

Photometry of symbiotic stars – an international campaign V.

Z And, EG And, V1413 Aql (AS 338), UV Aur, TX CVn,
T CrB, BF Cyg, CH Cyg, CI Cyg, V 1016 Cyg,
V 1329 Cyg, AG Dra, CQ Dra (4 Dra), YY Her, V 443 Her,
SS Lep, AG Peg, AX Per, FG Sge, PU Vul

L. Hric¹, A. Skopal^{1,9}, D. Chochol¹, R. Komžík¹, Z. Urban¹,
J. Papoušek², C. Blanco³, P. Niarchos⁴, H. Rovithis-Livanidou⁴,
P. Rovithis⁴, L. L. Chinarova⁵, A. I. Pikhun⁵, K. Tsvetkova⁶,
E. Semkov⁶, Z. Velič⁷ and E. Schweitzer⁸

¹ *Astronomical Institute of the Slovak Academy of Sciences,
059 60 Tatranská Lomnica, The Slovak Republic*

² *Department of Theoretical Physics and Astrophysics, Masaryk University,
Kotlářská 2, 611 37 Brno, The Czech Republic*

³ *Astronomy Institute, Catania University, I-95123 Catania, Italy*

⁴ *Section of Astrophysics, Astronomy and Mechanics, Department of
Physics, University of Athens, 157 83 Zografos Athens, Greece*

⁵ *Astronomical Observatory, Odessa State University, Shevchenko Park,
Odessa 270014, Ukraine*

⁶ *Department of Astronomy, Bulgarian Academy of Sciences, Trakia
Blvd. 72, Sofia 1784, Bulgaria*

⁷ *Rozkvet 2029/54-43, 01701 Považská Bystrica, The Slovak Republic*

⁸ *Observatoire de Strasbourg 11, rue de l' Université,
67000 Strasbourg, France*

⁹ *John Moores University, Liverpool L3 3AF, United Kingdom*

Received: October 23, 1993

Abstract. We present new observations of 20 symbiotic and symbiotic-like stars. Photoelectric UBV, photographic and visual observations were obtained during the 1992.75 to 93.75, 1955 to 93 and 1991.9 to 93.45 periods, respectively. The main results can be summarized as follows: V 1413 Aql: the time of the minimum is in good agreement with the ephemeris; UV Aur: the decrease in the U, B and V brightness was observed about 110 days prior to the primary

Contrib. Astron. Obs. Skalnaté Pleso 24, (1994), 31– 56.

minimum (0.3 of the orbital period); TX CVn: long-term (~ 9 -year) variations in the star's brightness reached minimum around JD 2 449 100; T CrB: the V light curve confirms the double wave during the whole orbital period; BF Cyg: the broad primary minimum observed in the UBV and visual bands agrees with our recent ephemeris; CH Cyg: the gradual increase in the star's brightness indicates the continuation of the current outburst; V 1016 Cyg: the orbital period (~ 13 – 14 years) is probably present in U observations; CI Cyg: the time of the minimum is in good agreement with the ephemeris; V 1329 Cyg: the long-term photographic observations confirm our ephemeris; CQ Dra: a gradual increase in the U band was observed during the last season; YY Her: the maxima of brightness observed in 1967 and 1993 probably reflect the orbital motion; FG Sge: photographic data obtained during 30 years of observations cover nearly the whole interval of activity of the system.

Key words: stars - binaries - symbiotic - photometry

1. Introduction

This is the fifth paper of the series presenting the results compiled as a part of the campaign of long-term photometry of symbiotic stars (Hric & Skopal, 1989). It represents the continuation of the previous campaign's contributions (Skopal *et al.*, 1990 - Paper I, Hric *et al.*, 1991 - Paper II, Skopal *et al.*, 1992 - Paper III, Hric *et al.*, 1993 - Paper IV).

2. Observations

Photoelectric UBV observations were performed at the Skalnaté Pleso Observatory (hereafter SP in the tables and * in the figures), at the Stará Lesná Observatory (SL, +), at the Observatory of the Masaryk University in Brno (B2, □), at the Serra LaNave station of the Catania Astrophysical Observatory (CA), at the Kryonerion Station of the National Observatory of Athens (K, ⊕). The observations carried out at the Skalnaté Pleso Observatory, at the Observatory of the Masaryk University in Brno, at the Catania Astrophysical Observatory, at the Kryonerion Station and at the Stará Lesná Observatory were performed in the same way as described in Paper II and III. New photoelectric observations of the normal campaign period were made between October 1, 1992 and September 30, 1993.

Photographic observations were made at the Skalnaté Pleso Observatory (*), at the Crimean Station of the Moscow Sternberg State Astronomical Institute (C, ●), at the Astronomical Observatory of the Odessa State University (O, ○), at the Rozhen Observatory (R, ■) and by Z. Velič at his private station near Považská Bystrica. The photographic observations at the Skalnaté Pleso Observatory were made with a 30 cm astrograph on photographic plates 24×24 cm and 9×12 cm using an ORWO ZU-2 and ORWO ZU-21 emulsions. The

limiting magnitude is 16 (m_{pg}). The photographic observations at the Crimean Station were made with a 40 cm astrograph on photographic plates 30×30 cm ($10^\circ \times 10^\circ$) using an ORWO ZU-21 emulsion. The limiting magnitude is 18 (m_{pg}). The photographic observations at the Odessa Observatory were performed using a seven-camera astrograph, diameter 20 cm, on photographic plates using an ORWO ZU-21 emulsion for the photographic region and ORWO ZP-3 emulsion with a yellow filter for the photovisual region. The limiting magnitude is 15 (m_{pg}) and 12 (m_{pv}). The photographic observations at the station near the city of Považská Bystrica were performed as described in Paper II. Some special differences in filters, emulsions and procedures actually used are noted in the tables.

Visual observations were collected by the members of Association Francaise des Observateurs d'Etoiles Variables - AFOEV (coordinator E. Schweitzer, denoted * in the figures) and by individual observers from the Czech Republic (+). The visual observations for 15 symbiotic stars reported in this paper were collected by members of the AFOEV (1623 magnitude estimates) and the individual Czech observers (218).

3. Results

The results for all the observed objects have been summarized in tables (UBV photoelectric and photographic photometry) and depicted in figures, if they exhibited interesting behaviour and/or provided a large amount of data (visual photometry). Individual stars are arranged in alphabetic order, and described in subsections.

3.1. Z Andromedae

Only visual observations were available for this star. They are shown in Figure 1. The new observations cover the ascending branch of the minimum. Some

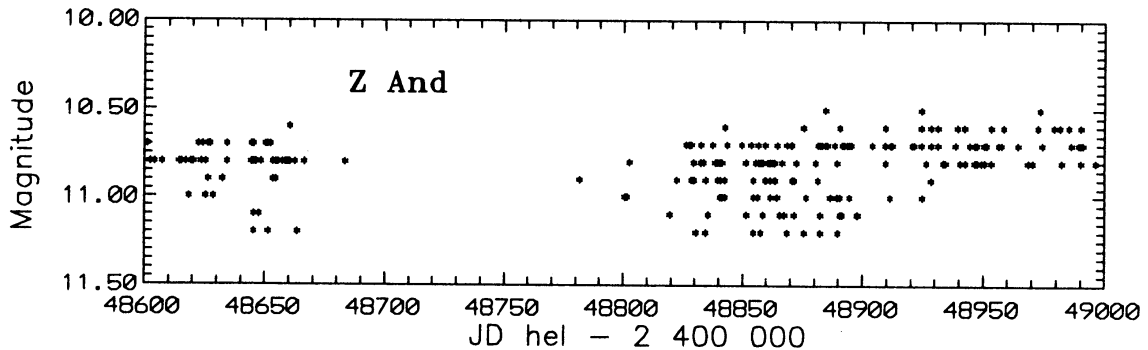


Figure 1. Visual observations of Z And

previous observations from the descending branch are shown for clarity, too.

3.2. EG Andromedae

UBV photoelectric observations were carried out during 14 nights. The standard stars S_1, S_2, S_3 are the same as used in the Paper II, and S_4 as in Paper III. The results are compiled in Table 1. Our data cover the descending branch of the secondary minimum, best visible in the U band.

The visual observations of EG And are displayed in Figure 2. The photographic observations taken on 4 nights are summarized in Table 2.

Table 1. Photoelectric observations of EG And

Date	JD _{hel} 2 44. ...	ΔU	ΔB	ΔV	Obs
Oct 28, 92	8924.412	-	0.684	-0.282	K
Oct 31, 92	8926.536	-	0.698	-0.268	K
Nov 9, 92	8935.529	-1.736	-1.286	-1.398	SP
Nov 19, 92	8945.549	-1.691	-1.395	-1.410	SP
Nov 24, 92	8951.428	-1.608	-1.271	-1.414	SP
Nov 30, 92	8957.40	-1.490	-1.319	-1.320	CA
Dec 15, 92	8972.335	-	-1.283	-	SP
Dec 20, 92	8977.29	-1.452	-1.297	-1.329	CA
Dec 21, 92	8978.367	-1.515	-1.305	-1.361	SP
Jan 2, 93	8990.287	-1.683	-1.339	-1.421	SP
Jan 4, 93	8992.257	-1.565	-1.337	-1.421	SL
Jan 14, 93	9002.25	-1.485	-1.258	-1.325	CA
Jan 18, 93	9006.26	-1.520	-1.297	-1.364	CA
Jan 19, 93	9007.242	-1.525	-1.396	-1.630	SP
Jan 30, 93	9018.222	-1.297	-1.257	-1.349	SP
Feb 4, 93	9023.227	-1.488	-1.333	-1.289	SP
Feb 13, 93	9032.247	-1.347	-1.266	-1.347	SP
Feb 16, 93	9035.252	-1.321	-1.329	-1.397	SP
Mar 3, 93	9050.265	-1.197	-1.287	-1.404	SP
Sep 19, 93	9250.498	-0.920	-1.242	-1.325	SP

Observatory : K - Kryonerion: EG And - S_3 SP - Skalnaté Pleso: EG And - S_1
SL - Stará Lesná: EG And - S_1 CA - Catania: EG And - S_1

Table 2. Photographic observations of EG And

Date	JD _{hel} 2 44. ...	mag	Date	JD _{hel} 2 44. ...	mag
Dec 23, 92	8980.197	6.31	Feb 11, 93	9030.258	7.18
Jan 17, 93	9005.220	7.03	Feb 13, 93	9032.255	5.58

Observer: Velič

Band: 570-650 nm

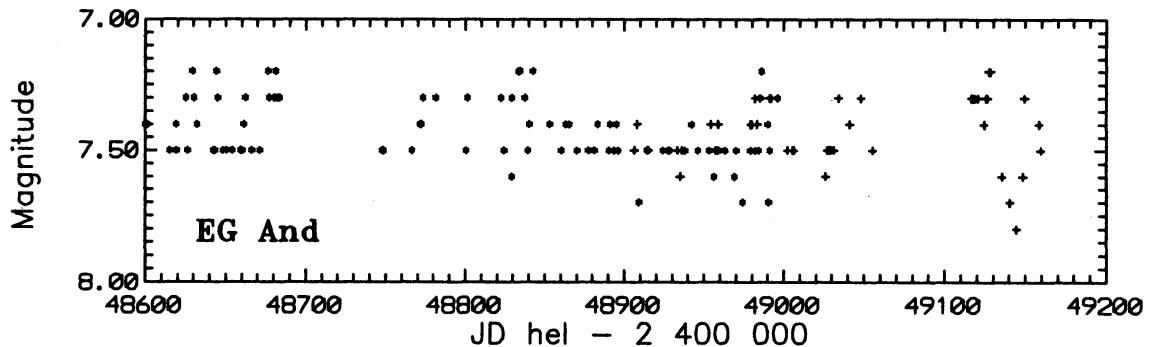


Figure 2. Visual observations of EG And

3.3. V 1413 Aquilae (AS 338)

The visual observations of this star, covering the primary minimum, are displayed in Figure 3. The observed minimum agrees with the ephemeris given by Munari (1992): $JD_{min} = 2446650 (\pm 15) + 434.1 (\pm 0.2) \times E$.

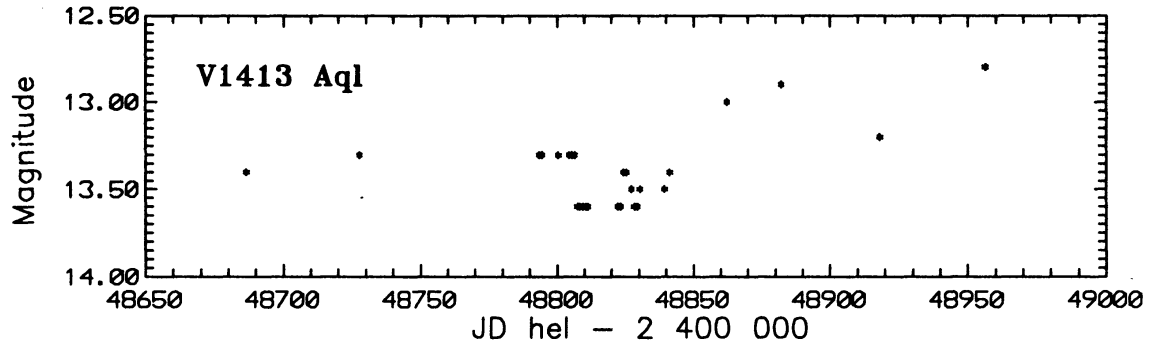


Figure 3. Visual observations of V 1413 Aql

3.4. UV Aurigae

The photoelectric observations of this star were obtained on 12 nights. The standard stars S_1, S_2, S_3 are the same as used in Paper II. The results are compiled in Table 3 and depicted in Figure 4. The decrease in the star's brightness around the primary minimum supports the 365-day period for light variations derived in Paper II. Moreover, the decrease of brightness by 0.8 mag in U, 1.3 mag in B and 2.0 mag in V colour was detected about 110 days prior to the primary minimum (see Figure 4). A similar decrease was recorded in Paper III, but with a smaller amplitude of light variations.

