.5	Oosterhoff (1935)
2423168.32	-1977	+14.61	pg	0.5	Oosterhoff (1935)
2423720.50	-1924	+14.77	pg	0.5	Oosterhoff (1935)
2423730.408	-1923	+14.260	pg	1	Bohlin (1925)
2423959.22	-1901	+13.93	pg	0.5	Oosterhoff (1935)
2424084.156	-1889	+13.877	vis	1	Bohlin (1925)
2424104.992	-1887	+13.882	vis	0.5	Beyer (1926)
2424302.443	-1868	+13.437	vis	1	Beyer (1926)
2424333.70	-1865	+13.45	pg	0.5	Oosterhoff (1935)
2424349.164	-1864	+18.495	vis	0	Zakharov (1954b)
2424427.2	-1856	+13.2	pg	0.5	Tsessevich (1950)
2424447.842	-1854	+13.017	vis	1	Beyer (1926, 1928)
2424686.987	-1831	+12.604	vis	1	Beyer (1928)
2424780.73	-1822	+12.61	pg	0.5	Oosterhoff (1935)
2424801.735	-1820	+12.780	vis	1	Beyer (1928)
2425020.63	-1799	+12.95	pg	0.5	Oosterhoff (1935)
2425083.292	-1793	+13.116	vis	1	Beyer (1928)
2425155.52	-1786	+12.43	pg	0.5	Oosterhoff (1935)
2425197.832	-1782	+13.084	vis	1	Beyer (1928)
2425426.194	-1760	+12.303	vis	1	Beyer (1934b)
2425447.687	-1758	+12.965	vis	1	Zakharov (1954b)
2425509.3	-1752	+12.1	pg	0.5	Tsessevich (1950)
2425520.605	-1751	+12.974	vis	1	Beyer (1934b)
2425530.50	-1750	+12.45	pg	0.5	Oosterhoff (1935)
2425791.87	-1725	+13.43	pg	0.5	Huth (1965)
2425800.74	-1724	+11.89	pg	0.5	Oosterhoff (1935)
2425853.026	-1719	+12.095	vis	1	Beyer (1934b)
2426113.47	-1694	+12.15	pg	0.5	Huth (1965)
2426238.53	-1682	+12.22	pg	0.5	Oosterhoff (1935)
2426300.945	-1676	+12.144	vis	1	Beyer (1934b)
2426500.54	-1657	+13.84	pg	0.5	Huth (1965)
2426614.184	-1646	+12.915	vis	1	Beyer (1934b)
2426771.73	-1631	+14.23	pg	0.5	Huth (1965)
2426842.79	-1624	+12.38	pg	0.5	Oosterhoff (1935)
2426907.02	-1618	+14.11	pg	0.5	Tsessevich (1950)
2426927.611	-1616	+13.874	vis	1	Florya, Kukarkina (1953)
2426979.672	-1611	+13.857	vis	1	Beyer (1934b)
2427197.79	-1590	+13.25	pg	0.5	Oosterhoff (1935)
2427229.193	-1587	+13.403	vis	1	Beyer (1934b)
2427291.412	-1581	+13.129	vis	1	Florya, Kukarkina (1953)
2427312.11	-1579	+13.00	pg	0.5	Huth (1965)
2427353.818	-1575	+13.041	vis	1	Beyer (1934b)
2427601.60	-1551	+10.85	pg	0.5	Huth (1965)
2427634.15	-1548	+12.15	pg	0.5	Tsessevich (1950)
2427932.71	-1520	+19.08	pg	0	Huth (1965)
2428367.02	-1478	+15.93	pg	0.5	Huth (1965)
2428752.24	-1441	+15.77	pg	0.5	Huth (1965)

Table 10 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2429156.51	-1402	+13.83	pg	0.5	Huth (1965)
2429541.12	-1365	+13.07	pg	0.5	Huth (1965)
2429562.000	-1363	+13.116	pg	1	Parenago[1] (1951)
2429812.230	-1339	+13.371	pg	1	Kapko (1949)
2430133.254	-1308	+11.512	pg	0.5	Kapko (1949)
2433118.570	-1021	+7.551	pg	1	Kapko (1951)
2433149.97	-1018	+7.70	pg	0.5	Vasil'yan. et al? (1970)
2433379.06	-996	+7.65	pg	0.5	Vasil'yan. et al? (1970)
2433483.485	-986	+7.920	pg	1	Kapko (1951)
2433556.53	-979	+8.06	pg	0.5	Huth (1965)
2433827.49	-953	+8.21	pg	0.5	Huth (1965)
2433859.047	-950	+8.520	pvis	1	Koval' (1955)
2433869.18	-949	+8.24	pg	0.5	Vasil'yan. et al.[2] (1970)
2433879.676	-948	+8.318	pg	1	Kapko (1952)
2434201.85	-917	+7.61	pg	0.5	Vasil'yan. et al.[2] (1970)
2434211.63	-916	+6.97	pg	0.5	Huth (1965)
2434232.747	-914	+7.258	pg	1	Koval' (1955)
2434253.698	-912	+7.378	pg	1	Kapko (1964)
2434575.472	-881	+6.269	pg	1	Koval' (1955)
2434596.10	-879	+6.07	pg	0.5	Vasil'yan. et al.[2] (1970)
2434606.852	-878	+6.402	pg	1	Kapko (1964)
2434607.09	-878	+6.64	pg	0.5	Huth (1965)
2434950.62	-845	+6.46	pg	0.5	Vasil'yan. et al.[2] (1970)
2434970.851	-843	+5.855	pg	1	Kapko (1964)
2435012.30	-839	+5.64	pg	0.5	Huth (1965)
2435335.87	-808	+8.35	pg	0.5	Huth (1965)
2435356.852	-806	+6.479	pg	1	Kapko (1964)
2435387.84	-803	+6.22	pg	0.5	Vasil'yan. et al.[2] (1970)
2435626.97	-780	+5.79	pg	0.5	Huth (1965)
2435627.283	-780	+6.104	pe	2	Walraven et al. (1958)
2435690.023	-774	+6.350	pg	1	Kapko (1964)
2435700.43	-773	+6.34	pg	0.5	Vasil'yan. et al.[2] (1970)
2435938.70	-750	+5.05	pg	0.5	Huth (1965)
2436041.959	-740	+4.156	pg	1	Kapko (1964)
2436063.39	-738	+4.76	pg	0.5	Vasil'yan. et al.[2] (1970)
2436395.029	-706	+3.096	pg	1	Kapko (1964)
2436426.34	-703	+3.16	pg	0.5	Vasil'yan. et al.[2] (1970)
2436457.68	-700	+3.25	pg	0.5	Huth (1965)
2436778.772	-669	+1.461	pg	1	Kapko (1964)
2436789.29	-668	+1.56	pg	0.5	Vasil'yan. et al.[2] (1970)
2436799.287	-667	+1.145	pe	3	Weaver et al. (1960)
2436810.19	-666	+1.63	pg	0.5	Huth (1965)
2437028.62	-645	+1.34	pg	0.5	Huth (1965)
2437131.843	-635	+0.402	pg	1	Kapko (1964)
2437163.54	-632	+0.85	pg	0.5	Vasil'yan. et al.[2] (1970)
2437402.87	-609	+0.62	pg	0.5	Huth (1965)
2437527.274	-597	+0.040	pg	1	Kapko (1964)
2437578.98	-592	-0.33	pg	0.5	Vasil'yan. et al.[2] (1970)
2437818.73	-569	-0.14	pg	0.5	Huth (1965)
2437829.23	-568	-0.06	pg	0.5	Vasil'yan. et al.[2] (1970)
2437829.325	-568	+0.039	pe	2	Michalowska-Smak, Smak (1965)
2437860.538	-565	+0.005	pg	1	Kapko (1964)
2437871.009	-564	+0.060	pe	2	Williams (1966)

Table 10 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2438224.72	-530	$-0^d.36$	pg	0.5	Huth (1965)
2438225.026	-530	-0.053	pe	3	Kwee and Braun (1967)
2438245.76	-528	-0.15	pg	0.5	Vasil'yan et al.[2] (1970)
2438287.402	-524	-0.171	pg	1	Kapko (1964)
2438463.64	-507	-1.00	pg	0.5	Huth (1965)
2438578.06	-496	-1.15	pg	0.5	Vasil'yan. et al. (1970)
2439598.85	-398	-1.09	pg	0.5	Vasil'yan. et al. (1970)
2443745.357	0	+0.010	pe	3	present paper

Remarks: [1] Observer: Fedorovich; [2] Obs.: Pahomova

Z Lacertae

The light and colour curves of Z Lac are shown in Fig. 13.

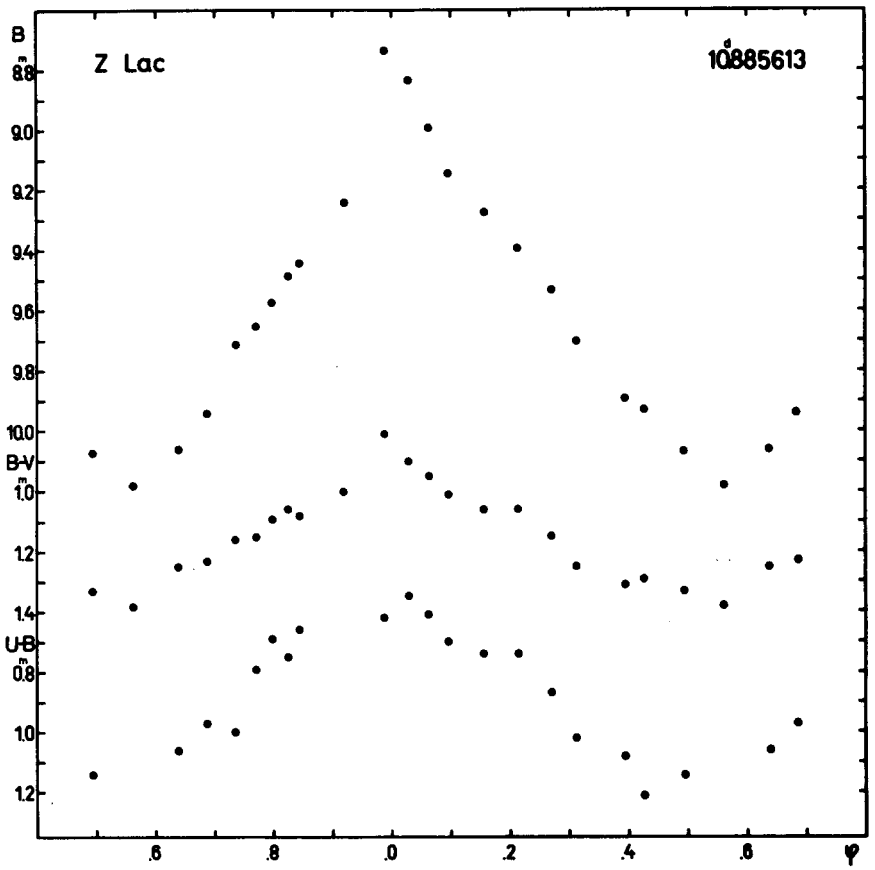

Figure 13 B, B-V and U-B curves of Z Lac

The O-C residuals have been computed using the ephemeris:

$$C = 2442827.123 + 10^{d}.885613 \times E \quad .$$

The O-C diagram in Fig. 14 shows a continuous decrease of the period. The equation of the fitted parabola is:

$$(O-C)_{par} = -3^{d}.4 \times 10^{-8} \times E^{2} \quad .$$

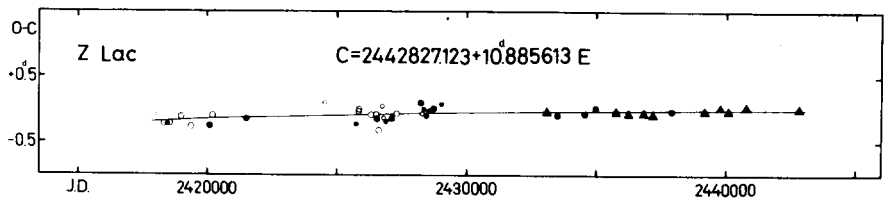

Figure 14 O-C diagram of Z Lac

Table 11 O-C residuals for Z Lac

Obs.Max.J.D.	E	O-C	Type	w	Reference
2417931.642	-2287	-0.084	vis	1	Enebo (1908)
2418334.276	-2250	-0.218	vis	1	Enebo (1909)
2418475.781	-2237	-0.226	pg	0.5	Robinson (1933)
2418541.107	-2231	-0.213	vis	1	Bilt (1926b)
2419009.285	-2188	-0.117	vis	1	Enebo (1912)
2419368.365	-2155	-0.262	vis	1	Bilt (1926b)
2420108.601	-2087	-0.248	pg	1	Hertzsprung (1922)
2420239.373	-2075	-0.103	vis	1	Bilt (1926b)
2421534.721	-1956	-0.143	pg	1	Hertzsprung (1922)
2424528.5	-1681	+0.1	vis	0.5	Selivanov (1929)
2425747.37	-1569	-0.23	pg	0.5	Kiehl, Hopp (1977)
2425834.646	-1561	-0.035	vis	1	Parenago (1938)
2425845.565	-1560	-0.002	vis	1	Beyer (1934b)
2426313.568	-1517	-0.080	vis	1	Terkán (1935)
2426542.105	-1496	-0.141	pg	1	Zonn (1933)
2426542.171	-1496	-0.075	vis	1	Kukarkin (1940)
2426618.132	-1489	-0.313	vis	1	Beyer (1934b)
2426760.019	-1476	+0.061	vis	0.5	Dziewulski et al. (1946)
2426803.371	-1472	-0.130	vis	0.5	Dziewulski et al. (1946)
2426879.52	-1465	-0.18	pg	0.5	Kiehl, Hopp (1977)
2427108.157	-1444	-0.141	pg	1	Zonn (1933)
2427293.293	-1427	-0.060	vis	1	Florya, Kukarkina (1953)
2428229.624	-1341	+0.108	pg	1	Gur'yev (1937)
2428283.881	-1336	-0.063	vis	0.5	Dziewulski (1947)
2428349.260	-1330	+0.002	pg	0.5	Dziewulski et al. (1946)
2428458.01	-1320	-0.10	pg	0.5	Fu De-Lian (1964)
2428556.071	-1311	-0.013	pg	0.5	Dziewulski et al. (1946)
2428741.160	-1294	+0.020	pg	1	Gur'yev (1938)
2429046.02	-1266	+0.08	pg	0.5	Katz (1946)
2433084.478	-895	-0.021	pe	3	Eggen (1951)
2433519.846	-855	-0.078	pg	1	Solov'yov (1952)
2434575.782	-758	-0.046	pg	1	Chuprina (1954)
2434967.738	-722	+0.028	pg	1	Chuprina (1956)
2435751.452	-650	-0.023	pe	3	Bahner et al. (1971)

Table 11 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2436230.385	-606	$-0^d.057$	pe	3	Bahner et al. (1971)
2436829.095	-551	-0.055	pe	3	Bahner et al. (1962)
2437199.191	-517	-0.070	pe	3	Mitchell et al. (1964)
2437928.575	-450	-0.022	pg	1	Girnyak (1964)
2439180.423	-335	-0.020	pe	3	Takase (1969)
2439768.312	-281	+0.046	pe	2	present paper[1]
2440083.936	-252	-0.013	pe	3	Asteriadis et al. (1977)
2440791.548	-187	+0.035	pe	3	Asteriadis et al. (1977)
2442827.154	0	+0.031	pe	3	present paper

Remark: [1] Observer: Abaffy

VX Persei

The light and colour curves of this neglected Cepheid variable are plotted in Fig. 15. VX Per is situated in the region of

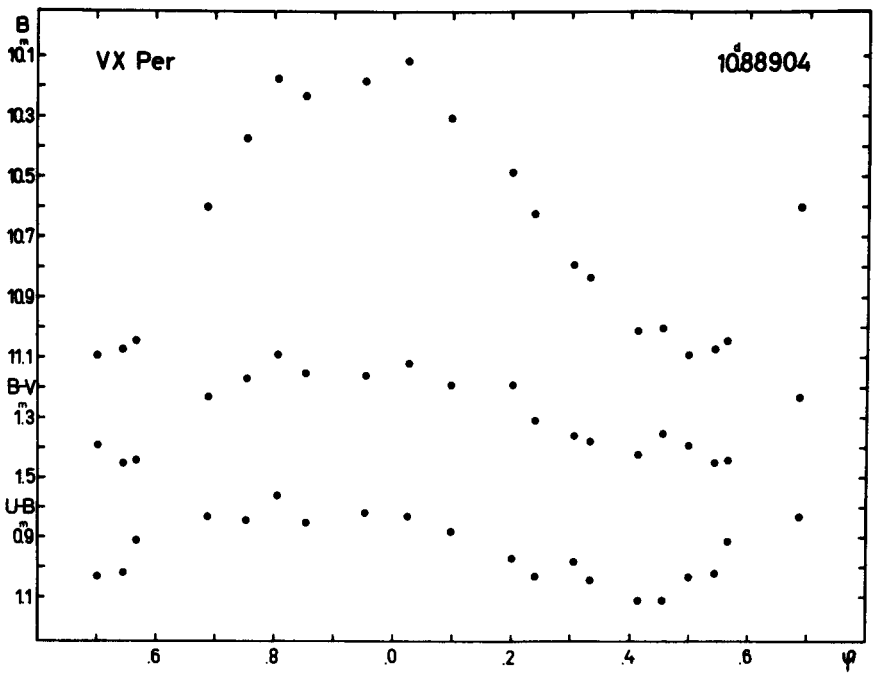

Figure 15 B, B-V and U-B curves of VX Per

the h and χ Per double cluster (Kukarkin et al., 1976). The O-C residuals have been calculated with the formula:

$$C = 2443758.994 + 10^d.88904 \times E \quad .$$

The O-C diagram in Fig. 16 shows one change in the period, but

both the time of the change and the values of the period are uncertain.

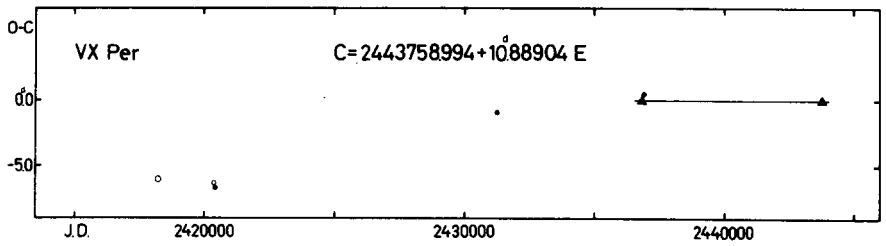

Figure 16 O-C diagram of VX Per

Table 12 O-C residuals for VX Per

Obs.Max.J.D.	E	O-C	Type	w	Reference
		d			
2418229.008	-2344	-6.076	vis	1	Pracka (1912)
2420363.01	-2148	-6.33	vis	0.5	Hoffmeister (1916b)
2420438.854	-2141	-6.705	pg	0.5	Robinson (1933)
2431279.215	-1146	-0.939	pg	0.5	Solov'yov (1955)
2436811.804	-638	+0.018	pe	3	Oosterhoff (1960)
2436822.654	-637	-0.022	pe	3	Weaver et al. (1960)
2436899.368	-630	+0.469	pg	0.5	Mauder (1960)
2443758.994	0	0.000	pe	3	present paper

SV Persei

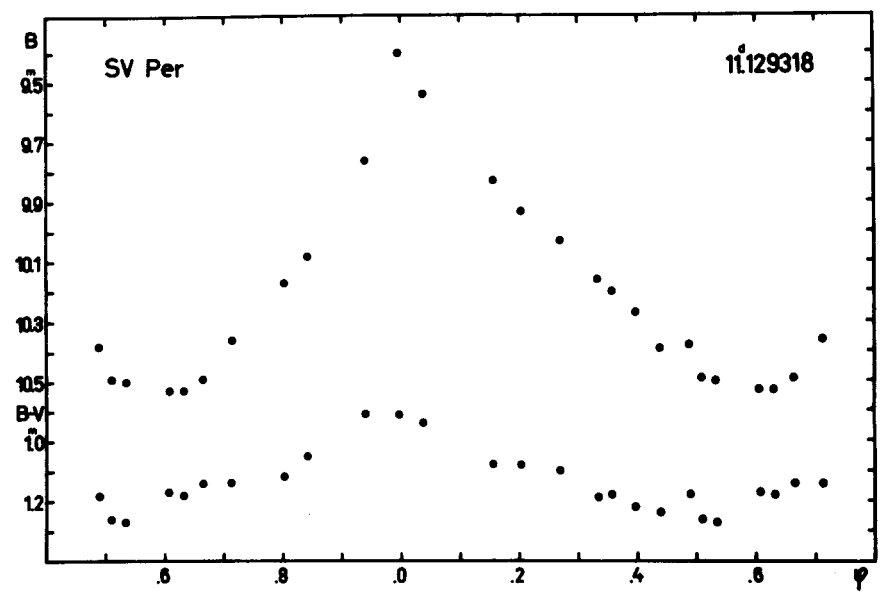

Figure 17 B and B-V curves of SV Per

The light and colour curves of SV Per are plotted in Fig. 17. According to Madore (1977) this Cepheid has a B2 photometric companion.

