

## TWO NEW ECLIPSING BINARY STARS IN FIELD OF RV Tri

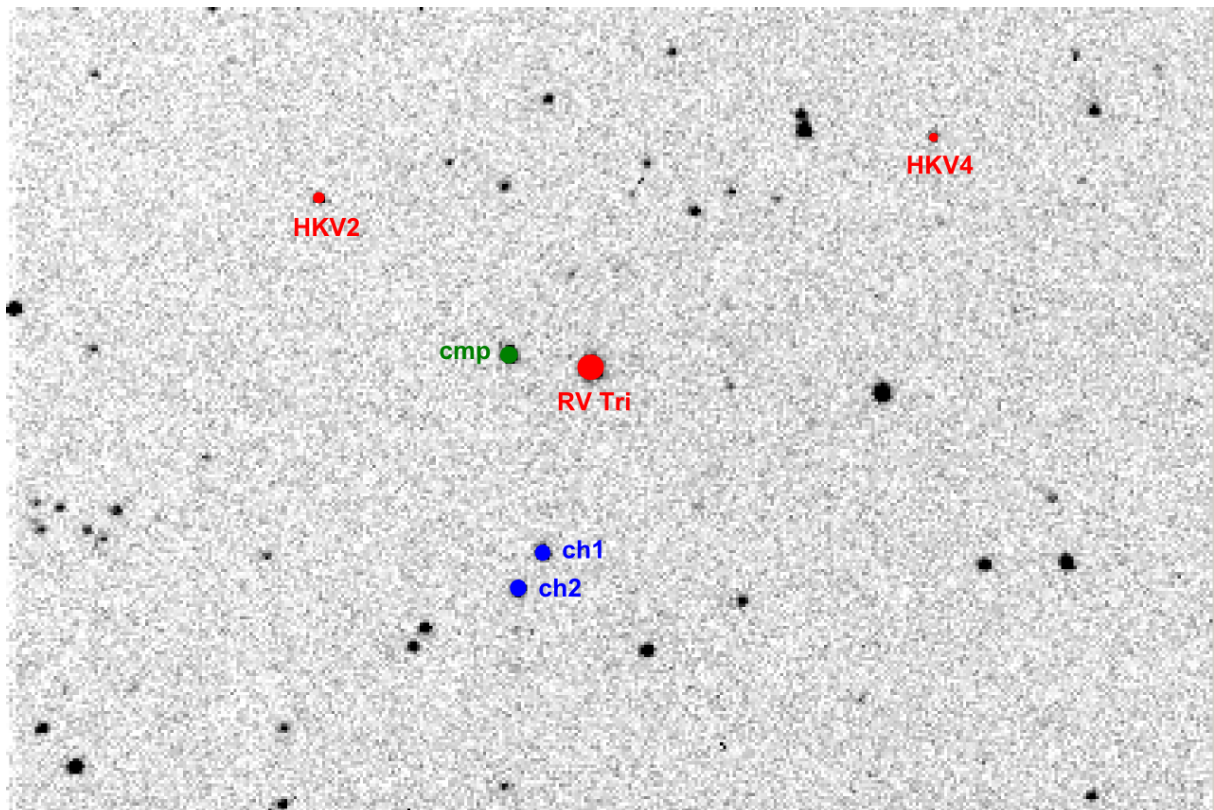
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**Abstract:** The new eclipsing binary HKV2 Tri = CzeV128 Tri = VSX J021331.9+370236 = USNO-B1.0 1270-0034289 (R.A. = 02h 13m 31.95s, Decl. = +37° 02' 36.5", J2000.0, R = 14.1 - 14.4 mag; Min. I = HJD 2454000.4696 + 0.494176 x E) and the new EW type eclipsing binary HKV4 Tri = CzeV130 Tri = VSX J021301.4+370326 = USNO-B1.0 1270-0034104 (R.A. = 02h 13m 01.49s, Decl. = +37° 03' 26.0", J2000.0, R = 14.4 - 15.0 mag; Min. I = HJD 2453999.4197 + 0.295562 x E) have been found near the variable star RV Tri by 0.40-m f/5 reflector at Hradec Králové observatory.

