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THREE NEW ECLIPSING BINARY STARS IN FIELD OF OP Lac

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Abstract: The new EW eclipsing binary HKV5 Lac = CzeV137 = USNO-B1.0 1454-0411281 (R.A. = 22h 34m 29.31s, Decl. = +55o 29' 03.6", J2000.0, R = 16.23 - 16.66 mag; Min. I = HJD 2454387.35273 + 0.387245 x E) and the new EA type eclipsing binary HKV6 Lac = CzeV138 = USNO-B1.0 1455-0409516 (R.A. = 22h 34m 16.26s, Decl. = +55o 34' 24.1", J2000.0, R = 14.10 - 14.23 mag; Min. I = HJD 2454387.58563 + 1.105815 x E) and the new EA type eclipsing binary HKV7 Lac = CzeV139 = USNO-B1.0 1455-0409575 (R.A. = 22h 34m 21.44s, Decl. = +55o 30' 13.8", J2000.0, R = 13.52 - 13.78 mag; Min. I = HJD 2454373.28108 + 1.324325 x E) have been found near the variable star OP Lac by 0.40-m f/5 reflector at Hradec Králové observatory.

The new EW eclipsing binary HKV5 Lac = CzeV137 = VSX J223429.3+552903 = USNO-B1.0 1454-0411281 (R.A. = 22h 34m 29.31s, Decl. = +55o 29' 03.6", J2000.0, R = 16.23 - 16.66 mag) and the new EA type eclipsing binary HKV6 Lac = CzeV138 = VSX J223416.2+553424 = USNO-B1.0 1455-0409516 (R.A. = 22h 34m 16.26s, Decl. = +55o 34' 24.1", J2000.0, R = 14.10 - 14.23 mag) and the new EA type eclipsing binary HKV7 Lac = CzeV139 = VSX J223421.4+553013 = USNO-B1.0 1455-0409575 (R.A. = 22h 34m 21.44s, Decl. = +55o 30' 13.8", J2000.0, R = 13.52 - 13.78 mag) have been found near the variable star OP Lac on 22nd September 2007, 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 HKV5, HKV6 and HKV7 Lac has been preliminary published in the Czech Variable Star catalogue (CzeV 137, CzeV 138 and CzeV 139) on 25th September 2007 and in the International Variable Star Index (VSX J223429.3+552903, VSX J223416.2+553424 and VSX J223421.4+553013) on 07th November 2007.