The photographic observations were obtained on 92 nights from October 1965 to April 1993. The results are summarized in Table 4. The observations from the Crimea are shown in Figure 5. The period analysis of these data gave 357 days as the best period.

Table 3. Photoelectric observations of UV Aur

Date	JD			U	B	V	Obs
	2 44. ...						
Nov 19, 92	48945.672	10.096	10.807	9.986	SP		
Dec 16, 92	48972.630	11.071	12.157	12.135	SP		
Dec 17, 92	48973.554	10.883	12.143	12.140	SP		
Jan 2, 93	48990.437	10.919	12.170	12.237	SP		
Jan 17, 93	49005.292	10.233	10.888	10.178	SP		
Jan 30, 93	49018.460	10.256	10.951	10.269	SP		
Feb 16, 93	49035.361	10.191	10.964	10.370	SP		
Mar 3, 93	49050.379	10.281	11.032	10.365	SP		
Mar 13, 93	49060.351	10.157	10.979	10.506	SP		
Apr 20, 93	49098.320	11.128	12.252	12.567	SP		
Sep 20, 93	49250.576	10.265	10.964	10.134	SP		
Sep 28, 93	49258.629	10.181	10.980	10.046	SP		

Observatory: SP - Skalnaté Pleso

Table 4. Photographic observations of UV Aur

Date	JD _{hel} 2 4... ..	mag	Obs	Note	Date	JD _{hel} 2 4... ..	mag	Obs	Note
Oct 18, 65	39052.408	10.70	C		Oct 21, 66	39420.486	10.70	C	
Oct 21, 65	39055.419	10.77	C		Oct 22, 66	39420.519	10.77	C	
Oct 22, 65	39056.413	10.70	C		Oct 22, 66	39420.552	10.77	C	
Oct 22, 65	39056.451	10.57	C		Oct 22, 66	39420.584	10.70	C	
Oct 22, 65	39056.487	10.57	C		Nov 11, 66	39441.354	10.77	C	
Oct 23, 65	39056.523	10.57	C		Nov 11, 66	39441.386	10.70	C	
Oct 23, 65	39056.563	10.57	C		Nov 11, 66	39441.419	10.77	C	
Oct 26, 65	39060.401	10.41	C		Nov 12, 66	39442.378	10.77	C	
Oct 26, 65	39060.438	10.57	C		Nov 12, 66	39442.410	10.77	C	
Oct 26, 65	39060.483	10.41	C		Nov 12, 66	39442.443	10.77	C	
Oct 27, 65	39060.527	10.41	C		Nov 12, 66	39442.475	10.57	C	
Oct 27, 65	39060.562	10.53	C		Nov 13, 66	39442.508	10.57	C	
Oct 27, 65	39060.596	10.57	C		Nov 16, 66	39446.336	10.77	C	
Dec 20, 65	39115.383	10.04	C		Nov 16, 66	39446.369	10.77	C	
Jan 19, 66	39145.331	10.57	C		Nov 16, 66	39446.403	10.77	C	
Jan 19, 66	39145.366	10.57	C		Nov 19, 66	39449.377	10.57	C	
Mar 13, 66	39198.359	10.57	C		Nov 19, 66	39449.409	10.77	C	
Sep 13, 66	39382.481	10.41	C		Nov 19, 66	39449.442	10.77	C	
Sep 14, 66	39382.525	10.77	C		Nov 19, 66	39449.478	10.77	C	
Sep 14, 66	39382.561	10.83	C		Nov 23, 66	39452.569	10.77	C	
Sep 16, 66	39384.516	10.77	C		Mar 11, 67	39561.309	10.18	C	
Sep 16, 66	39385.471	10.77	C		Mar 11, 67	39561.343	10.18	C	
Sep 17, 66	39385.556	10.97	C		Apr 4, 67	39585.296	10.18	C	
Sep 18, 66	39386.506	10.77	C		Apr 5, 67	39586.290	10.30	C	
Sep 18, 66	39386.575	10.77	C		Apr 6, 67	39587.279	10.30	C	
Sep 18, 66	39387.459	10.77	C		Apr 7, 67	39588.275	10.30	C	
Sep 20, 66	39389.498	10.77	C		Apr 8, 67	39589.284	10.53	C	
Sep 21, 66	39389.534	10.70	C		Apr 12, 67	39593.292	10.30	C	
Sep 21, 66	39389.572	10.97	C		Sep 5, 67	39739.477	10.97	C	
Sep 21, 66	39390.476	10.77	C		Sep 9, 67	39743.490	10.97	C	
Sep 22, 66	39390.528	10.77	C		Oct 3, 67	39766.532	10.53	C	
Sep 22, 66	39390.569	10.97	C		Oct 4, 67	39767.524	10.77	C	
Sep 27, 66	39395.577	10.77	C		Oct 4, 67	39768.491	10.77	C	
Oct 11, 66	39410.427	10.77	C		Oct 5, 67	39768.531	10.57	C	
Oct 11, 66	39410.466	10.83	C		Oct 5, 67	39769.495	10.77	C	
Oct 12, 66	39410.502	10.77	C		Oct 15, 67	39778.563	10.77	C	
Oct 12, 66	39410.538	10.77	C		Oct 15, 67	39778.597	11.16	C	
Oct 12, 66	39410.571	10.97	C		Feb 21, 68	39908.231	10.10	C	
Oct 12, 66	39411.470	10.77	C		Feb 21, 68	39908.271	10.18	C	
Oct 13, 66	39411.502	10.77	C		Feb 22, 68	39909.300	10.10	C	
Oct 13, 66	39411.568	10.77	C		Feb 22, 68	39909.339	9.98	C	
Oct 15, 66	39414.431	10.77	C		Feb 23, 68	39910.226	10.10	C	
Oct 15, 66	39414.464	10.77	C		Feb 23, 68	39910.263	10.10	C	
Oct 16, 66	39414.531	10.77	C		Feb 23, 68	39910.299	10.18	C	
Oct 16, 66	39414.563	10.77	C		Feb 27, 68	39914.239	10.04	C	
Oct 16, 66	39414.596	10.87	C		Feb 27, 68	39914.273	10.10	C	
Oct 16, 66	39415.414	10.77	C		Feb 27, 68	39914.306	10.10	C	
Oct 16, 66	39415.448	10.73	C		Mar 16, 68	39932.246	10.04	C	
Oct 16, 66	39415.489	10.77	C		Mar 17, 68	39933.268	10.18	C	
Oct 17, 66	39415.529	10.77	C		Mar 17, 68	39933.302	10.04	C	
Oct 17, 66	39415.564	10.73	C		Oct 1, 68	40130.580	10.77	C	
Oct 17, 66	39416.454	10.77	C		Oct 22, 68	40152.426	10.57	C	
Oct 17, 66	39416.487	10.77	C		Oct 24, 68	40153.522	10.77	C	
Oct 18, 66	39416.520	10.77	C		Oct 27, 68	40156.528	10.77	C	
Oct 18, 66	39416.552	10.77	C		Feb 20, 69	40273.291	10.18	C	
Oct 18, 66	39416.585	10.70	C		Mar 9, 69	40290.227	10.10	C	
Oct 18, 66	39417.456	10.70	C		Mar 9, 69	40290.260	10.18	C	
Oct 18, 66	39417.488	10.77	C		Mar 11, 69	40292.261	10.10	C	
Oct 19, 66	39417.524	10.77	C		Mar 11, 69	40292.295	10.10	C	
Oct 19, 66	39417.558	10.70	C		Mar 12, 69	40293.277	10.04	C	
Oct 19, 66	39417.592	10.77	C		Mar 12, 69	40293.311	10.10	C	
Oct 19, 66	39418.446	10.70	C		Mar 13, 69	40294.259	10.18	C	
Oct 19, 66	39418.479	10.70	C		Mar 13, 69	40294.291	10.18	C	
Oct 20, 66	39418.511	10.77	C		Mar 14, 69	40295.274	10.10	C	
Oct 20, 66	39418.543	10.70	C		Jun 29, 69	40401.583	10.57	C	
Oct 20, 66	39418.576	10.77	C		Oct 9, 69	40503.565	10.77	C	
Oct 20, 66	39418.606	10.77	C		Oct 13, 69	40507.558	10.97	C	
Oct 20, 66	39419.451	10.77	C		Oct 14, 69	40508.538	10.57	C	
Oct 20, 66	39419.486	10.83	C		Oct 15, 69	40509.545	10.77	C	
Oct 21, 66	39419.519	10.77	C		Oct 16, 69	40510.549	10.77	C	
Oct 21, 66	39419.554	10.77	C		Oct 17, 69	40511.529	10.77	C	
Oct 21, 66	39419.600	10.77	C		Oct 22, 69	40516.591	10.77	C	
Oct 21, 66	39420.421	10.77	C		Nov 5, 69	40531.486	10.77	C	
Oct 21, 66	39420.454	10.70	C		Nov 8, 69	40534.458	10.77	C	

Table 4. – continued

Date	JD _{hel} 2 4... ..	mag	Obs	Note	Date	JD _{hel} 2 4... ..	mag	Obs	Note
Nov 8, 69	40534.489	10.53	C		Jan 29, 93	49017.498	10.11	V	1
Nov 11, 69	40537.431	10.57	C		Feb 11, 93	49030.279	9.88	V	2
Feb 8, 70	40626.326	10.77	C		Feb 11, 93	49030.302	9.51	V	2
Feb 8, 70	40626.358	10.57	C		Feb 11, 93	49030.315	10.52	V	1
Feb 14, 70	40632.246	10.18	C		Feb 11, 93	49030.326	9.90	V	1
Mar 2, 70	40648.275	10.04	C		Feb 13, 93	49032.287	10.19	V	1
Mar 3, 70	40649.280	10.02	C		Feb 13, 93	49032.313	10.06	V	2
Mar 3, 70	40649.314	10.02	C		Mar 10, 93	49057.311	10.46	V	2
Sep 7, 72	41567.574	10.57	C		Mar 10, 93	49057.324	10.14	V	2
Jan 19, 80	44258.277	10.53	C		Mar 10, 93	49057.337	10.17	V	1
Oct 23, 87	47091.508	10.57	C		Mar 10, 93	49057.365	10.08	V	2
Dec 22, 92	48979.298	10.11	V	2	Mar 19, 93	49066.325	10.21	V	2
Dec 22, 92	48979.317	9.98	V	1	Mar 19, 93	49066.346	10.53	V	1
Jan 16, 93	49004.325	9.68	V	2	Apr 10, 93	49088.334	10.24	V	2
Jan 16, 93	49004.344	9.97	V	1	Apr 10, 93	49088.354	10.12	V	1
Jan 17, 93	49005.291	10.23	V	2	Apr 17, 93	49095.313	10.09	V	2
Jan 17, 93	49005.314	10.27	V	1	Apr 17, 93	49095.332	10.41	V	1
Jan 29, 93	49017.479	10.39	V	2					

Observer: V - Velić
 Observatory: C - Crimea
 Note: 1 - 400-650 nm
 2 - 570-650 nm

