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BVR_CI_C PHOTOMETRY OF THREE RRAB STARS

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The discovery of small amplitude light curve modulation of RR Gem and SS Cnc (Jurcsik et al., 2005, 2006) warns that having not enough extended and accurate photometry similar modulation behaviour of RR Lyrae stars may have escaped detection. In this note CCD observations of three RRab stars (TZ Aur, BH Aur, TW Lyn) extending over 20-30 days intervals are published.

Photoelectric observations of TZ Aur were obtained by Fitch et al. (1966), Sturch (1966), Stepien (1972), and Epstein (1969). Because of the inhomogeneity, their observations did not allow to resolve smaller light curve changes. For TW Lyn and BH Aur only a few, *V* and *R* band measurements were published by Schmidt et al. (1995) and Schmidt & Reiswig (1993), respectively. According to our observations the light curves of the three stars remain stable within the accuracy limit of the photometry. Our data do not, however, exclude the possibility of light curve changes on longer time scales.

The observations were made with the 60-cm automatic telescope of Konkoly Observatory, Svábhegy, Budapest, equipped with a Wright 750×1100 CCD camera using *BVR_CI_C* filters. Log of observations are summarized in Table 1.

Table 1. Log of observations

Star	Comparison	Observation period	No. of nights	filters
TZ Aur	BD +41 1609	2453329 – 2453358	13	<i>BVR_CI_C</i>
BH Aur	GSC 02397-00378	2453743 – 2453762	12	<i>VR_CI_C</i>
TW Lyn	GSC 02971-00853	2453361 – 2453387	17	<i>BVR_CI_C</i>

Data reduction was performed using standard IRAF¹ packages. Instrumental magnitudes were transformed to the standard *BVR_CI_C* system by observing photometric standards in M67 (Chevalier & Ilovaisky, 1991).

¹IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

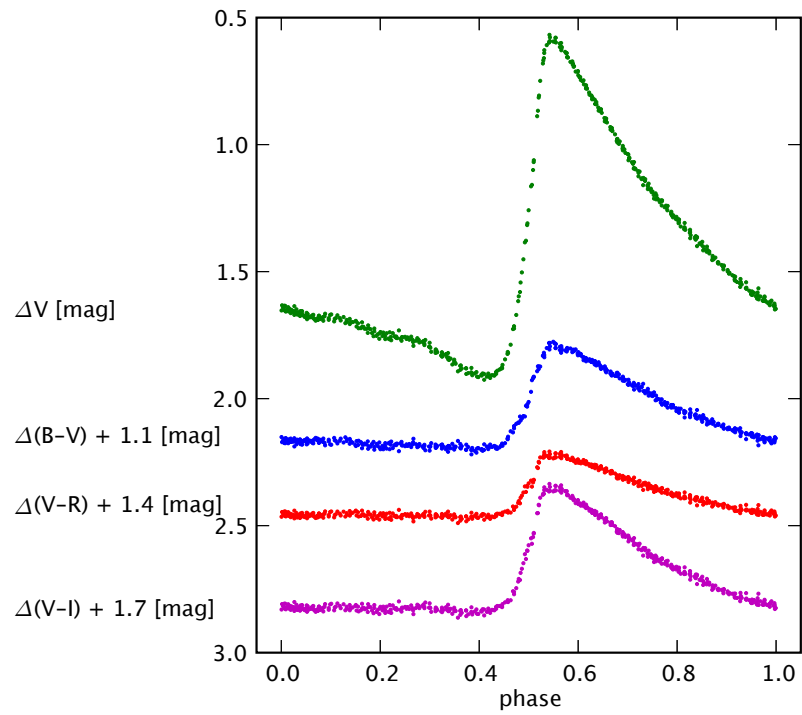


Figure 1. Differential V , $B - V$, $V - R_C$ and $V - I_C$ light and colour curves of TZ Aur

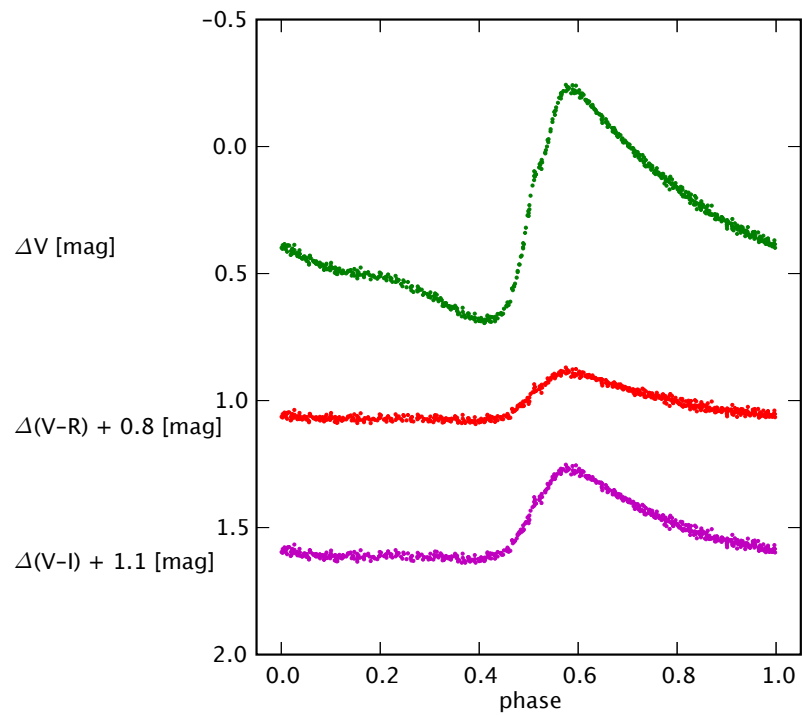


Figure 2. Differential V , $V - R_C$ and $V - I_C$ light and colour curves of BH Aur