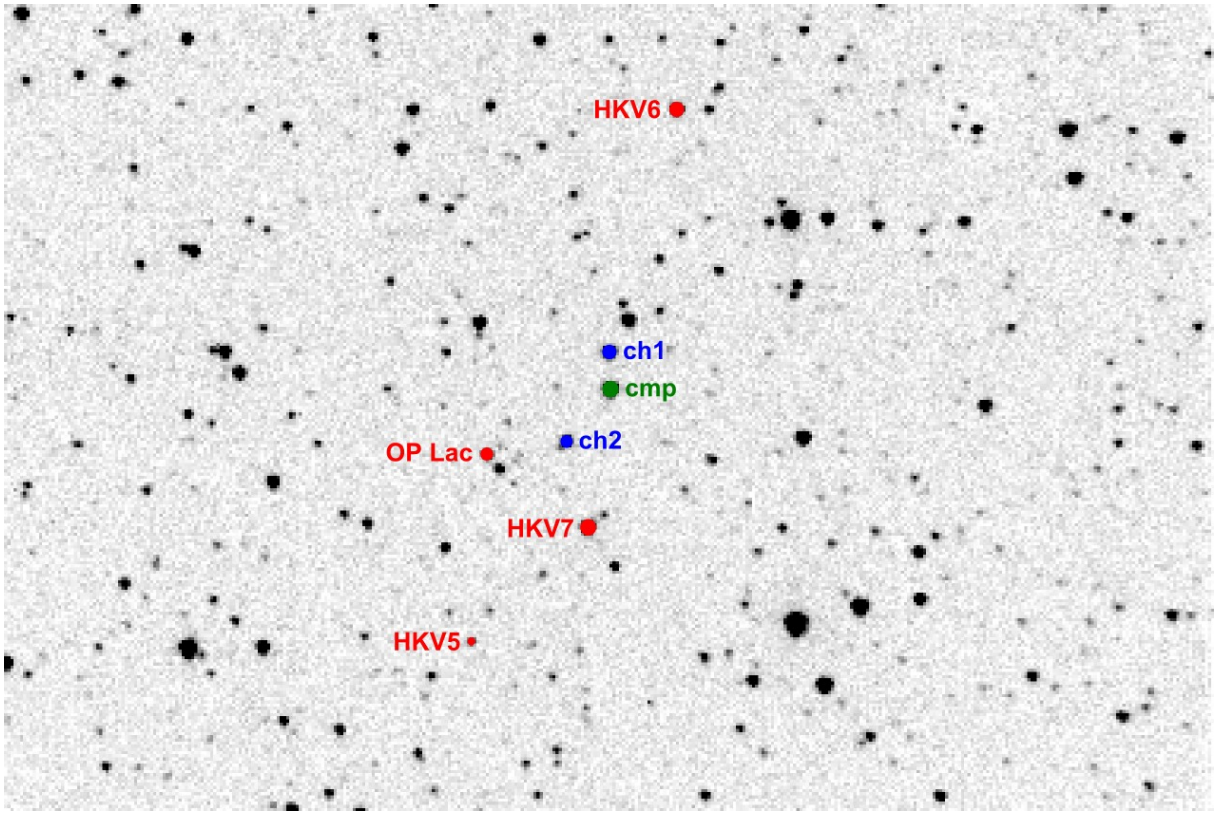

Figure 1. Close vicinity of HKV5, HKV6 and HKV7 Lac (field of view is 13' x 9', N is to the top, E to the left).

Comparison stars are *cmp* USNO-B1.0 1455-0409556 (R.A. = 22h 34m 20.25s, Decl. = +55° 31' 35.8", J2000.0, R2mag = 12.66), *ch1* USNO-B1.0 1455-0409561 (R.A. = 22h 34m 20.37s, Decl. = +55° 31' 57.9", J2000.0, R2mag = 13.29) and *ch2* USNO-B1.0 1455-0409604 (R.A. = 22h 34m 23.21s, Decl. = +55° 31' 02.9", J2000.0, R2mag = 13.21). Magnitudes were taken from the USNO-B1.0 catalogue.

During ten nights (2007 September – 2008 October; time span 397 days) I obtained a total of 3113 CCD frames of HKV5, HKV6 and HKV7. Images were processed using C-Munipack (Motl, 2006). I searched my data for periods using PerSea 2.01 (Maciejewski, 2004). I obtained minima timings using the Kwee and Van Woerden method implemented in AVE (Barbera, 2000). The period of HKV5 was further improved by analysis of these minima timings. My phased R band light curves are shown in Figures 2, 3 and 4; minima timings are given in Tables 2, 3 and 4. The best observed primary minima were chosen as the basic ones. Final ephemerides are:

Final ephemeris of HKV5 is : Min. I = HJD 2454387.35273 + 0.387245 x E
± 0.00040 ± 0.000009

Final ephemeris of HKV6 is : Min. I = HJD 2454387.58563 + 1.105815 x E
± 0.00045 ± 0.000090

Final ephemeris of HKV7 is : Min. I = HJD 2454373.28108 + 1.324325 x E
± 0.00035 ± 0.000150

Figure 2 and the period given above suggest that HKV5 is an EW type eclipsing binary with amplitude of 0.43 mag (R = 16.23 - 16.66 mag). Figure 3 and the period given above suggest that HKV6 is an EA type eclipsing binary with depth of primary minimum 0.13 mag. (R = 14.10 - 14.23 mag) and depth of secondary minimum 0.04 mag (R = 14.10 - 14.14 mag). Although small amplitude variability of the light curve outside eclipses is possible, scatter in the light curves is consistent with being due to the measurement errors. Figure 4 and the period given above suggest that HKV7 is an EA type eclipsing binary with depth of primary minimum 0.26 mag. (R = 13.52 - 13.78 mag) and depth of secondary minimum 0.08 mag (R = 13.52 - 13.60 mag). Although small amplitude variability of the light curve outside eclipses is possible, scatter in the light curves is consistent with being due to the measurement errors.

