

## V473 Cas: FIRST ELEMENTS AND LIGHTCURVE

W. MOSCHNER<sup>1,3</sup>, P. FRANK<sup>2,3</sup>, U. BASTIAN<sup>4</sup>

<sup>1</sup> D-57368 Lennestadt, Germany, e-mail: wolfgang.moschner@t-online.de

<sup>2</sup> D-84149 Velden, Germany, e-mail: frank.velden@t-online.de

<sup>3</sup> Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D-12169 Berlin, Germany

<sup>4</sup> Astronomisches Rechen-Institut, Mönchhofstr. 14, D-69120 Heidelberg, Germany,  
e-mail: s01@ix.urz.uni-heidelberg.de

V473 Cas = SON 8461 = GSC 3679-1417 was discovered by Hoffmeister (1964) on photographic plates of the Sonneberg Observatory. He classified the star as a short-period variable with a photographic magnitude range of 13.5–14.0. A first follow-up investigation was performed by Gessner and Meinunger (1973). On the plates of the Sonneberg astrograph (400/1600 mm and 400/1950 mm) they found six (partly uncertain) minima in the period between JD 2438286 and JD 2438328 (42 days) which were insufficient for determining a period. Nevertheless they classified the star as an eclipsing binary and gave the photographic magnitude range as 13.4–14.0. This is the information given for V473 Cas in the fourth edition of the GCVS (Kholopov et al. 1985).

About 15 years after Gessner and Meinunger we put V473 Cas on our observing program, after a photographic minimum had accidentally been found by Peter Frank in a series of photographs aimed at V470 Cas. Our subsequent CCD observations were made with an SBIG ST6 camera without filters, attached to a 32-cm Ritchey-Chretien telescope with  $f = 1740$  mm (Wolfgang Moschner), and with an OES-LcCCD 11 camera without filters, attached to a 30cm flatfield camera with  $f = 576$  mm (Peter Frank). The integration times were 60 seconds at both telescopes. The CCD observations cover 3 years. GSC 3679-2081 served as the comparison star; several other stars in the same field were used to check its constancy.

V473 Cas turned out to be a  $\beta$ -Lyr-type eclipsing binary (see Fig. 1). In the instrumental system of the ST6 camera the amplitude of variability is 0.85 mag for the primary minima and 0.30 mag for the secondary minima. From 17 individual nightly CCD series we determined moments of primary minima, using the method of Kwee and van Woerden (1956). They are listed in Table 1.

Using the 17 CCD minima, a weighted least-squares fit led to the following elements:

$$\text{Min. I} = \text{JD}_{\text{hel}} 2450334.4400 + 0^{\text{d}}41546073 \times E.$$