The O-C residuals have been calculated using the formula:

$$C = 2443839.296 + 11^{d}.129318 \times E \quad .$$

The O-C diagram in Fig. 18 shows a rejumping period, the sudden changes in the period (jump and rejump) occurred at about J.D. 2426300. The values of the period are as follows:

before J.D. 2426300 $P = 11^{d}.129289$

after J.D. 2426300 $P = 11^{d}.129318$.

Although the rejumping period seems to be the proper interpretation of the O-C diagram, another possibility cannot be excluded, viz. a sinusoidal wave caused by the light-time effect in the binary system. In this latter case the average period would be $P = 11^{d}.128986$ in the course of the last 70 years.

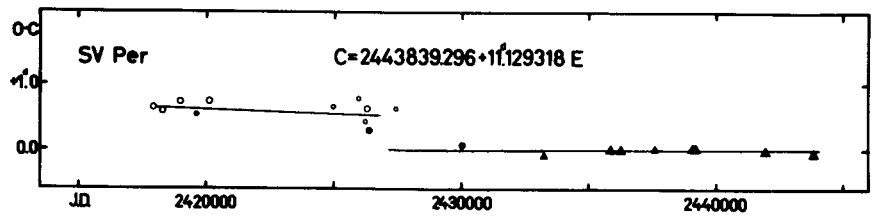

Figure 18 O-C diagram of SV Per

Table 13 O-C residuals for SV Per

Obs.Max.J.D.	E	O-C	Type	w	Reference
2417930.893	-2328	$+0^{d}.649$	vis	1	Enebo (1908)
2418298.108	-2295	+0.597	vis	1	Enebo (1909)
2418977.140	-2234	+0.740	vis	1	Enebo (1914)
2419611.313	-2177	+0.542	pg	0.5	Robinson (1933)
2420112.339	-2132	+0.749	vis	1	Enebo (1914)
2424953.506	-1697	+0.663	vis	0.5	Mergentaler[1] (1948)
2425955.263	-1607	+0.781	vis	0.5	Mergentaler[2] (1948)
2426210.883	-1584	+0.427	vis	0.5	Zakharov (1953)
2426288.996	-1577	+0.634	vis	1	Kukarkin (1940)
2426377.692	-1569	+0.296	pg	1	Rügemer (1932)
2426623.44	-1547	+1.20	vis	0	Mergentaler[3] (1948)
2427401.925	-1477	+0.632	vis	0.5	Mergentaler[4] (1948)
2430027.889	-1241	+0.077	pg	1	Mergentaler (1948)
2433232.980	-953	-0.076	pe	2	Eggen et al. (1957)
2434000.04	*-884*	*-0.94*	*pg*	*0*	*Fu De-Lian (1964)*
2435848.470	-718	+0.024	pe	3	Bahner et al (1977)
2436260.245	-681	+0.015	pe	3	Bahner et al. (1977)
2437595.773	-561	+0.024	pe	2	Mitchell et al. (1964)

Table 13 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2439075.985	-428	+0^d.037	pe	3	Takase (1969)
2439209.541	-416	+0.041	pe	3	Wamsteker (1972)
2441913.906	-173	-0.018	pe	3	Vasil'yanovskaya (1977)
2443839.246	0	-0.050	pe	3	present paper

Remarks: [1] Observer: Grouiller; [2] Obs.: Grouiller and Bloch; [3] Obs.: Rybka; [4] Obs.: Chang Yuin

AA Geminorum

This variable has two faint companions within the edge of the diaphragm. The light and colour curves in Fig. 19 are not complete since the weather conditions did not permit the coverage of the light curve at the other phases.

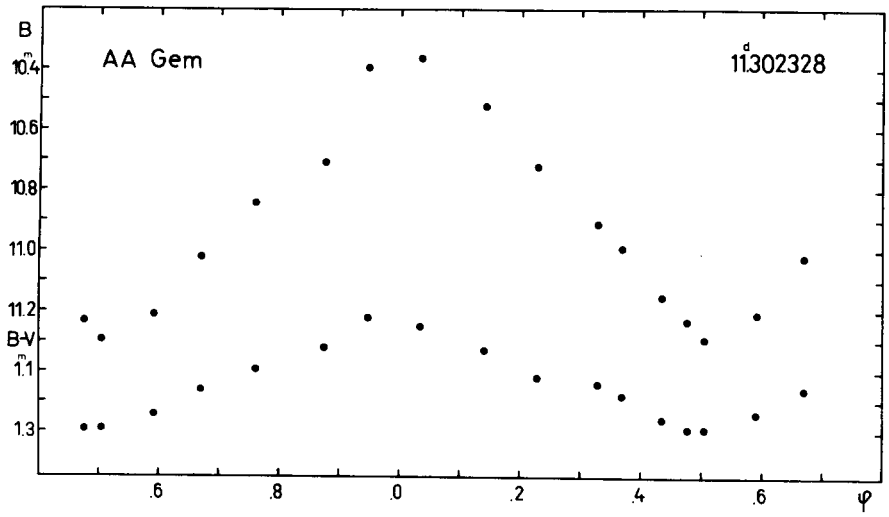

Figure 19 B and B-V curves of AA Gem

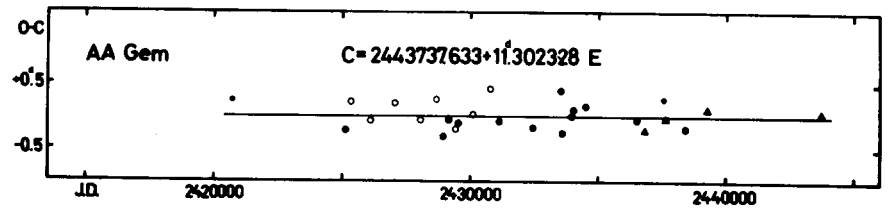

Figure 20 O-C diagram of AA Gem

The O-C residuals have been computed by the formula:

$C = 2443737.633 + 11^d.302328 \times E$.

The period of the light variation has been constant since its discovery (see Fig. 20).

Table 14 O-C residuals for AA Gem

Obs.Max.J.D.	E	O-C	Type	w	Reference
2420726.34	-2036	+0^d.25	pg	0.5	Kukarkin (1930)
2425133.785	-1646	-0.216	pg	1	Prager (1929)
2425348.970	-1627	+0.225	vis	1	Kukarkin (1940)
2426015.515	-1568	-0.068	vis	1	Beyer (1934a)
2427055.602	-1476	+0.205	vis	1	Beyer (1934a)
2428061.251	-1387	-0.053	vis	1	Martynov (1951)
2428683.197	-1332	+0.265	vis	1	Martynov (1951)
2428953.877	-1308	-0.311	pg	1	Koshkina (1963)
2429157.579	-1290	-0.051	pg	1	Chudovicheva (1952)
2429439.991	-1265	-0.197	vis	1	Martynov (1951)
2429530.500	-1257	-0.107	pg	1	Koshkina (1963)
2430118.358	-1205	+0.030	vis	1	Martynov (1951)
2430785.592	-1146	+0.427	vis	1	Martynov (1951)
2431135.468	-1115	-0.069	pg	1	Chudovicheva (1952)
2432446.439	-999	-0.168	pg	1	Chudovicheva (1952)
2433543.332	-902	+0.399	pg	1	Chudovicheva (1952)
2433599.199	-897	-0.246	pg	1	Satyvaldiev (1970)
2433972.437	-864	+0.015	pg	1	Rosino, Nobili (1955)
2434029.050	-859	+0.117	pg	1	Koshkina (1963)
2434537.701	-814	+0.163	pg	1	Rosino, Nobili (1955)
2436504.096	-640	-0.047	pg	1	Satyvaldiev (1970)
2436831.705	-611	-0.206	pe	2	Weaver et al. (1960)
2437566.83	-546	+0.27	pg	0.5	Ahnert (1962)
2437634.342	-540	-0.034	pe	2	Mitchell et al. (1964)
2438436.673	-469	-0.168	pg	1	Satyvaldiev (1970)
2439250.725	-397	+0.116	pe	2	Takase (1969)
2443737.679	0	+0.046	pe	2	present paper

RX Aurigae

The light and colour curves of RX Aur are plotted in Fig. 21. According to the G.C.V.S. (Kukarkin et al., 1969-1970) the spectral type of this Cepheid is G0 III. Apart from the variation in

Table 15 O-C residuals for RX Aur

Obs.Max.J.D.	E	O-C	Type	w	Reference
2415816.313	-2410	-0^d.867	pg	1	Williams (1906)
2416222.77	-2375	-1.23	pg	0.5	Kukarkin[1] (1931)
2417338.90	-2279	-0.96	vis	0.5	Williams (1906, 1907)
2417478.47	-2267	-0.88	vis	0.5	Müller, Hartwig (1918-1920)
2417675.843	-2250	-1.103	vis	1	Zeipel (1908)
2419698.601	-2076	-0.840	pg	0.5	Robinson (1933)
2421883.742	-1888	-0.924	pg	1	Jordan (1929)
2425115.469	-1610	-0.540	vis	0.5	Dziewulski et al.[2] (1946)
2425243.007	-1599	-0.861	pg	1	Hellerich (1935)
2425592.584	-1569	+0.010	vis	0	Parenago (1938)
2425650.202	-1564	-0.490	vis	1	Kukarkin (1931)
2426219.80	-1515	-0.44	pg	0.5	Kiehl, Hopp (1977)

Table 15 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
		d			
2426219.952	-1515	-0.293	vis	0.5	Zakharov (1951)
2426405.567	-1499	-0.655	vis	1	Terkán (1935)
2426452.003	-1495	-0.713	pg	1	Iwanowska et al. (1932)
2426498.823	-1491	-0.387	vis	1	Zverev (1936)
2426568.123	-1485	-0.829	vis	0.5	Iwanowska et al. (1932)
2426673.385	-1476	-0.178	vis	1	Kukarkin (1940)
2426905.458	-1456	-0.576	vis	0.5	Dziewulski et al. (1946)
2426997.79	-1448	-1.23	pg	0	Kiehl, Hopp (1977)
2427707.442	-1387	-0.616	vis	0.5	Dziewulski et al. (1946)
2428370.107	-1330	-0.493	pg	0.5	Dziewulski et al. (1946)
2428416.608	-1326	-0.486	pg	0.5	Dziewulski et al. (1946)
2428881.32	-1286	-0.71	pg	0.5	Karimova[3] (1949)
2430043.972	-1186	-0.417	pg	1	Mergentaler (1948)
2433287.54	-907	+0.18	vis	0.5	Pohl[4] (1951)
2433461.739	-892	+0.030	pe	2	Eggen et al. (1957)
2433982.06	-847	-2.71	pg	0	Fu De-Lian (1964)
2436228.158	-654	+0.047	pe	3	Bahner et al. (1977)
2436542.00	-627	+0.054	pg	0.5	Kiehl, Hopp (1977)
2437611.298	-535	-0.014	pe	3	Mitchell et al. (1964)
2437936.922	-507	+0.151	pe	1	Williams (1966)
2439064.203	-410	-0.051	pe	3	Takase (1969)
2439494.226	-373	-0.099	pe	3	Wamsteker (1972)
2441005.307	-243	-0.078	pe	2	Evans (1976)
2442365.266	-126	-0.072	vis	0.5	Berdnikov (1977)
2443515.872	-27	-0.197	vis	0.5	Busch[5] (1980)
2443829.995	0	+0.091	pe	3	present paper

Remarks: [1] Observer: Blazhko; [2] Obs.: Rybka; [3] Obs.: Ishchenko; [4] Obs.: Mielke; [5] Obs.: Branzke

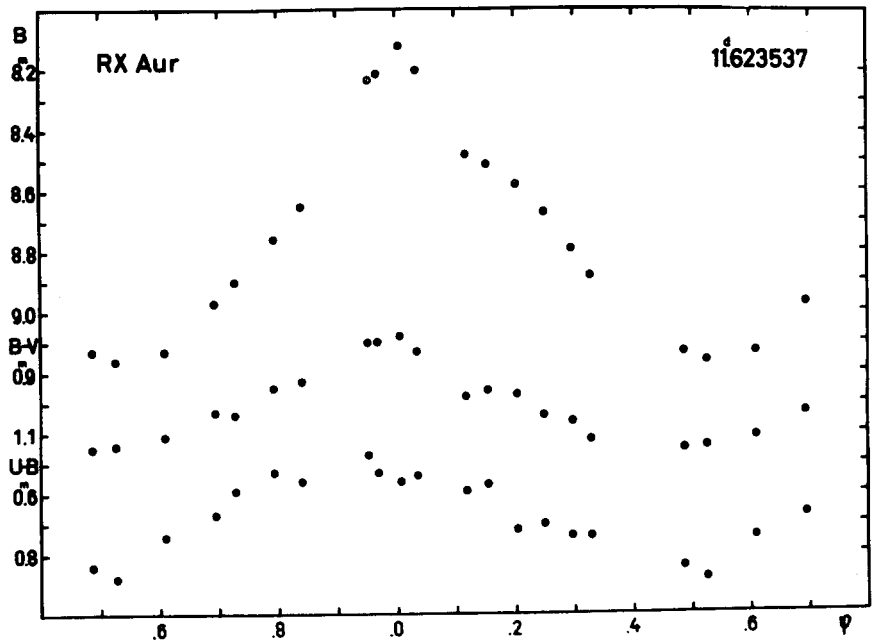

Figure 21 B, B-V and U-B curves of RX Aur

the spectral type during a pulsation cycle, the III luminosity class is not typical for a Cepheid variable.

The O-C residuals have been calculated with the formula:

$C = 2443829.904 + 11^d.623537 \times E$.

The O-C diagram in Fig. 22 shows one change in the period:

before J.D. 2434900 $P = 11^d.624230$

after J.D. 2434900 $P = 11^d.623537$.

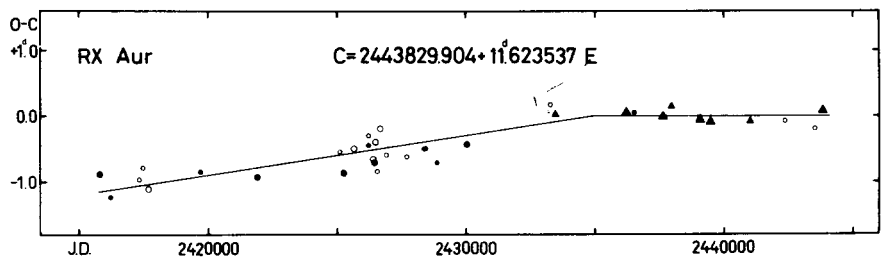

Figure 22 O-C diagram of RX Aur

RY Cassiopeiae

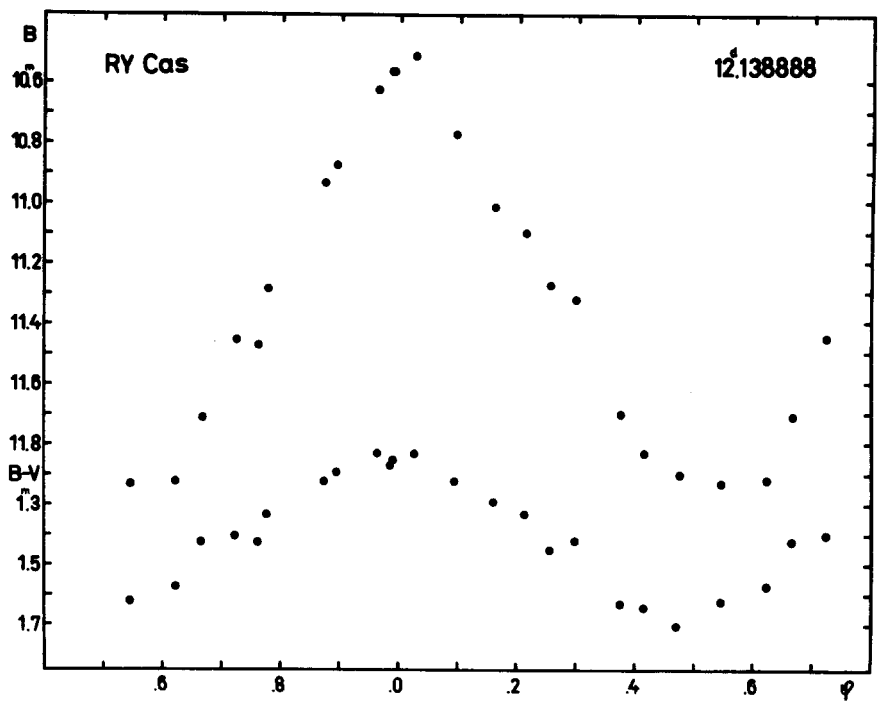

Figure 23 B and B-V curves of RY Cas

The light and colour curves in Fig. 23 show some minor changes in the shape of the light curve in comparison with the earlier photoelectric light curves.

The O-C residuals have been derived using the formula:

$$C = 2443826.530 + 12^{d}.138888 \times E \quad .$$

The period of RY Cas is continuously increasing (see Fig. 24), the approximate parabola being:

$$(O-C)_{par} = 5^{d}.31 \times 10^{-7} \times E^{2} \quad .$$

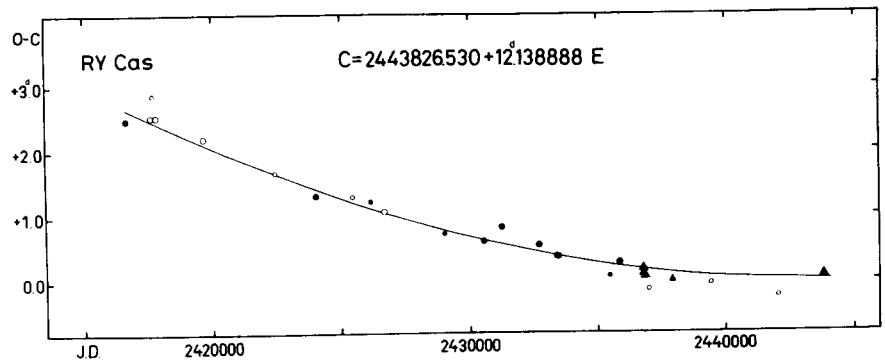

Figure 24 O-C diagram of RY Cas

Table 16 O-C residuals for RY Cas

Obs.Max.J.D.	E	O-C	Type	w	Reference
2416637.920	-2240	$+2^{d}.494$	pg	1	Kukarkin[1] (1940)
2417284.5	-2187	+5.7	vis	0	Dunér et al. (1906)
2417536.9	-2166	+3.2	vis	0	Ichinohe (1907)
2417633.346	-2158	+2.536	vis	1	Graff (1921b)
2417694.384	-2153	+2.880	vis	0.5	Pracka (1910)
2417839.703	-2141	+2.532	vis	1	Luizet (1908b)
2419672.345	-1990	+2.202	vis	1	Graff (1921b)
2422451.620	-1761	+1.672	vis	0.5	Graff (1921b)
2424041.467	-1630	+1.324	pg	1	Kukarkin (1940)
2425485.97	-1511	+1.30	vis	0.5	Nielsen[2] (1955)
2426165.68	-1455	+1.23	pg	0.5	Kiehl, Hopp (1977)
2426699.636	-1411	+1.077	vis	1	Kukarkin (1940)
2429017.82	-1220	+0.73	pg	0.5	Pevunova (1940)
2430547.208	-1094	+0.621	pg	1	Solov'yov (1954)
2431251.473	-1036	+0.831	pg	1	Solov'yov (1954)
2432732.134	-914	+0.548	pg	1	Solov'yov (1954)
2433423.88	-857	+0.38	vis	0.5	Nielsen[3] (1955)
2433472.434	-853	+0.375	pg	1	Solov'yov (1954)
2435291.32	-703	-1.57	pg	0	Parenago[4] (1956)
2435438.63	-691	+0.07	pg	0.5	Romano (1959)
2435875.84	-655	+0.28	pg	1	Zonn, Semeniuk (1959)
2436798.286	-579	+0.172	pe	3	Weaver et al. (1960)
2436810.350	-578	+0.097	pe	3	Oosterhoff (1960)
2436871.012	-573	+0.065	pe	3	Bahner et al. (1962)

Table 16 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2437016.475	-561	$-0^d.139$	vis	0.5	Sachse (1973)
2437939.164	-485	-0.005	pe	1	Williams (1966)
2439055.344	-393	-0.783	vis	0	Sachse (1973)
2439444.331	-361	-0.060	vis	0.5	Sachse (1973)
2442066.14	-145	-0.25	vis	0.5	Small (1974)
2443826.585	0	+0.055	pe	3	present paper

Remarks: [1] Observers: Blazhko and Parenago; [2] Obs.: Brun; [3] Obs.: Petersen; [4] Obs.: Zhdanova

SZ Cassiopeiae

The light and colour curves of this small amplitude Cepheid can be seen in Fig. 25. SZ Cas is situated in the corona of the double cluster h and χ Per (Efremov, 1964).