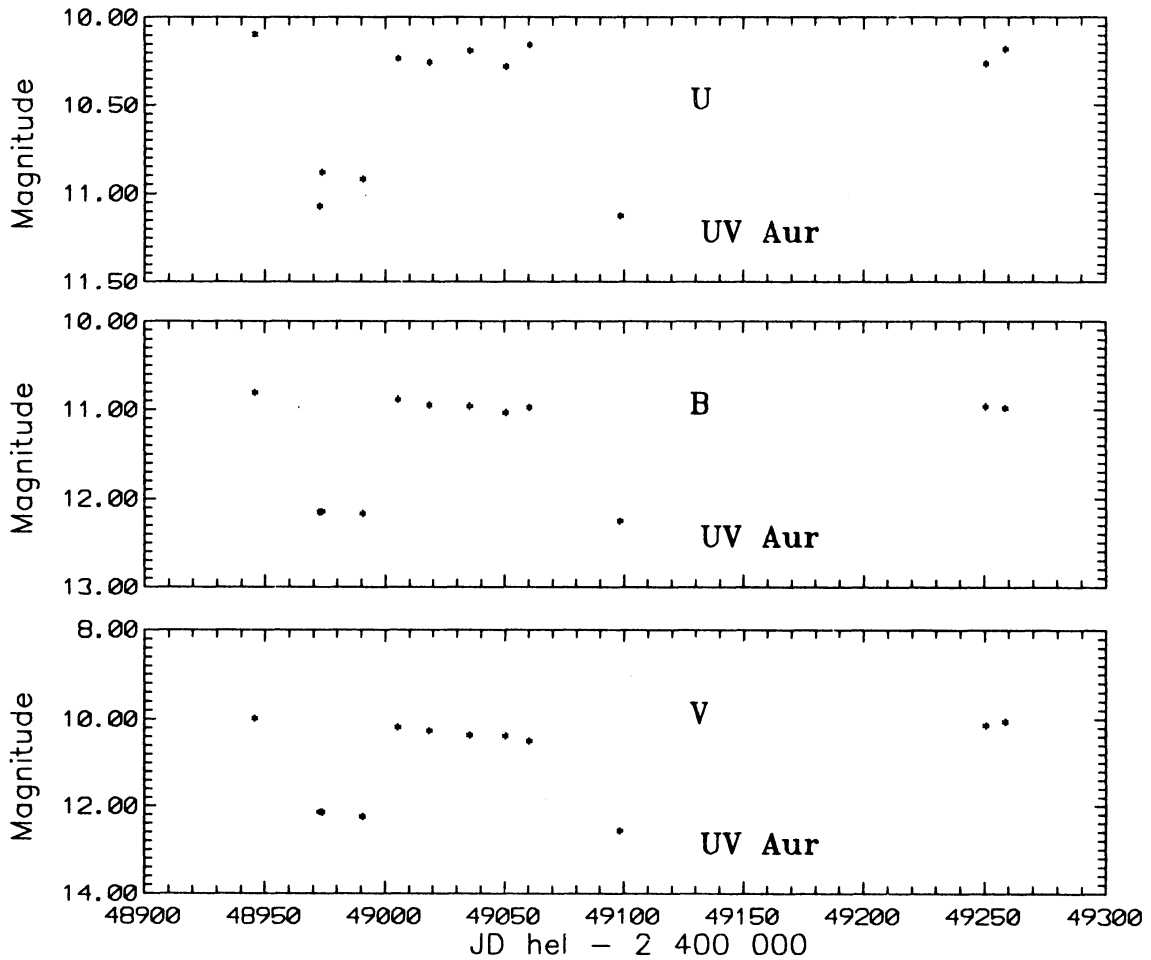


Figure 4. Photoelectric observations of UV Aur

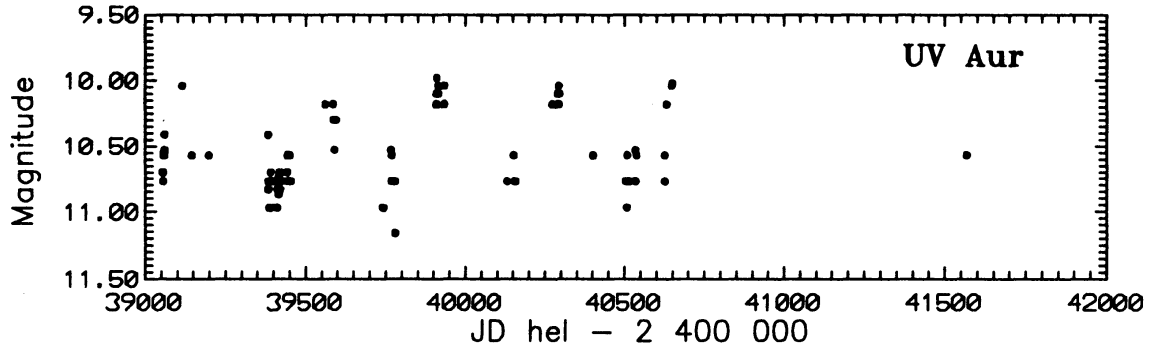


Figure 5. Photographic observations of UV Aur

3.5. TX Canum Venaticorum

The photoelectric photometry of this star was carried out on 16 nights. The standard stars S_1 , S_2 , S_3 are the same as used in Paper II. The results are summarized in Table 5.

The photographic observations were made on 54 nights from May 1982 to March 1991. These observations show the long-term increase of brightness following the ~ 9 years period found in Paper III. The results are summarized in Table 6 and depicted in Figure 6.

The visual observations are shown in Figure 7.

The photoelectric and visual observations show a slight decrease in agreement with the periodicity mentioned. Since the long-term variations of brightness reached minimum around JD 2 449 100, we expect a slow increase of brightness in all three passbands in the near future.

Table 5. Photoelectric observations of TX CVn

Date	JD			Obs	
	2 44. ...	U	B		
Jan 31, 93	49018.648	10.639	10.547	9.929	SP
Feb 16, 93	49034.535	10.591	10.543	9.937	SP
Mar 3, 93	49050.438	10.495	10.513	9.887	SP
Mar 20, 93	49066.684	10.605	10.772	9.623	K
Mar 21, 93	49068.328	10.385	10.407	9.449	K
Mar 22, 93	49069.329	10.488	10.462	9.356	K
Mar 23, 93	49070.314	10.361	10.676	9.500	K
Apr 17, 93	49095.368	10.656	10.571	9.948	SP
Apr 20, 93	49098.420	-	10.526	9.893	B2
Apr 24, 93	49102.390	-	10.537	9.895	B2
Apr 26, 93	49104.390	-	10.519	9.919	B2
May 11, 93	49119.350	-	10.535	9.909	B2
May 13, 93	49121.340	-	10.576	9.927	B2
May 17, 93	49125.353	10.738	10.623	9.999	SP
May 17, 93	49125.360	-	10.588	9.968	B2
May 18, 93	49126.360	-	10.602	10.002	B2

Observatory: SP - Skalnaté Pleso, B2 - Brno University, K - Kryonerion

Table 6. Photographic observations of TX CVn

Date	JD _{hel} 2 44. ...	mag	Date	JD _{hel} 2 44. ...	mag	Date	JD _{hel} 2 44. ...	mag
May 18, 82	5108.334	10.12	Mar 15, 85	6139.545	9.96	Feb 13, 88	7204.570	9.65
May 21, 82	5111.332	10.12	Jun 13, 85	6230.394	9.89	Mar 21, 88	7242.464	9.89
May 23, 82	5113.343	10.00	Jun 23, 85	6240.361	9.96	Apr 11, 88	7263.469	9.89
May 25, 82	5115.462	10.20	Jul 9, 85	6256.317	10.12	Apr 19, 88	7270.554	9.93
May 27, 82	5117.473	10.12	Jul 16, 85	6263.357	10.00	Jul 12, 88	7355.369	10.12
Jun 10, 82	5131.346	10.12	Jul 18, 85	6265.320	10.00	Jul 30, 88	7373.309	9.96
Nov 15, 82	5288.595	10.12	Aug 14, 85	6292.287	10.00	Sep 12, 88	7417.324	10.00
Feb 15, 83	5380.633	10.12	Aug 18, 85	6296.294	10.12	Sep 16, 88	7421.403	10.12
Apr 11, 83	5435.506	10.24	Nov 12, 85	6381.534	10.00	Sep 30, 88	7435.262	10.00
May 11, 83	5466.482	10.20	Apr 8, 86	6529.395	9.89	Oct 14, 88	7449.365	10.24
Mar 2, 84	5761.520	9.96	Apr 9, 86	6530.442	9.89	Oct 15, 88	7450.294	10.20
Mar 2, 84	5761.553	10.18	May 1, 86	6552.465	10.00	Mar 4, 89	7589.613	9.84
May 29, 84	5850.374	9.89	Jun 7, 86	6589.349	10.12	Apr 1, 89	7618.442	9.89
Jun 2, 84	5854.386	9.96	Jul 8, 86	6620.303	10.12	Apr 28, 89	7645.454	9.89
Jun 19, 84	5871.379	9.96	Aug 9, 86	6652.304	10.12	May 8, 89	7655.482	9.93
Jun 28, 84	5880.356	9.89	Aug 27, 86	6670.270	10.03	Jun 2, 89	7680.345	9.89
Jul 17, 84	5899.326	9.96	Feb 3, 87	6829.642	9.93	Jun 2, 89	7680.372	9.89
Jul 31, 84	5913.303	9.96	May 28, 87	6944.312	9.89	Mar 11, 91	8326.582	10.24
Feb 15, 85	6112.483	10.12	Jun 25, 87	6972.351	9.89			

Observatory: Crimea

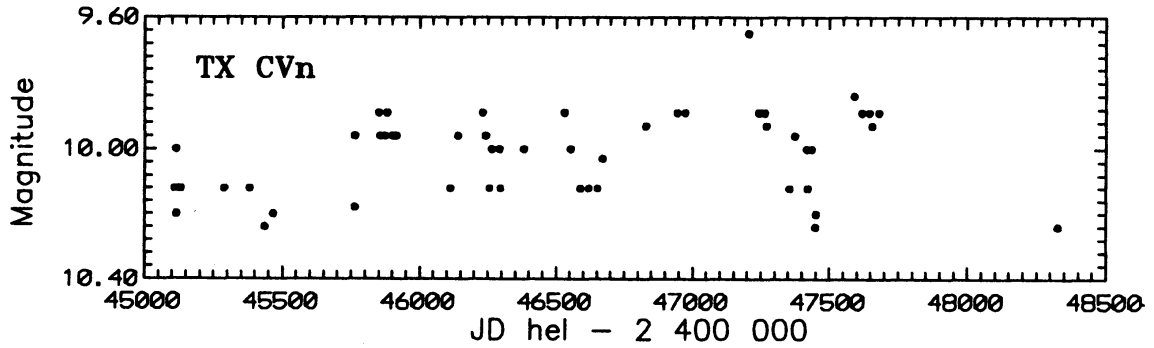


Figure 6. Photographic observations of TX CVn

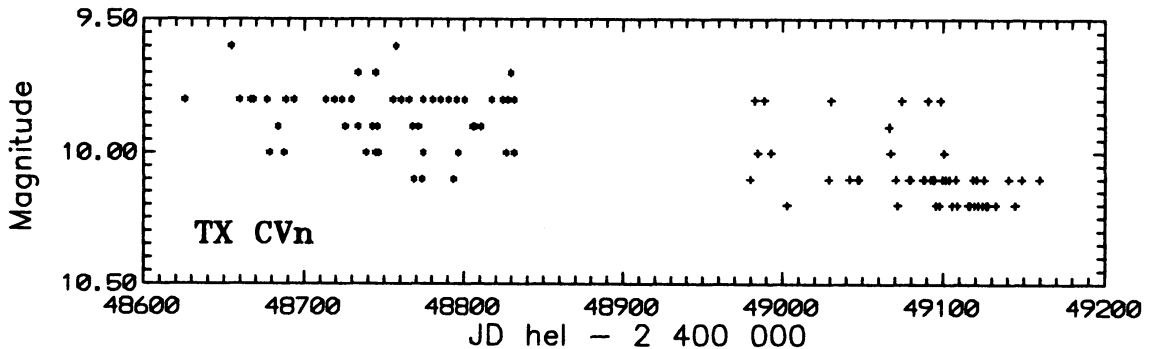


Figure 7. Visual observations of TX CVn

3.6. T Coronae Borealis

T CrB was observed photoelectrically on 8 nights. The standard stars S_1 , S_2 , S_3 are the same as used in Paper II. The observations are given in Table 7. The period analysis of the data published in Papers II to V shows a periodicity of 114.4 days in the V band. This is very close to half the orbital period of 227.8 days. The phase diagram of the V data according to ephemeris $JD_{min} = 2435571 + 227.8 \times E$ (Paper II) is given in Figure 9. The double wave is clearly visible in the V-band, less significant in the B-band and absent in the U-band. This behaviour confirms the presence of a tidal ellipsoidal deformation of the M giant in agreement with the conclusion of Bailey (1975).

Table 7. Photoelectric observations of T CrB

Date	JD			U	B	V	Obs
	2 44. ...						
Feb 8, 93	49026.582			13.158	11.753	10.252	SP
Feb 16, 93	49034.594			12.177	11.448	10.031	SP
Mar 4, 93	49050.543			11.846	11.355	9.965	SP
Apr 20, 93	49098.436			11.273	11.222	10.053	SP
May 17, 93	49125.409			12.151	11.744	10.350	SP
Jun 16, 93	49155.373			-	10.920	9.133	K
Jun 16, 93	49155.365			-	10.934	9.147	K
Jun 19, 93	49158.342			-	10.708	9.078	K
Jun 19, 93	49158.356			-	10.815	9.081	K
Sep 18, 93	49249.295			11.728	11.530	10.219	SP

Observatory: SP - Skalnaté Pleso, K - Kryonerion

Table 8. Photographic observations of T CrB

Date	JD _{hel}		mag	Date	JD _{hel}		mag
	2 44. ...				2 44. ...		
Jan 30, 93	9017.656	9.40		Apr 17, 93	9095.387	9.85	
Jan 30, 93	9017.663	9.91		Apr 17, 93	9095.455	9.73	
Jan 30, 93	9017.677	10.14		May 14, 93	9122.379	9.93	
Mar 20, 93	9066.592	9.82		May 14, 93	9122.393	9.76	
Apr 10, 93	9088.414	9.86		May 14, 93	9122.419	10.00	
Apr 10, 93	9088.428	9.87					

Observer: Velić

Band: 570–650 nm

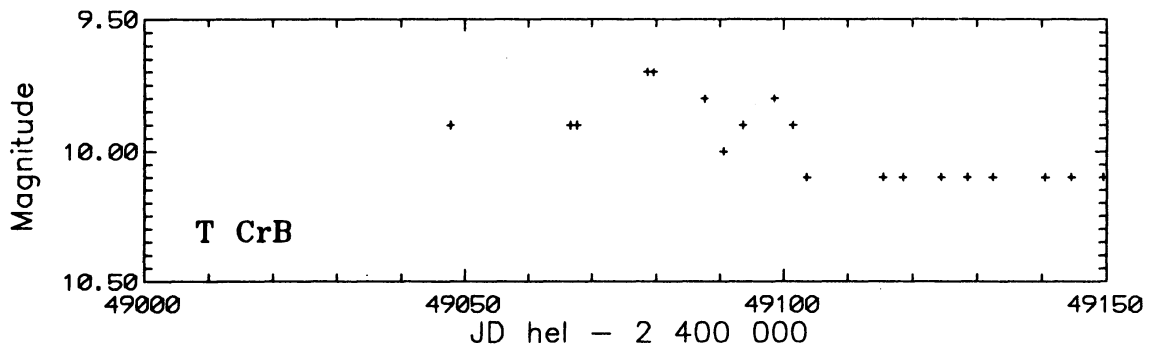


Figure 8. Visual observations of T CrB

The photographic observations are compiled in Table 8.