The new eclipsing binary HKV2 Tri = CzeV128 Tri = VSX J021331.9+370236 = USNO-B1.0 1270-0034289 (R.A. = 02h 13m 31.95s, Decl. = +37° 02' 36.5", J2000.0, R = 14.1 - 14.4 mag) and the new EW type eclipsing binary HKV4 Tri = CzeV130 Tri = VSX J021301.4+370326 = USNO-B1.0 1270-0034104 (R.A. = 02h 13m 01.49s, Decl. = +37° 03' 26.0", J2000.0, R = 14.4 - 15.0 mag) have been found near variable star RV Tri on 18th August 2006 and 17th September 2006, respectively, by Martin Lehký at Hradec Králové observatory (HPHK) using a 0.40-m f/5 JST (Jan Šindel Telescope) reflector and SBIG ST-7 CCD camera + R band filter. Discovery of HKV2 Tri has been preliminary published in the Czech Variable Star catalogue (CzeV 128) on 13th September 2006 and in the International Variable Star Index (VSX J021331.9+370236) on 10th October 2006. Discovery of HKV4 Tri has been preliminary published in the Czech Variable Star catalogue (CzeV 130) on 21st September 2006 and in the International Variable Star Index (VSX J021301.4+370326) on 03rd October 2006.



**Figure 1.** Close vicinity of HKV2 and HKV4 Tri (field of view is 13' x 9', north is to the top, east to the left).

Comparison stars are *cmp* USNO-B1.0 1270-0034239 ( R.A. = 02h 13m 22.27s, Decl. = +37° 01' 07.3", J2000.0, R2mag = 12.50), *ch1* USNO-B1.0 1269-0032162 ( R.A. = 02h 13m 20.28s, Decl. = +36° 59' 10.0", J2000.0, R2mag = 13.24) and *ch2* USNO-B1.0 1269-0032169 ( R.A. = 02h 13m 21.42s, Decl. = +36° 58' 48.1", J2000.0, R2mag = 13.59). Magnitudes were taken from the USNO-B1.0 catalogue.

During seven nights (2006 August – 2007 January; time span 150 days) we obtained a total of 1429 CCD frames of HKV2 and during six nights (2006 September – 2007 January; time span 120 days) we obtained a total of 1256 CCD frames of HKV4. Images were processed using C-Munipack (Motl, 2006). All data are available upon request.

We searched our data for periods using PerSea 2.01 (Maciejewski, 2004). The periods were further improved by analysis of minima timings, which were obtained using the Kwee and Van Woerden method implemented in AVE (Barbera, 2000). Our phased R band light curves are shown in Figures 4 and 5; minima timings are given in Tables 1 and 2. The best observed primary minima were chosen as the basic ones. Final ephemerides are:

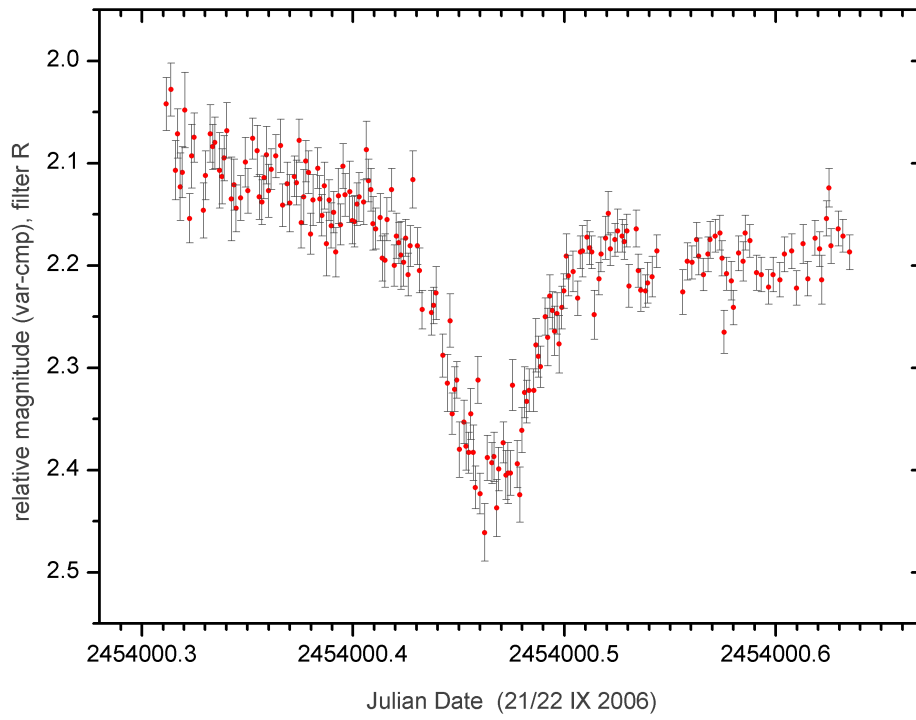
$$\text{Final ephemeris of HKV2 is : } \text{Min. I} = \text{HJD } 2454000.4696 + 0.494176 \times E \\ \pm 0.0004 \pm 0.000009$$

$$\text{Final ephemeris of HKV4 is : } \text{Min. I} = \text{HJD } 2453999.4197 + 0.295562 \times E \\ \pm 0.0006 \pm 0.000007$$

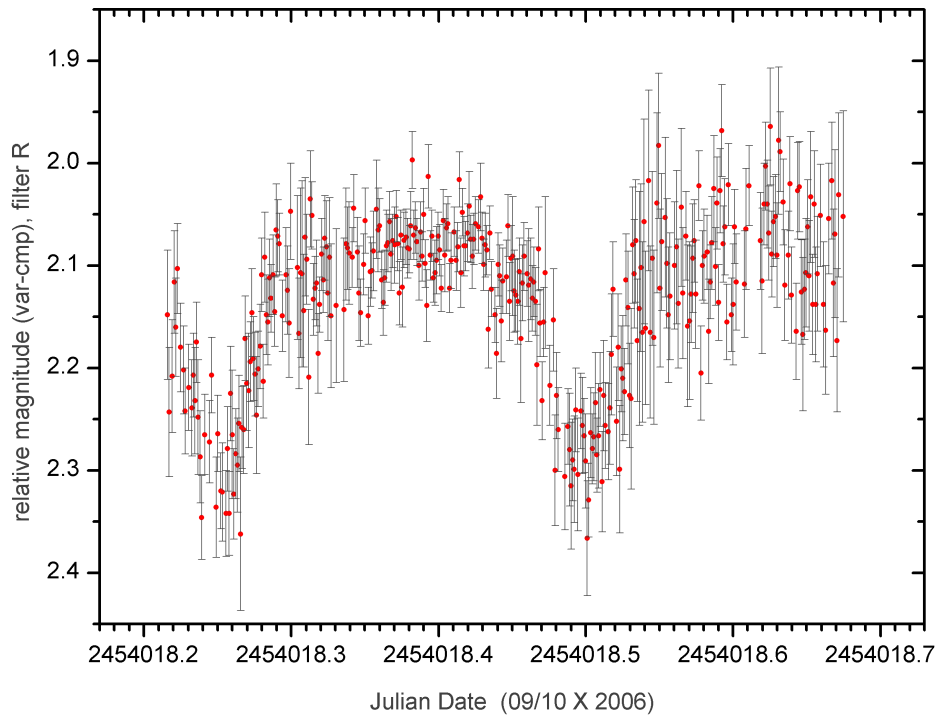
Figure 5 and the period given above suggest that HKV4 is an EW type eclipsing binary with amplitude of 0.55 mag. The situation is less clear in HKV2 (total amplitude is 0.26 mag). The period is well constrained by the detection of two minima in one observing run (cf. Figure 3) but the data suffer from systematic errors (an example is given in Figure 2) due to variations in local atmospheric conditions and inhomogeneities in the flat field. However, as our period determination is based on minima timings, we do not believe that it is seriously affected by the systematic trends. Unfortunately, systematic errors and high noise in the data do not permit us to determine the subtype of variability unambiguously. The period is too short for a usual EB and the star seems to be almost constant between the eclipses, which makes EW less probable. HKV2 could be an EA star with two similarly deep minima. Further investigation of HKV2 is needed, especially with observing setups that can provide higher signal-to-noise ratio.