The O-C residuals have been computed with the ephemeris:

$$C = 2443818.142 + 13^d.637747 \times E \quad .$$

The period of SZ Cas is continuously increasing (see Fig. 26). The least squares fitting procedure has resulted in the parabola:

$$(O-C)_{par} = 1^d.01 \times 10^{-5} \times E^2 \quad .$$

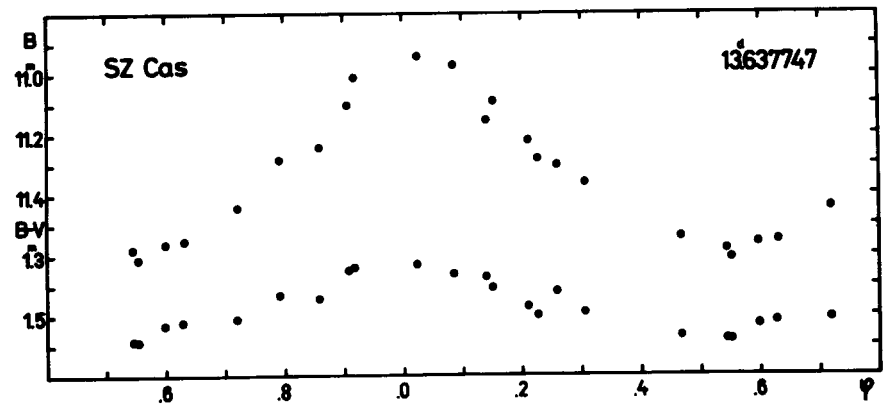

Figure 25 B and B-V curves of SZ Cas

Table 17 O-C residuals for SZ Cas

Obs.Max.J.D.	E	O-C	Type	w	Reference
2415753.8	-2061	$+43^d.1$	pg	0.5	Gerasimovic (1927b)
2416039.2	-2036	+42.1	pg	0.5	Gerasimovic (1927b)
2416338.4	-2016	+41.2	pg	0.5	Gerasimovic (1927b)
2416678.7	-1993	+40.6	pg	0.5	Gerasimovic (1927b)
2416738.046	-1989	+45.383	pg	0	Kukarkin (1932c)
2417085.8	-1963	+38.6	pg	0.5	Gerasimovic (1927b)
2417220.442	-1953	+36.820	vis	0.5	Pracka (1910)

Table 17 (cont.)

Obs.Max.J.D.	E	O-C d	Type	w	Reference
2417480.8	-1934	+38.1	pg	0.5	Gerasimovic (1927b)
2417833.6	-1908	+36.3	pg	0.5	Gerasimovic (1927b)
2418542.5	-1856	+36.0	pg	0.5	Gerasimovic (1927b)
2419017.2	-1821	+33.4	pg	0.5	Gerasimovic (1927b)
2419030.229	-1820	+32.787	vis	0.5	Mündler (1911b, 1919)
2419805.7	-1763	+30.9	pg	0.5	Gerasimovic (1927b)
2420581.0	-1706	+28.9	pg	0.5	Gerasimovic (1927b)
2420718.996	-1696	+30.473	pg	0.5	Robinson (1933)
2420814.397	-1689	+30.410	vis	0.5	Zinner[1] (1932)
2420839.8	-1687	+28.5	pg	0.5	Gerasimovic (1927b)
2421084.6	-1669	+27.9	pg	0.5	Gerasimovic (1927b)
2421248.225	-1657	+27.830	vis	0.5	Zinner[1] (1932)
2421261.961	-1656	+27.928	vis	0.5	Luizet (1923)
2421479.3	-1640	+27.1	pg	0.5	Gerasimovic (1927b)
2421969.959	-1604	+26.763	vis	0.5	Zinner[1] (1932)
2422323.3	-1578	+25.5	pg	0.5	Gerasimovic (1927b)
2422582.0	-1559	+25.1	pg	0.5	Gerasimovic (1927b)
2422935.7	-1533	+24.2	pg	0.5	Gerasimovic (1927b)
2423439.4	-1496	+23.3	pg	0.5	Gerasimovic (1927b)
2423806.919	-1467	+22.627	vis	1	Beyer (1927)
2424105.6	-1447	+21.3	pg	0.5	Gerasimovic (1927b)
2424255.315	-1436	+20.978	vis	1	Beyer (1927)
2424390.7	-1426	+20.0	pg	0.5	Gerasimovic (1927b)
2424758.807	-1399	+19.873	vis	1	Beyer (1927)
2424880.4	-1390	+18.7	pg	0.5	Gerasimovic (1927b)
2425166.947	-1369	+18.881	vis	1	Beyer (1934a)
2425520.728	-1343	+18.080	vis	1	Beyer (1934a)
2426282.663	-1287	+16.301	vis	1	Kukarkin (1940)
2426623.239	-1262	+15.934	vis	1	Kukarkin (1932c)
2426691.049	-1257	+15.555	vis	1	Dunst (1933)
2428458.06	-1127	+9.66	pg	0	Fu De-Lian (1964)
2429604.696	-1043	+10.724	pg	1	Efremov (1958)
2430638.866	-967	+8.425	vis	0.5	Stein (1944)
2430653.134	-966	+9.056	pg	1	Filin (1958)
2431525.288	-902	+8.394	pg	1	Filin (1958)
2432805.023	-808	+6.181	pg	1	Filin (1958)
2433186.576	-780	+5.877	pg	1	Filin (1958)
2434249.160	-702	+4.716	pg	1	Efremov (1958)
2434893.313	-655	+7.895	pg	0	Filin (1958)
2436457.166	-540	+3.407	pg	1	Makarenko (1969)
2436484.05	-538	+3.02	pg	0.5	Smykov (1980)
2436606.84	-529	+3.07	pg	0.5	Vasil'yan. et al.[2] (1970)
2436824.793	-513	+2.815	pe	3	Oosterhoff (1960)
2436838.243	-512	+2.627	pe	3	Weaver et al. (1960)
2436892.930	-508	+2.763	pe	3	Bahner et al. (1962)
2437205.92	-485	+2.09	pg	0.5	Smykov (1980)
2437615.141	-455	+2.174	pg	1	Makarenko (1969)
2437968.44	-429	+0.89	pg	0	Smykov (1980)
2438201.44	-412	+2.05	pg	0.5	Vasil'yan. et al.[2] (1970)
2438295.77	-405	+0.92	pg	0	Smykov (1980)
2438664.78	-378	+1.71	pg	0.5	Vasil'yan. et al.[2] (1970)
2438665.010	-378	+1.936	pg	1	Makarenko (1969)
2439059.47	-349	+0.90	pg	0.5	Smykov (1980)
2441500.2	-170	+0.5	vis	0.5	Cragg (1976)

Table 17 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2442303.91	-111	-0.44	pg	0.5	Smykov (1980)
2442372.39	-106	-0.15	pg	0.5	Smykov (1980)
2442699.48	-82	-0.37	pg	0.5	Smykov (1980)
2443817.966	0	-0.176	pe	3	present paper

Remarks: [1] Observer: Hartwig; [2] Observer: Shakhovskaya

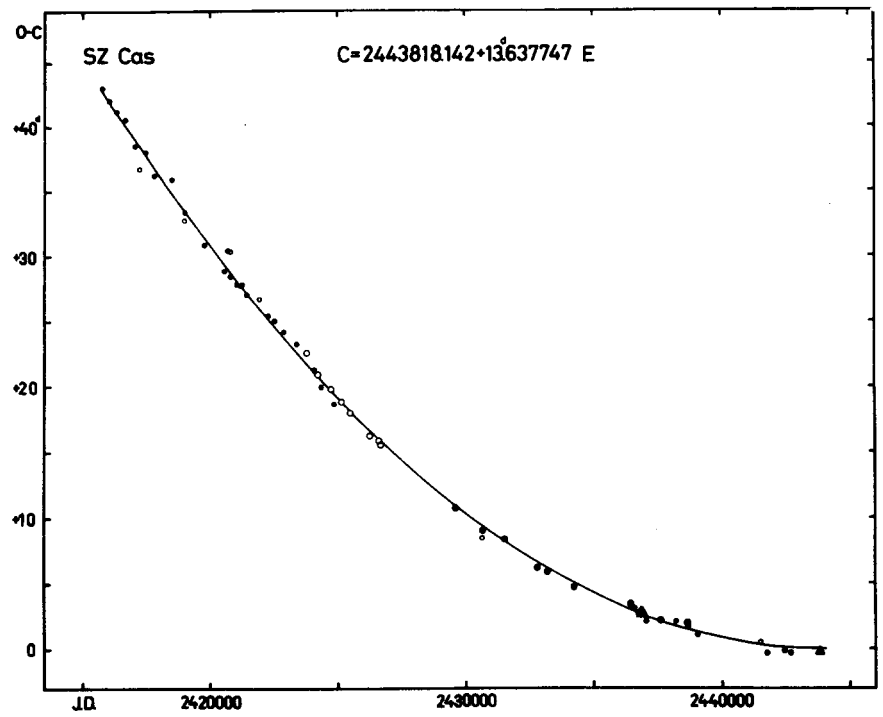

Figure 26 O-C diagram of SZ Cas

TT Aquilae

Its light and colour curves are plotted in Fig. 27. This variable has a faint companion within the edge of the diaphragm.

The O-C residuals have been calculated using the formula:

$$C = 2443810.823 + 13.^{d}754707 \times E \quad .$$

The period of TT Aql has been constant since J.D. 2425000. Before that date the period might have had another value but that part of the O-C diagram (see Fig. 28) is very uncertain.

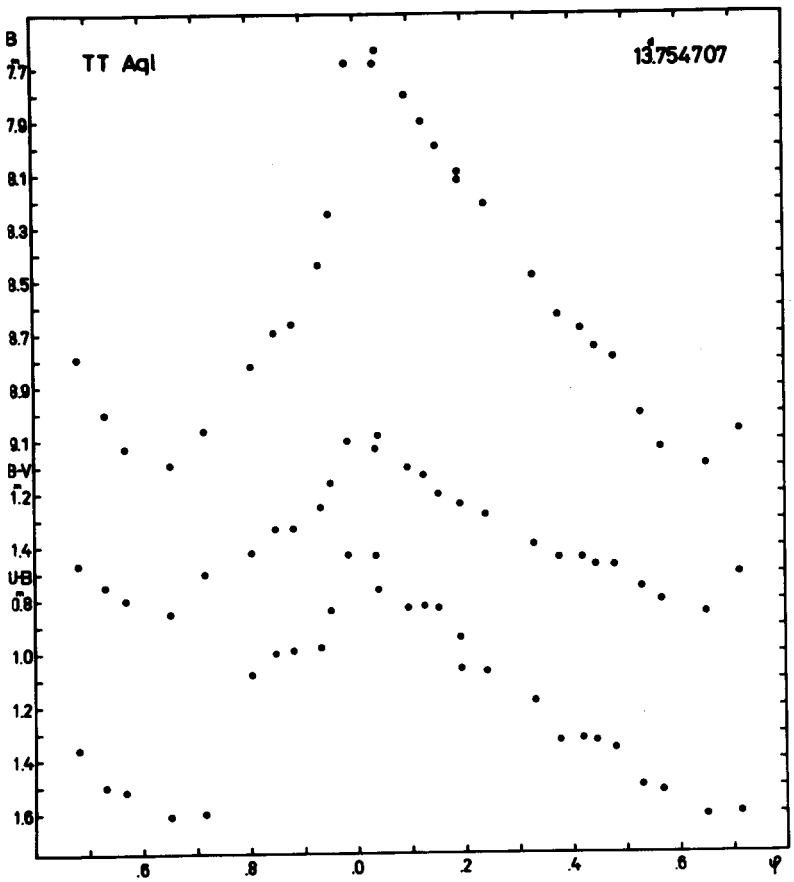

Figure 27 B, B-V and U-B curves of TT Aql

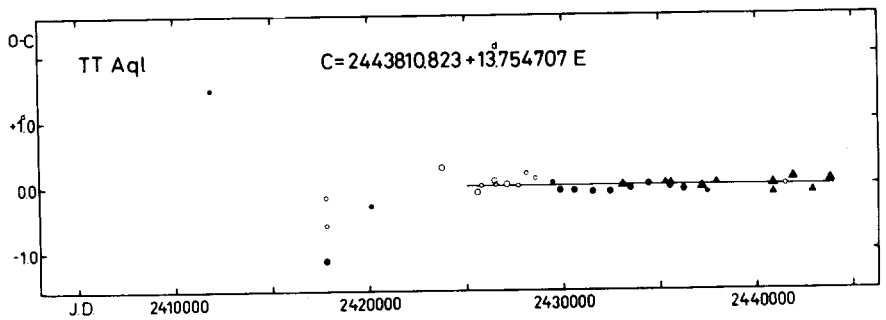

Figure 28 O-C diagram of TT Aql

Table 18 O-C residuals for TT Aql

Obs.Max.J.D.	E	O-C	Type	w	Reference
2411873.865	-2322	+1^d.472	pg	0.5	Pickering (1907)
2417744.514	-1895	-1.139	pg	1	Jordan (1919)
2417745.486	-1895	-0.167	vis	0.5	Ichinohe (1911)
2417800.1	-1891	-0.6	vis	0.5	Pickering (1908)
2420097.402	-1724	-0.306	pg	0.5	Robinson (1933)
2423742.991	-1459	+0.286	vis	1	Kukarkin[1] (1940)
2425613.245	-1323	-0.101	vis	1	Kukarkin (1940)
2425805.920	-1309	+0.008	vis	0.5	Parenago (1938)
2426466.209	-1261	+0.072	vis	1	Kukarkin (1940)
2426521.173	-1257	+0.017	vis	0.5	Zverev (1936)
2427085.125	-1216	+0.026	vis	1	Florya, Kukarkina (1953)
2427662.80	-1174	0.00	vis	0.5	Krebs[2] (1940)
2428089.378	-1143	+0.185	vis	0.5	Dziewulski et al. (1956)
2428584.5	-1107	+0.1	vis	0.5	Krebs (1939)
2429519.731	-1039	+0.049	pg	0.5	Solov'yov (1944)
2429835.963	-1016	-0.078	pg	1	Erleksova (1960)
2430564.956	-963	-0.084	pg	1	Erleksova (1960)
2431527.765	-893	-0.105	pg	1	Erleksova (1960)
2432449.337	-826	-0.098	pg	1	Erleksova (1960)
2433109.654	-778	-0.007	pe	3	Eggen (1951)
2433494.741	-750	-0.052	pg	1	Erleksova (1960)
2434416.368	-683	+0.010	pg	1	Erleksova (1960)
2435282.936	-620	+0.031	pe	2	Irwin (1961)
2435502.954	-604	-0.026	pg	1	Erleksova (1960)
2435558.014	-600	+0.015	pe	2	Walraven et al. (1958)
2436218.152	-552	-0.073	pg	1	Erleksova (1960)
2437208.525	-480	-0.039	pe	3	Mitchell et al. (1964)
2437469.787	-461	-0.116	pg	0.5	Zoj Von Shor (1963)
2437937.601	-427	+0.038	pe	1	Williams (1966)
2440867.193	-214	-0.123	pe	1	Evans (1976)
2440867.331	-214	+0.015	pe	3	Pel (1976)
2441500.0	-168	0.0	vis	0.5	Cragg (1976)
2441912.777	-138	+0.104	pe	3	Landis (1976)
2442916.670	-65	-0.097	pe	2	Dean (1977)
2443810.884	0	+0.061	pe	3	present paper

Remarks: [1] Observer: Kanda; [2] Observer: Loreta

TX Cygni

The light and colour curves of this Cepheid are shown in Fig. 29. The O-C residuals have been computed with the formula:

$$C = 2443794.231 + 14^d.708157 \times E \quad .$$

Although the G.C.V.S. (Kukarkin et al., 1969-1970) reported a variation in the period of TX Cyg, the period was constant until the sixties (see Fig. 30) with P = 14^d.708157 . The period change can only be seen on the basis of the recent observations. Assuming that the change in the period occurred at about J.D. 2437000, the new period is P = 14^d.7098 which can be refined by future observations.

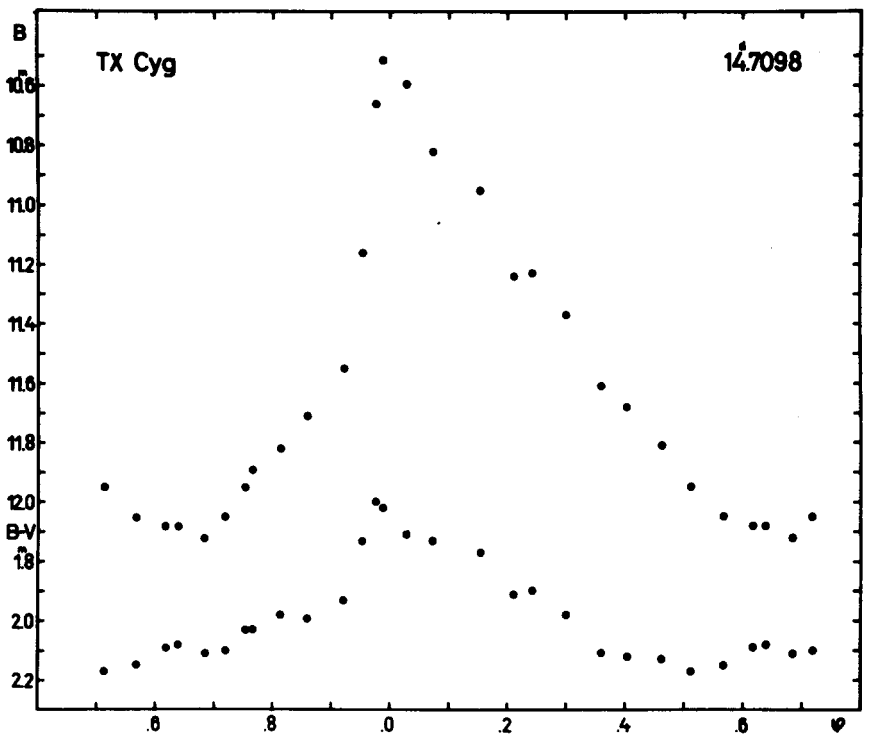

Figure 29 B and B-V curves of TX Cyg

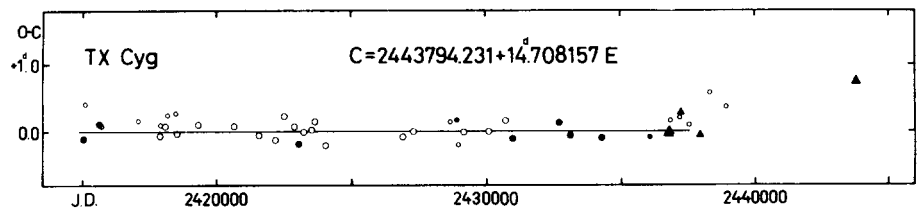

Figure 30 O-C diagram of TX Cyg

Table 19 O-C residuals for TX Cyg

Obs.Max.J.D.	E	O-C	Type	w	Reference
2415054.388	-1954	-0.104	pg	1	Williams (1900b)
2415099.03	-1951	+0.41	vis	0.5	Williams (1902)
2415613.522	-1916	+0.120	pg	1	Kulikovsky (1933)
2415614.51	-1916	+1.11	vis	0	Williams (1902)
2415731.144	-1908	+0.077	vis	0.5	Zinner[1] (1932)
2415938.65	-1894	+1.67	vis	0	Yendell (1904)
2416320.92	-1868	+1.53	vis	0	Yendell (1904)
2417084.377	-1816	+0.159	vis	0.5	Zinner[1] (1932)

Table 19 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2417511.71	-1787	+0^d.96	vis	0	Seares (1907)
2417893.095	-1761	-0.072	vis	1	Zeipel (1908)
2417908.0	-1760	+0.1	vis	0.5	Müller, Hartwig[2] (1918-1920)
2418099.158	-1747	+0.077	vis	1	Bilt (1925)
2418172.86	-1742	+0.24	vis	0.5	Müller, Hartwig[2] (1918-1920)
2418496.46	-1720	+0.26	vis	0.5	Müller, Hartwig[2] (1918-1920)
2418554.996	-1716	-0.038	vis	1	Bilt (1925)
2419319.957	-1664	+0.099	vis	1	Bilt (1925)
2420395.5	-1591	+1.9	vis	0	Yendell (1915)
2420643.670	-1574	+0.078	vis	1	Doberck (1920b)
2421570.143	-1511	-0.063	vis	1	Doberck (1920b)
2422187.816	-1469	-0.132	vis	1	Doberck (1920b)
2422511.750	-1447	+0.222	vis	1	Leiner (1925)
2422894.003	-1421	+0.063	vis	1	Leiner (1925)
2423040.836	-1411	-0.185	pg	1	Henroteau (1924)
2423246.928	-1397	-0.008	vis	1	Leiner (1925)
2423526.414	-1378	+0.023	vis	1	Doberck (1924b)
2423658.906	-1369	+0.142	vis	1	Leiner (1925)
2424040.967	-1343	-0.209	vis	1	Leiner (1925)
2426909.179	-1148	-0.088	vis	1	Florya, Kukarkina (1953)
2427291.667	-1122	-0.012	vis	1	Florya, Kukarkina (1953)
2428674.389	-1028	+0.143	vis	0.5	Dziewulski (1949)
2428909.736	-1012	+0.160	pg	0.5	Shteiman[3] (1958)
2428982.9	-1007	-0.2	vis	0.5	Krebs (1939)
2429174.308	-994	-0.015	vis	1	Conceicao-Silva (1949)
2430086.220	-932	-0.009	vis	1	Conceicao-Silva (1949)
2430704.128	-890	+0.157	vis	1	Conceicao-Silva (1949)
2430998.028	-870	-0.106	pg	1	Solov'yov (1950)
2432719.114	-753	+0.125	pg	1	Solov'yov (1950)
2433130.754	-725	-0.063	pg	1	Solov'yov (1950)
2434307.370	-645	-0.100	pg	1	Shteiman (1958)
2436087.069	-524	-0.088	pg	0.5	Korovkina (1958)
2436440.72	-500	+0.57	pg	0	Korovkina (1959)
2436778.400	-477	-0.040	pe	3	Weaver et al. (1960)
2436793.138	-476	-0.010	pe	3	Oosterhoff (1960)
2436837.432	-473	+0.159	vis	0.5	Busch, Häussler (1968)
2437190.466	-449	+0.197	vis	0.5	Busch, Häussler (1968)
2437219.971	-447	+0.286	pe	1	Mitchell et al. (1964)
2437543.356	-425	+0.092	vis	0.5	Busch, Häussler (1968)
2437955.031	-397	-0.062	pe	1	Williams (1966)
2438323.369	-372	+0.572	vis	0.5	Busch, Häussler (1968)
2438911.485	-332	+0.362	vis	0.5	Busch, Häussler (1968)
2443794.971	0	+0.740	pe	3	present paper