The visual observations are shown in Figure 8. The time of the maximum light and the decrease to minimum agrees with the ephemeris given above.

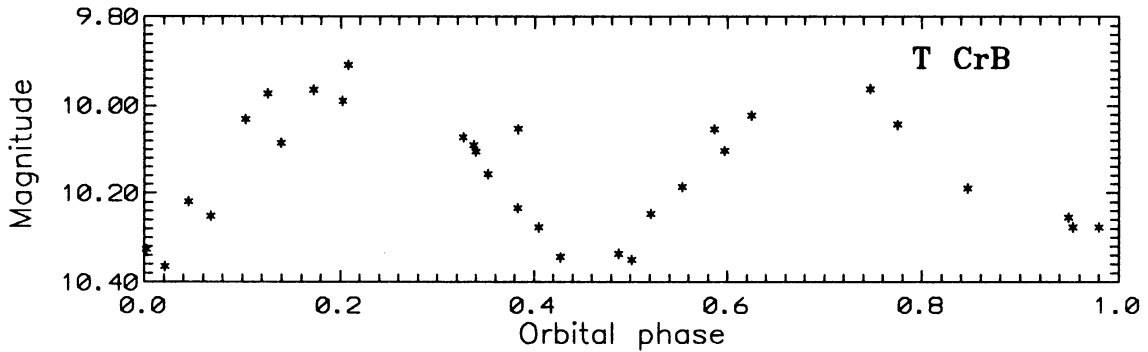


Figure 9. Phase diagram for photoelectric the V data of T CrB

3.7. BF Cygni

The photoelectric observations were made on 9 nights. The standard stars S_1 , S_2 , S_3 are the same as used in Paper III. The results are given in Table 9. The observations cover the descending branch of the light curve and the primary minimum which is in agreement with the ephemeris published in Paper III: $JD_{min} = 2448444 + 759 \times E$.

Table 9. Photoelectric observations of BF Cyg

Date	JD_{hel} 2 44. ...	U	B	V	Obs
Nov 10, 92	8937.208	10.993	11.756	11.270	SP
Feb 14, 93	9032.682	11.257	11.990	11.752	SP
May 14, 93	9121.529	11.627	11.376	11.043	SL
May 18, 93	9125.558	11.502	11.990	12.067	SP
Jun 19, 93	9158.493	12.006	12.436	12.172	SP
Jul 1, 93	9170.436	12.091	12.688	12.405	SP
Jul 8, 93	9177.431	12.166	12.480	12.120	SP
Sep 19, 93	9250.329	12.005	12.216	11.903	SP
Sep 29, 93	9260.374	12.186	12.480	11.657	SP

Observatory: SP - Skalnaté Pleso, SL - Stará Lesná

The visual photometry of BF Cyg is illustrated in Figure 10.

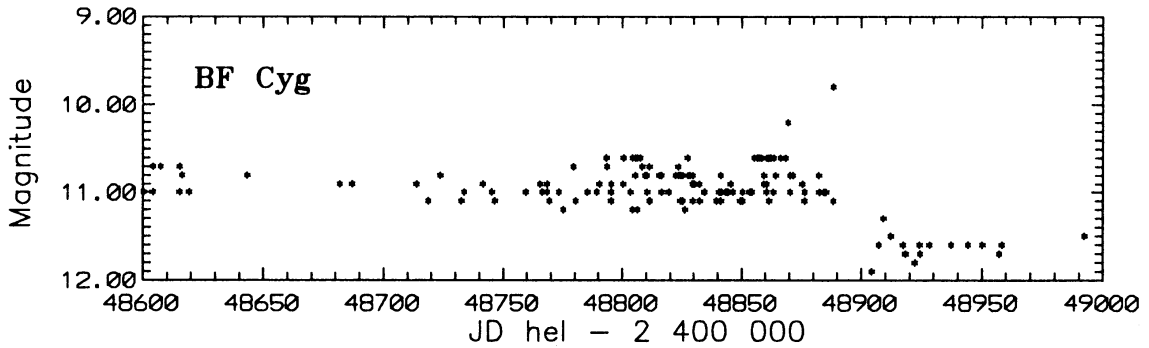


Figure 10. Visual observations of BF Cyg

3.8. CH Cygni

This star was observed photoelectrically on 41 nights. The standard stars S_1 , S_2 , S_3 are the same as used in Paper II and S_4 is the same as in Paper III. The results are compiled in Table 10 and shown in Figure 11. The continuous increase in the star's brightness and its irregular variations (amplitude ~ 1 mag), mainly in the U-band, were detected. Our observations indicate the continuation of the current outburst of CH Cyg.

The visual observations (Figure 12) also show a long-term increase in the star's brightness.

Table 10. Photoelectric observations of CH Cyg

Date	JD	U	B	V	Obs
	2 44. ...				
Sep 21, 92	48887.300	9.152	9.339	8.246	B2
Sep 26, 92	48892.340	10.172	9.906	8.469	B2
Sep 27, 92	48893.260	10.290	9.997	8.494	B2
Oct 8, 92	48904.270	9.784	9.723	8.409	B2
Dec 23, 92	48980.250	8.184	8.944	8.014	SP
Dec 29, 92	48986.199	8.025	8.874	7.956	SL
Jan 2, 93	48990.227	8.363	9.082	8.084	SP
Jan 31, 93	49018.690	8.455	8.981	7.963	SP
Feb 5, 93	49023.639	9.029	9.269	8.090	SP
Feb 16, 93	49034.630	8.552	9.054	8.056	SP
Feb 17, 93	49035.590	8.804	9.218	8.134	SP
Mar 4, 93	49050.584	8.507	9.146	8.133	SP
Mar 14, 93	49060.540	8.061	8.922	8.042	SP
Apr 10, 93	49088.493	7.807	8.723	7.990	SP
Apr 17, 93	49095.485	7.551	8.490	7.825	SP
Apr 21, 93	49098.520	7.993	8.754	8.003	B2
Apr 25, 93	49102.530	8.119	8.882	8.069	B2
Apr 26, 93	49104.431	8.062	9.043	8.106	SP
Apr 27, 93	49104.550	7.961	8.719	7.984	B2
May 9, 93	49117.401	8.272	9.032	8.053	SL
May 12, 93	49119.500	8.421	9.016	7.996	B2
May 14, 93	49121.500	8.889	9.254	8.093	B2
May 17, 93	49125.453	8.586	9.102	8.010	SP
May 18, 93	49125.510	8.716	9.007	7.949	B2
May 20, 93	49128.470	7.860	8.488	7.646	B2
Jun 1, 93	49140.399	7.568	8.394	7.689	SP
Jun 9, 93	49148.450	7.944	8.684	7.841	B2
Jun 9, 93	49148.482	7.645	8.678	7.850	SL
Jun 10, 93	49149.410	7.901	8.825	7.927	SP
Jun 11, 93	49149.503	7.736	8.770	7.902	SL
Jun 14, 93	49153.450	7.564	8.586	7.823	SP
Jun 19, 93	49158.441	7.544	8.536	7.821	SP
Jun 23, 93	49161.511	7.855	8.763	7.966	SP
Jul 1, 93	49170.358	8.354	9.215	8.122	SP
Jul 7, 93	49176.330	-	9.560	8.030	K
Jul 8, 93	49177.360	8.289	9.177	8.130	SP
Jul 30, 93	49199.430	7.863	8.546	7.738	B2
Aug 16, 93	49216.433	7.777	8.778	7.884	SL
Aug 22, 93	49222.325	7.594	8.575	7.878	SP
Sep 2, 93	49233.450	7.656	8.661	7.895	SP
Sep 19, 93	49250.456	7.746	8.750	8.017	SP
Sep 27, 93	49258.452	7.968	8.945	8.095	SP
Sep 30, 93	49261.497	8.190	9.120	8.187	SP

Observatory: SP - Skalnaté Pleso, SL - Stará Lesná,
B2 - Brno University, K - Kryonerion

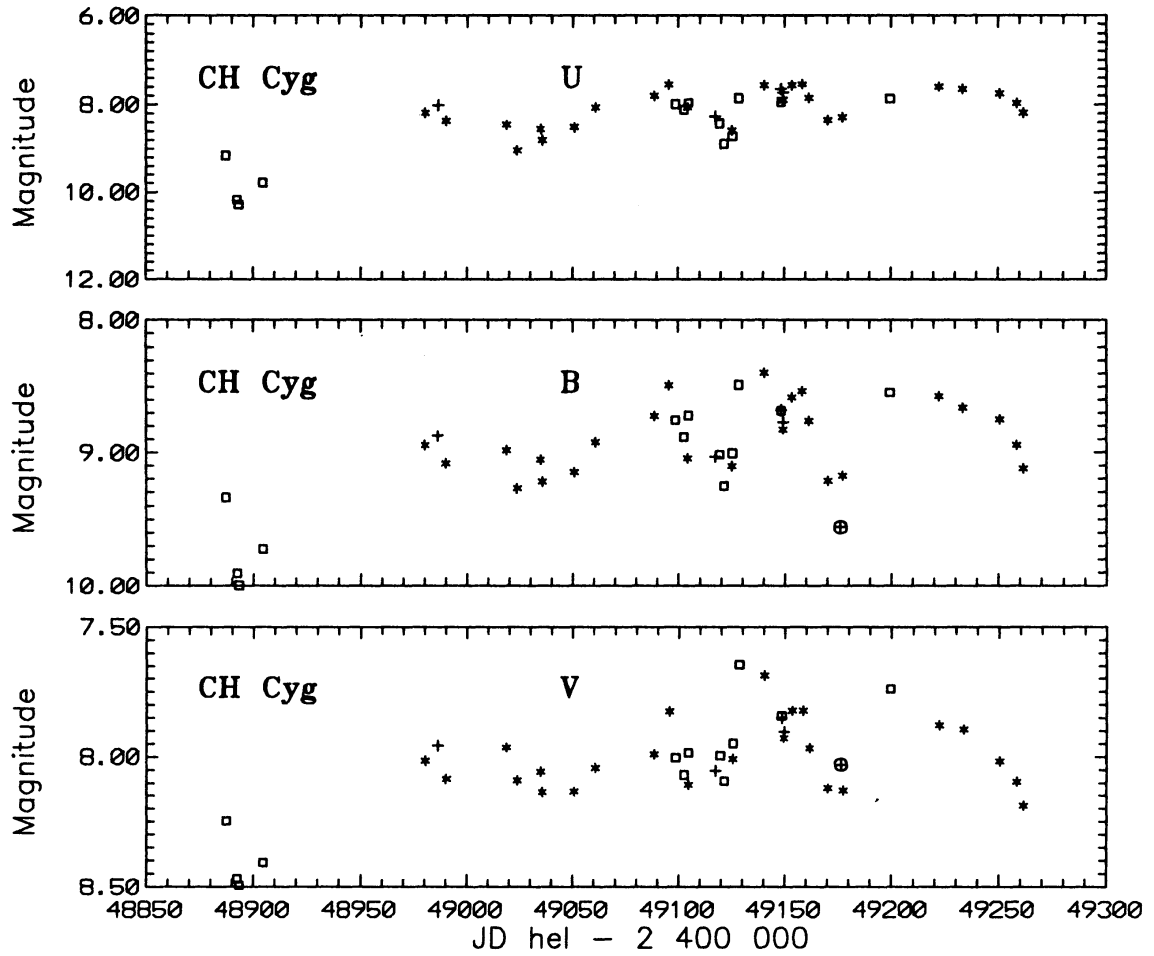


Figure 11. Photoelectric observations of CH Cyg

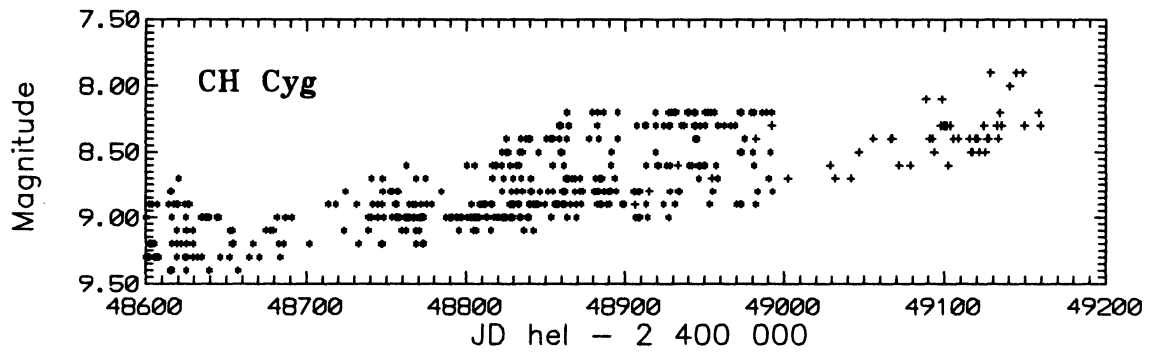


Figure 12. Visual observations of CH Cyg

3.9. CI Cygni

The visual observations of CI Cyg which cover the primary minimum are plotted in Figure 13. The position of the primary minimum agrees with the ephemeris given by Whitney (see Aller, 1954): $JD_{min} = 2411902 + 855.^d25 E$.

