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MULTICOLOUR CCD PHOTOMETRY OF THREE RRab STARS

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We present multicolour CCD photometric observations of the three monoperiodic fundamental mode RR Lyrae variables BK Cas, EZ Cep, and ET Per. These stars were targets of our survey of brighter, northern, short period fundamental mode RR Lyrae variables (Sódor, 2007). The observations of all the three stars span two seasons, that is about 200−400 days. During these intervals none of them showed light curve variation exceeding our photometric accuracy which was somewhat less than 0.01 mag. Our light curves consist typically of 350−600 data points in each band.

Earlier photometric observations of BK Cas were published by Goranskij et al. (1973) and Schmidt & Seth (1996). NSVS (Wozniak et al., 2004) and Hipparcos (ESA, 1997) photometry is available of EZ Cep. ET Per was observed by Schmidt & Reiswig (1993) and by the NSVS (Wozniak et al., 2004). The few number of data points and/or the large errors of these observations do not allow to study the light curve stability of these variables and provide Fourier parameters only with large uncertainty.

Our observations were made with the 60 cm automatic telescope of Konkoly Observatory, Svábhegy, Budapest, equipped with a Wright 750x1100 CCD camera using $BVI_{\rm C}$ filters. ET Per was also observed with a Photometrics AT 200 CCD camera and $BVR_{\rm C}I_{\rm C}$ filters attached to the 60/90 cm Schmidt telescope of Konkoly Observatory, Piszkéstető mountain station. Log of observations are summarized in Table 1.

Table 1. Log of observations

Star	Comparison	$V_{\rm comp}$ * [mag]	Observation period	No. of nights	filters	telescope
BK Cas	GSC 4025-01395	12.74	2453991 – 2454328	11	$VI_{\rm C}$	60 cm
EZ Cep	GSC 4521-00784	13.63	2453964 – 2454166	26	$BVI_{\rm C}$	60 cm
ET Per	GSC 3671-01241	11.90	2453728 – 2453751	4	$BVR_{\rm C}I_{\rm C}$	Schmidt
ET Per	GSC 3671-01241	11.90	2453988 – 2454171	8	$BVI_{\rm C}$	60 cm

* V magnitudes of the comparison stars from the NOMAD catalogue (Zacharias et al., 2004).

CCD reduction and photometry was performed using standard IRAF[†] packages. Instrumental magnitudes were transformed to the standard $BVR_{\rm C}I_{\rm C}$ system by observing photometric standards in M67 (Chevalier & Ilovaisky, 1991) with both telescopes.

[†] IRAF 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.

