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UBV OBSERVATIONS OF T CrB

T Coronae Borealis is a spectroscopic binary, with a period of 227.5 days, containing an M3 giant and a hotter companion. The star has experienced two outbursts with an amplitude of about 8 mag in 1866 and 1946, and is classified as a recurrent nova as well as a symbiotic star. The ultraviolet observations and the behaviour of the star during the outbursts point to the hotter component is an white dwarf with a mass close to the Chandrasekhar limit (Selvelli, Cassatella and Gilmozzi, 1992), in spite of the existence of some doubts that it can be a main sequence star (e.g. Kenyon and Garcia, 1986). The M giant fills the Roche lobe and the main part of the accretion is realized through the L_1.

UBV observations of the recurrent nova T CrB were carried out with a single channel photon counting photometer, mounted at the 0.6 m telescope of the National Astronomical Observatory "Rozhen". The comparison star was HD 142929 ($V = 8\overset{\mathrm{m}}{.}41$, $B - V = 0\overset{\mathrm{m}}{.}51$, $U - B = 0\overset{\mathrm{m}}{.}03$). The data was processed using the APRN software (Kirov et al., 1991). The accuracy is better than ± 0.04 mag. Our observations are summarized in Table 1.

The long term photometry in the U band is presented in Figure 1. The triangles indicate our data, the circles denote the data from Hric et al. (1991, 1993, 1994) and Skopal et al. (1992,1995), the crosses denote the data of Mikolajewski et al. (1996). From Figure 1 it is visible that since 1990 TCrB has experienced three small outbursts with an amplitude of $\sim$1 mag in the U band and peaks at JD 2448100, JD 2449100 and JD 2450200. The typical time between these mini outbursts is of about 1000 days. Since 1994 the star has shown a considerable increase in the U brightness. It is interesting to note that UV flux observations of Selvelli, Cassatella and Gilmozzi (1992) over the period 1979-90 do not show similar behaviour. They had observed only two minima in 1979 and 1989.

In the V band as well as in the IR (see Yudin and Munari, 1993 and references therein), TCrB shows a double wave light curve, as a result of the ellipsoidal shape of the M giant. In Figure 2 the V data are shown, using the ephemeris of Kenyon and Garcia (1986). The dots refer to the data obtained before 1989: Lines et al. (1988), Rajkova and Antov (1986) and Bruch (1980, 1992). The other symbols are the same as in Figure 1. A Fourier analysis of the data using a three-term truncated Fourier series yields

$$V = (10.080 \pm 0.005) + (0.018 \pm 0.007)\cos\phi + (0.162 \pm 0.007)\cos 2\phi - (0.019 \pm 0.007)\cos 4\phi + (0.018 \pm 0.008)\sin\phi + (0.039 \pm 0.007)\sin 2\phi + (0.015 \pm 0.008)\sin 4\phi,$$

where ϕ is the orbital phase. This fit is also plotted in Figure 2. Although the data spread over 17 years a distinction between the observations obtained in different epochs is not visible. This points to the fact that the V light curve has not changed in its main features over the last 17 years.