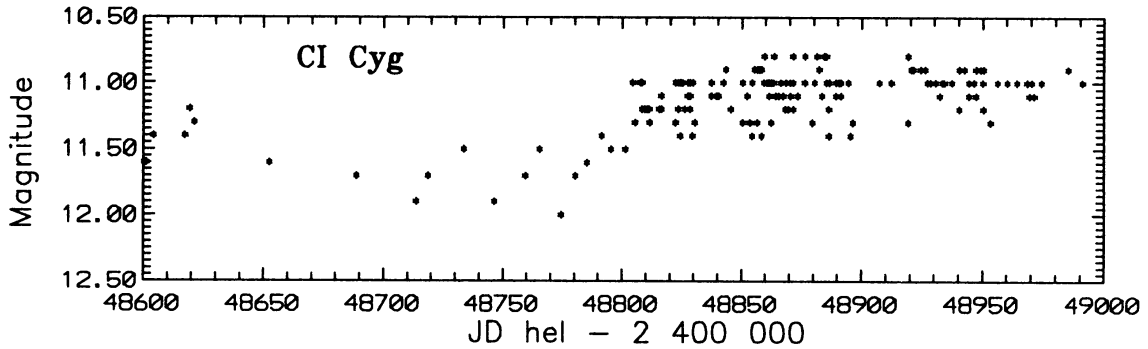


Figure 13. Visual observations of CI Cyg

3.10. V 1016 Cygni

The photoelectric measurements of this star were made on 8 nights. The standard stars S_1 , S_2 , S_3 are the same as used in Paper III. The results are compiled in Table 11. The long-term photoelectric observations published in Papers II – V are shown in Figure 14. The observed maximum in the U-light resembles the light curve in the period 1978–1984 published by Taranova & Yudin (1986). This could be connected with the long-term orbital period (~ 13 –14 years) which is also discernible in the visual observations (Paper III).

Table 11. Photoelectric observations of V1016 Cyg

Date	JD			U	B	V	Obs
	2	44.	...				
Dec 15, 92	48972.217	-	11.344	-	-	-	SP
Dec 22, 92	48979.208	10.402	11.449	10.838	11.075	11.157	SP
Feb 8, 93	49026.672	10.472	11.475	11.075	11.228	11.104	SP
Mar 14, 93	49060.634	10.454	11.436	11.228	11.058	11.157	SP
May 18, 93	49125.507	10.551	11.332	11.058	11.104	11.157	SP
Jun 10, 93	49149.449	10.539	11.341	11.104	11.157	11.083	SP
Jul 2, 93	49171.417	10.560	11.350	11.157	11.083	11.083	SP
Sep 19, 93	49250.370	10.522	11.362	11.063	11.083	11.083	SP
Sep 30, 93	49261.445	10.455	11.460	11.083	11.083	11.083	SP

Observatory: SP - Skalnaté Pleso

The photographic observations at observatories Crimea and Odessa were made on 218 nights from September 1958 to July 1987. They are displayed in Figure 15. The outburst of the star in 1966 is clearly visible. The large scatter of the data cannot be explained by observational errors only, therefore, we cannot exclude the possibility that these variations also correspond to physical processes in the V 1016 Cyg system.

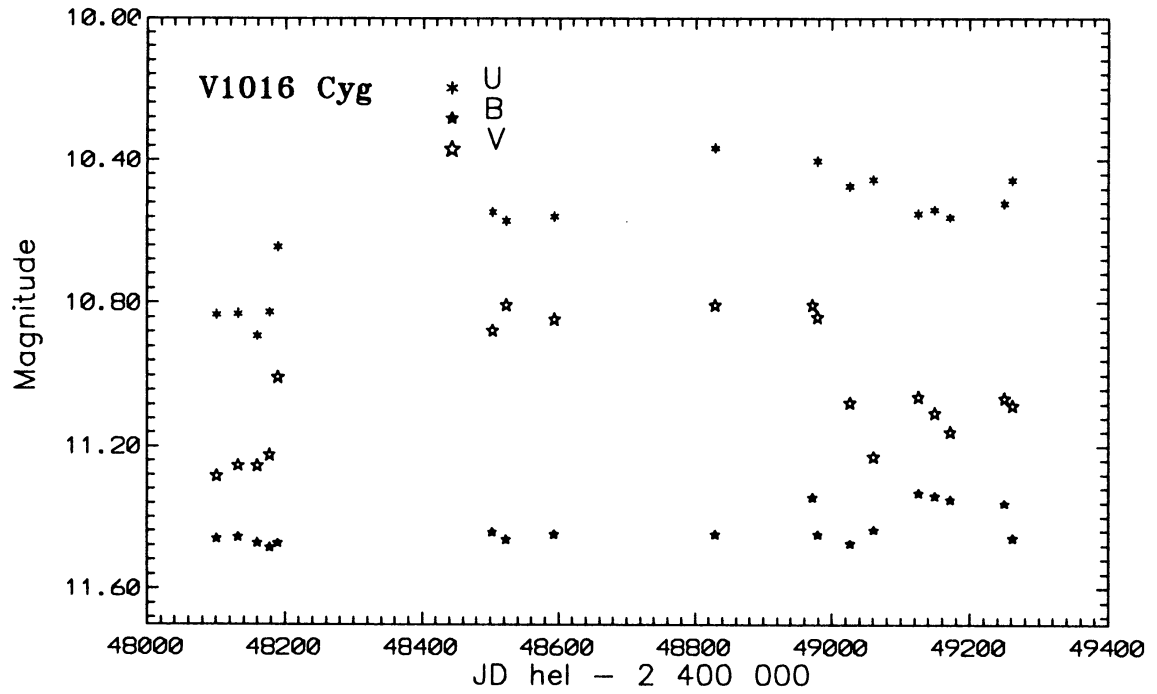


Figure 14. Photoelectric observations of V 1016 Cyg

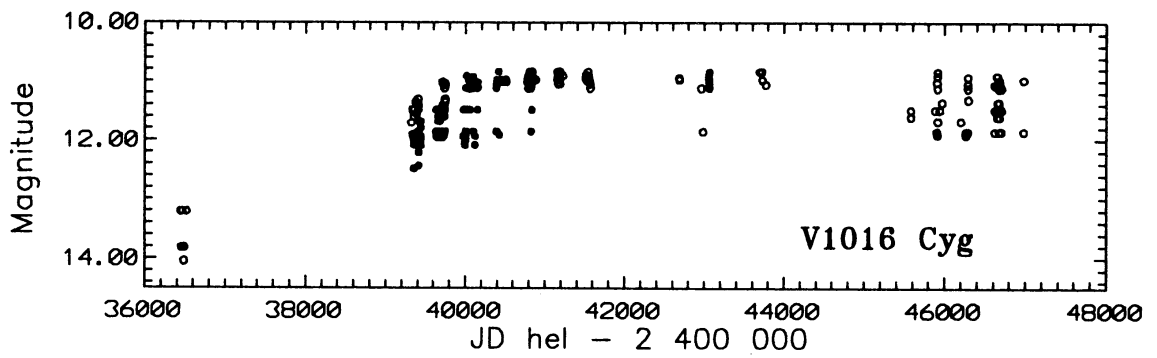


Figure 15. Photographic observations of V 1016 Cyg

Table 12. Photographic observations of V 1016 Cyg

JD _{hel} 2 43. ...	mag	Obs	JD _{hel} 2 43. ...	mag	Obs	JD _{hel} 2 4. ...	mag	Obs	JD _{hel} 2 44. ...	mag	Obs
6451.344	13.21	○	9415.294	12.09	○	39710.429	11.02	○	0387.472	11.12	○
6453.367	13.21	○	9415.328	12.01	○	39711.411	11.49	○	0390.469	10.98	○
6454.382	13.82	○	9416.229	12.09	○	39711.443	11.97	○	0392.505	11.86	○
6455.393	13.82	○	9416.243	12.01	○	39711.476	11.94	○	0413.503	10.84	○
6462.347	13.82	○	9416.263	12.09	○	39733.347	11.49	○	0425.439	10.98	○
6463.341	13.21	○	9416.298	11.97	○	39734.357	11.12	○	0427.438	11.92	○
6465.344	13.21	○	9418.237	11.97	○	39734.387	11.86	○	0479.299	10.98	○
6478.236	13.82	○	9418.270	12.22	○	39734.423	11.86	○	0480.297	11.02	○
6479.268	13.82	○	9418.305	11.94	○	39735.339	11.92	○	0505.237	11.02	○
6482.247	13.82	○	9418.335	12.01	○	39735.372	11.86	○	0509.250	10.98	○
6483.262	14.05	○	9418.370	12.22	○	39735.408	11.86	○	0769.433	10.98	○
6484.295	13.82	○	9419.333	12.09	○	39737.290	11.61	○	0769.469	11.02	○
6488.285	13.82	○	9419.367	12.01	○	39737.338	11.12	○	0774.427	10.98	○
6490.263	13.82	○	9434.189	12.03	○	39739.408	11.49	○	0774.460	10.93	○
6518.197	13.21	○	9434.222	12.01	○	39739.441	11.86	○	0779.420	11.12	○
9319.432	11.71	○	9434.255	11.97	○	39741.337	11.36	○	0779.454	11.12	○
9330.464	11.91	○	9435.189	11.94	○	39742.276	11.49	○	0793.413	11.02	○
9331.436	11.49	○	9435.275	11.97	○	39742.311	11.86	○	0794.384	11.01	○
9351.381	11.61	○	9437.234	11.80	○	39742.347	11.06	○	0797.421	11.12	○
9352.328	12.49	○	9437.267	11.69	○	39743.361	11.31	○	0798.407	10.91	○
9352.418	11.97	○	9441.185	11.97	○	39744.363	11.05	○	0800.480	10.84	○
9352.457	11.97	○	9441.218	11.94	○	39970.549	11.94	○	0801.410	11.12	○
9352.494	12.01	○	9441.250	12.09	○	39975.524	11.49	○	0802.382	10.98	○
9352.529	12.09	○	9443.238	12.09	○	39994.417	12.09	○	0803.446	10.91	○
9354.390	11.49	○	9443.271	11.97	○	39994.441	12.03	○	0806.443	11.05	○
9360.379	11.92	○	9626.523	11.49	○	39999.440	11.86	○	0807.399	10.84	○
9363.393	12.01	○	9627.502	11.86	○	39999.465	11.94	○	0807.483	10.84	○
9376.323	11.36	○	9628.486	11.94	○	40000.461	12.01	○	0808.381	10.93	○
9384.289	11.56	○	9646.377	11.86	○	40000.483	11.97	○	0809.431	10.90	○
9404.227	11.31	○	9646.413	11.97	○	40004.431	11.12	○	0809.505	10.98	○
9406.232	11.86	○	9647.371	11.92	○	40004.454	11.94	○	0810.498	10.93	○
9407.231	11.49	○	9647.403	11.97	○	40007.448	11.86	○	0823.265	11.86	○
9408.228	11.31	○	9653.375	11.61	○	40007.472	11.12	○	0826.533	11.12	○
9408.282	12.09	○	9653.407	11.86	○	40007.495	11.49	○	0827.331	11.02	○
9408.319	11.94	○	9655.444	11.69	○	40013.512	10.91	○	0828.354	10.93	○
9408.357	11.97	○	9671.379	11.61	○	40036.406	10.98	○	0828.359	10.98	○
9409.323	12.09	○	9671.411	11.49	○	40037.334	11.12	○	0828.392	10.98	○
9409.357	12.01	○	9675.383	11.86	○	40056.477	11.49	○	0829.382	10.90	○
9409.391	12.22	○	9675.415	11.86	○	40059.419	11.12	○	0834.459	11.49	○
9410.237	11.42	○	9676.427	11.87	○	40060.525	11.02	○	0837.346	10.84	○
9410.346	11.98	○	9677.373	11.50	○	40062.458	11.02	○	0838.346	10.95	○
9411.211	12.44	○	9677.405	11.69	○	40064.517	11.12	○	0853.260	10.98	○
9412.208	11.87	○	9684.422	11.94	○	40094.377	10.93	○	0881.224	10.98	○
9412.241	12.03	○	9684.454	11.86	○	40095.477	11.12	○	1150.395	10.84	○
9412.274	11.98	○	9704.394	11.58	○	40096.504	11.86	○	1152.446	10.98	○
9412.310	11.69	○	9704.458	11.41	○	40117.285	11.05	○	1158.393	10.91	○
9412.343	11.87	○	9705.371	11.92	○	40118.308	12.09	○	1163.421	10.95	○
9414.205	11.91	○	9705.408	11.92	○	40121.307	11.06	○	1164.394	11.05	○
9414.242	11.94	○	9708.414	11.50	○	40123.314	11.94	○	1165.420	10.91	○
9414.278	11.94	○	9708.477	11.58	○	40145.351	11.12	○	1180.386	10.98	○
9414.316	11.97	○	9708.509	11.58	○	40151.280	11.49	○	1182.381	10.91	○
9414.351	11.97	○	9709.368	11.94	○	40152.274	11.12	○	1185.340	11.05	○
9415.197	11.97	○	9709.402	11.94	○	40156.367	11.02	○	1186.365	10.84	○
9415.230	11.95	○	9709.436	11.92	○	40386.484	11.05	○	1219.272	10.91	○
9415.262	11.94	○	9709.470	11.86	○	40387.450	11.86	○	1512.457	10.93	○