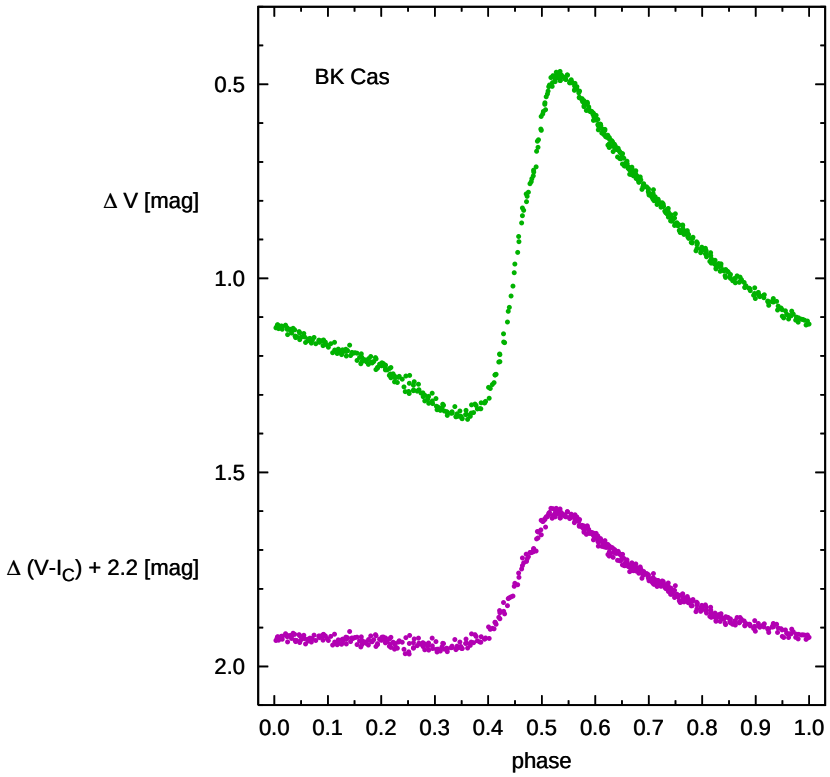

Figure 1. Differential V and $V - I_C$ light and colour curves of BK Cas.

Our photometric data available electronically from the IBVS website (5793-t5.txt−5793-t16.txt) list the relative BVR_CI_C magnitude and relative $B-V, V-R_C$ and $V-I_C$ colour time series with respect to the comparison stars. The constancy of the brightness of the comparisons was checked by measuring magnitude differences to several check stars in our field of view. The $r.m.s.$ scatter of these data is between 0.006 and 0.01 mag in each band in accordance with the $r.m.s.$ scatter of the Fourier fit of the light curves of the variables. The V light curves and the colour curves of the three stars are plotted in Figs. $1-3$.

Fourier parameters of the V light curves are listed in Table 2. Normal and discrete maximum timings are given in Table 3.

Spectroscopic [Fe/H] values from the literature (transformed to the metallicity scale used by Jurcsik & Kovács, 1996) and [Fe/H] calculated from the Fourier parameters according to the formula derived in Jurcsik & Kovács (1996) are given in Table 4. The

Table 2. Fourier parameters of the V light curves.

Star	P [d]	A_1 [mag]	R_{21}	R_{31}	R_{41}	R_{51}	ϕ_{21} * [rad]	ϕ_{31} * [rad]	ϕ_{41} * [rad]	ϕ_{51} * [rad]
BK Cas	0.3902700(2)	0.306	0.539	0.301	0.167	0.095	2.612	5.461	1.978	4.647
EZ Cep	0.3790035(1)	0.393	0.572	0.349	0.231	0.137	2.431	5.266	1.675	4.421
ET Per	0.3940135(1)	0.439	0.542	0.369	0.239	0.166	2.320	5.042	1.346	4.098

* Phase differences are given according to sine term decomposition.

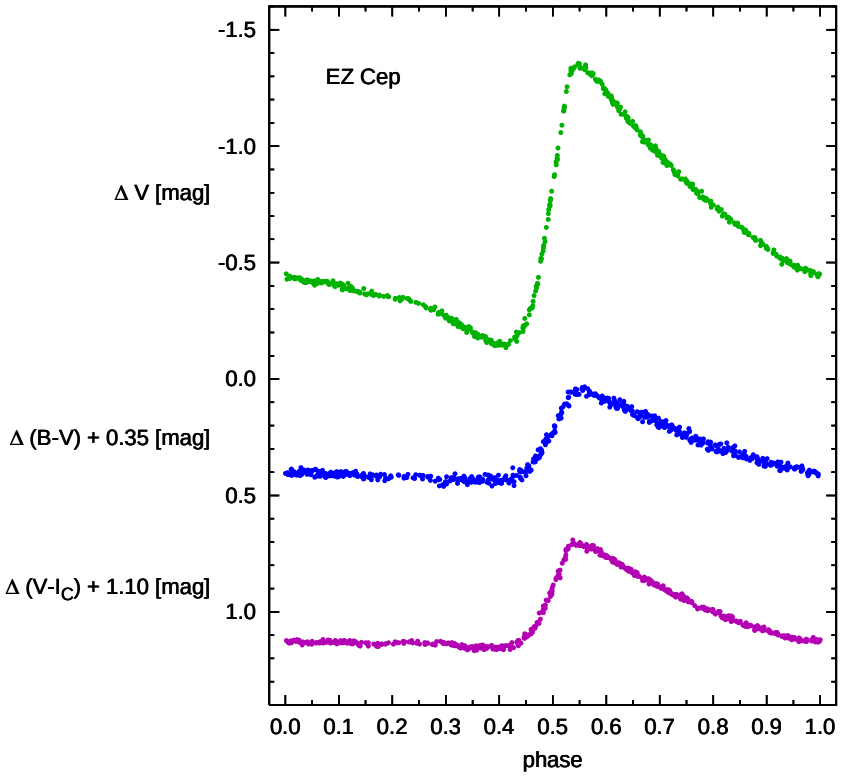

Figure 2. Differential V, $B-V$ and $V-I_{\rm C}$ light and colour curves of EZ Cep.