**Table 1:** Minima timings of HKV2 Tri

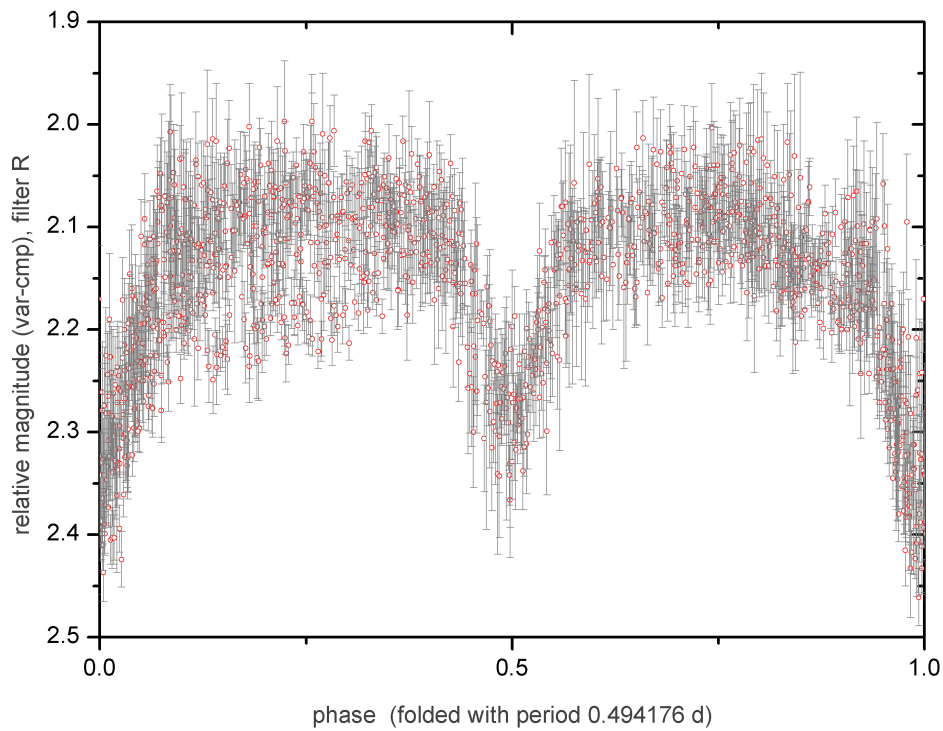
Hel. J.D.	Error	Type	O – C	Observer	Remarks
2453966.3732	0.0005	Min I	0.0017	ML	DISCOVERY
2453996.5161	0.0006	Min I	– 0.0001	ML	
2453999.4799	0.0006	Min I	– 0.0013	ML	
2454000.4696	0.0004	Min I	0.0000	ML	basic minimum
2454017.2697	0.0005	Min I	– 0.0019	ML PH	
2454017.5167	0.0005	Min II	– 0.0020	ML PH	
2454018.2572	0.0005	Min I	– 0.0027	ML PH	
2454018.5022	0.0006	Min II	– 0.0048	ML PH	
2454116.3547	0.0004	Min II	0.0008	ML	



**Figure 2.** CCD R band light curve of HKV2 Tri – basic minimum. The overall decline is caused by variations in local atmospheric conditions.