Table 12. – continued

JD _{hel} 2 44. ...	mag	Obs	JD _{hel} 2 44. ...	mag	Obs	JD _{hel} 2 44. ...	mag	Obs	JD _{hel} 2 44. ...	mag	Obs
1513.485	10.90	○	3694.455	10.84	○	5969.292	11.36	○	6656.390	10.91	○
1515.479	10.98	○	3717.399	10.84	○	6202.526	11.68	○	6669.319	11.12	○
1537.407	10.84	○	3719.397	10.84	○	6261.452	11.90	○	6671.333	11.06	○
1543.407	10.91	○	3723.393	10.84	○	6263.438	11.92	○	6672.304	11.02	○
1544.381	11.01	○	3729.395	10.98	○	6265.440	11.86	○	6673.273	11.36	○
1545.392	10.98	○	3773.258	11.06	○	6271.428	11.86	○	6674.369	11.86	○
1561.313	11.01	○	5581.301	11.61	○	6288.374	11.86	○	6675.388	11.49	○
1564.354	11.05	○	5582.304	11.49	○	6289.387	10.93	○	6678.333	10.98	○
1568.345	11.12	○	5583.281	11.61	○	6290.364	11.12	○	6680.334	11.61	○
2687.254	10.95	○	5882.483	11.49	○	6291.331	11.05	○	6681.319	11.02	○
2688.246	10.98	○	5902.403	11.86	○	6294.337	11.31	○	6682.318	11.12	○
2961.494	11.12	○	5903.382	11.86	○	6618.462	11.06	○	6683.420	11.49	○
2982.447	11.86	○	5907.402	11.02	○	6619.459	11.49	○	6702.263	11.86	○
3049.349	10.98	○	5909.404	11.91	○	6620.489	11.86	○	6709.240	11.49	○
3050.325	10.93	○	5911.395	10.91	○	6649.418	10.91	○	6710.267	11.12	○
3063.239	11.05	○	5912.394	11.12	○	6652.372	11.61	○	6978.466	11.86	○
3064.259	11.12	○	5914.401	10.84	○	6653.366	11.05	○	6979.464	10.98	○
3065.262	10.98	○	5916.371	11.68	○	6654.382	11.49	○			
3066.244	10.84	○	5941.310	11.49	○	6655.387	11.36	○			

Observatory: ○ = Crimea
○ = Odessa

3.11. V 1329 Cygni

Only the long-term photographic observations, made from August, 1955 to July 1993 were available for this star. All observations are summarized in Tables 13, 14 and 15. All the observations except the 1955 data and the V observations from Table 13 are displayed in Figure 16. The minima in the star's brightness agree with the ephemeris derived by Hric et al. (1993): $JD_{min} = 2446784.862 (\pm 2.4) + 963^d.306 (\pm 0.772)E$.

Table 13. Photographic observations of V 1329 Cyg

Date	JD _{hel} 2 44. ...	V	Date	JD _{hel} 2 44. ...	B
Aug 10, 83	5557.4806	12.90	Jun 24, 91	8431.5271	13.94
Jul 06, 83	5614.3396	12.90	Aug 09, 91	8478.3125	13.99
Jul 01, 87	6978.3833	13.30	Sep 12, 91	8512.3250	14.22
Jul 25, 87	7002.3486	13.01	Sep 15, 91	8515.3403	14.18
Aug 10, 88	7384.4319	12.70	Nov 02, 91	8563.2111	14.22
Aug 11, 88	7385.4146	12.71	Jan 08, 92	8630.2132	14.67
Mar 13, 91	8329.5694	12.42	May 11, 92	8753.5535	14.42
Apr 19, 91	8366.4958	12.88	May 12, 92	8754.5361	14.78
Aug 09, 91	8478.3278	13.14	Aug 22, 92	8857.3049	14.03
Sep 12, 91	8512.3375	13.24	Aug 26, 92	8861.2917	14.29
Nov 02, 91	8563.2257	13.37	Aug 27, 92	8862.2847	14.06
May 11, 92	8753.5417	13.35	Jun 10, 93	9149.3396	13.3
May 12, 92	8754.5486	13.61	Jun 13, 93	9152.3438	13.5
Jul 21, 92	8825.3389	13.16	Jul 15, 93	9184.3547	13.6
Aug 26, 92	8861.3035	13.04			
Aug 27, 92	8862.2965	13.14			
Jun 10, 93	9149.3335	12.8			
Jul 15, 93	9184.3688	12.9			

Observer: Tsvetkova & Semkov (Bulgaria)
B mag: Kodak 103aO- or ORWO ZU 21 plus GG13 filter
V mag: Kodak 11aD plus GG11 filter

Table 14. Photographic observations of V 1329 Cyg

Date	JD _{hel} 2 44. ...	mag	Date	JD _{hel} 2 44. ...	mag	Date	JD _{hel} 2 44. ...	mag
Sep 13, 79	4130.455	13.710	Sep 18, 82	5231.374	13.230	Jul 31, 86	6643.403	14.220
Oct 25, 79	4172.266	13.700	Oct 15, 82	5258.372	13.210	Aug 10, 86	6653.446	14.220
Oct 26, 79	4173.316	13.620	Nov 11, 82	5285.220	13.150	Sep 8, 86	6682.325	14.390
Dec 13, 79	4221.285	13.490	Dec 5, 82	5309.205	13.430	Oct 1, 86	6705.391	14.320
Mar 25, 80	4323.622	13.240	Jan 12, 83	5346.690	13.680	Oct 29, 86	6733.266	14.520
Apr 18, 80	4347.533	13.240	Mar 13, 83	5406.623	13.390	Nov 26, 86	6761.212	14.360
May 20, 80	4380.441	13.160	Apr 5, 83	5429.573	13.600	Apr 25, 87	6910.505	14.440
Jun 13, 80	4404.476	12.980	Apr 18, 83	5442.571	13.460	May 27, 87	6943.402	14.060
Jun 15, 80	4405.503	13.030	May 14, 83	5469.400	13.480	Jun 25, 87	6972.398	13.990
Jul 7, 80	4428.417	12.910	May 30, 83	5485.393	13.410	Aug 22, 87	7030.448	13.770
Aug 17, 80	4468.549	13.020	Jul 16, 83	5532.390	13.570	Nov 22, 87	7122.272	13.580
Aug 17, 80	4469.390	13.060	Aug 15, 83	5562.380	13.780	Dec 12, 87	7142.308	13.410
Sep 3, 80	4486.441	13.110	Sep 1, 83	5579.348	13.780	Apr 18, 88	7270.457	13.220
Sep 16, 80	4499.304	13.180	Sep 27, 83	5605.259	14.090	Jul 12, 88	7354.510	13.300
Nov 2, 80	4546.247	13.390	Nov 2, 83	5641.314	14.100	Aug 6, 88	7380.465	13.510
Nov 8, 80	4552.242	13.530	Dec 27, 83	5696.214	14.460	Aug 20, 88	7393.507	13.460
Dec 3, 80	4577.297	13.570	Jul 30, 84	5912.406	14.600	Oct 5, 88	7440.425	13.750
Dec 29, 80	4603.232	13.560	Aug 23, 84	5935.521	14.860	Nov 9, 88	7475.355	13.790
Apr 6, 81	4701.458	13.910	Dec 15, 84	6050.238	14.360	Jul 7, 89	7715.418	14.320
Jun 27, 81	4783.401	14.460	Mar 27, 85	6151.533	14.030	Aug 26, 89	7765.366	14.560
Jul 31, 81	4817.486	14.310	Jun 19, 85	6236.495	13.290	Dec 27, 89	7888.198	14.290
Sep 7, 81	4855.390	14.480	Jul 29, 85	6275.505	13.070	May 23, 90	8035.436	13.770
Sep 24, 81	4872.474	14.550	Aug 14, 85	6292.375	13.030	Jul 22, 90	8095.459	13.430
Nov 17, 81	4926.335	14.050	Aug 21, 85	6299.357	13.180	Sep 20, 90	8155.294	13.490
Feb 25, 82	5025.606	14.170	Oct 6, 85	6345.317	13.260	Oct 17, 90	8182.252	13.480
Apr 1, 82	5060.504	14.210	Mar 19, 86	6508.595	13.810	Nov 14, 90	8210.340	13.330
Apr 16, 82	5076.463	14.050	May 2, 86	6553.477	13.900	Dec 13, 90	8239.217	13.440
May 17, 82	5106.523	13.680	Jun 2, 86	6584.470	14.250	May 8, 91	8385.485	13.790
Jul 15, 82	5166.431	13.420	Jun 15, 86	6597.491	14.350	Jun 9, 91	8417.382	13.930
Aug 18, 82	5200.437	13.400	Jul 2, 86	6614.464	14.140	Jul 7, 91	8445.397	13.880