Remarks: [1] Observer: Hartwig; [2] Obs.: Belyavsky; [3] Obs: Milstein Nikolayev

RW Cassiopeiae

The light and colour curves of RW Cas are plotted in Fig. 31. The O-C residuals have been calculated using the ephemerides:

$$C_{max} = 2443829.972 + 14^d.791548 \times E$$

$$C_{med} = 2443829.215 + 14^d.791548 \times E$$

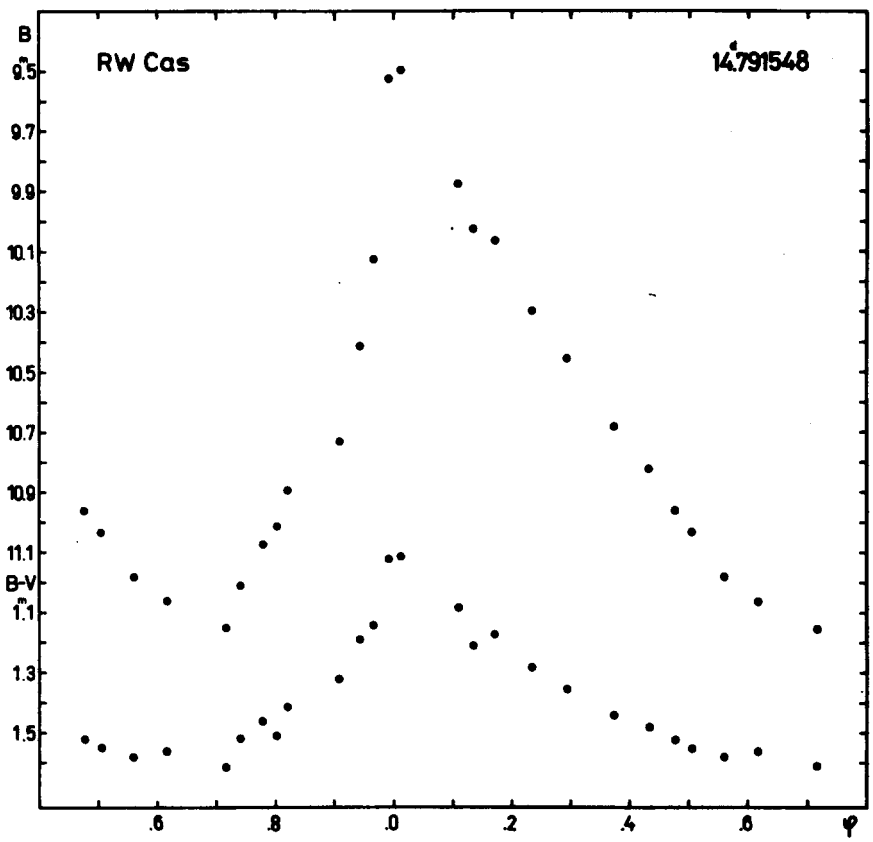

Figure 31 B and B-V curves of RW Cas

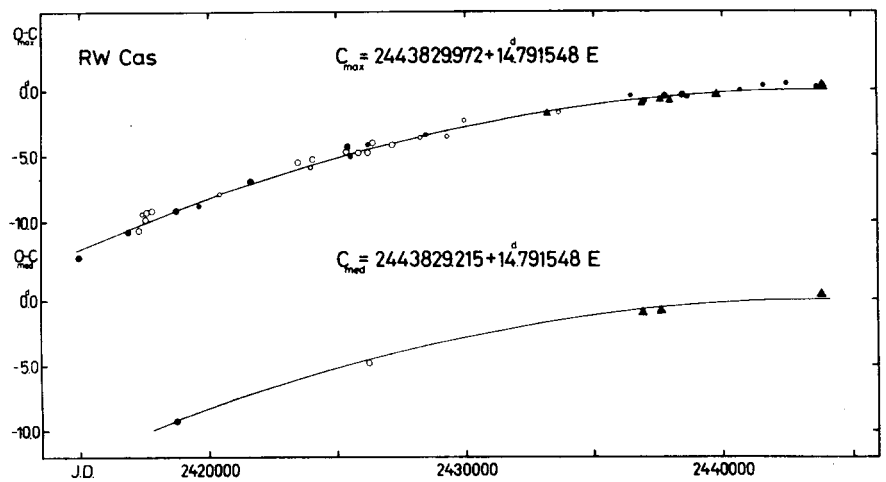

Figure 32 O-C diagram of RW Cas

for the maximum and median brightnesses, respectively. The period of RW Cas is continuously decreasing (see Fig. 32). The least squares fitting procedure has resulted in the formula:

$$(O-C)_{par} = -3^{d}.20\times10^{-6}\times E^{2}$$

for the fitted parabola.

Table 20 O-C residuals for RW Cas

(maximum brightness)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2414988.475	-1949	$-12^{d}.770$	pg	1	Ceraski (1905)
2416913.376	-1819	-10.770	pg	1	Kukarkin (1932b)
2417327.602	-1791	-10.708	vis	1	Kulikovsky[1] (1935)
2417461.95	-1782	-9.48	vis	0.5	Seares (1907)
2417565.095	-1775	-9.879	vis	1	Pracka (1909)
2417610.025	-1772	-9.324	vis	1	Hartwig (1910)
2417832.029	-1757	-9.193	vis	1	Graff (1921a)
2418763.907	-1694	-9.183	pg	1	Whittaker et al. (1911)
2419651.734	-1634	-8.849	pg	0.5	Robinson (1933)
2420466.157	-1579	-7.961	vis	0.5	Kukarkin[2] (1932b)
2421650.497	-1499	-6.945	pg	1	Kukarkin (1932b)
2422125.956	-1467	-4.815	vis	0	Graff (1921a)
2423500.864	-1374	-5.521	vis	1	Nielsen[3] (1927a)
2424018.179	-1339	-5.910	vis	0.5	Kukarkin[4] (1932b)
2424077.975	-1335	-5.280	vis	1	Kulikovsky[1] (1935)
2425394.993	-1246	-4.710	vis	1	{Kukarkin (1932b) {Kulikovsky[5] (1935)
2425424.937	-1244	-4.349	pg	1	Kukarkin (1932b)
2425557.29	-1235	-5.12	pg	0.5	Kiehl, Hopp (1977)
2425868.248	-1214	-4.785	vis	1	Beyer (1934a)
2426208.442	-1191	-4.796	vis	1	Lassovszky (1932a)
2426223.87	-1190	-4.16	pg	0.5	Kiehl, Hopp (1977)
2426416.318	-1177	-4.002	vis	1	Beyer (1934a)
2427155.692	-1127	-4.205	vis	1	Beyer (1934a)
2428250.826	-1053	-3.646	vis	0.5	Dziewulska (1948)
2428458.06	-1039	-3.49	pg	0.5	Fu De-Lian (1964)
2429286.31	-983	-3.57	vis	0.5	Parenago[6] (1956)
2429953.14	-938	-2.36	vis	0.5	Conceicao-Silva (1948)
2433178.259	-720	-1.798	pe	2	Eggen (1951)
2433622.04	-690	-1.76	vis	0.5	Parenago[6] (1956)
2436478.11	-497	-0.46	pg	0.5	Smykov (1978)
2436891.747	-469	-0.989	pe	3	Bahner et al. (1962)
2436995.411	-462	-0.866	pg	1	Shinada et al. (1969)
2437587.153	-422	-0.786	pe	3	Mitchell et al. (1964)
2437587.24	-422	-0.70	pg	0.5	Smykov (1978)
2437779.760	-409	-0.469	pg	1	Shinada et al. (1969)
2437956.907	-397	-0.820	pe	1	Williams (1966)
2438475.018	-362	-0.414	pg	1	Shinada et al. (1969)
2438652.39	-350	-0.54	pg	0.5	Smykov (1978)
2439776.710	-274	-0.378	pe	3	present paper[7]
2440708.91	-211	-0.04	pg	0.5	Smykov (1978)
2441596.78	-151	+0.33	pg	0.5	Smykov (1978)
2442085.86	-118	+1.29	vis	0	Small (1974)
2442499.16	-90	+0.43	pg	0.5	Smykov (1978)
2443667.50	-11	+0.24	pg	0.5	Smykov (1978)
2443830.363	0	+0.391	pe	3	present paper

Table 20 (cont.)

Remarks: [1] Observer: Blazhko; [2] Obs.: Luizet; [3] Obs.: Aage Nielsen; [4] Obs.: Selivanov; [5] Obs.: Kukarkin; [6] Obs.: Latyshev; [7] Obs.: Abaffy

Table 21 O-C residuals for RW Cas

(median brightness)

Obs.Med.J.D.	E	O-C	Type	w	Reference
2418763.063	-1694	$-9^d.270$	pg	1	Whittaker et al. (1911)
2426207.657	-1191	-4.824	vis	1	Lassovszky (1932a)
2436891.022	-469	-0.957	pe	3	Bahner et al. (1962)
2437586.399	-422	-0.783	pe	3	Mitchell et al. (1964)
2443829.608	0	+0.393	pe	3	present paper

SZ Cygni

The light and colour curves of SZ Cyg are shown in Fig. 33. The variable has a B4 photometric companion (Madore, 1977).

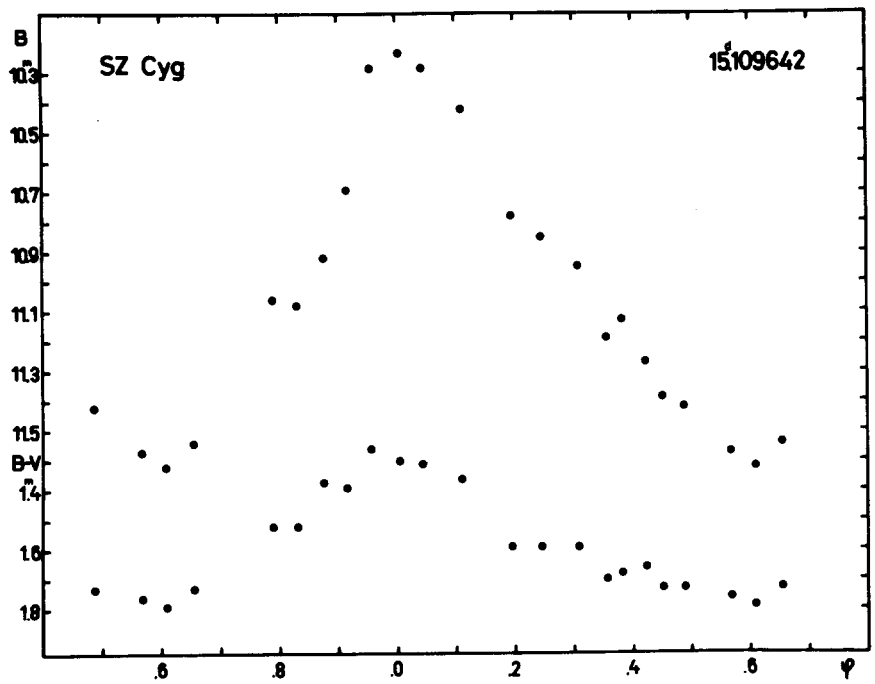

Figure 33 B and B-V curves of SZ Cyg

The O-C residuals have been computed with the formula:

$$C = 2443760.128 + 15^d.109642 \times E \quad .$$

The O-C diagram of SZ Cyg is plotted in Fig. 34 using the residuals listed in Table 22 except the first one (Deichmüller,

1900a). The O-C diagram has a sinusoidal structure as is to be expected for a member of a binary system with an inclination significantly different from zero, due to the light-time effect. The orbital period of the system is roughly 60-70 years. Spectroscopic observations of SZ Cyg are badly needed since the only radial velocity measurements are those of Joy (1937).

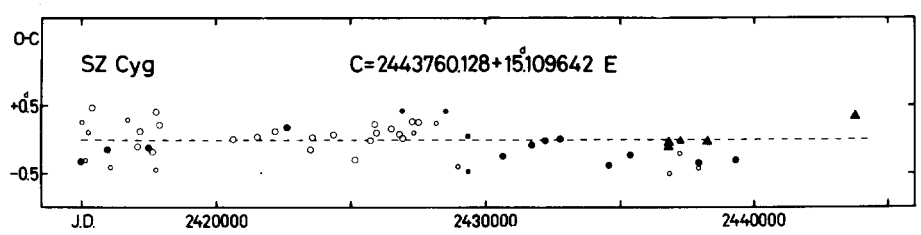

Figure 34 ,O-C diagram of SZ Cyg

Table 22 O-C residuals for SZ Cyg

Obs.Max.J.D.	E	O-C	Type	w	Reference
2406484.5	-2467	-0.1	vis	0.5	Deichmüller (1900a)
2414991.044	-1904	-0.326	pg	1	Williams (1900a)
2415021.853	-1902	+0.264	vis	0.5	Williams (1900a)
2415172.363	-1892	-0.322	vis	0.5	Esch (1936)
2415278.6	-1885	+0.1	vis	0.5	Deichmüller (1900b)
2415399.359	-1877	+0.468	vis	1	Zinner[1] (1932)
2415973.353	-1839	-0.143	pg	1	Florya, Parenago (1933)
2416078.85	-1832	-0.41	vis	0.5	Yendell (1904)
2416441.125	-1808	-0.770	vis	0	Furness[2] (1913b)
2416714.161	-1790	+0.292	vis	0.5	Lau (1907)
2417091.500	-1765	-0.110	vis	1	Nijland (1923)
2417182.386	-1759	+0.118	vis	1	Zinner[1] (1932)
2417499.452	-1738	-0.118	pg	1	Florya, Parenago (1933)
2417665.585	-1727	-0.191	vis	1	Nijland (1923)
2417771.959	-1720	+0.415	vis	1	Luizet (1908a)
2417786.208	-1719	-0.445	vis	0.5	Graff (1914)
2417907.751	-1711	+0.220	vis	1	Zeipel (1908)
2420657.495	-1529	+0.010	vis	1	Doberck (1920a)
2421548.993	-1470	+0.039	vis	1	Doberck (1920a)
2422198.794	-1427	+0.125	vis	1	Doberck (1920a)
2422667.246	-1396	+0.178	pg	1	Henroteau (1924)
2423028.962	-1372	-0.737	vis	0	Eaton[3] (1920,1921,1922, 1923) and Walker[3] (1921)
2423513.067	-1340	-0.141	vis	1	Doberck (1924a)
2423573.673	-1336	+0.027	vis	1	Eaton[4] (1922,1923,1924)
2424374.528	-1283	+0.071	vis	1	Campbell[4] (1925, 1926)
2425174.974	-1230	-0.294	vis	1	Campbell[4] (1927, 1928)
2425749.422	-1192	-0.013	vis	1	Beyer (1934a)
2425900.762	-1182	+0.231	vis	1	Campbell[4] (1929, 1930)
2425976.176	-1177	+0.097	vis	1	Lassovszky (1932b)
2426520.192	-1141	+0.166	vis	1	Beyer (1934a)
2426626.566	-1134	+0.772	vis	0	Campbell[4] (1931, 1932)
2426822.299	-1121	+0.080	vis	1	Lassovszky (1932b)

Table 22 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2426912.898	-1115	+0^d.021	vis	1	Florya, Kukarkina (1953)
2426913.31	-1115	+0.43	pg	0.5	Sandig (1948)
2427275.777	-1091	+0.268	vis	1	Florya, Kukarkina (1953)
2427351.2	-1086	+0.1	vis	0.5	Miczaika (1934b)
2427517.521	-1075	+0.258	vis	1	Campbell[4] (1933,1934,1935)
2427576.71	-1071	-0.99	pg	0	Sandig (1948)
2427593.60	-1070	+0.79	vis	0	Solov'yov (1935)
2428197.437	-1030	+0.240	vis	0.5	Dziewulski (1948a)
2428530.03	-1008	+0.42	pg	0.5	Sandig (1948)
2428997.6	-977	-0.4	vis	0.5	Krebs (1939)
2429330.464	-955	+0.044	pg	0.5	Uranova (1950)
2429360.17	-953	-0.47	pg	0.5	Sandig (1948)
2430659.819	-867	-0.249	pg	1	Filin (1951)
2431702.567	-798	-0.067	pg	1	Filin (1951)
2432201.239	-765	-0.013	pg	1	Kulikov (1957)
2432820.760	-724	+0.013	pg	1	Filin (1951)
2434588.194	-607	-0.381	pg	1	Kulikov (1957)
2435389.154	-554	-0.232	pg	1	Kulikov (1957)
2436779.369	-462	-0.104	pe	3	Oosterhoff (1960)
2436794.540	-461	-0.043	pe	3	Weaver et al. (1960)
2436839.40	-458	-0.51	vis	0.5	Busch et al. (1964)
2437202.34	-434	-0.20	vis	0.5	Busch et al. (1964)
2437217.632	-433	-0.021	pe	2	Mitchell et al. (1964)
2437927.38	-386	-0.43	vis	0.5	Busch et al. (1964)
2437942.574	-385	-0.342	pg	1	Girnyak (1971)
2438229.979	-366	-0.020	pe	3	Kwee, Braun (1967)
2439302.479	-295	-0.305	pg	1	Girnyak (1971)
2443760.486	0	+0.358	pe	3	present paper

Remarks: [1] Observer: Hartwig; [2] Obs.: Whitney; [3] Obs.: McAteer; [4] Obs.: Peltier

SV Monocerotis

The light and colour curves of SV Mon are shown in Fig. 35. The O-C residuals have been calculated using the formula:

$$C = 2443794.338 + 15^d.232780 \times E \quad .$$

The period has been constant with the value used in the ephemeris since J.D. 2433000; earlier reliable values for the period cannot be determined (see Fig. 36).