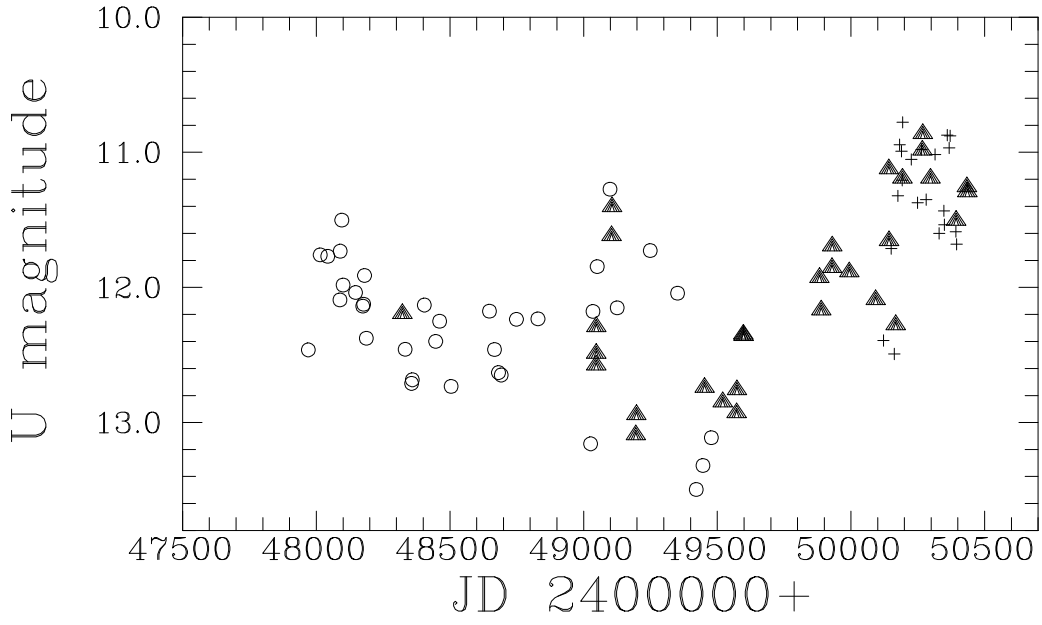

Figure 1. U band light curve of T CrB

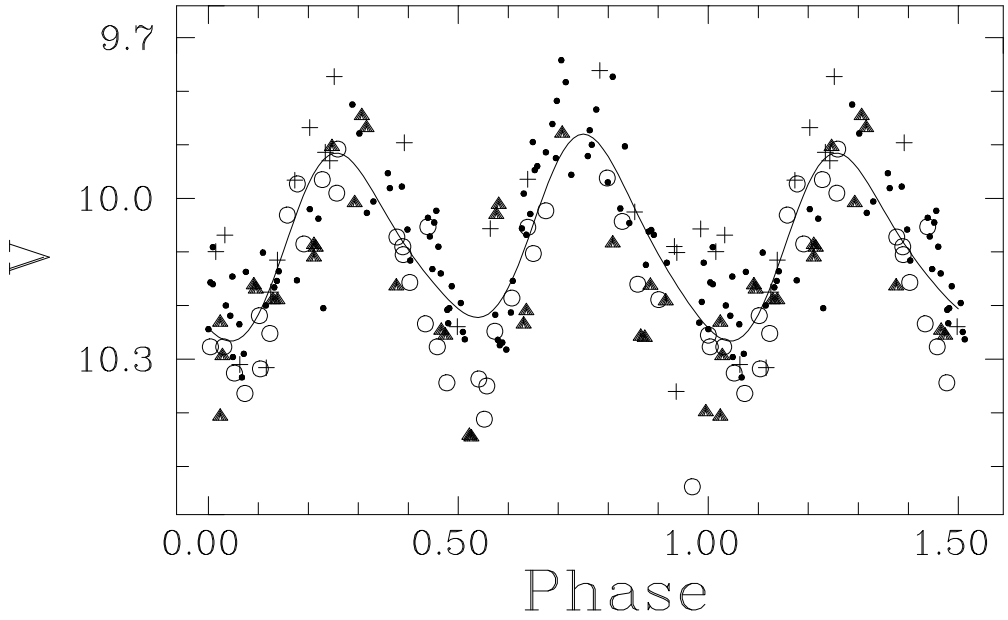

Figure 2. Phase plot of the V data according to the orbital ephemeris of Kenyon and Garcia (1986)

Most of the radiation flux in the U is emitted from the hotter component. The ellipsoidal variations are suggestive of a large orbital inclination but an eclipse cannot be detected in the UV flux (Selvelli et al., 1992). We also fail to detect eclipse in the U band. The U magnitudes of TCrB do not show correlation with the orbital period. It is worth noting that the eccentricity of the system is practically zero (Kenyon and Garcia, 1986) so the lack of connection with the orbital period is not surprising.

We ascribe the variability in the U band to the accretion disk and/or the boundary layer between the disk and the white dwarf. In our opinion the most likely reason for the observed variability is the changes in the mass transfer rate and/or in the structure of the accretion disk.

