COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 4307

Konkoly Observatory
Budapest
13 March 1996

HU ISSN 0374 – 0676

NEW TIMES OF MINIMA OF THE ECLIPSING BINARIES 44i BOOTIS AND VW CEPHEI

The eclipsing variable stars 44i Boo and VW Cep are two well observed active close binaries of W UMa type. Here, we present new times of minima for these two systems determined from our photoelectric observations made during 1995.

44i Bootis

The eclipsing binary 44i Boo is the fainter companion (B+C) of the close visual binary ADS 9494. Its light curves are characterized by "active" and "quiet" intervals and its period is variable (e.g. Bergeat et al., 1972; Rovithis and Rovithis-Livaniou, 1990, Oprescu et al., 1989 & 1991; Gherega et al., 1994).

New photoelectric observations of the system were made during two nights in April, as well as during one in May and two in August 1995. The observations in April were made with the two-beam, multi-mode, nebular-stellar photometer of the National Observatory of Athens, attached to the 48-inch Cassegrain reflector at the Kryonerion Astronomical Station; while, those in May and August with an EMI 9502B type photocell, attached to the 50cm Cassegrain telescope of the Bucharest Observatory.

From our observations of 44i Boo six new minima times were derived and are presented in Table I.

Table 1. Photoelectric minima of 44i Bootis

Hel JD 2440000+	Min	Filter	$(O-C)_I$ days	$(O-C)_{II}$ days	$(O-C)_{III}$ days
9812.4825	II	V	0.0528	0.0155	−0.0068
.4827	II	B	0.0530	0.0157	−0.0066
.6152	I	V	0.0516	0.0143	−0.0080
.6148	I	B	0.0512	0.0139	−0.0084
9813.4184	I	V	0.0513	0.0140	−0.0073
.4188	I	B	0.0517	0.0144	−0.0069
9866.4487	I	V	0.0541	0.0164	−0.0051
.4468	I	B	0.0522	0.0145	−0.0070
.4471	I	U	0.0525	0.0148	−0.0067
9938.3678	II	V	0.0646	0.0265	+0.0048
.3683	II	B	0.0651	0.0270	+0.0053
.3646	II	U	0.0614	0.0233	+0.0016
9943.3130	I	V	0.0552	0.0171	−0.0047
.3128	I	B	0.0550	0.0169	−0.0049
.3139	I	U	0.0561	0.0180	−0.0038

In Table 1 the residuals $(O-C)_I$, $(O-C)_{II}$ & $(O-C)_{III}$ have been calculated using Kwee & Van Woerden's method (1956) and according to the following ephemeris formulae:

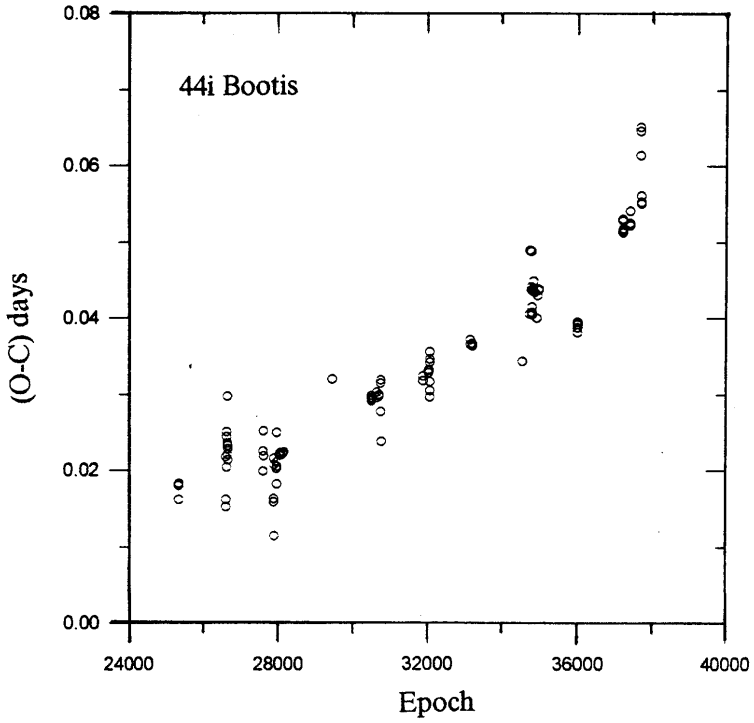

Figure 1. The latest part of the (O−C) diagram of 44i Boo, based on Duerbeck's (1975) ephemeris formula.