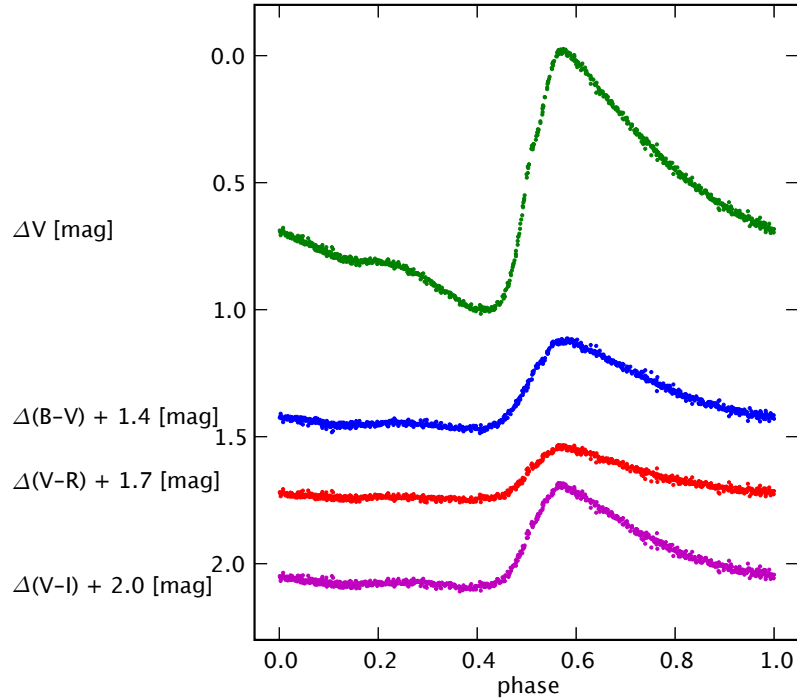


Figure 3. Differential V , $B - V$, $V - R_C$ and $V - I_C$ light and colour curves of TW Lyn

Our photometric data available electronically from the IBVS website list the BVR_CI_C magnitude differences between the variable and the comparison. Standard magnitudes of the comparison stars are available only for TZ Aur in UBV bands (Stepien, 1972). The constancy of the brightness of the comparison stars was checked by measuring magnitude differences to 3-6 other stars in our field of views. The rms. scatter of these data is typically less than 0.01 mag. in each band which equals to the rms scatter of the Fourier fit of the light curves of the variables. The V light curves and the $B - V$, $V - R_C$ and $V - I_C$ colour curves of the three stars are plotted in Figs. 1-3.

Normal maximum timings and the Fourier parameters of the V light curves are listed in Table 2.

Spectroscopic $[\text{Fe}/\text{H}]$ values from the literature (transformed for the metallicity scale used by Jurcsik & Kovács (1996)) and $[\text{Fe}/\text{H}]$ calculated from the Fourier parameters according to the formula derived in Jurcsik & Kovács (1996) are given in Table 3.

Table 2. Fourier parameters and normal maximum timings of the V light curves

Star	T_0 [HJD] -2453000	P^* [d]	A_1 [mag]	R_{21}	R_{31}	R_{41}	R_{51}	φ_{21}	φ_{31}	φ_{41}	φ_{51}
TZ Aur	343.622	0.3916746	0.441	0.560	0.349	0.238	0.152	2.359	5.094	1.416	4.174
BH Aur	755.264	0.4560898	0.316	0.532	0.326	0.171	0.101	2.606	5.447	2.057	4.707
TW Lyn	375.551	0.4818600	0.344	0.552	0.343	0.195	0.110	2.558	5.358	1.992	4.658

*Taken from the GCVS (Kholopov et al., 1985).

Table 3. Spectroscopic and ,photometric' [Fe/H] values

Star	[Fe/H] spect.	ref.	[Fe/H] phot.
TZ Aur	-0.60	Layden (1994)	-0.30
	-0.63	Suntzeff et al. (1994)	
BH Aur	+0.14	Fernley & Barnes (1997)	-0.17
TW Lyn	-1.03	Layden (1994)	-0.43
	-0.09	Fernley & Barnes (1997)	

The relative absolute magnitudes of the three stars estimated from the Fourier parameters using the first equation of Table 6. of Kovács & Walker (2001) indicate slight brightness differences between the stars. TW Lyn is the brightest and TZ Aur is the faintest, but the difference between their M_V is only 0.08 mag.

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