Observatory: Skalnaté Pleso

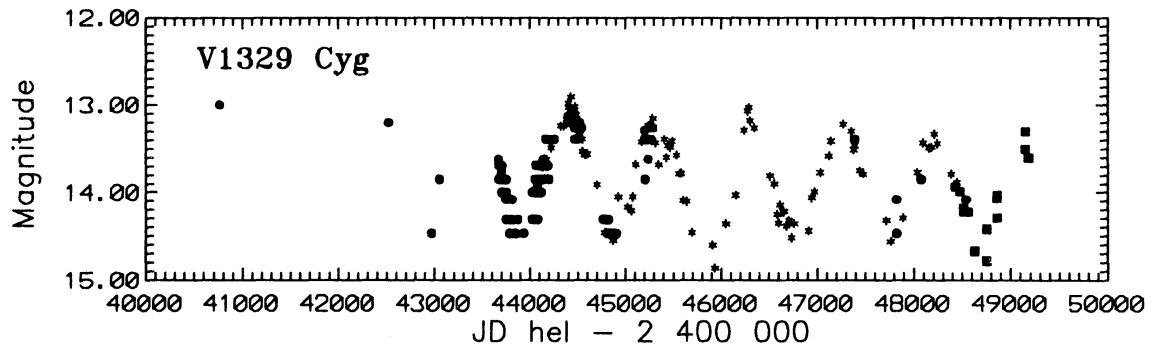


Figure 16. Photographic observations of V 1329 Cyg

Table 15. Photographic observations of V 1329 Cyg

Date	JD _{hel} 2 4... ..	mag	Date	JD _{hel} 2 4... ..	mag	Date	JD _{hel} 2 4... ..	mag
Aug 18, 55	35338.420	14.47	Jul 21, 79	44076.449	13.94	Oct 10, 80	44523.349	13.26
Aug 22, 55	35342.361	14.47	Jul 22, 79	44077.394	13.85	Oct 13, 80	44526.321	13.26
Jun 27, 70	40765.429	13.00	Jul 22, 79	44077.426	14.31	Oct 29, 80	44542.255	13.26
Apr 16, 75	42518.567	13.20	Jul 26, 79	44081.484	13.69	Jun 8, 81	44764.489	14.31
Jul 10, 76	42969.507	14.47	Jul 27, 79	44082.415	14.31	Jun 9, 81	44765.469	14.31
Sep 29, 76	43051.345	13.85	Aug 1, 79	44087.441	14.00	Jun 30, 81	44786.468	14.31
Jun 9, 78	43669.495	13.69	Aug 2, 79	44088.469	13.85	Jul 26, 81	44812.433	14.47
Jun 10, 78	43670.453	13.85	Aug 17, 79	44103.385	13.69	Jul 27, 81	44813.464	14.47
Jun 11, 78	43671.443	13.62	Aug 19, 79	44105.410	13.69	Jul 29, 81	44815.457	14.47
Jun 12, 78	43672.483	13.85	Aug 21, 79	44107.416	13.85	Jul 30, 81	44816.451	14.47
Jun 14, 78	43674.448	13.69	Aug 24, 79	44110.386	13.85	Aug 1, 81	44818.451	14.31
Jul 1, 78	43691.454	13.69	Aug 26, 79	44112.417	13.85	Aug 2, 81	44819.431	14.31
Jul 4, 78	43694.471	13.85	Aug 31, 79	44117.461	13.85	Aug 4, 81	44821.372	14.31
Jul 5, 78	43694.501	13.85	Sep 2, 79	44119.483	14.00	Aug 5, 81	44822.457	14.31
Jul 5, 78	43695.485	13.69	Sep 13, 79	44130.373	13.69	Aug 6, 81	44823.412	14.47
Jul 6, 78	43696.456	13.69	Sep 19, 79	44136.418	13.85	Aug 7, 81	44824.412	14.47
Jul 7, 78	43697.454	13.76	Sep 20, 79	44137.432	13.85	Aug 8, 81	44825.406	14.47
Jul 8, 78	43698.459	13.69	Sep 22, 79	44139.433	13.69	Aug 9, 81	44826.415	14.47
Jul 10, 78	43700.446	14.00	Sep 23, 79	44140.417	13.62	Aug 22, 81	44839.445	14.47
Jul 11, 78	43701.452	13.85	Sep 24, 79	44141.410	13.69	Sep 1, 81	44849.467	14.47
Jul 13, 78	43703.437	13.69	Sep 25, 79	44142.406	13.85	Sep 2, 81	44850.433	14.47
Jul 16, 78	43705.504	14.00	Sep 26, 79	44143.408	13.85	Sep 4, 81	44852.471	14.47
Jul 16, 78	43706.483	13.85	Sep 28, 79	44145.453	13.85	Sep 5, 81	44853.329	14.47
Aug 1, 78	43722.432	14.00	Sep 29, 79	44146.383	13.85	Sep 6, 81	44854.352	14.47
Aug 3, 78	43724.483	13.85	Oct 15, 79	44162.301	13.69	Sep 7, 81	44855.436	14.47
Aug 6, 78	43727.384	14.00	Oct 17, 79	44164.265	13.39	Sep 18, 81	44866.281	14.47
Aug 12, 78	43733.429	13.85	Nov 10, 79	44188.235	13.69	Sep 19, 81	44867.277	14.47
Aug 25, 78	43746.393	14.31	Nov 17, 79	44195.251	13.39	Sep 25, 81	44873.357	14.47
Aug 26, 78	43747.421	14.31	Nov 21, 79	44199.248	13.85	Sep 27, 81	44875.320	14.47
Aug 27, 78	43748.430	14.08	Jan 13, 80	44252.173	13.39	Sep 29, 81	44877.317	14.47
Aug 30, 78	43751.365	13.85	Jun 9, 80	44400.463	13.13	Oct 21, 81	44899.227	14.47
Aug 31, 78	43752.355	14.00	Jun 22, 80	44413.488	13.20	Oct 26, 81	44904.275	14.47
Sep 2, 78	43754.469	14.00	Jun 23, 80	44414.498	13.20	Oct 28, 81	44906.282	14.47
Sep 5, 78	43757.472	14.08	Jul 17, 80	44438.452	13.13	Aug 17, 82	45199.446	13.39
Sep 8, 78	43760.429	14.31	Jul 20, 80	44441.448	13.20	Aug 18, 82	45200.366	13.29
Sep 27, 78	43779.354	14.31	Jul 21, 80	44442.462	13.10	Aug 19, 82	45201.441	13.39
Oct 1, 78	43783.293	14.31	Aug 5, 80	44457.412	13.13	Aug 22, 82	45204.424	13.85
Oct 3, 78	43785.292	14.47	Aug 6, 80	44458.459	13.13	Aug 23, 82	45205.430	13.39
Oct 5, 78	43787.255	14.31	Aug 9, 80	44461.434	13.13	Sep 16, 82	45229.425	13.39
Nov 1, 78	43814.274	14.08	Aug 9, 80	44461.470	13.20	Sep 17, 82	45230.444	13.39
Nov 2, 78	43815.325	14.31	Aug 11, 80	44463.454	13.26	Sep 20, 82	45233.411	13.39
Nov 3, 78	43816.304	14.31	Aug 13, 80	44465.420	13.39	Sep 23, 82	45236.319	13.39
Dec 5, 78	43848.426	14.47	Aug 22, 80	44473.530	13.20	Sep 24, 82	45237.435	13.62
Dec 27, 78	43870.222	14.31	Sep 1, 80	44484.344	13.20	Oct 20, 82	45263.336	13.39
Mar 2, 79	43934.604	14.47	Sep 5, 80	44488.413	13.26	Oct 22, 82	45265.295	13.26
May 24, 79	44018.457	14.31	Sep 7, 80	44490.437	13.26	Nov 10, 82	45284.199	13.26
May 29, 79	44023.491	14.00	Sep 8, 80	44491.442	13.39	Aug 14, 88	47388.426	13.39
Jun 19, 79	44044.498	14.31	Sep 9, 80	44492.332	13.20	Oct 23, 89	47823.225	14.08
Jun 24, 79	44049.473	13.85	Sep 10, 80	44493.412	13.26	Oct 23, 89	47823.268	14.47
Jun 28, 79	44052.506	14.00	Sep 11, 80	44494.389	13.26	Oct 23, 89	47823.309	14.47
Jun 28, 79	44053.488	13.85	Sep 13, 80	44496.406	13.39	Oct 24, 89	47824.261	14.47
Jul 1, 79	44056.419	13.85	Oct 1, 80	44514.288	13.26	Oct 24, 89	47824.300	14.47
Jul 1, 79	44056.494	13.85	Oct 2, 80	44515.247	13.20	Jul 2, 90	48075.417	13.85
Jul 3, 79	44058.421	13.69	Oct 7, 80	44520.243	13.20	Oct 12, 91	48542.299	14.08
Jul 19, 79	44074.459	13.85	Oct 8, 80	44521.279	13.29			

Observatory: Crimea

3.12. AG Draconis

The photoelectric observations were made on 7 nights. Stars S_1 and S_2 are the same as used in Paper II. The results are summarized in Table 16. Our observations cover the maximum of brightness best visible in the U band and a part of the descending branch.

The visual brightness estimates of this star are shown in Figure 17.

Table 16. Photoelectric observations of AG Dra

Date	JD			U	B	V	Obs
	2 44. ...						
Dec 16, 92	48972.689	-	11.165	-	-	-	SP
Dec 17, 92	48973.605	11.042	11.095	9.762	-	-	SP
Dec 31, 92	48987.616	11.064	11.130	9.769	-	-	SP
Jan 3, 93	48990.505	11.148	11.141	9.788	-	-	SP
Apr 10, 93	49088.340	11.311	11.029	9.677	-	-	SP
Apr 20, 93	49098.369	11.484	11.152	9.774	-	-	SP
Apr 26, 93	49104.324	-	11.114	9.753	-	-	SP
Jun 21, 93	49160.479	-	11.470	9.920	-	-	K
Jul 7, 93	49176.354	-	11.360	9.890	-	-	K

Observatory: SP - Skalnaté Pleso, K - Kryonerion

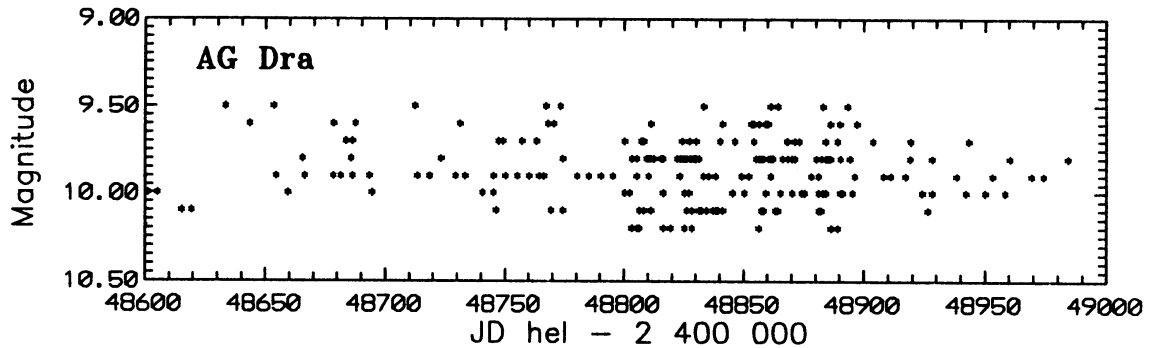


Figure 17. Visual observations of AG Dra

3.13. CQ Draconis (4 Dra)

The star was measured photoelectrically on 18 nights. The same comparison stars as described in Paper II were used. The results are compiled in Table 17. Comparison with the previous light curve development shows that, while the decrease in the B and V bands continued, in the U band an increase was detected. The rising U brightness trend is most probably connected with the orbital motion within the wide binary CQ Dra A - CQ Dra B (1703-day orbit).

Table 17. Photoelectric observations of CQ Dra

Date	JD			Obs	
	2 44. ...	U	B		V
Nov 9, 92	48935.676	8.415	6.549	4.963	SP
Dec 16, 92	48972.549	8.325	6.423	4.815	SP
Dec 17, 92	48973.675	8.322	6.436	4.818	SP
Jan 3, 93	48990.595	8.406	6.576	4.967	SP
Jan 29, 93	49016.682	8.326	6.510	4.948	SP
Jan 31, 93	49018.590	8.340	6.530	4.969	SP
Feb 5, 93	49023.593	8.323	6.539	4.976	SP
Feb 13, 93	49032.450	8.308	6.494	4.923	SP
Feb 16, 93	49035.414	8.338	6.511	4.943	SP
Mar 3, 93	49050.494	8.239	6.588	4.915	SP
Mar 13, 93	49060.495	8.373	6.481	4.906	SP
Apr 17, 93	49095.318	8.374	6.541	4.990	SP
May 13, 93	49121.474	8.232	6.532	4.947	SL
May 14, 93	49122.343	8.334	6.587	5.083	SP
Jun 22, 93	49161.482	8.304	6.717	5.130	SP
Jul 2, 93	49171.369	8.243	6.567	5.007	SP
Jul 9, 93	49178.408	8.139	6.578	5.014	SP
Sep 20, 93	49250.613	8.323	6.579	5.016	SP

Observatory: SP - Skalnaté Pleso

3.14. YY Herculis

The photoelectric measurements of this star were made on 3 nights during the recent maximum of brightness which was announced by visual observers in the IAU Circ. No. 5805 in May 1993. The standard stars S_1 and S_2 are the same as used in Paper II. The results are summarized in Table 18.

Table 18. Photoelectric observations of YY Her

Date	JD			Obs	
	2 44. ...	U	B		V
Jun 21, 93	49160.408	-	13.560	11.890	K
Jul 1, 93	49170.486	11.154	11.804	11.722	SP
Jul 7, 93	49176.388	-	13.310	11.590	K
Sep 18, 93	49249.392	11.874	12.376	11.801	SP
Sep 30, 93	49261.256	11.550	12.305	11.764	SP

Observatory: SP - Skalnaté Pleso, K - Kryonerion

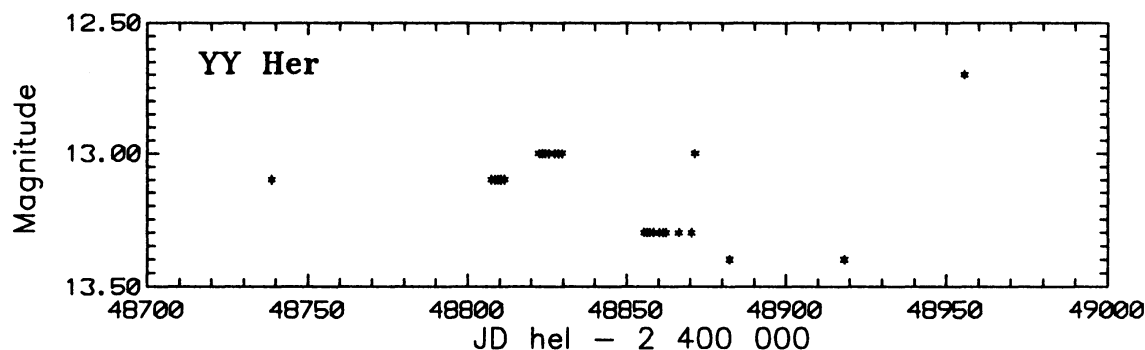


Figure 18. Visual observations of YY Her

The visual observations cover the descending branch and the minimum in the light curve (Figure 18). The long-term behaviour of the star's brightness shows that the maximum in the visual brightness also occurred in the summer of 1987 (Paper III). These two maxima could be connected with the orbital motion of the symbiotic binary system.

3.15. V 443 Herculis

The photoelectric observations of this star were carried out on 6 nights. The standard stars S_1 , S_2 are the same as used in Paper II and S_3 as in Paper III. The results are compiled in Table 19.

Table 19. Photoelectric observations of V443 Her

Date	JD			U	B	V	Obs
	2 44. ...						
Oct 19, 92	48915.260			11.890	12.383	11.403	SP
Apr 17, 93	49095.419			11.977	12.345	11.436	SP
Jun 10, 93	49149.489			11.760	12.419	11.491	SP
Jun 21, 93	49160.384			-	12.690	11.810	K
Jul 2, 93	49170.526			11.598	12.320	11.450	SP
Jul 7, 93	49176.373			-	12.660	11.920	K
Sep 19, 93	49250.282			11.525	12.290	11.398	SP
Sep 30, 93	49261.306			11.972	12.116	11.238	SP

Observatory: SP - Skalnaté Pleso, K - Kryonerion

The photographic photometry includes 5 measurements on 3 nights (Table 20).

Table 20. Photographic observations of V 443 Her

Date	JD _{hel}		mag	Date	JD _{hel}		mag
	2 44. ...				2 44. ...		
Mar 20, 93	9066.616		11.11	May 14, 93	9122.445		11.17
Apr 17, 93	9095.483		11.20	May 14, 93	9122.472		11.31
Apr 17, 93	9095.510		11.21				

Observer: Velić Band: 570-650 nm

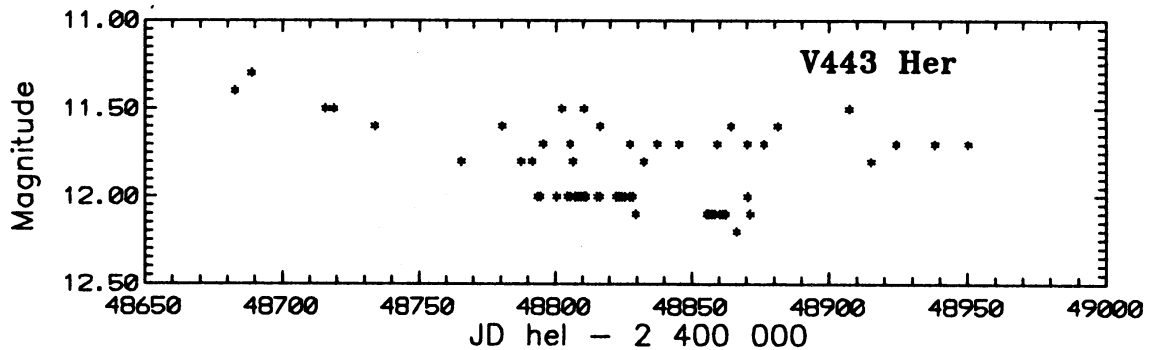


Figure 19. Visual observations of V 443 Her

The visual observations are shown in Figure 19.