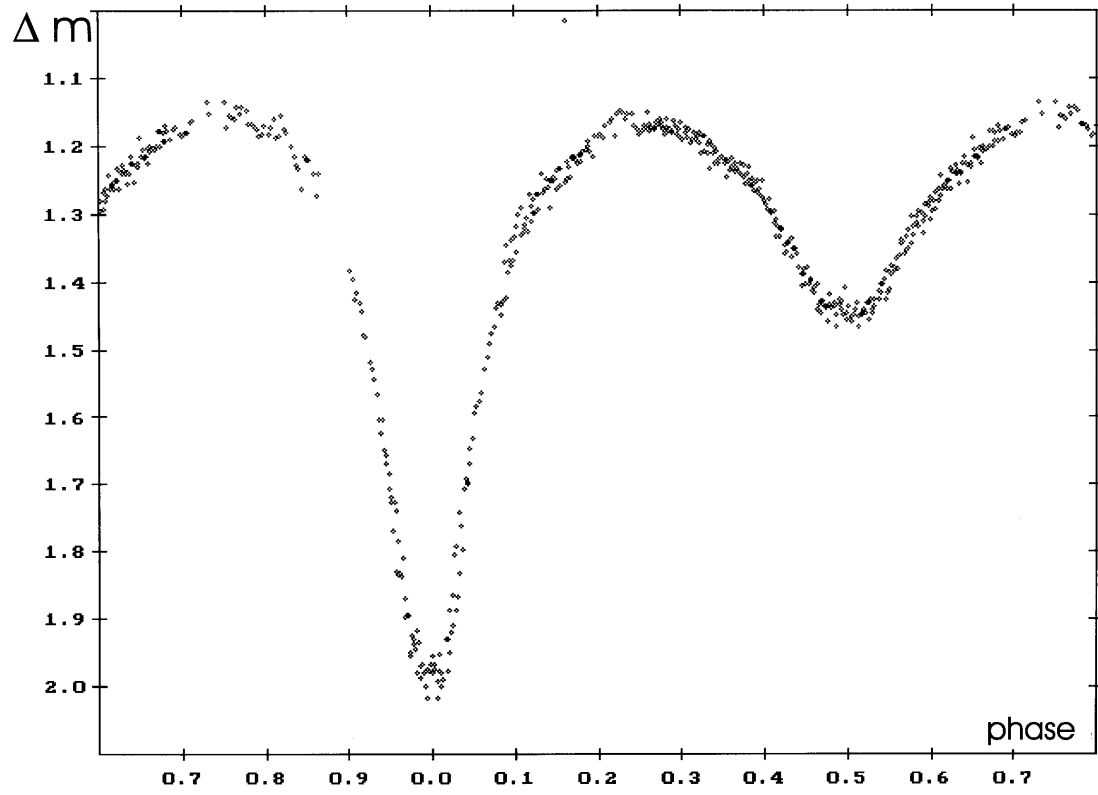
$\pm 2$ 
 $\pm 4$

In addition to the CCD observations, one of us (Wolfgang Moschner) investigated the variable on about 320 photographic plates of the 0.4-m astrographs of the Sonneberg Observatory. Twenty additional times of minimum light could be found in this way, from

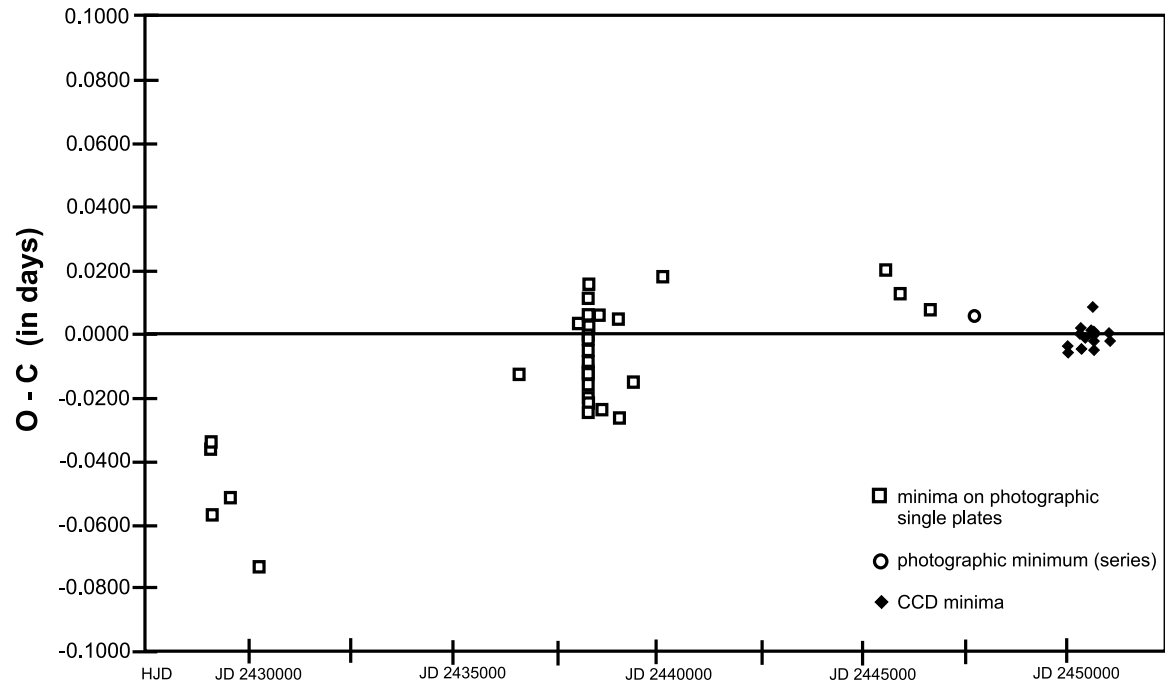
Table 1: Observed times of minima for V473 Cas