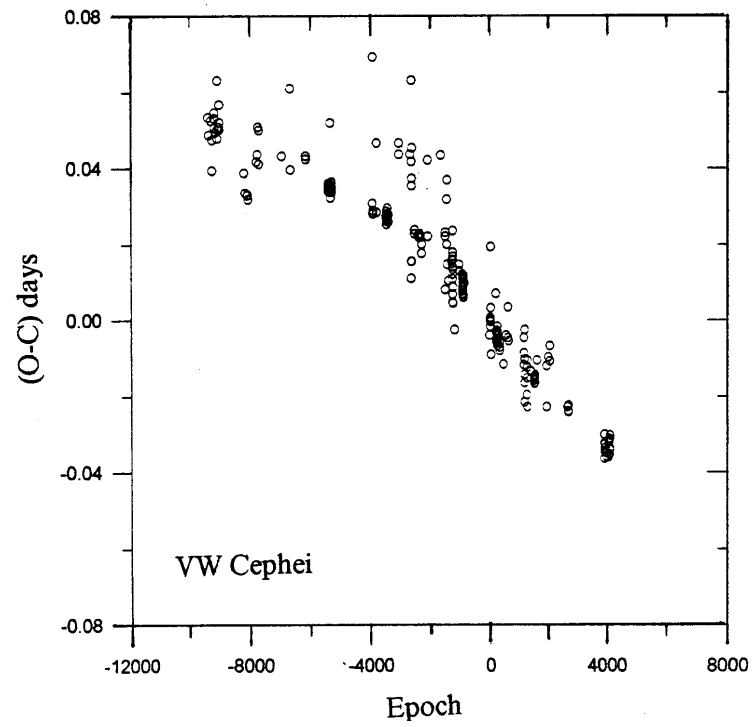

Figure 2. The latest part of the (O−C) diagram of VW Cep, based on Navratil's (1994) ephemeris formula.

(I): Min I = J.D. 2439852.4903 + 0.2678159 × E
(Duerbeck, 1975)

(II): Min I = J.D. 2439852.4644 + 0.2678176 × E
(Rovithis and Rovithis-Livaniou, 1990)

(III): Min I = J.D. 2443604.5880 + 0.26781856 × E
(Oprescu et al., 1991)

From the recent part of the O−C diagram of 44i Boo, which is presented in Figure 1 – based on Duerbeck's (1975) ephemeris and corresponding to the last years – and from a comparison of the O−C values presented in Table 1, with those of Rovithis-Livaniou et al. (1995), we can see that the period of 44i Boo is continuously increasing.

VW Cephei

The eclipsing binary VW Cep is a member of a triple system (Hershey, 1975). Its light curves show temporal variation on short time scales (from night to night; e.g. Kwee, 1966; Kreiner & Winiarski, 1981), as well as on long time scales (e.g. Karimie, 1983; Kotarska & Glownia, 1983; Bradstreet & Guinan, 1990).

Photoelectric observations of VW Cep were made during nine nights (1 in August, 3 in September and 5 in October 1995), at the Bucharest Observatory using the same instruments as for the observations of 44i Bootis.