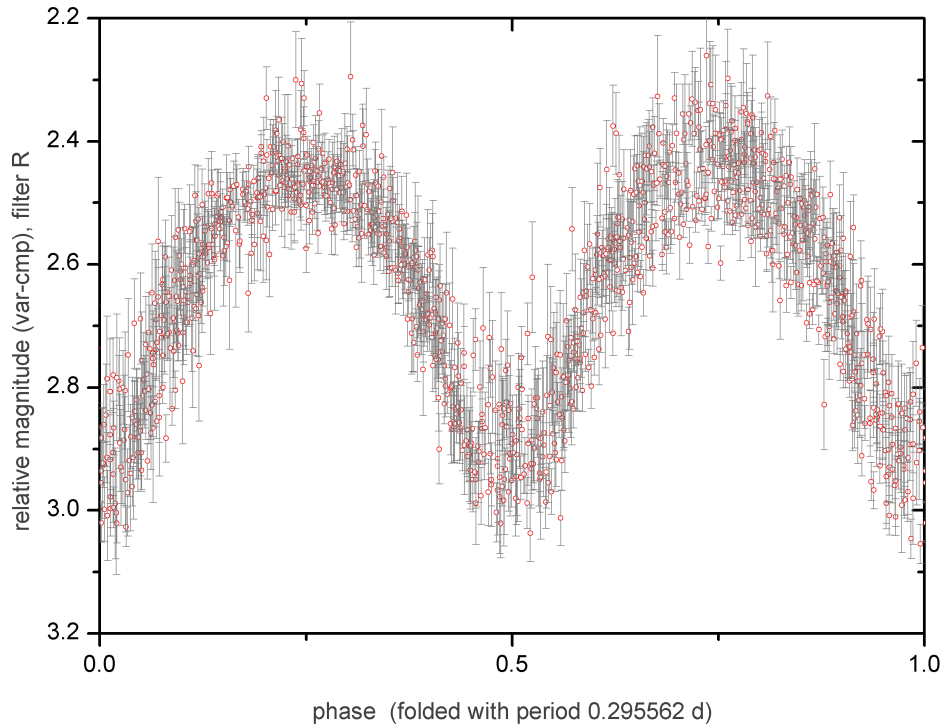
**Figure 3.** CCD R band light curve of HKV2 Tri showing both minima.



**Figure 4.** Phased CCD R band light curve of HKV2 Tri.

**Table 2:** Minima timings of HKV4 Tri

Hel. J.D.	Error	Type	O – C	Observer	Remarks
2453996.4622	0.0008	Min I	– 0.0019	ML	DISCOVERY
2453999.4197	0.0006	Min I	0.0000	ML	basic minimum
2453999.5638	0.0006	Min II	– 0.0037	ML	
2454000.4548	0.0005	Min II	0.0006	ML	
2454000.6006	0.0005	Min I	– 0.0013	ML	
2454017.2939	0.0005	Min II	– 0.0073	ML PH	
2454017.4489	0.0008	Min I	– 0.0001	ML PH	
2454018.3351	0.0006	Min I	– 0.0006	ML PH	
2454018.4824	0.0006	Min II	– 0.0010	ML PH	
2454018.6298	0.0006	Min I	– 0.0014	ML PH	
2454116.3141	0.0005	Min II	– 0.0004	ML	
2454116.4598:	0.0006:	Min I	– 0.0024	ML	uncertain



**Figure 5.** Phased CCD R band light curve of HKV4 Tri.

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#### References:

- Barbera, R., 2000, AVE, <http://www.astrogea.org/soft/ave/aveint.htm>  
Maciejewski, G., 2004, PerSea 2.01, <http://sun.astr.uni.torun.pl/~gm/down.html>  
Motl, D., 2006, C-Munipack, <http://integral.sci.muni.cz/cmunicipack/index.html>