Table 1. Photometric observations of T CrB

JD2400000+	V	$B-V$	$U-B$		JD	V	$B-V$	$U-B$
48321.44	10.40	1.40	0.37		49889.34	10.19	1.45	0.51
49046.57	10.11	1.54	0.92		49929.37	10.16	1.36	0.32
49046.60	10.08	1.54	0.84		49930.39	10.17	1.33	0.18
49047.54	10.09	1.51	0.68		49994.23	10.16	1.36	0.34
49104.53	10.24	1.24	0.12		50092.66	10.08	1.43	0.57
49106.45	10.25	1.18	-0.05		50141.64	10.23	1.08	-0.20
49195.32	10.25	1.61	1.21		50142.57	10.29	1.27	0.08
49197.32	10.26	1.56	1.11		50167.52	10.19	1.46	0.62
49452.51	10.40	1.53	0.80		50192.39	9.90	1.14	0.13
49520.40	10.01	1.53	1.30		50267.36	10.03	1.16	-0.22
49572.32	10.44	1.56	0.92		50268.36	10.01	1.14	-0.30
49573.29	10.44	1.52	0.78		50297.30	9.88	1.22	0.08
49597.27	10.23	1.49	0.61		50393.18	10.19	1.25	0.05
49598.29	10.21	1.49	0.64		50433.66	9.84	1.29	0.11
49882.33	10.16	1.37	0.38		50435.66	9.87	1.29	0.12

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References:

Bruch, A., 1980, *IBVS*, No. 1805
Bruch, A., 1992, *A&A*, **266**, 237
Kenyon, S.J., Garcia, M.R., 1986, *AJ*, **91**, 125
Kirov, N. K., Antov, A.P., Genkov, V.V., 1991, *Compt. rend. Acad. bulg. Sci.*, **44**, No. 11, 5
Lines, H.C., Lines, R.D., McFaul, T.G., 1988, *AJ*, **95**, 1505
Mikolajewski, M., Tomov, T., Kolev, D., 1996, *IBVS*, No. 4428
Hric, L., Skopal, A., Urban, Z. et al., 1991, *Contr. Astr. Obs. Skalnaté Pleso*, **21**, 303
Hric, L., Skopal, A., Urban, Z., et al.,1993, *Contr. Astr. Obs. Skalnaté Pleso*, **23**, 73
Hric, L., Skopal, A., Chochol, D., et al.,1994, *Contr. Astr. Obs. Skalnaté Pleso*, **24**, 31
Rajkova, D., Antov, A., 1986, *IBVS*, No. 2690
Selvelli, P.L., Cassatella, A., Gilmozzi, R., 1992, *ApJ*, **393**, 289
Skopal, A., Hric, L., Urban, Z., et al., 1992, *Contr. Astr. Obs. Skalnaté Pleso*, **22**, 131
Skopal, A., Hric, L., Chochol, D., et al., 1995, *Contr. Astr. Obs. Skalnaté Pleso*, **25**, 53
Yudin, B., Munari, U., 1993, *A&A*, **270**, 165

CORRIGENDA

In the No. 4428 issue of the IBVS, Figure 2 is erroneously the repetition of Figure 1. The correct version of Figure 2 is as follows:

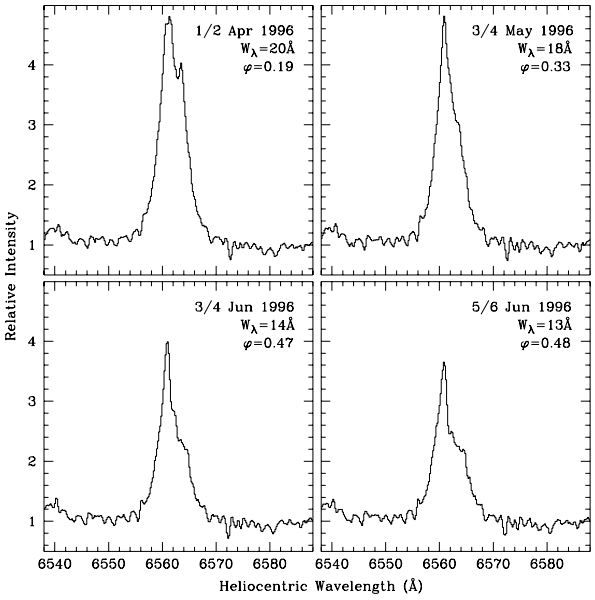

Figure 2. T CrB Hα profiles in 1996. The equivalent width and orbital phase are written in each box

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The hardcopy of IBVS No. 4430 has been distributed in an incomplete form: the last three references (page 4) are missing. The references cut off the end of the paper are as follows:

Krisciunas, K., Crowe, R.A., Luedeke, K.D., and Roberts, M., 1995, *MNRAS*, **277**, 1404
Krisciunas, K., and Handler, G., 1995, *IBVS*, No. 4195
Mantegazza, L., Poretti, E., and Zerbi, F.M., 1994, *MNRAS*, **270**, 439

The electronically accessible versions (both LaTeX and PostScript) contain the complete paper.

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