Table 2. New minima of VW Cephei

Hel.JD 2400000+	Min. Type	Filter	E	$(O-C)_I$ days	$(O-C)_{II}$ days
49953.3496	II	V	3919.5	−0.0299	+0.0010
.3473	II	B		−0.0322	−0.0013
.3431	II	U		−0.0364	−0.0055
.4851	I	V	3920	−0.0336	−0.0026
.4843	I	B		−0.0344	−0.0034
.4862	I	U		−0.0325	−0.0015
49975.3304	II	V	3998.5	−0.0360	−0.0045
.3324	II	B		−0.0340	−0.0025
.3316	II	U		−0.0348	−0.0033
49994.2599	II	V	4066.5	−0.0319	+0.0001
.2600	II	B		−0.0318	+0.0002
.2558	II	U		−0.0360	−0.0040
49996.3481	I	V	4074	−0.0310	+0.0010
.3472	I	B		−0.0319	+0.0001
.3475	I	U		−0.0316	+0.0004
50003.3057	I	V	4099	−0.0313	+0.0017
.3067	I	B		−0.0303	+0.0027
.3034	I	U		−0.0336	−0.0006
50004.2770	II	V	4102.5	−0.0340	−0.0000
.2758	II	B		−0.0352	−0.0022
.2775	II	U		−0.0335	−0.0005

From our observations seven new minima times were derived and are presented in Table 2; where the residuals have been found using Kwee & Van Woerden's method (1956) and the C's have been calculated according to the ephemeris:

$$\text{Min I} = \text{J.D. } 2448862.5255 + 0.27831460 \times \text{E} \qquad \text{(I)}$$

(Navratil, 1994)

and its improvement:

$$\text{Min I} = \text{J.D. } 2448862.5220 + 0.2783076 \times \text{E} \qquad \text{(II)}$$

(Aluigi et al., 1994)

From the recent part the O−C diagram of VW Cep, presented in Figure 2 – corresponding to the last years and based on Aluigi et al.'s (1994) ephemeris – it is clear that the orbital period of the system is decreasing.

Moreover, from the O−C values of Table 2, one can notice that better results are obtained from the improved ephemeris – that of Navratil's (1994) – which corresponds to a smaller period for VW Cep, indicating again that the period of the system is continuously decreasing.

Acknowledgements: This work was partly financially supported by a bilateral Greek-Romanian cooperation program of the Ministry of Industry, Energy and Technology.

G. OPRESCU
A. DUMITRESCU
Astron. Inst.
Bucharest Obs.
Bucharest, Romania

P. ROVITHIS
Astron. Inst.
Athens National Obs.
Athens, Greece

H. ROVITHIS-LIVANIOU
Section of Astroph.
Astron. & Mechanics
Dept. of Physics
Athens University, Greece
e-mail: elivan@atlas.uoa.gr

References:

Aluigi, M., Galli, G. & Gaspani, A., 1994, *IBVS*. No. 4117
Bergeat, J., Lunel, M. & Van't Veer F., 1972, *A&A*, **17**, 215
Bradstreet, D. & Guinan, E., 1990, in "Active Close Binaries", (Ed. C. Ibanoglu), Kluwer, p. 467
Duerbeck, H.W., 1975, *IBVS*, No. 1023
Gherega, O., Farkas, L. & Horváth, A., 1994, *IBVS*, No. 4045
Hershey, J.L., 1975, *ApSS*, **36**, 137
Karimie, M.T., 1983, *ApSS*, **92**, 53
Kotarska, I. & Glownia, Z., 1983, *AN*, **304**, 181
Kreiner, J.M. & Winiarski, M., 1981, *Acta Astron.*, **31**, 351
Kwee, K.K., 1966, *Bull. A. I. Neth.*, **18**, 448
Kwee, K.K. & Van Woerden, H., 1956, *Bull. A. I. Neth.*, **12**, 327
Navratil, M., 1994, *IBVS*, No. 3997
Oprescu, G., Suran, M.D. & Popescu, N., 1989, *IBVS*, No. 3368
Oprescu, G., Suran, M.D. & Popescu, N., 1991, *IBVS*, No. 3560
Rovithis, P. & Rovithis-Livaniou, H., 1990, *A&ASS*, **86**, 523
Rovithis-Livaniou, H., Rovithis, P., Oprescu, G. & Dumitrescu, A., 1995, *IBVS*, No. 4172