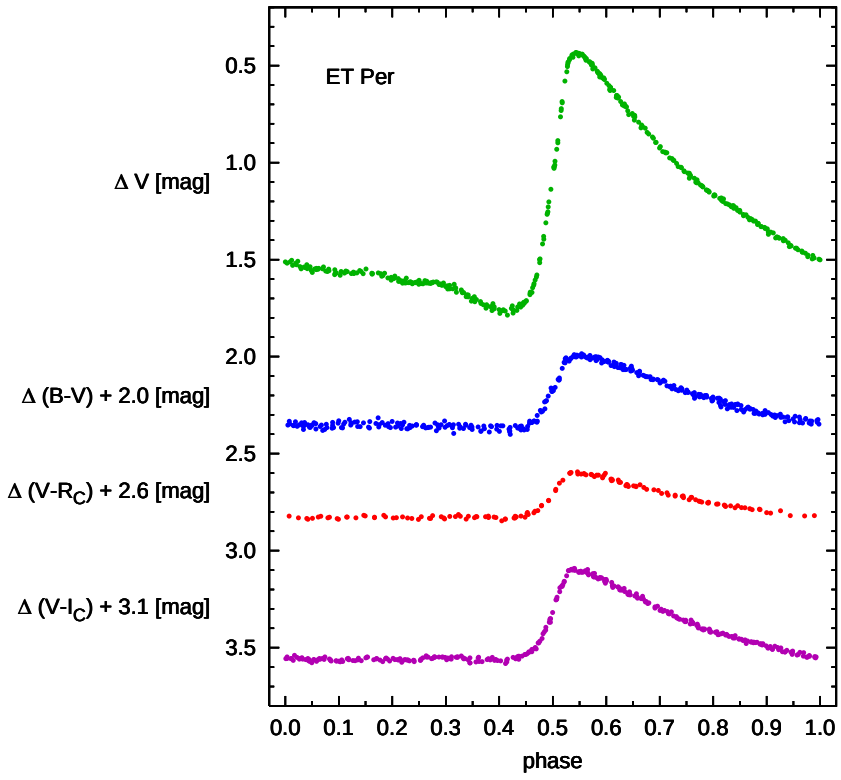

Figure 3. Differential V, $B-V$, $V-R_{\rm C}$ and $V-I_{\rm C}$ light and colour curves of ET Per.

metallicity of EZ Cep given by Mendes de Oliveira & Smith (1990) seems to be erroneous, as it differs significantly from the other two [Fe/H] determinations.

Table 3. Normal and discrete maximum timings of the V light curves.

Star	$T_{\max}$ - 2450000 [HJD]	type
BK Cas	54019.4667	Normal
	54327.1793	Normal
EZ Cep	54005.4023	Normal
	54166.478	Discrete
ET Per	53733.9048	Normal
	54000.2585	Normal
	54171.262	Discrete

Table 4. Spectroscopic and photometric [Fe/H] values.

Star	$[Fe/H]_{phot}$	$[Fe/H]_{spect}$
BK Cas	+0.21	
EZ Cep	0.00	-0.01 [a]
		-0.92 [b]
ET Per	-0.38	

a: Fernley & Barnes (1997)
b: Mendes de Oliveira & Smith (1990)

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ERRATUM FOR IBVS 5793

In IBVS 5793 Table 3 the 2nd line on the maximum timings of BK Cas gives erroneous $T_{\max}$ value. This line should correctly be: "BK Cas **54321.1434** normal".