Table 23 O-C residuals for SV Mon

Obs.Max.J.D.	E	O-C	Type	w	Reference
2419041.759	-1625	+0^d.689	pg	0.5	Robinson (1933)
2422621.464	-1390	+0.690	vis	1	Esch (1921)
2422728.089	-1383	+0.686	vis	1	Leiner (1921)
2423047.978	-1362	+0.686	vis	1	Leiner (1926b)
2423459.184	-1335	+0.607	vis	1	Leiner (1926b)
2423809.690	-1312	+0.759	vis	1	Leiner (1926b)
2424419.659	-1272	+1.417	vis	0.5	Leiner (1926b)
2427008.827	-1102	+1.013	vis	1	Florya, Kukarkina (1953)

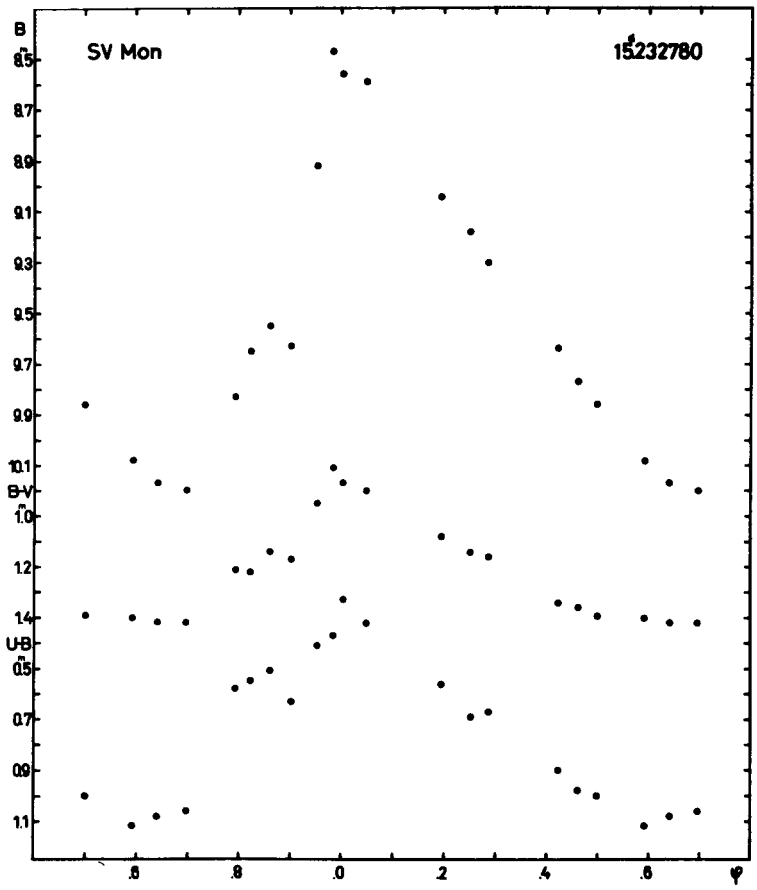

Figure 35 B, B-V and U-B curves of SV Mon

Table 23 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2429964.707	-908	+1^d.733	vis	0	Esch (1936)
2431608.67	-800	+0.56	vis	0.5	Nielsen[1] (1955)
2433192.420	-696	+0.097	pg	1	Satyvaldiev (1970)
2434045.326	-640	-0.033	pg	1	Satyvaldiev (1970)
2435477.219	-546	-0.021	pe	3	Walraven et al. (1958)
2435538.224	-542	+0.053	pg	1	Satyvaldiev (1970)
2436848.276	-456	+0.086	pg	1	Satyvaldiev (1970)
2437564.109	-409	-0.022	pe	3	Mitchell et al. (1964)
2437899.291	-387	+0.039	pe	2	Eggen (1969)
2438097.263	-374	-0.015	pg	1	Fridel' (1971)
2438386.627	-355	-0.074	pg	1	Satyvaldiev (1970)
2439209.191	-301	-0.080	pe	2	Wamsteker (1972)
2439346.203	-292	-0.163	pe	2	Takase (1969)
2440732.705	-201	+0.156	pe	3	Pel (1976)
2441493.5	-151	-0.7	vis	0	Cragg (1976)

Table 23 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2442865.108	-61	-0^d.030	pe	2	Dean (1977)
2443794.342	0	+0.004	pe	3	present paper

Remark: [1] Observer: Arthur Nielsen

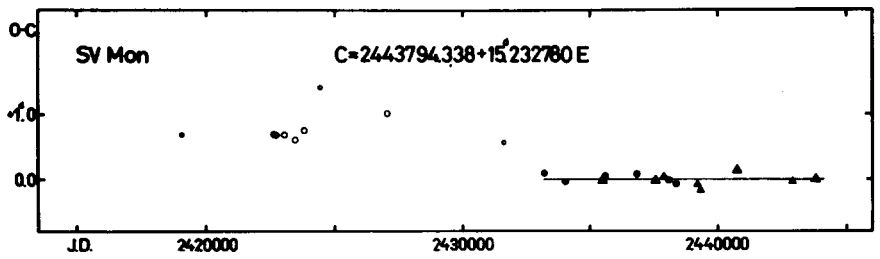

Figure 36 O-C diagram of SV Mon

X Cygni

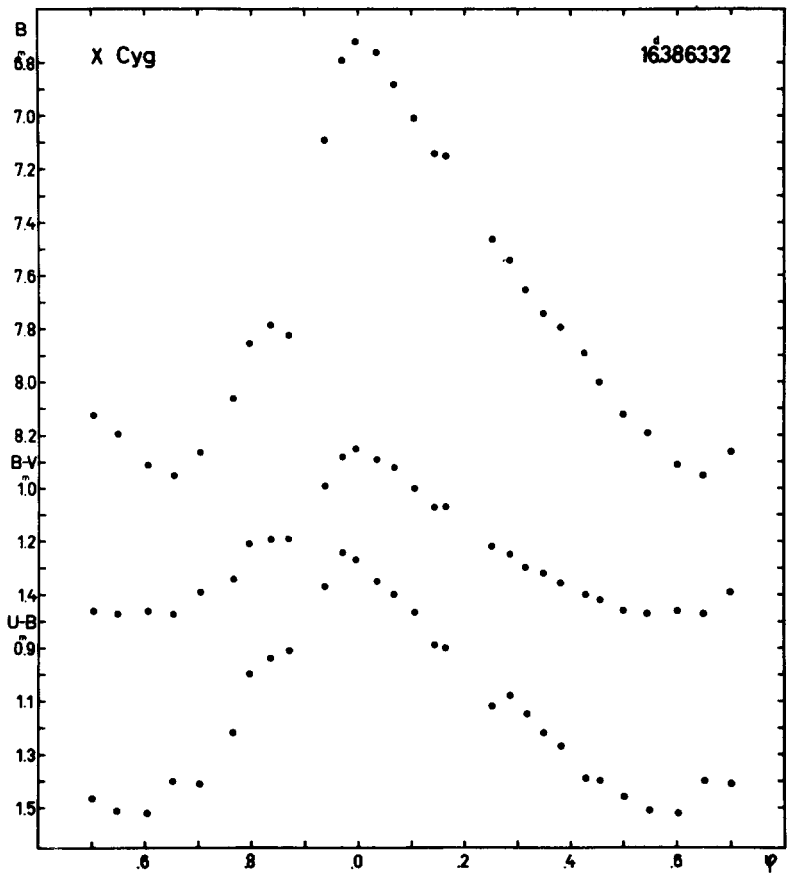

Figure 37 B, B-V and U-B curves of X Cyg

The light and colour curves of this bright Cepheid are shown in Fig. 37. According to Madore (1977) X Cyg has a B4 photometric companion.

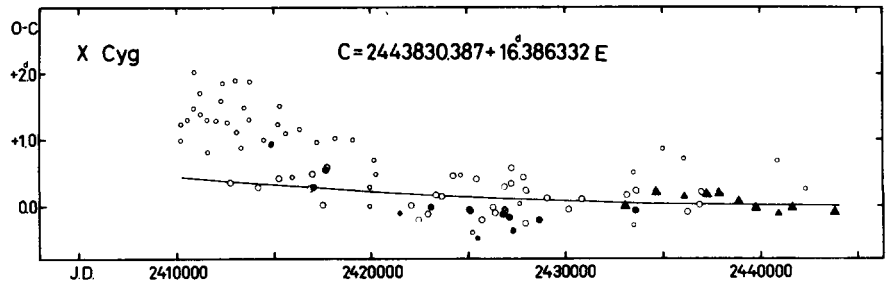

Figure 38 O-C diagram of X Cyg

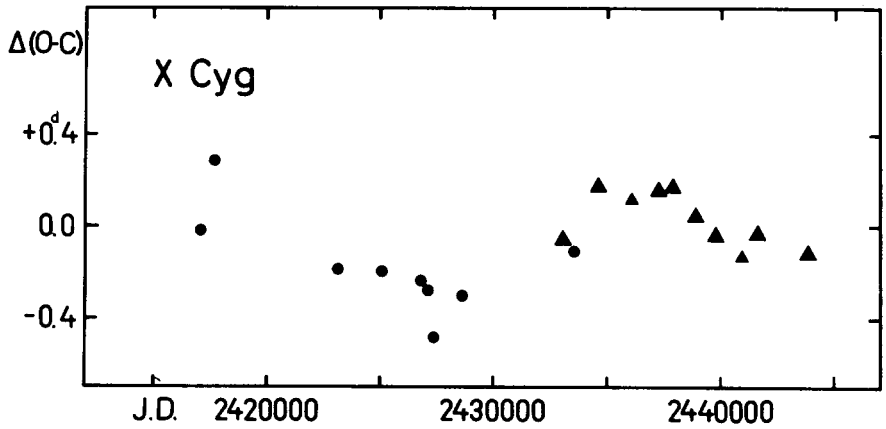

Figure 39 Deviations from the mean O-C curve

The O-C residuals have been computed using the formula:

$$C = 2443830.387 + 16^{d}.386332 \times E \quad .$$

The O-C diagram in Fig. 38 shows a slow period increase. The equation of the approximate parabola is as follows:

$$(O-C)_{par} = 1^{d}.01 \times 10^{-7} \times E^{2} \quad .$$

The O-C residuals based on photoelectric and photographic observations show some systematic deviations from the above mentioned parabola. These Δ(O-C) deviations as a function of time are plotted in Fig. 39. Although a sinusoidal wave can be seen in this latter figure as if it were a result of the light-time effect, no variation can be found in the mean radial velocity of the star (Abt, 1978; Duncan, 1921; Evans, 1976). Only radial ve-

locity observations made at different phases of the 55 year long cycle can resolve the problem.

Table 24 O-C residuals for X Cyg

Obs.Max.J.D.	E	O-C	Type	w	Reference
2410255.77	-2049	+0^{d}.98	vis	0.5	Chandler (1887)
2410256.02	-2049	+1.23	vis	0.5	Sawyer (1896)
2410551.04	-2031	+1.29	vis	0.5	Sawyer (1896)
2410568.28	-2030	+2.15	vis	0	Chandler (1887)
2410895.34	-2010	+1.48	vis	0.5	Sawyer (1896)
2410928.65	-2008	+2.02	vis	0.5	Yendell (1889a)
2411239.67	-1989	+1.70	vis	0.5	Yendell (1890a)
2411272.12	-1987	+1.38	vis	0.5	Sawyer (1896)
2411616.15	-1966	+1.29	vis	0.5	Yendell (1891a)
2411632.0	-1965	+0.8	vis	0.5	Gore (1892)
2411927.45	-1947	+1.25	vis	0.5	Dunér (1892)
2412009.41	-1942	+1.28	vis	0.5	Yendell (1892a)
2412321.05	-1923	+1.58	vis	0.5	Dunér (1893)
2412354.09	-1921	+1.85	vis	0.5	Yendell (1893a)
2412648.46	-1903	+1.26	vis	0.5	Corder (1894)
2412778.634	-1895	+0.346	vis	1	Moraes Pereira (1894)
2412829.563	-1892	+2.116	vis	0	Porro (1896)
2413025.97	-1880	+1.89	vis	0.5	Yendell (1895a)
2413107.12	-1875	+1.11	vis	0.5	Sawyer (1896)
2413336.29	-1861	+0.87	vis	0.5	Sperra (1895, 1896)
2413517.15	-1850	+1.48	vis	0.5	Hisgen (1896)
2413746.38	-1836	+1.30	vis	0.5	Sperra (1897b)
2413763.35	-1835	+1.88	vis	0.5	Yendell (1897)
2414204.170	-1808	+0.271	vis	1	Pickering (1904)
2414516.24	-1789	+1.00	vis	0.5	Luizet (1902a)
2414860.26	-1768	+0.91	vis	0.5	Luizet (1902a)
2414876.68	-1767	+0.94	vis	0.5	Yendell (1900)
2415204.68	-1747	+1.22	vis	0.5	Luizet (1902a)
2415269.413	-1743	+0.403	vis	1	Prittwitz (1907)
2415336.06	-1739	+1.50	vis	0.5	Yendell (1902a)
2415630.60	-1721	+1.09	vis	0.5	Luizet (1902a)
2415941.28	-1702	+0.43	vis	0.5	Yendell (1904)
2416351.66	-1677	+1.15	vis	0.5	Luizet (1912)
2416832.0	-1648	+6.8	vis	0	Furness[1] (1913a)
2416907.893	-1643	+0.249	vis	1	Prittwitz (1907)
2417039.215	-1635	+0.481	vis	1	Nijland (1923)
2417055.372	-1634	+0.251	pg	1	Wilkens (1906)
2417252.71	-1622	+0.95	vis	0.5	Luizet (1912)
2417530.338	-1605	+0.014	vis	1	Nijland (1923)
2417694.729	-1595	+0.542	pg	1	Jordan (1919)
2417743.921	-1592	+0.575	vis	1	Zeipel (1908)
2417810.20	-1588	+1.31	vis	0	Sperra (1909)
2418203.17	-1564	+1.01	vis	0.5	Luizet (1912)
2419104.41	-1509	+1.00	vis	0.5	Luizet (1912)
2419939.103	-1458	-0.012	vis	0.5	Kaiser (1915)
2419988.558	-1455	+0.284	vis	0.5	Kaiser (1915)
2420201.98	-1442	+0.68	vis	0.5	Dziewulski (1924a)
2420300.083	-1436	+0.469	vis	0.5	Hoffmeister (1916a)
2421512.089	-1362	-0.114	pg	0.5	Robinson (1933)
2422134.891	-1324	+0.008	vis	1	Leiner (1926b)
2422478.780	-1303	-0.216	vis	1	Leiner (1926b)

Table 24 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2422970.460	-1273	-0.126 d	vis	1	Hellerich (1922)
2423183.584	-1260	-0.025	pg	1	Henroteau (1924)
2423364.017	-1249	+0.159	vis	1	AFOEV[2] (1922, 1923)
2423675.346	-1230	+0.147	vis	1	Hellerich (1925)
2424314.718	-1191	+0.452	vis	1	Parenago (1938)
2424675.22	-1169	+0.46	vis	0.5	Azarnova[3] (1956)
2425117.137	-1142	-0.059	pg	1	Hellerich (1935)
2425133.508	-1141	-0.074	vis	1	Kukarkin (1940)
2425231.5	-1135	-0.4	vis	0.5	Lause (1937)
2425478.101	-1120	+0.406	vis	1	Parenago (1938)
2425559.129	-1115	-0.498	pg	0.5	Iwanowska et al. (1932)
2425690.504	-1107	-0.213	vis	1	Zverev (1936)
2426296.989	-1070	-0.023	vis	1	Kukarkin (1940)
2426428.000	-1062	-0.102	vis	1	Zverev (1936)
2426804.859	-1039	-0.129	pg	1	Kox (1935)
2426903.261	-1033	-0.045	vis	0.5	Dziewulski et al. (1948)
2426919.614	-1032	-0.078	vis	1	Florya, Kukarkina (1953)
2426919.975	-1032	+0.283	vis	1	Parenago (1938)
2427148.928	-1018	-0.173	pg	1	Dziewulski (1948b)
2427264.372	-1011	+0.567	vis	1	Jaschek (1938)
2427280.529	-1010	+0.337	vis	1	Florya, Kukarkina (1953)
2427328.968	-1007	-0.383	pg	1	Liau (1935)
2427624.336	-989	+0.031	vis	0.5	Dziewulski et al. (1948)
2427886.915	-973	+0.429	vis	1	Jaschek (1938)
2427951.757	-969	-0.274	vis	1	Miczaika (1937)
2428001.425	-966	+0.235	vis	1	Krebs (1936)
2428672.816	-925	-0.214	pg	1	Dziewulski (1948b)
2429050.036	-902	+0.120	vis	1	Conceicao-Silva (1949)
2430164.128	-834	-0.058	vis	1	Conceicao-Silva (1949)
2430819.740	-794	+0.101	vis	1	Conceicao-Silva (1949)
2433031.783	-659	-0.011	pe	3	Eggen (1951)
2433146.670	-652	+0.171	vis	1	Chadov (1953)
2433490.3	-631	-0.3	vis	0.5	Domke, Pohl[4] (1953)
2433491.1	-631	+0.5	vis	0.5	Domke, Pohl[5] (1953)
2433605.249	-624	-0.067	pg	1	Romano (1951)
2433638.317	-622	+0.229	vis	1	Chadov (1953)
2434605.093	-563	+0.211	pe	3	present paper[6]
2435015.398	-538	+0.858	vis	0.5	Azarnova (1956)
2435196.43	-527	+1.64	vis	0	Marks (1959)
2436096.180	-472	+0.142	pe	1	Svolopoulos (1960)
2436129.522	-470	+0.711	vis	0.5	Azarnova (1959)
2436259.812	-462	-0.090	vis	1	Latyshev (1969)
2436898.988	-423	+0.019	vis	1	Azarnova (1962)
2436964.715	-419	+0.201	vis	1	Mayall[7] (1964)
2437226.867	-403	+0.172	pe	3	Mitchell et al. (1964)
2437898.718	-362	+0.183	pe	3	Williams (1966)
2438881.767	-302	+0.052	pe	3	Wisniewski, Johnson (1968)
2439782.931	-247	-0.032	pe	3	present paper[8]
2440914.30	-178	+0.68	vis	0.5	Braune et al.[9] (1972)
2440929.879	-177	-0.127	pe	2	Evans (1976)
2441618.198	-135	-0.034	pe	3	Landis (1973)
2442372.254	-89	+0.251	vis	0.5	Berdnikov (1977)
2443830.274	0	-0.113	pe	3	present paper

Remarks: (Observers) [1] Whitney, [2] Ellsworth, Bernard, Houdard; [3] Yorontsov-Yeliaminov; [4] Mielke; [5] Sofronijewic; [6] Detre; [7] Oravec; [8] Abaffy; [9] Bauer

RW Camelopardalis

The light and colour curves of RW Cam are plotted in Fig. 40. The amplitude of the light variation is smaller than that given by Schaltenbrand and Tammann (1971). According to Madore (1977) this variable has a B2 photometric companion. The presence of an early type companion was also reported by Miller and Preston (1964).

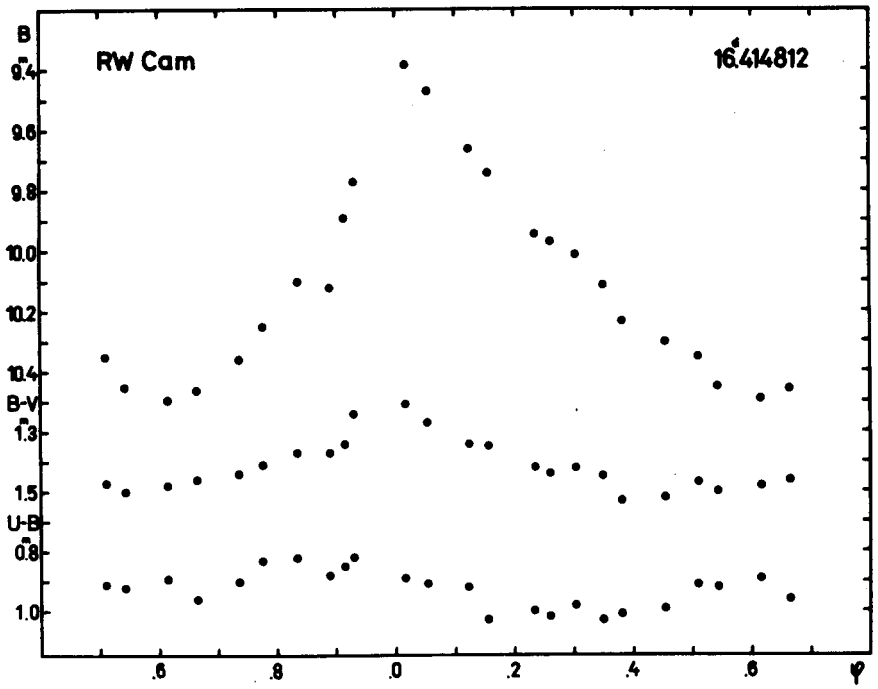

Figure 40 B, B-V and U-B curves of RW Cam

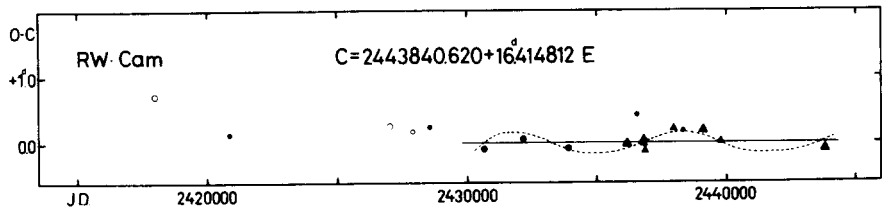

Figure 41 O-C diagram of RW Cam

The O-C residuals have been calculated with the ephemeris:

$$C = 2443840.620 + 16^{d}.414812 \times E \quad .$$

The O-C diagram in Fig. 41 also shows the presence of the com-

Table 25 O-C residuals for RW Cam

Obs.Max.J.D.	E	O-C	Type	w	Reference
		d			
2417955.185	-1577	+0.724	vis	1	Enebo (1908)
2420876.433	-1399	+0.135	pg	0.5	Robinson (1933)
2427015.703	-1025	+0.265	vis	1	Florya, Kukarkina (1953)
2427130.150	-1018	-0.191	vis	0	Dziewulski et al. (1946)
2427902.012	-971	+0.174	vis	0.5	Dziewulski (1947)
2428575.084	-930	+0.239	pg	0.5	Dziewulski et al. (1946)
2430643.017	-804	-0.094	pg	1	Filin (1958)
2432169.750	-711	+0.061	pg	1	Filin (1958)
2433909.575	-605	-0.084	pg	1	Filin (1958)
2436174.873	-467	-0.030	pe	3	Bahner et al. (1977)
2436552.861	-444	+0.418	pg	0.5	Nikulina (1970)
2436831.480	-427	-0.015	pe	3	Oosterhoff (1960)
2436831.546	-427	+0.051	pe	3	Weaver et al. (1960)
2436880.608	-424	-0.132	pe	3	Bahner et al. (1962)
2437964.318	-358	+0.201	pe	1	Williams (1966)
2438358.045	-334	-0.028	pg	0.5	Nikulina (1970)
2439113.340	-288	+0.186	pe	3	Wamsteker (1972)
2439786.182	-247	+0.021	pe	2	present paper[1]
2443840.515	0	-0.105	pe	3	present paper

Remark: [1] Observer: Abaffy

Table 26

Obs.Max.J.D.	O-C	Phase	Obs.Max.J.D.	O-C	Phase
	d			d	
2430643.017	-0.094	.097	2436880.608	-0.132	.043
2432169.750	+0.061	.329	2437964.318	+0.201	.207
2433909.575	-0.084	.592	2439113.340	+0.186	.381
2436174.873	-0.030	.936	2439786.182	+0.021	.483
2436831.480	-0.015	.035	2443840.515	-0.105	.097
2436831.546	+0.051	.035			

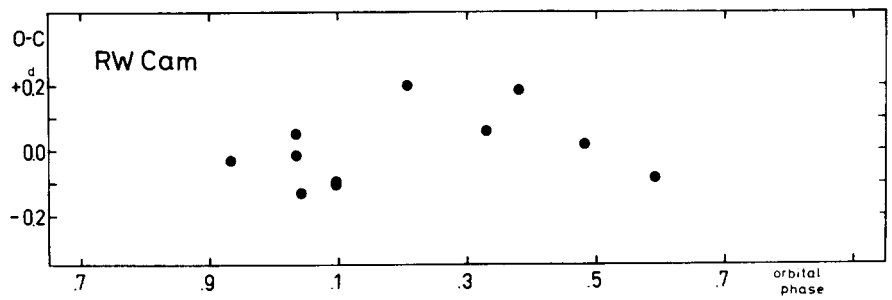

Figure 42 O-C variations due to orbital motion

panion. After J.D. 2430000 a wave-like structure can clearly be seen. The probable orbital period is $P_{orb}=6600^d \pm 300^d$ (see Table 26 and Fig. 42). Radial velocity measurements would be needed to check this value of the orbital period since the only series of radial velocity measurements is that of Joy (1937). Before J.D.