3.16. SS Leporis

The visual observations are shown in Figure 20.

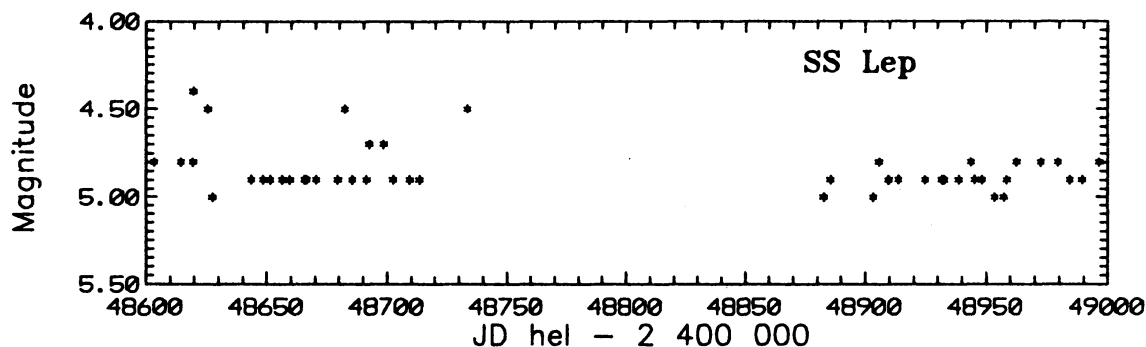


Figure 20. Visual observations of SS Lep

3.17. AG Pegasi

This star was observed photoelectrically on 2 nights. Stars S_1 , S_2 and S_3 are the same as used in Paper III. The results are in Table 21.

Only one photographic observation is given in Table 22.

Table 21. Photoelectric observations of AG Peg

Date	JD		U	B	V	Obs
	2 44. ...					
Oct 28, 92	48924.353	-	10.047	8.602	K	
Oct 30, 92	48926.439	-	10.123	8.818	K	

Observatory: K - Kryonerion

Table 22. Photographic observations of AG Peg

Date	JD _{hel}	mag
	2 44. ...	
Dec 22, 92	8979.258	8.28

Observers: Velić Band: 570–650 nm

3.18. AX Persei

The photoelectric observations of this star were made on 17 nights. The standard stars S_1 , S_2 are the same as used in Paper II and S_3 as in Paper III. The results are summarized in Table 21. The light curve covers the ascending branch of the primary minimum.

The photographic observations made on 3 nights are given in Table 24.

Table 23. Photoelectric observations of AX Per

Date	JD			Obs	
	2 44. ...	U	B		
Nov 30, 92	48957.266	12.018	12.360	11.521	SP
Dec 16, 92	48973.317	11.899	12.276	11.366	SP
Jan 2, 93	48990.350	11.801	12.180	11.253	SP
Jan 4, 93	48992.305	11.879	12.239	11.246	SL
Jan 17, 93	49005.396	11.841	12.161	11.190	SP
Jan 28, 93	49016.417	11.695	12.173	11.195	SP
Jan 30, 93	49018.271	11.710	12.062	11.120	SP
Feb 4, 93	49023.277	11.772	12.099	11.141	SP
Feb 8, 93	49027.245	11.577	12.125	11.121	SP
Feb 13, 93	49032.320	11.644	12.123	11.089	SP
Feb 16, 93	49035.310	11.550	12.081	11.057	SP
Mar 3, 93	49050.321	11.561	12.113	11.095	SP
Jun 15, 93	49153.506	11.407	11.926	11.107	SP
Jul 9, 93	49178.493	11.756	12.150	11.127	SP
Sep 20, 93	49250.538	11.760	12.141	11.230	SP
Sep 28, 93	49258.535	11.593	12.259	11.377	SP
Oct 1, 93	49261.614	11.781	12.133	11.266	SP

Observatory: SP - Skalnaté Pleso, SL - Stará Lesná

Table 24. Photographic observations of AX Per

Date	JD _{hel}	mag	Date	JD _{hel}	mag
2 44. ...			2 44. ...		
Dec 23, 92	8980.220	11.81	Mar 19, 93	9066.292	10.51
Jan 17, 93	9005.249	10.66			

Observer: Velić
Band: 570–650 nm

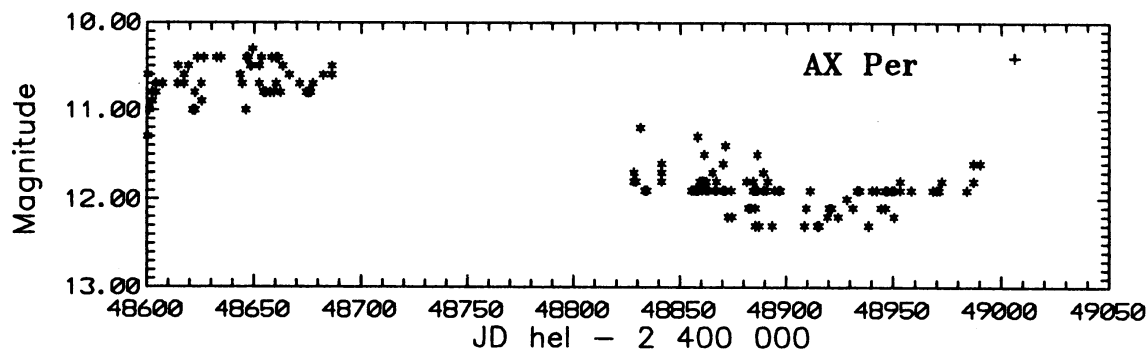


Figure 21. Visual observations of AX Per

The visual observations (Figure 21) cover the primary minimum which is in good accord with the ephemeris given in Paper III.

3.19. FG Sagittae

The star was observed photographically between June 1958 and October 1988 on 1519 plates. These data are available on request. The results are shown in Figure 22. The observations cover nearly the whole interval of the systems's activity.

New visual observations (Figure 23) show the gradual decline in the star's brightness.

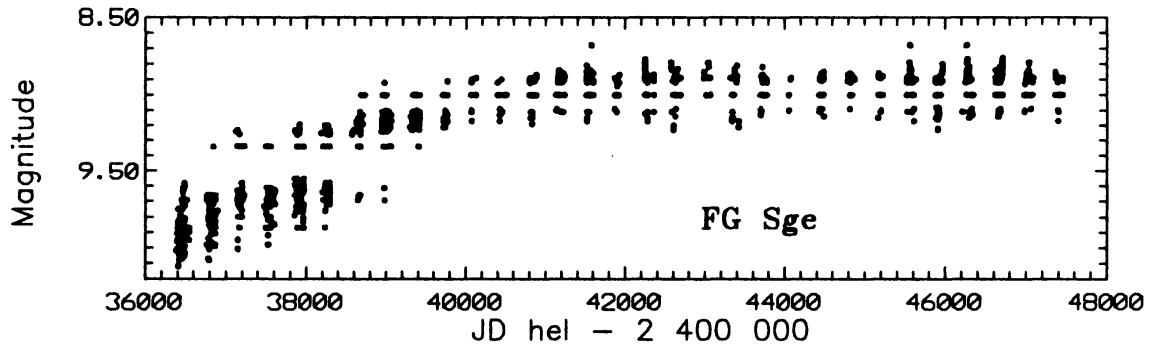


Figure 22. Photographic observations of FG Sge

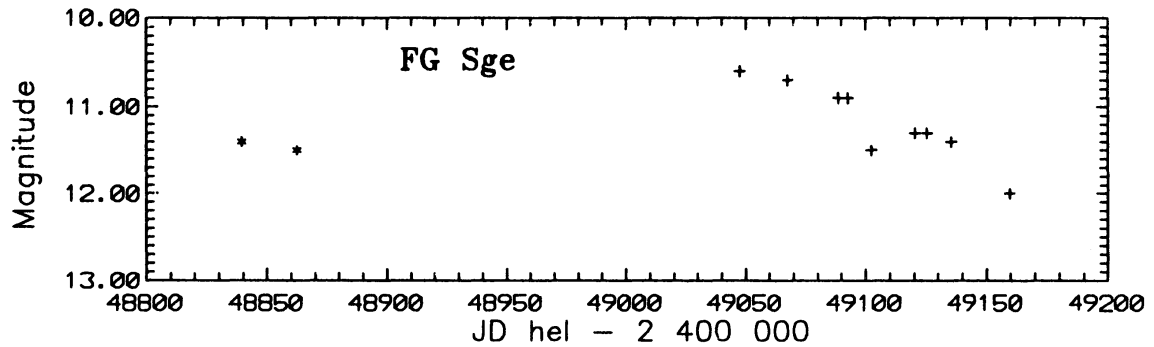


Figure 23. Visual observations of FG Sge

3.20. PU Vulpeculae

The photoelectric observations of PU Vul were obtained on 22 nights. The list of standard stars was presented in Paper II. The results are summarized in Table 25. During our observational period, the PU Vul brightness slowly decreased in all three colours with increasing amplitude of light variations in the B and V bands on the time scale of days.

Table 25. Photoelectric observations of PU Vul

Date	JD			Obs	
	2 44. ...	U	B		V
Sep 2, 92	48868.400	10.749	11.568	11.446	B2
Sep 17, 92	48883.350	10.726	11.461	11.300	B2
Sep 18, 92	48884.370	10.720	11.467	11.427	B2
Sep 21, 92	48887.360	10.680	11.542	11.457	B2
Sep 26, 92	48892.330	10.769	11.534	11.473	B2
Sep 27, 92	48893.320	10.669	11.481	11.450	B2
Oct 8, 92	48904.310	10.690	11.486	11.439	B2
Apr 21, 93	49098.580	10.840	11.640	11.760	B2
Apr 25, 93	49102.570	11.184	11.589	11.533	B2
Apr 27, 93	49104.590	10.855	11.577	11.590	B2
May 12, 93	49119.550	10.974	11.706	11.510	B2
May 14, 93	49121.560	10.864	11.710	11.670	B2
May 18, 93	49125.540	-	-	11.740	B2
May 21, 93	49128.500	10.860	11.620	11.370	B2
Jun 9, 93	49148.490	10.908	11.654	11.512	B2
Jun 10, 93	49148.529	10.876	11.508	11.397	SL
Jun 17, 93	49155.544	-	11.522	11.280	K
Jun 20, 93	49158.544	-	11.584	11.382	K
Jul 7, 93	49176.404	-	11.100	10.810	K
Jul 10, 93	49178.540	10.790	11.233	11.186	SP
Jul 30, 93	49199.460	11.001	11.577	11.346	B2
Sep 19, 93	49250.417	10.954	11.503	11.349	SP
Sep 30, 93	49261.385	10.862	11.539	11.626	SP

Observatory: SP - Skalnaté Pleso, SL - Stará Lesná,
B2 - Brno University, K - Kryonerion

Acknowledgements. We gratefully acknowledge the very precise systematic observations of the symbiotic stars by the members of the French Association of Variable Star Observers and by the individual observers from the Czech Republic (J. Krtička, T. Nejezchleba and V. Šimon). Two of us (L.H. & D.C.) would like to thank the Konkoly Observatory staff in Budapest for providing the iris-photometer for photographic plates measurements. This work was supported by Slovak Academy of Sci. Grant No. 495/93. L.L.Ch. thanks the American Astronomical Society for financial support of her part of work.

References

- Aller, L.H.: 1954, *Publ. Dominion Astrophys. Obs.* **9**, 321
 Bailey, J.: 1975, *Journ. British Astron. Ass.* **85**, 217
 Hric, L., Chochol, D., Komžík, R. : 1993, *Astrophys. Space Sci.* **201**, 107
 Hric, L., Skopal, A.: 1989, *Inf. Bull. Variable Stars*, No. 3364
 Hric, L., Skopal, A., Urban, Z., Dapergolas, A., Hanžl, D., Isles, J.E., Niarchos, P., Papoušek, J., Pigulski, A., Velič, Z.: 1991, *Contrib. Astron. Obs. Skalnaté Pleso* **21**, 303 - Paper II
 Hric, L., Skopal, A., Urban, Z., Komžík, R., Luthardt, R., Papoušek, J., Hanžl, D., Blanco, C., Niarchos, P., Velič, Z. and Schweitzer, E.: 1993, *Contrib. Astron. Obs. Skalnaté Pleso* **23**, 73 - Paper IV
 Munari, U.: 1992, *Astron. Astrophys.* **257**, 163
 Skopal, A., Hric L., Urban, Z.: 1990, *Contrib. Astron. Obs. Skalnaté Pleso* **19**, 123 - Paper I
 Skopal, A., Hric, L., Urban, Z., Pigulski, A., Blanco, C., Papoušek, J., Hanžl, D., Agerer, F., Niarchos, P., Rovithis-Livaniou, H., Rovithis, P., Tsvetkova, K., Semkov, E., Velič, Z., Michálek, F., Komačka, L., Schweitzer, E. and Korth, S.: 1992, *Contrib. Astron. Obs. Skalnaté Pleso* **22**, 131 - Paper III
 Taranova, O.G., Yudin, B.F.: 1986, *Astron. Zh.* **63**, 317