No.	Observer	Type	Weight	JD hel.	O–C	Ref.
1	W. Moschner	P	0	29086.4960	–0.0359	this paper
2	W. Moschner	P	0	29106.4170	–0.0570	this paper
3	W. Moschner	P	0	29108.5170	–0.0343	this paper
4	W. Moschner	P	0	29553.4580	–0.0517	this paper
5	W. Moschner	P	0	30259.5120	–0.0733	this paper
6	W. Moschner	P	0	36604.2810	–0.0128	this paper
7	W. Moschner	P	0	38044.2840	+0.0033	this paper
8	I. Meinunger	P	0	38286.4970	+0.0027	VSS 7
9	W. Moschner	P	0	38291.4910	+0.0112	this paper
10	I. Meinunger	P	0	38296.4670	+0.0017	VSS 7
11	I. Meinunger	P	0	38318.4830	–0.0048	VSS 7
12	I. Meinunger	P	0	38322.6190	–0.0018	VSS 7
13	I. Meinunger	P	0	38325.5390	–0.0204	VSS 7
14	W. Moschner	P	0	38327.6310	+0.0061	this paper
15	I. Meinunger	P	0	38328.4440	–0.0118	VSS 7
16	W. Moschner	P	0	38339.2360	–0.0218	this paper
17	W. Moschner	P	0	38343.4280	+0.0156	this paper
18	W. Moschner	P	0	38372.5010	+0.0063	this paper
19	W. Moschner	P	0	38640.4430	–0.0238	this paper
20	W. Moschner	P	0	39054.4780	+0.0045	this paper
21	W. Moschner	P	0	39063.3790	–0.0269	this paper
22	W. Moschner	P	0	39414.4550	–0.0152	this paper
23	W. Moschner	P	0	40127.4190	+0.0182	this paper
24	W. Moschner	P	0	45607.3480	+0.0202	this paper
25	W. Moschner	P	0	45940.5400	+0.0127	this paper
26	W. Moschner	P	0	46685.4560	+0.0076	this paper
27	P. Frank	F	5	47776.4540	+0.0057	this paper
28	P. Frank	E	5	50043.4058	–0.0040	this paper
29	P. Frank	E	5	50043.6116	–0.0059	this paper
30	W. Moschner	E	10	50330.4931	+0.0000	this paper
31	W. Moschner	E	10	50332.5719	+0.0015	this paper
32	W. Moschner	E	10	50334.4400	+0.0000	this paper
33	W. Moschner	E	10	50368.3019	+0.0019	this paper
34	W. Moschner	E	10	50369.3390	+0.0003	this paper
35	W. Moschner	E	10	50376.3968	–0.0047	this paper
36	F. Agerer	E	10	50465.3090	–0.0011	this paper
37	P. Frank	E	10	50604.4905	+0.0010	this paper
38	P. Frank	E	10	50652.4836	+0.0084	this paper
39	W. Moschner	E	10	50668.4700	–0.0004	this paper
40	P. Frank	E	10	50672.4121	–0.0052	this paper
41	P. Frank	E	10	50673.4566	+0.0006	this paper
42	W. Moschner	E	10	50685.5020	–0.0023	this paper
43	W. Moschner	E	5	51041.5544	+0.0002	this paper
44	W. Moschner	E	10	51079.3588	–0.0023	this paper

Notes to Table 1: O–C residuals were computed with respect to the elements derived in this paper. In the third column, “P” denotes minimum light on a single photographic plate, “F” a minimum time derived from a dense series of photographic plates, and “E” a minimum time from a dense series of CCD measurements. The fourth column lists the weights used in the least-squares adjustment for the elements. In the last column, “VSS 7” is an abbreviation for Gessner & Meinunger (1973). Minima nos. 38 and 40 are secondary minima, all others are primary minima.



**Figure 1.** Folded differential lightcurve of V473 Cas.



**Figure 2.** O-C diagram for V473 Cas using the elements derived in this paper.

plates taken between JD 2429086 and JD 2446685. They are listed in Table 1. Residuals from the least-squares fit are listed in Table 1 and displayed in the O—C diagram, Fig. 2, both for the CCD minima which were used for the fit, and for the photographic minima which were not used. A small decrease in the period around or before JD 2438000 is indicated in Fig. 2.

Acknowledgements: We thank for help and assistance by the management and staff of Sonneberg Observatory, especially by Dr. Peter Kroll in using the library and plate archive. This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France.

#### References:

- Gessner H., Meinunger I., 1973, *Veröffentlichungen der Sternwarte in Sonneberg*, **7**, 619  
 Hoffmeister C., 1964, *Mitteilungen über Veränderliche Sterne (Sonneberg)*, **2**, 99  
 Kholopov P.N. et al., 1985, *General Catalogue of Variable Stars*, 4th edition, Moscow  
 Kwee, K.K., van Woerden, H., 1956, *Bull. Astron. Inst. Netherlands*, **12**, 32