2430000 the period was shorter than that used in the ephemeris but the accurate value cannot be determined in lack of a satisfactory number of data points in the O-C diagram.

CD Cygni

The light and colour curves of this Cepheid are plotted in Fig. 43. The O-C residuals have been derived using the formula:

$$C = 2443831.167 + 17^{d}.073967 \times E \quad .$$

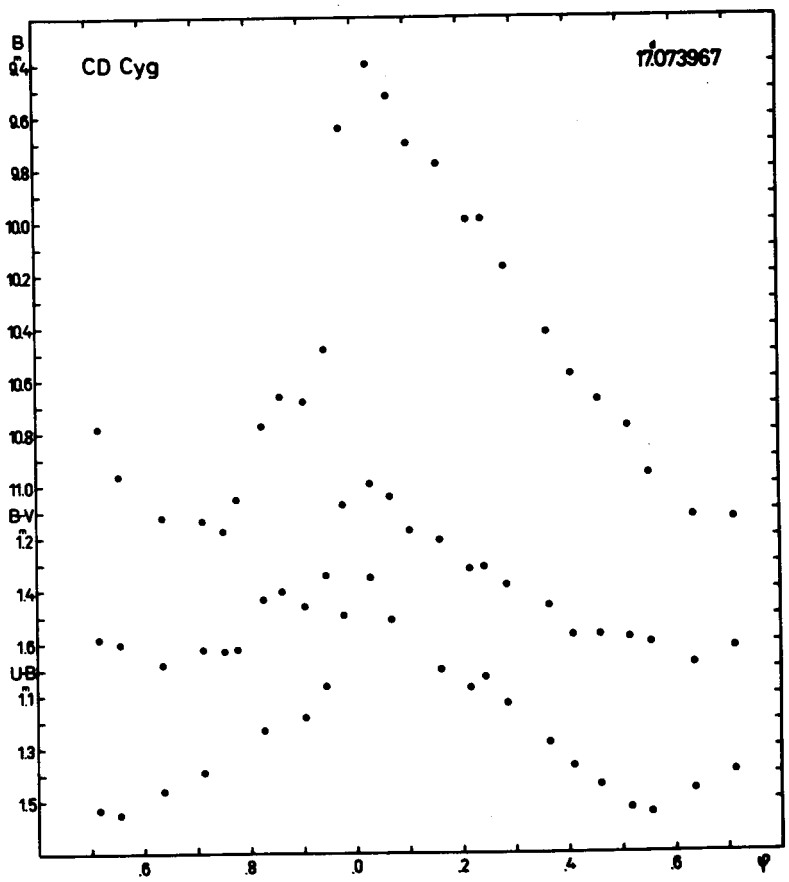

Figure 43 B, B-V and U-B curves of CD Cyg

The period of CD Cyg is continuously increasing. The positive parabola shown in Fig. 44 is a least squares fitted parabola to the O-C residuals. The equation of this parabola is

$$(O-C)_{par} = 1^{d}.54 \times 10^{-6} \times E^{2} \quad .$$

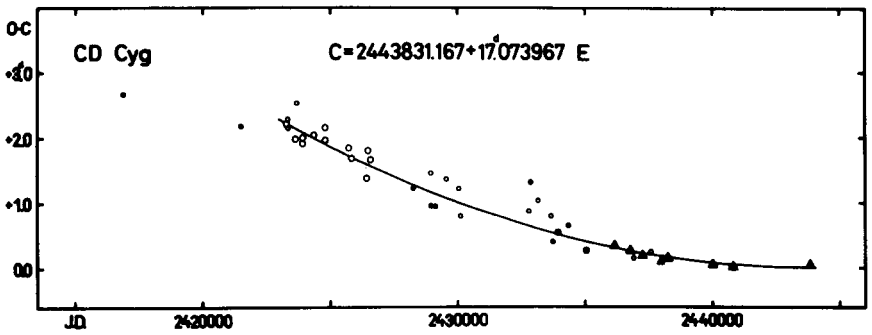

Figure 44 O-C diagram of CD Cyg

Table 27 O-C residuals for CD Cyg

Obs.Max.J.D.	E	O-C d	Type	w	Reference
2416891.124	-1578	+2.677	pg	0.5	Kukarkin (1932d)
2421500.608	-1308	+2.190	pg	0.5	Robinson (1933)
2422972.7	-1222	+5.9	vis	0	Kristensen[1] (1923b)
2423276.338	-1204	+2.227	vis	1	Leiner (1924a)
2423327.6	-1201	+2.3	vis	0.5	Kristensen[2] (1923b)
2423344.570	-1200	+2.163	vis	0.5	Kristensen (1923b)
2423634.659	-1183	+1.995	vis	1	Leiner (1924a, 1926a)
2423686.431	-1180	+2.545	vis	0.5	Nielsen[1] (1933)
2423907.775	-1167	+1.927	vis	1	Nielsen[2] (1933)
2423924.936	-1166	+2.015	vis	1	Leiner (1926a)
2424368.905	-1140	+2.060	vis	1	Leiner (1926a)
2424795.868	-1115	+2.174	vis	1	Nielsen[2] (1933)
2424812.738	-1114	+1.970	vis	1	Nielsen[1] (1933)
2425734.623	-1060	+1.861	vis	1	Nielsen[2] (1933)
2425853.978	-1053	+1.698	vis	1	Nielsen[1] (1933)
2426434.190	-1019	+1.395	vis	1	Kukarkin (1932d)
2426468.767	-1017	+1.824	vis	1	Nielsen[1] (1933)
2426588.139	-1010	+1.679	vis	1	Nielsen[2] (1933)
2428193.727	-916	+2.314	vis	0	Dziewulski (1950)
2428260.945	-912	+1.236	pg	0.5	Wachmann (1966)
2428944.133	-872	+1.465	vis	0.5	Nielsen[2] (1952)
2428960.700	-871	+0.958	pg	0.5	Wachmann (1966)
2429148.50	-860	+0.95	pg	0.5	Smirnov (1946)
2429541.628	-837	+1.371	vis	0.5	Nielsen[1] (1952)
2430053.703	-807	+1.227	vis	0.5	Nielsen[3] (1952)
2430121.57	-803	+0.80	vis	0.5	Ashbrook (1943)
2432768.11	-648	+0.87	vis	0.5	Nielsen[4] (1955)
2432888.071	-641	+1.317	pg	0.5	Wachmann (1966)
2433160.98	-625	+1.04	vis	0.5	Nielsen[1] (1955)
2433672.96	-595	+0.80	vis	0.5	Nielsen[5] (1955)
2433740.850	-591	+0.398	pg	0.5	Jagott (1954)
2433928.810	-580	+0.544	pg	1	Shteiman (1958)
2434151.462	-567	+1.234	pg	0	Wachmann (1966)
2434355.773	-555	+0.658	pg	0.5	Jagott (1954)
2435055.408	-514	+0.260	pg	1	Shteiman (1958)
2435107.498	-511	+1.128	pg	0	Wachmann (1966)
2436165.306	-449	+0.350	pe	3	Bahner et al. (1971)

Table 27 (cont.)

Obs.Max.J.D.	E	O-C d	Type	w	Reference
2436779.890	-413	+0.271	pe	3	Weaver et al. (1960)
2436796.966	-412	+0.273	pe	3	Oosterhoff (1960)
2436899.29	-406	+0.15	vis	0.5	Busch et al. (1964)
2437257.891	-385	+0.201	pe	3	Mitchell et al. (1964)
2437582.34	-366	+0.25	vis	0.5	Busch et al. (1964)
2437940.36	-345	-0.29	vis	0	Busch et al. (1964)
2437957.816	-344	+0.094	pe	1	Williams (1966)
2438231.052	-328	+0.146	pe	3	Kwee, Braun (1967)
2440006.657	-224	+0.059	pe	3	Asteriadis et al. (1977)
2440792.027	-178	+0.026	pe	3	Asteriadis et al. (1977)
2443831.224	0	+0.057	pe	3	present paper

Remarks: [1] Observer: Kierulff; [2] Obs.: Vaaben; [3] Obs.: Sjögren; [4] Obs.: Buhl; [5] Obs.: Darnell

SZ Aquilae

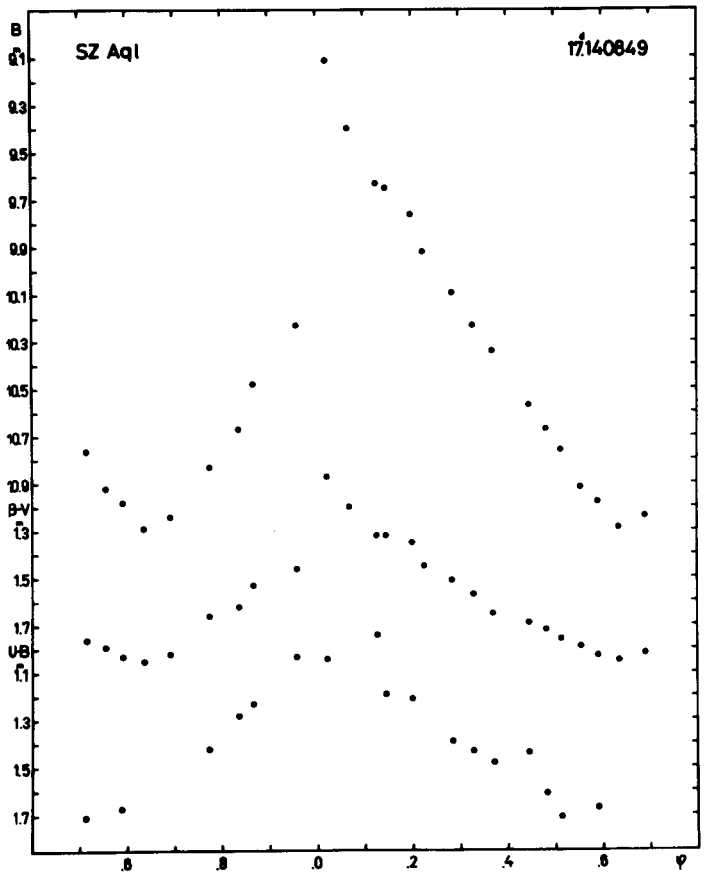

Figure 45 B, B-V and U-B curves of SZ Aql

Its light and colour curves are shown in Fig. 45. The O-C residuals have been calculated with the ephemerides:

$$C_{max} = 2443807.183 + 17^d.140849 \times E$$

$$C_{med} = 2443806.524 + 17^d.140849 \times E$$

for the maximum and median brightnesses, respectively. The period of SZ Aql is continuously increasing. The equation of the least squares fitted parabola shown in Fig. 46 is

$$(O-C)_{par} = 2^d.02 \times 10^{-6} \times E^2 \quad .$$

It is worth mentioning that the rate of the period increase is almost the same as in CD Cyg. This is important since the difference in the period of the two stars is less than 0.5 per cent.

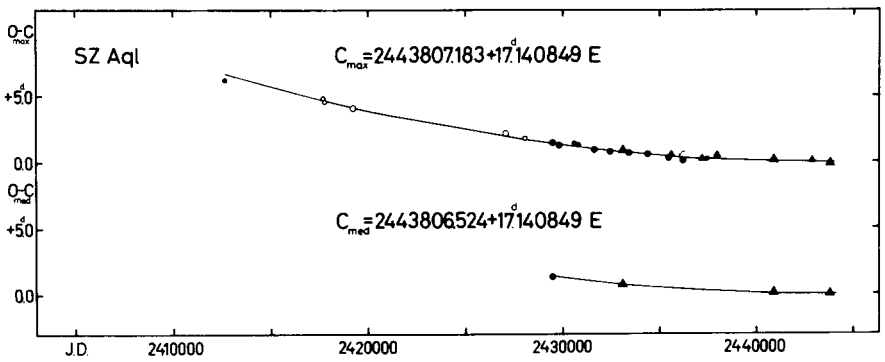

Figure 46 O-C diagram of SZ Aql

Table 28 O-C residuals for SZ Aql
(maximum brightness)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2412685.63	-1816	+6d.23	pg	0.5	Pickering (1907)
2417740.811	-1521	+4.859	vis	0.5	Ichinohe (1910)
2417809.1	-1517	+4.6	vis	0.5	Pickering (1908)
2419265.600	-1432	+4.113	vis	1	Biesbroeck et al. (1914)
2420258.765	-1374	+3.109	pg	0	Robinson (1933)
2423601.8	-1179	+3.7	vis	0	Hacar (1925)
2427097.073	-975	+2.218	vis	1	Florya, Kukarkina (1953)
2428125.097	-915	+1.791	vis	0.5	Dziewulski (1956b)
2429513.184	-834	+1.469	pg	1	Ahnert (1951)
2429547.473	-832	+1.476	pg	0.5	Solov'yov (1944)
2429838.681	-815	+1.290	pg	1	Erleksova (1960)
2430610.179	-770	+1.450	pg	0.5	Erleksova (1960)
2430832.873	-757	+1.313	pg	0.5	Filin (1948)
2431638.130	-710	+0.950	pg	1	Erleksova (1960)
2432460.734	-662	+0.793	pg	1	Erleksova (1960)
2433112.198	-624	+0.905	pe	3	Eggen (1951)
2433454.820	-604	+0.710	pg	1	Erleksova (1960)
2434414.613	-548	+0.615	pg	1	Erleksova (1960)

Table 28 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2435494.235	-485	+0^d.364	pg	1	Erleksova (1960)
2435580.096	-480	+0.521	pe	1	Walraven et al. (1958)
2436231.149	-442	+0.221	pg	1	Erleksova (1960)
2437156.786	-388	+0.252	pe	2	Mitchell et al. (1964)
2437465.336	-370	+0.267	pg	0.5	Zoj Von Shor (1963)
2437945.611	-342	+0.598	pe	1	Williams (1966)
2440910.526	-169	+0.146	pe	3	Pel (1976)
2441495.7	-135	+2.5	vis	0	Cragg (1976)
2442898.836	-53	+0.118	pe	2	Dean (1977)
2443807.095	0	-0.088	pe	3	present paper

Table 29 O-C residuals for SZ Aql

(median brightness)

Obs.Med.J.D.	E	O-C	Type	w	Reference
2429512.395	-834	+1^d.339	pg	1	Ahnert (1951)
2433111.359	-624	+0.725	pe	3	Eggen (1951)
2440909.789	-169	+0.068	pe	3	Pel (1976)
2443806.512	0	-0.012	pe	3	present paper

YZ Aurigae

YZ Aur has a faint companion within the edge of the diaphragm. This may be the reason that the amplitude of the light variation is less than that derived by Schaltenbrand and Tammann

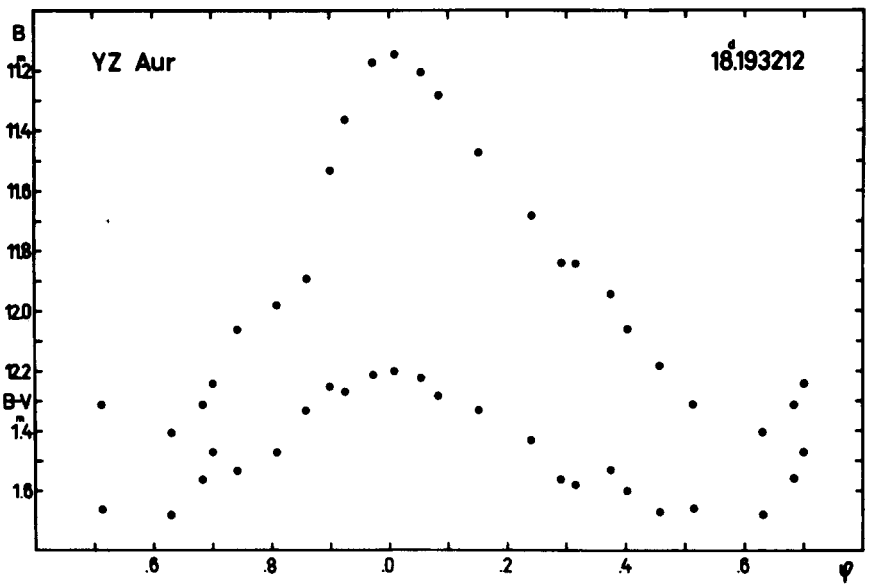

Figure 47 B and B-V curves of YZ Aur

(1971). The light curve in Fig. 47 shows the presence of a bump at the bottom of the ascending branch which is normal for a Cepheid with a period of 18 days but was unnoticed on the previous incomplete light curves. The Cepheid variable YZ Aur has a B3 photometric companion (Madore, 1977).

The O-C residuals have been computed with the formula:

$$C = 2443816.490 + 18^{d}.193212 \times E \quad .$$

The O-C diagram in Fig. 48 shows a rejumping period:

before J.D. 2428000 $P = 18^{d}.193121$

after J.D. 2429000 $P = 18^{d}.193212$.

The sudden period change and the rejump of the period took place between J.D. 2428000 and J.D. 2429000.

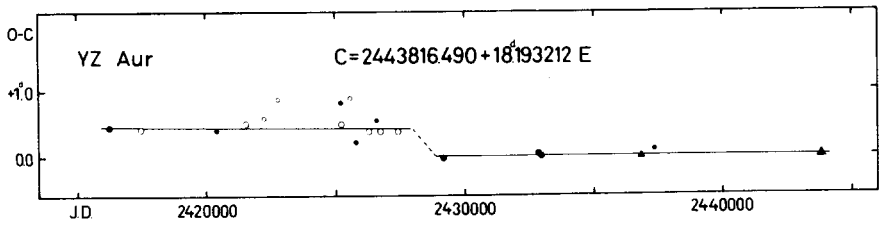

Figure 48 O-C diagram of YZ Aur

Table 30 O-C residuals for YZ Aur

Obs.Max.J.D.	E	O-C	Type	w	Reference
2416290.613	-1513	$+0^{d}.453$	pg	1	Yakimov (1962)
2417509.537	-1446	+0.432	vis	1	Williams (1918)
2420420.436	-1286	+0.417	pg	0.5	Robinson (1933)
2421548.525	-1224	+0.526	vis	1	Williams (1918)
2422239.93	-1186	+0.59	vis	0.5	Nijland (1935)
2422786.02	-1156	+0.88	vis	0.5	Nijland (1935)
2423386.79	-1123	+1.28	vis	0	Nijland (1935)
2425205.66	-1023	+0.83	pg	0.5	Oosterhoff (1935)
2425241.720	-1021	+0.499	vis	1	Beyer (1930)
2425587.785	-1002	+0.893	vis	0.5	Beyer (1930)
2425823.62	-989	+0.22	pg	0.5	Oosterhoff (1935)
2426315.010	-962	+0.390	vis	1	Kukarkin (1940)
2426606.26	-946	+0.55	pg	0.5	Oosterhoff (1935)
2426751.640	-938	+0.383	vis	1	Detre (1935)
2427424.795	-901	+0.389	vis	1	Detre (1935)
2428567.99	-838	-2.59	pg	0	Fu De-Lian (1964)
2429170.930	-805	-0.024	pg	1	Yakimov (1962)
2430245.058	-746	+0.704	vis	0	Lagrula (1941, 1942)
2432846.025	-603	+0.042	pg	1	Filatov (1958)
2432973.338	-596	+0.002	pg	1	Yakimov (1962)
2436830.288	-384	-0.009	pe	2	Weaver et al. (1960)
2437376.2	-354	+0.1	pg	0.5	Ahnert (1961)
2443816.489	0	-0.001	pe	3	present paper

VX Cygni

The light and colour curves of this variable are shown in Fig. 49. According to Madore (1977) VX Cyg has a B7 photometric companion.

The O-C residuals have been calculated using the formula:

$$C = 2443783.642 + 20^{d}.133407 \times E \quad .$$

The O-C diagram in Fig. 50 shows a continuous increase in period. The equation of the fitted parabola is:

$$(O-C)_{par} = 8^{d}.02 \times 10^{-7} \times E^{2} \quad .$$

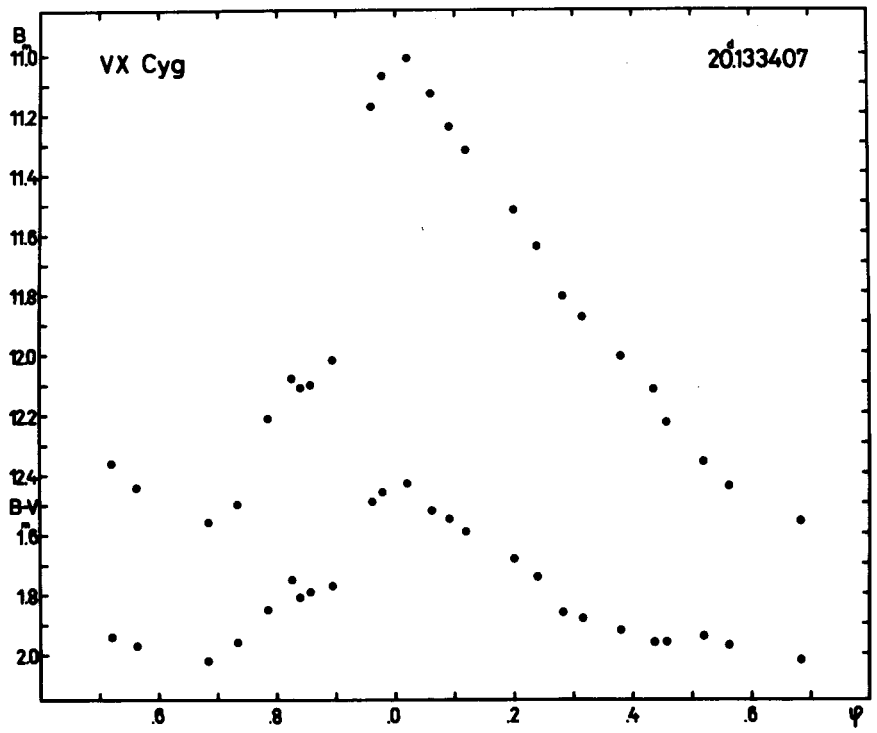

Figure 49 B and B-V curves of VX Cyg

Table 31 O-C residuals for VX Cyg

Obs.Max.J.D.	E	O-C	Type	w	Reference
2414976.2	-1431	$+3^{d}.5$	pg	0	Williams (1905)
2415337.4	-1413	+2.3	pg	0.5	Williams (1905)
2415477.663	-1406	+1.591	pg	1	Kulikovsky (1933)
2415681.0	-1396	+3.6	pg	0	Williams (1905)
2416423.86	-1359	+1.52	vis	0.5	Williams (1905)
2416424.0	-1359	+1.7	vis	0.5	Hartwig (1903)
2416726.78	-1344	+2.44	vis	0	Williams (1905)

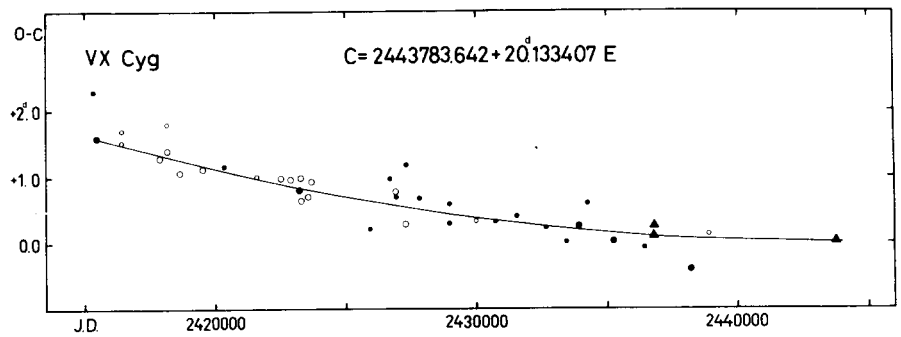

Figure 50 O-C diagram of VX Cyg

Table 31 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2417471.81	-1307	+2.53	vis	0	Seares (1907)
2417492.5	-1306	+3.1	vis	0	Müller, Hartwig (1918-1920)
2417873.230	-1287	+1.283	vis	1	Bilt (1925)
2417914.44	-1285	+2.23	vis	0	Müller, Hartwig[1] (1918-1920)
2418175.75	-1272	+1.80	vis	0.5	Müller, Hartwig[1] (1918-1920)
2418195.480	-1271	+1.398	vis	1	Bilt (1925)
2418658.210	-1248	+1.060	vis	1	Bilt (1925)
2419524.000	-1205	+1.113	vis	1	Bilt (1925)
2420369.659	-1163	+1.169	pg	0.5	Robinson (1933)
2421597.62	-1102	+0.99	vis	0.5	Parenago[2] (1949)
2422523.743	-1056	+0.979	vis	1	Leiner (1924b)
2422906.248	-1037	+0.949	vis	1	Leiner (1924b)
2423228.236	-1021	+0.803	pg	1	Henroteau (1924)
2423268.681	-1019	+0.981	vis	1	Leiner (1924b)
2423308.602	-1017	+0.635	vis	1	Doberck (1924c)
2423570.397	-1004	+0.696	vis	1	Leiner (1924b)
2423691.429	-998	+0.927	vis	1	Doberck (1924c)
2425925.52	-887	+0.21	pg	0.5	Oosterhoff (1935)
2426349.5	-866	+1.4	vis	0	Miczaika (1936)
2426711.48	-848	+0.97	pg	0.5	Oosterhoff (1935)
2426792.37	-844	+1.32	pg	0	Sandig (1948)
2426912.623	-838	+0.776	vis	1	Florya, Kukarkina (1953)
2426932.67	-837	+0.69	pg	0.5	Oosterhoff (1935)
2427294.665	-819	+0.283	vis	1	Florya, Kukarkina (1953)
2427315.68	-818	+1.17	pg	0.5	Oosterhoff (1935)
2427818.52	-793	+0.67	pg	0.5	Sandig (1948)
2428985.88	-735	+0.29	pg	0.5	Sandig (1948)
2429006.30	-734	+0.58	pg	0.5	Milstein (1946)
2429992.579	-685	+0.321	vis	0.5	Conceicao-Silva (1948)
2430717.381	-649	+0.320	pg	0.5	Nikulina (1970)
2431542.930	-608	+0.399	pg	0.5	Nikulina (1970)
2432670.232	-552	+0.231	pg	0.5	Nikulina (1970)
2433455.217	-513	+0.013	pg	0.5	Nikulina (1970)
2433918.520	-490	+0.247	pg	1	Shteiman (1958)
2434261.138	-473	+0.598	pg	0.5	Nikulina (1970)
2435226.968	-425	+0.024	pg	1	Shteiman (1958)

Table 31 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2436093.605	-382	$+0^d.924$	pg	0	Korovkina (1958)
2436375.695	-368	+1.147	pg	0	Nikulina (1970)
2436434.88	-365	-0.07	pg	0.5	Korovkina (1959)
2436777.320	-348	+0.104	pe	3	Weaver et al. (1960)
2436797.613	-347	+0.263	pe	3	Oosterhoff (1960)
2436858.84	-344	+1.09	vis	0	Busch, Häussler (1968)
2437402.084	-317	+0.732	pg	0	Nikulina (1970)
2438206.277	-277	-0.411	pg	1	Dultsev (1967)
2438670.39	-254	+0.63	vis	0	Busch, Häussler (1968)
2438911.49	-242	+0.13	vis	0.5	Busch, Häussler (1968)
2443783.660	0	+0.018	pe	3	present paper

Remarks: [1] Observer: Belyavsky; [2] Observer: Doberck

T Monocerotis

The light and colour curves (Fig. 51) of this long period Cepheid are incomplete because the weather conditions during the

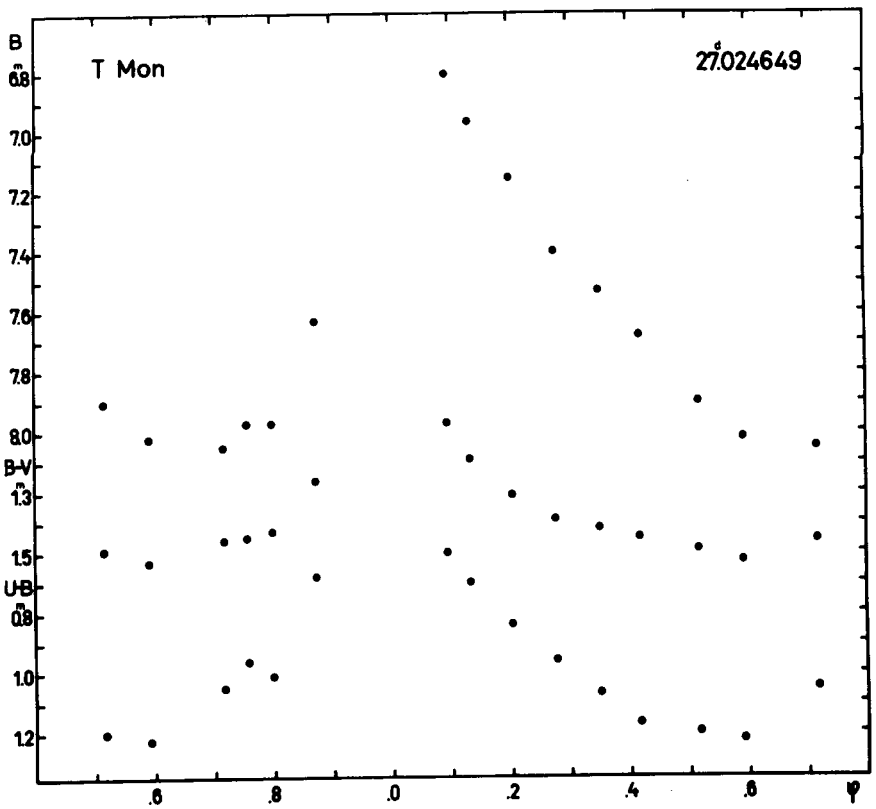

Figure 51 B, B-V and U-B curves of T Mon

observing runs did not permit observation of the star at the missing light curve phases. Based on IUE observations, Mariska et al. (1980) pointed out that T Mon has an A0 III companion.

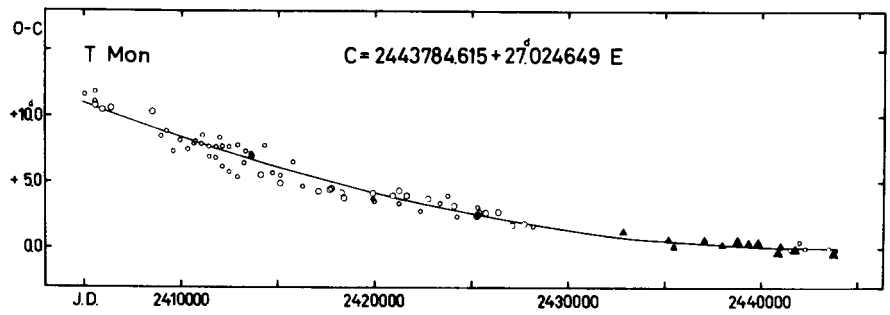

Figure 52 O-C diagram of T Mon

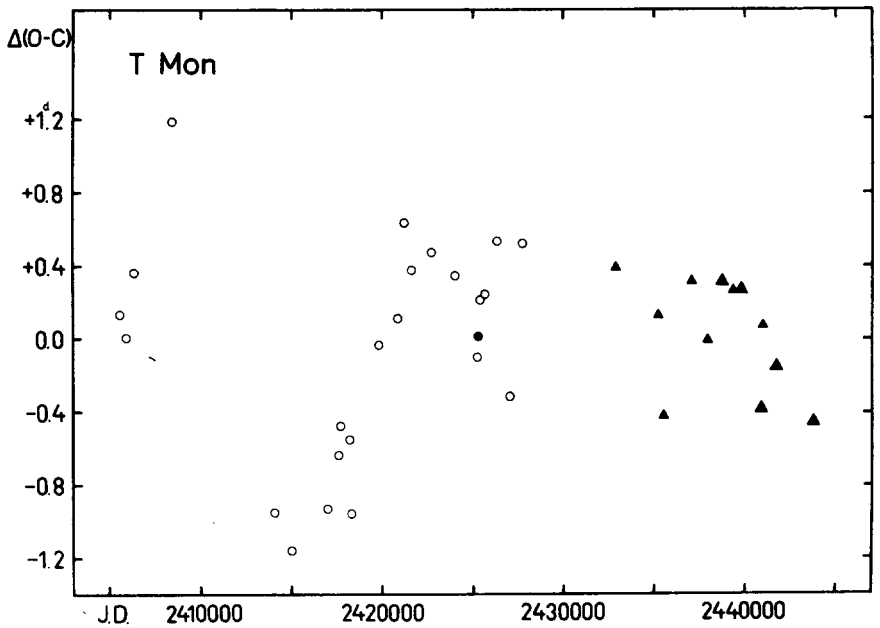

Figure 53 Deviations from the mean O-C curve

The O-C residuals have been computed with the formula:

$$C = 2443784.615 + 27^{d}.024649 \times E \quad .$$

The O-C diagram in Fig. 52 can well be approximated by the parabola:

$$(O-C)_{par} = 5^{d}.34 \times 10^{-6} \times E^{2} \quad .$$

The deviation of each reliable O-C residual from this parabola

is plotted in Fig. 53. These deviations have a wave-like trend. If this wave is attributed to the light-time effect, the orbital period would be about 100 years. Although the available radial velocity data are not very homogeneous (Evans, 1976; Sanford, 1927 and 1956; Wallerstein, 1972), the two series of Sanford's observations show a difference of about 2 km/sec in the average value of the radial velocity, thereby supporting the observability of the orbital motion.

Table 32 O-C residuals for T Mon

Obs.Max.J.D.	E	O-C	Type	w	Reference
2405015.8	-1435	+11.^{d}6	vis	0.5	Müller, Hartwig[1] (1918-1920)
2405555.8	-1415	+11.1	vis	0.5	Müller, Hartwig[1] (1918-1920)
2405556.62	-1415	+11.88	vis	0.5	Sanford[2] (1927)
2405582.574	-1414	+10.813	vis	1	Valentiner[3] (1900)
2405933.570	-1401	+10.488	vis	1	Valentiner[3] (1900)
2406366.087	-1385	+10.611	vis	1	Valentiner[3] (1900)
2408473.713	-1307	+10.314	vis	1	Sawyer (1883)
2408931.31	-1290	+8.49	vis	0.5	Sawyer (1885)
2409228.94	-1279	+8.85	vis	0.5	Sawyer (1885)
2409578.72	-1266	+7.31	vis	0.5	Sawyer (1887a)
2409930.90	-1253	+8.17	vis	0.5	Sawyer (1887b)
2410335.59	-1238	+7.49	vis	0.5	Sawyer (1888b)
2410660.29	-1226	+7.90	vis	0.5	Sawyer (1888a)
2410714.50	-1224	+8.06	vis	0.5	Yendell (1888)
2411038.63	-1212	+7.89	vis	0.5	Yendell (1889b)
2411066.28	-1211	+8.52	vis	0.5	Sawyer (1890a)
2411415.95	-1198	+6.87	vis	0.5	Sawyer (1890b)
2411416.76	-1198	+7.68	vis	0.5	Yendell (1890b)
2411767.19	-1185	+6.78	vis	0.5	Sawyer (1891)
2411768.05	-1185	+7.64	vis	0.5	Yendell (1891b)
2411957.926	-1178	+8.348	vis	0.5	Markwick (1892, 1894)
2412117.89	-1172	+6.16	vis	0.5	Sawyer (1896)
2412119.37	-1172	+7.64	vis	0.5	Yendell (1892b)
2412468.78	-1159	+5.73	vis	0.5	Sawyer (1896)
2412470.67	-1159	+7.62	vis	0.5	Yendell (1893b)
2412819.31	-1146	+4.94	vis	0	Sawyer (1896)
2412846.711	-1145	+5.319	vis	0.5	Porro (1896)
2412876.16	-1144	+7.74	vis	0.5	Yendell (1894)
2413226.16	-1131	+6.42	vis	0.5	Yendell (1895b)
2413308.11	-1128	+7.30	vis	0.5	Sperra (1895)
2413604.93	-1117	+6.85	vis	0.5	Hisgen (1897)
2413605.20	-1117	+7.1	vis	0.5	Yendell (1897)
2413606	-1117	+8	vis	0	Müller, Hartwig[4] (1918-1920)
2413659.0	-1115	+6.9	vis	0.5	Sperra (1897a)
2414090.032	-1099	+5.506	vis	1	Pickering (1904)
2414308.49	-1091	+7.77	vis	0.5	Yendell (1900)
2414711.75	-1076	+5.66	vis	0.5	Luizet (1902b)
2415089.305	-1062	+4.867	vis	1	Wendell (1909)
2415089.90	-1062	+5.46	vis	0.5	Luizet (1902b)
2415766.55	-1037	+6.50	vis	0.5	Yendell (1902b)
2416278.19	-1018	+4.67	vis	0.5	Nielsen[5] (1930a)

Table 32 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2417061.531	-989	+4^{d}.294	vis	1	Nijland (1923)
2417173.63	-985	+8.29	vis	0	Furness[6] (1913b)
2417656.144	-967	+4.365	vis	1	Zeipel (1908)
2417764.361	-963	+4.483	vis	1	Nijland (1923)
2418277.561	-944	+4.215	vis	1	Nijland (1923)
2418385.211	-940	+3.766	vis	1	Bemporad (1910)
2419844.940	-886	+4.164	vis	1	Kaiser (1915)
2419871.505	-885	+3.704	pg	0.5	Robinson (1933)
2419979.4	-881	+3.5	vis	0.5	Dziewulski (1924b)
2420925.705	-846	+3.943	vis	1	Luyten (1922)
2421249.41	-834	+3.35	vis	0.5	Nielsen[7] (1930a)
2421250.411	-834	+4.353	vis	1	Luyten (1922)
2421628.374	-820	+3.971	vis	1	Luyten (1922)
2422383.89	-792	+2.80	vis	0.5	Nielsen[8] (1930a)
2422736.133	-779	+3.720	vis	1	Gallisot (1923)
2423357.40	-756	+3.42	vis	0.5	Nielsen[9] (1930a)
2423790.35	-740	+3.98	vis	0.5	Sanford (1927)
2424086.834	-729	+3.188	vis	1	Eaton[10] (1924), Campbell[10] (1925)
2424221.16	-724	+2.39	vis	0.5	Nielsen[11] (1930a)
2425275.141	-685	+2.411	vis	1	Kukarkin (1940)
2425302.270	-684	+2.515	pg	1	Hellerich (1935)
2425302.9	-684	+3.1	vis	0.5	Lause (1937)
2425383.521	-681	+2.692	vis	1	Ahnert (1929)
2425680.746	-670	+2.646	vis	1	Zverev (1936)
2426356.475	-645	+2.759	vis	1	Zverev (1936)
2427085.110	-618	+1.728	vis	1	Florya, Kukarkina (1953)
2427734.385	-594	+2.412	vis	1	Krebs (1935)
2428193.05	-577	+1.66	vis	0.5	Nielsen (1941b)
2432840.908	-405	+1.276	pe	2	Eggen (1951)
2435191.449	-318	+0.672	pe	2	Irwin (1961)
2435488.134	-307	+0.086	pe	2	Walraven et al. (1958)
2435736.940	-298	+5.670	pg	0	Nikulina (1972)
2437056.133	-249	+0.656	pe	2	Mitchell et al. (1964)
2437974.560	-215	+0.245	pe	1	Williams (1966)
2438758.533	-186	+0.503	pe	3	Wisniewski, Johnson (1968)
2439352.984	-164	+0.411	pe	1	Takase (1969)
2439812.386	-147	+0.394	pe	3	present paper[12]
2440919.687	-106	-0.315	pe	3	Pel (1976)
2441001.207	-103	+0.131	pe	1	Evans (1976)
2441514.4	-84	-0.1	vis	0.5	Cragg (1976)
2441730.626	-76	-0.116	pe	3	Landis (1976)
2442001.5	-66	+0.5	vis	0.5	Böhme (1976)
2442298.250	-55	-0.009	vis	0.5	Berdnikov (1977)
2443214.40	-21	-2.70	vis	0	Busch[13] (1977)
2443541.383	-9	-0.010	vis	0.5	Busch[14] (1980)
2443784.184	0	-0.431	pe	3	present paper
2443838.47	+2	-0.19	vis	0.5	Busch[15] (1980)

Remarks: [1] from Uranometria Argentina; Observers: [2] Davis; [3] Schönfeld; [4] Prittwitz; [5] Worsell; [6] Whitney; [7] de Roy; [8] Bemporad; [9] Bernard; [10] Schuller; [11] Aurino; [12] Abaffy; [13] Rümmler; [14] Branzke; [15] Richter

SV Vulpeculae

The light and colour curves of the longest period programme star are shown in Fig. 54. The O-C residuals have been calculated with the formulae:

$$C_{max} = 2443715.321 + 44^{d}.994772 \times E$$

$$C_{med} = 2443711.336 + 44^{d}.994772 \times E$$

for the maximum and median brightnesses, respectively. The O-C diagram can well be approximated by a parabola after J.D. 2423000, indicating a continuous period shortening (see Fig. 55). The equation of the fitted parabola is

$$(O-C)_{par} = -2^{d}.063 \times 10^{-4} \times E^{2} \quad .$$

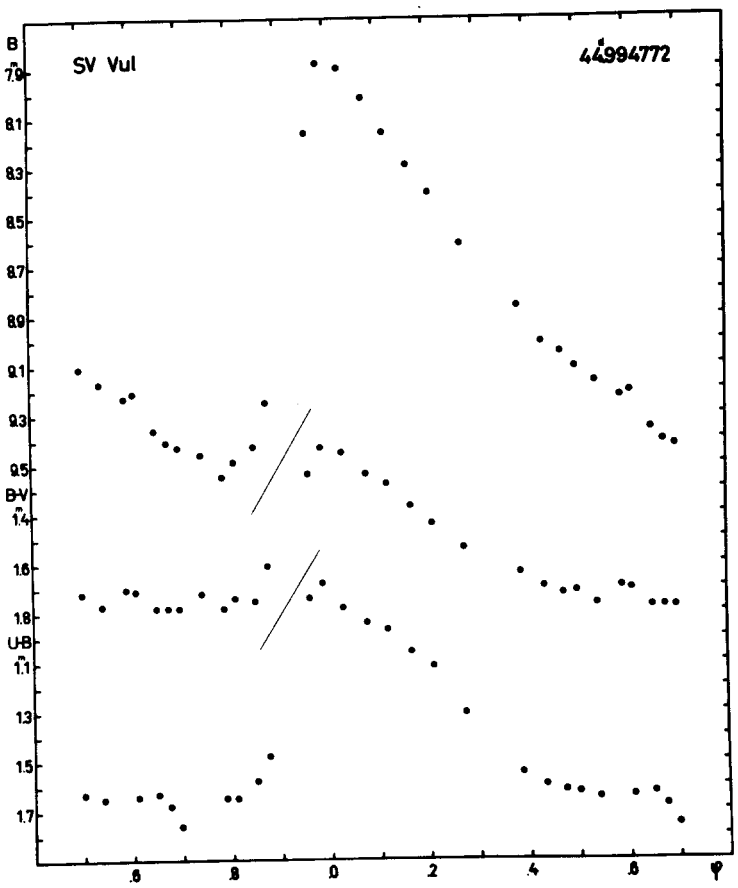

Figure 54 B, B-V and U-B curves of SV Vul

The deviations from this parabola are plotted in Fig. 56. Al-

though there is a slight indication of a periodicity with P≈9000 days in this Δ(O-C) diagram, no other indication of the binary nature of SV Vul exists. The available radial velocity measurements (Fernie, 1979; Joy, 1937; Sanford, 1956) show the constancy of the average value of the radial velocity.

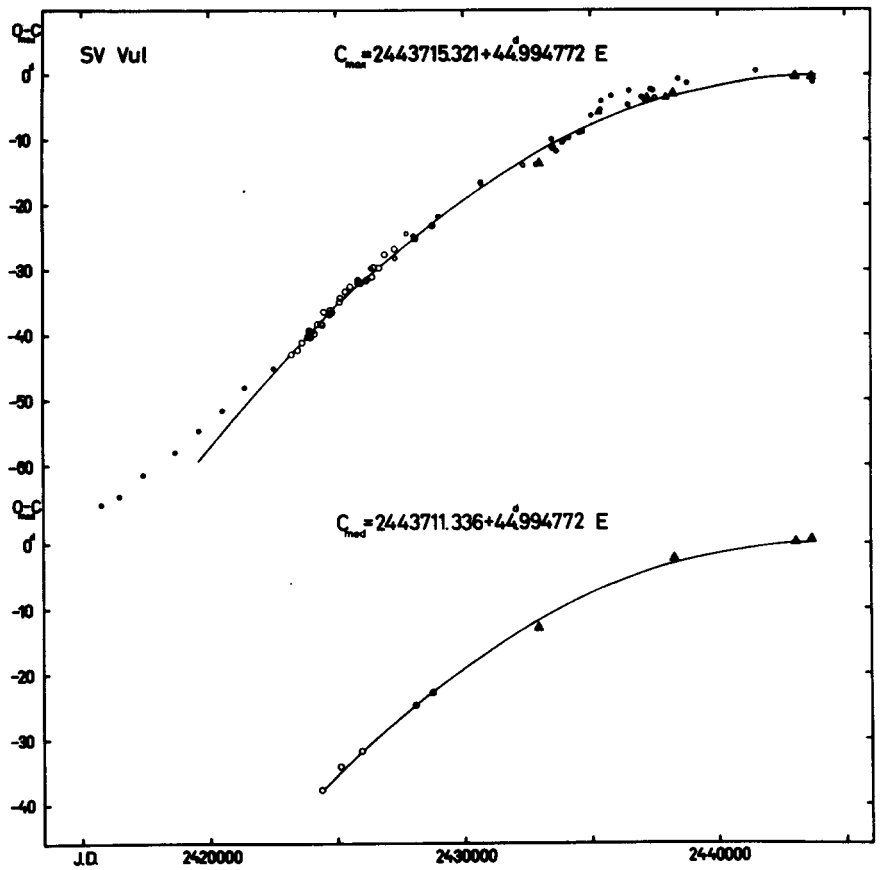

Figure 55 O-C diagram of SV Vul

Table 33 O-C residuals for SV Vul
(maximum brightness)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2415752.59	-620	-65.97	pg	0.5	Gerasimovic (1927a)
2416473.78	-604	-64.70	pg	0.5	Gerasimovic (1927a)
2417422.04	-583	-61.33	pg	0.5	Gerasimovic (1927a)
2418685.27	-555	-57.95	pg	0.5	Gerasimovic (1927a)
2419588.63	-535	-54.49	pg	0.5	Gerasimovic (1927a)
2420536.48	-514	-51.53	pg	0.5	Gerasimovic (1927a)

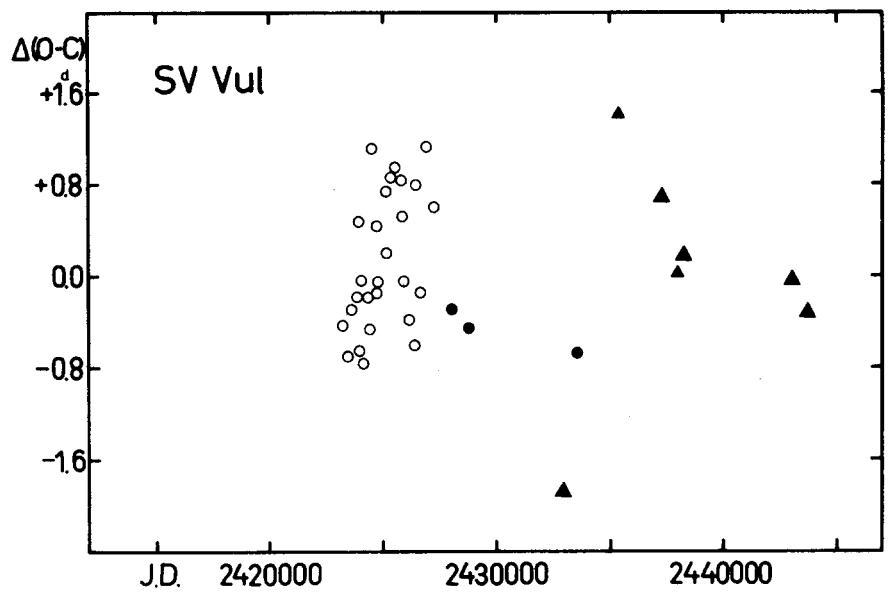

Figure 56 Deviations from the mean O-C curve

Table 33 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
		d			
2421394.85	-495	-48.06	pg	0.5	Gerasimovic (1927a)
2422522.70	-470	-45.08	pg	0.5	Gerasimovic (1927a)
2423244.750	-454	-42.945	vis	1	Kristensen[1] (1923a, 1924)
2423470.375	-449	-42.293	vis	1	Leiner (1924c)
2423651.506	-445	-41.141	vis	1	Zakharov (1924a, 1924b)
2423877.492	-440	-40.129	vis	1	Kristensen[1] (1926)
2423923.337	-439	-39.279	vis	1	Beyer (1930)
2423967.382	-438	-40.229	vis	1	Ahnert (1931)
2424013.182	-437	-39.424	vis	1	Zakharov (1928)
2424147.972	-434	-39.618	vis	1	Leiner (1929)
2424329.238	-430	-38.331	vis	1	Zakharov (1928)
2424374.408	-429	-38.156	vis	1	Beyer (1930)
2424419.308	-428	-38.251	vis	1	Nielsen (1927b)
2424511.224	-426	-36.324	vis	1	Ahnert (1931)
2424735.814	-421	-36.708	vis	1	Leiner (1929)
2424736.399	-421	-36.123	vis	1	Beyer (1930)
2424781.074	-420	-36.443	vis	1	Zakharov (1928)
2425142.660	-412	-34.815	vis	1	Beyer (1930)
2425143.200	-412	-34.275	vis	1	Ahnert (1931)
2425369.141	-407	-33.308	vis	1	Leiner (1929)
2425549.866	-403	-32.562	vis	1	Beyer (1930)
2425865.562	-396	-31.829	vis	1	Ahnert (1931)
2425865.877	-396	-31.514	vis	1	Kukarkin (1940)
2425955.316	-394	-32.065	vis	1	Zakharov (1954a)
2426180.58	-389	-31.77	pg	0.5	Nassau, Townson (1932)
2426180.762	-389	-31.593	vis	1	Ahnert (1931)
2426362.56	-385	-29.77	vis	0.5	Nielsen (1937a)

Table 33 (cont.)

Obs.Max.J.D.	E	O-C	Type	w	Reference
2426406.297	-384	-31^d.032	vis	1	Zverev (1936)
2426452.863	-383	-29.460	vis	1	Terkán (1935)
2426677.678	-378	-29.619	vis	1	Kukarkin (1940)
2426904.699	-373	-27.572	vis	1	Florya, Kukarkina (1953)
2427265.340	-365	-26.889	vis	1	Florya, Kukarkina (1953)
2427309.0	-364	-28.2	vis	0.5	Miczaika (1934a)
2427762.809	-354	-24.363	vis	0.5	Dziewulski et al. (1947)
2428032.45	-348	-24.69	vis	0.5	Nielsen[2] (1952)
2428077.005	-347	-25.130	pg	1	Nassau, Ashbrook (1942)
2428422.03	-340	+4.93	pg	0	Fu De-Lian (1964)
2428753.872	-332	-23.185	pg	1	Dziewulski et al. (1946)
2429025.37	-326	-21.65	pg	0.5	Kholopov (1946)
2430695.04	-289	-16.79	vis	0.5	Nielsen[3] (1952)
2430695.11	-289	-16.72	vis	0.5	Kukarkin (1951)
2432362.68	-252	-13.96	vis	0.5	Nielsen[3] (1955)
2432857.74	-241	-13.84	pg	0.5	Wachmann (1966)
2432947.901	-239	-13.669	pe	3	Eggen (1951)
2433491.61	-227	-9.90	pg	0.5	Nikulina (1970)
2433535.293	-226	-11.210	pg	1	Chuprina (1953)
2433669.72	-223	-11.77	pg	0.5	Wachmann (1966)
2433896.09	-218	-10.37	vis	0.5	Nielsen[4] (1955)
2433941.34	-217	-10.12	vis	0.5	Dziewulski (1953)
2434166.73	-212	-9.70	pg	0.5	Wachmann (1966)
2434527.62	-204	-8.77	pg	0.5	Nikulina (1970)
2434617.73	-202	-8.65	pg	0.5	Dziewulski (1956a)
2434662.83	-201	-8.54	pg	0.5	Wachmann (1966)
2435025.01	-193	-6.32	pg	0.5	Wachmann (1966)
2435340.566	-186	-5.727	pe	1	Walraven et al. (1958)
2435387.87	-185	-5.37	pg	0.5	Wachmann (1966)
2435432.40	-184	-3.88	pg	0.5	Nikulina (1970)
2435838.11	-175	-3.13	pg	0.5	Huth (1966)
2436466.60	-161	-4.56	pg	0.5	Nikulina (1970)
2436513.77	-160	-2.39	pg	0.5	Huth (1966)
2437007.76	-149	-3.34	pg	0.5	Wachmann (1966)
2437232.486	-144	-3.588	pe	3	Mitchell et al. (1964)
2437368.90	-141	-2.16	pg	0.5	Huth (1966)
2437458.83	-139	-2.22	pg	0.5	Nikulina (1970)
2437547.5	-137	-3.5	vis	0.5	Lohsen (1964a)
2437952.641	-128	-3.349	pe	1	Williams (1966)
2438268.111	-121	-2.843	pe	3	Fernie et al. (1965)
2438450.46	-117	-0.47	pg	0.5	Huth (1966)
2438809.70	-109	-1.19	pg	0.5	Nikulina (1970)
2441511.4	-49	+0.8	vis	0.5	Cragg (1976)
2443085.325	-14	-0.069	pe	3	Fernie (1979)
2443715.004	0	-0.317	pe	3	present paper
2443759.32	+1	-1.00	vis	0.5	Busch[5] (1980)

Remarks: [1] Observer: Axel Nielsen; [2] Obs.: Moller Nicolaisen; [3] Obs.: Arthur Nielsen; [4] Obs.: Darsenius; [5] Obs.: Branzke

Table 34 O-C residuals for SV Vul
(median brightness)

Obs.Med.J.D.	E	O-C	Type	w	Reference
2424370.940	-429	-37^d.639	vis	1	Beyer (1930)
2425139.462	-412	-34.028	vis	1	Beyer (1930)

Table 34 (cont.)

Obs.Med.J.D.	E	O-C	Type	w	Reference
		d			
2425951.669	-394	-31.727	vis	1	Zakharov (1954a)
2428073.392	-347	-24.758	pg	1	Nassau, Ashbrook (1942)
2428750.349	-332	-22.723	pg	1	Dziewulski et al. (1946)
2432944.568	-239	-13.017	pe	3	Eggen (1951)
2438264.733	-121	-2.236	pe	3	Fernie et al. (1965)
2443081.677	-14	+0.268	pe	3	Fernie (1979)
2443711.761	0	+0.425	pe	3	present paper

GENERAL REMARKS

Period changes, instability of the period

From the point of view of stellar evolution, it is even more important to study the period changes of the long period Cepheids than the short period ones. The tendency of the long period Cepheids to undergo a considerable amount of period change has been known for a long time (e.g. Parenago, 1956). Parenago, however, found that all the period changes were sudden. In this part of this series on Cepheids there are 17 stars for which Parenago also published O-C diagrams. On the basis of the newly constructed O-C diagrams for 11 stars out of the 17, the diagrams can be approximated by parabolas, thereby supporting the existence of Cepheids with continuously changing (increasing or decreasing) period.

The statistics of the observed period changes based on the whole programme (Papers I and II and the present paper) as well as the comparison of the theoretically calculated evolutionary period changes with the observed changes in the period will be published in a separate paper.

Cepheid binaries

The role of binaries in Cepheid research has seen an increase of late, since the frequency of Cepheids with companions is estimated to be at least as high as 20 per cent (Madore, 1977). Recent discoveries, viz. that AU Peg (Harris et al., 1979) and T Mon (Mariska et al., 1980) are also members in binary systems, indicate that the above mentioned frequency is really a lower limit of the true value.

Cepheids in binaries are important in several respects. They may serve as fundamental stars in deriving Cepheid masses and in

a new calibration of the period - luminosity - colour relation. Moreover, their existence stresses the importance of some theoretical investigations to be made concerning the pulsational behaviour of a Cepheid in a binary system (non-radial pulsation) and their evolutionary status.

The membership of a Cepheid in a binary system causes two effects which can be observed in the O-C diagram:

1. Periodic quasi sinusoidal variation due to the light-time effect. The present sample contains at least four stars (RW Cam, X Cyg, SZ Cyg, T Mon) showing this kind of apparent period change. The duplicity of ζ Gem and SV Vul is rather doubtful. The value of the orbital period of RW Cam has been able to be determined using the O-C diagram (see p. 63): $P_{orb} = 6600 \pm 300$ days. In the other three cases less accurate (and considerably longer) values for the orbital period could be determined.
2. Rejumping period (or "stepwise" O-C diagram). YZ Aur is a very clear example showing this kind of period change (see Fig. 48). The O-C diagram of SV Per can be interpreted as showing either a rejumping period or a ligth-time effect (but based on the shape of the O-C diagram in Fig. 18, the former interpretation is preferred). In the case of AN Aur the occurrence of the rejump can only be suspected since the period change was accompanied by a change in the shape of the light curve – as in the case of SU Cyg (Paper I, p. 77).

If both the orbital period and the amount of the apparent O-C variation can be determined from the O-C diagram, some conclusions can be drawn as to the mass of the binary system without using any spectroscopic data. A detailed description of these results along with a summary of the other data on Cepheid binaries will be published in a separate paper.

Summary of the observations

The fundamental parameters of the light variations of the observed Cepheids are summarized in Table 35. The successive columns contain the following data:

1. Name of the Cepheid
2. Period of light variation
3. Decimal logarithm of the period

4-5. The moments of the normal maximum and normal median bright-

Table 35 Summary

Name	Period	$\log P$	Norm.Max. Hel.J.D.	Norm.Med. 2440000+	Max.-Med. / P	Type
SZ Aql	17.140849	1.2340	3807.095	3806.512	0.034	I
TT Aql	13.754707	1.1385	3810.884	3810.059	0.060	I
RX Aur	11.623537	1.0653	3829.995	3828.182	0.156	I
SY Aur	10.144698	1.0062	3832.981	3830.333	0.251	I
YZ Aur	18.193212	1.2599	3816.489	3814.233	0.124	I
AN Aur	10.29056	1.0124	3799.026	3795.918	0.302	I
RW Cam	16.414812	1.2152	3840.515	3839.070	0.088	I
RW Cas	14.791548	1.1700	3830.363	3829.608	0.051	I
RY Cas	12.138888	1.0842	3826.585	3824.218	0.195	I
SZ Cas	13.637747	1.1347	3817.966	3815.594	0.174	Is
X Cyg	16.386332	1.2145	3830.274	3828.783	0.091	I
SZ Cyg	15.109642	1.1793	3760.486	3758.688	0.119	I
TX Cyg	14.7098	1.1676	3794.971	3794.235	0.050	I
VX Cyg	20.133407	1.3039	3783.660	3782.050	0.080	I
BZ Cyg	10.141932	1.0061	3774.144	3770.970	0.313	Is
CD Cyg	17.073967	1.2323	3831.224	3830.490	0.043	I
AA Gem	11.302328	1.0532	3737.679	3735.147	0.224	I
ζ Gem	10.150135	1.0065	3785.473	3782.611	0.282	Is
AP Her	10.4156	1.0177	3745.357	3743.441	0.187	II
Z Lac	10.885613	1.0369	2827.154	2825.369	0.164	I
T Mon	27.024649	1.4318	3784.184	-	-	I
SV Mon	15.232780	1.1828	3794.342	3793.352	0.065	I
SV Per	11.129318	1.0465	3839.246	3838.322	0.083	I
VX Per	10.88904	1.0370	3758.994	3755.650	0.307	I
SV Vul	44.994772	1.6532	3715.004	3711.761	0.072	I

nesses derived from the observations listed in Table 3

6. Fractional period between the moment of median brightness and that of the subsequent light maximum (a measure of the asymmetry of the light curve)

7. Type of Cepheid

8-10. The maximum and minimum magnitudes and the amplitude in V

11-13. The corresponding quantities for B as under 8-10

14-16. The corresponding quantities for U as under 8-10

17. Name of Cepheid

of the observations

V_{max}	V_{min}	A_V	B_{max}	B_{min}	A_B	U_{max}	U_{min}	A_U	Name
$7^m.95$	$9^m.24$	$1^m.29$	$8^m.99$	$11^m.08$	$2^m.09$	$10^m.18$:	$12^m.76$:	$2^m.58$:	SZ Aql
6.56	7.58	1.02	7.52	9.19	1.67	8.20	10.81	2.61	TT Aql
7.34	8.03	0.69	8.12	9.17	1.05	8.67	10.05	1.38	RX Aur
8.73	9.37	0.64	9.64	10.60	0.96	10.33:	11.43:	1.10:	SY Aur
9.94	10.75	0.81	11.13	12.41	1.28				YZ Aur
10.20	10.80	0.60	11.33	12.24	0.91				AN Aur
8.16	9.00	0.84	9.37	10.48	1.11	10.24	11.44	1.20	RW Cam
8.55	9.75	1.20	9.45	11.36	1.91				RW Cas
9.38	10.35	0.97	10.52	11.94	1.42				RY Cas
9.61	10.03	0.42	10.94	11.59	0.65				SZ Cas
5.87	6.87	1.00	6.72	8.34	1.62	7.29	9.79	2.50	X Cyg
8.94	9.82	0.88	10.22	11.61	1.39				SZ Cyg
8.82	10.00	1.18	10.41	12.11	1.70				TX Cyg
9.57	10.54	0.97	10.98	12.54	1.56				VX Cyg
10.05	10.53	0.48	11.54	12.24	0.70				BZ Cyg
8.34	9.52	1.18	9.29	11.15	1.86	9.98	12.58	2.60	CD Cyg
9.40	10.00	0.60	10.35	11.30	0.95				AA Gem
3.66	4.17	0.51	4.35	5.10	0.75	4.87	5.94	1.07	ζ Gem
10.43	11.15	0.72	11.06	12.08	1.02				AP Her
7.89	8.82	0.93	8.73	10.18	1.45	9.33	11.23	1.90	Z Lac
5.61:	6.60	0.99:	6.49:	8.05	1.56:	7.08:	9.28	2.20:	T Mon
7.63	8.78	1.15	8.43	10.21	1.78	8.79	11.26	2.47	SV Mon
8.49	9.35	0.86	9.38	10.53	1.15				SV Per
8.98	9.68	0.70	10.08	11.09	1.01	10.85	12.12	1.27	VX Per
6.74	7.76	1.02	7.86	9.53	1.67	8.66	11.20	2.54	SV Vul

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