Table 1: Coordinates of new variable stars HKV5, HKV6 and HKV7 Lac

HKV5 Lac	R.A. = 22h 34m 29.31s, Decl. = +55o 29' 03.6", J2000.0, R = 16.23 - 16.66 mag
HKV6 Lac	R.A. = 22h 34m 16.26s, Decl. = +55o 34' 24.1", J2000.0, R = 14.10 - 14.23 mag
HKV7 Lac	R.A. = 22h 34m 21.44s, Decl. = +55o 30' 13.8", J2000.0, R = 13.52 - 13.78 mag

Table 2: Minima timings of HKV5 Lac

Hel. J.D.	Error	Type	O – C	Observer	Remarks
2454366.45154	0.00090	Min I	0.0099	ML	DISCOVERY
2454367.40805	0.00035	Min II	– 0.0017	ML	
2454367.59783	0.00114	Min I	– 0.0056	ML	
2454368.37583	0.00060	Min I	– 0.0021	ML	
2454368.57075	0.00055	Min II	– 0.0008	ML	
2454387.35273	0.00040	Min I	0.0000	ML	basic minimum
2454387.54053	0.00040	Min II	– 0.0058	ML	
2454388.32278	0.00061	Min II	0.0019	ML	
2454388.51346	0.00055	Min I	– 0.0010	ML	
2454716.31603	0.00055	Min II	0.0014	ML	
2454716.50957	0.00060	Min I	0.0013	ML	
2454763.36112	0.00059	Min I	– 0.0034	ML	

Table 3: Minima timings of HKV6 Lac

Hel. J.D.	Error	Type	O – C	Observer	Remarks
2454366.57501	0.00038	Min I	– 0.0001	ML	DISCOVERY
2454387.58563	0.00045	Min I	0.0000	ML	basic minimum
2454410.2460:	0.0010:	Min II	– 0.0088	ML	uncertain
2454763.56638	0.00112	Min I	0.0037	ML	

Table 4: Minima timings of HKV7 Lac

Hel. J.D.	Error	Type	O – C	Observer	Remarks
2454367.32379	0.00052	Min II	0.0022	ML	
2454373.28108	0.00035	Min I	0.0000	ML	basic minimum
2454388.51408	0.00030	Min II	0.0033	ML	
2454716.2818:	0.0009:	Min I	0.0006	ML	uncertain
2454763.29335	0.00041	Min II	– 0.0014	ML	

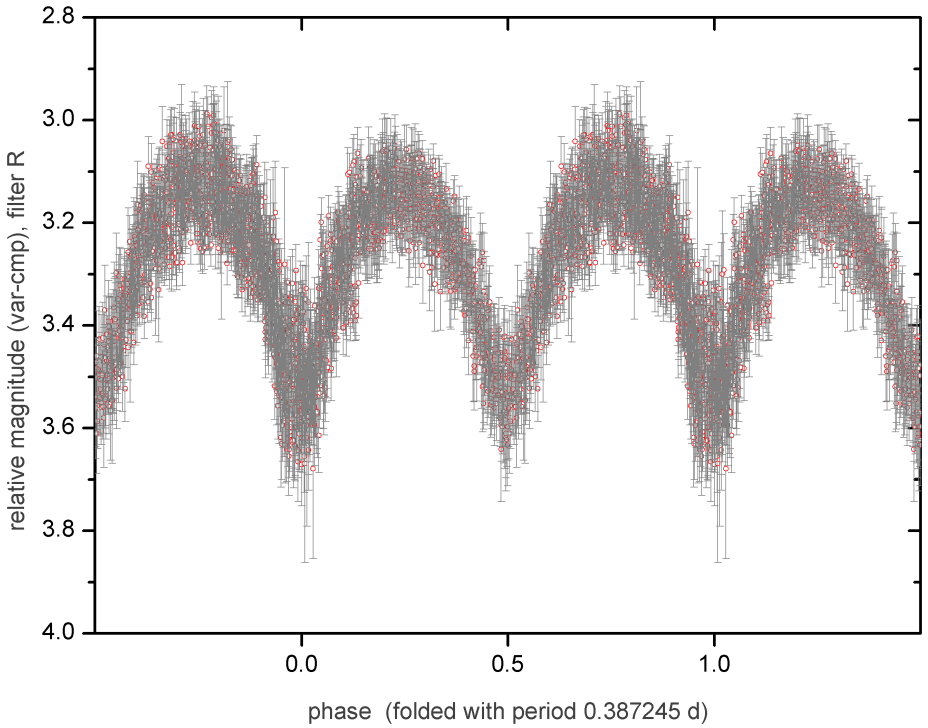

Figure 2. Phased CCD R band light curve of HKV5 Lac.

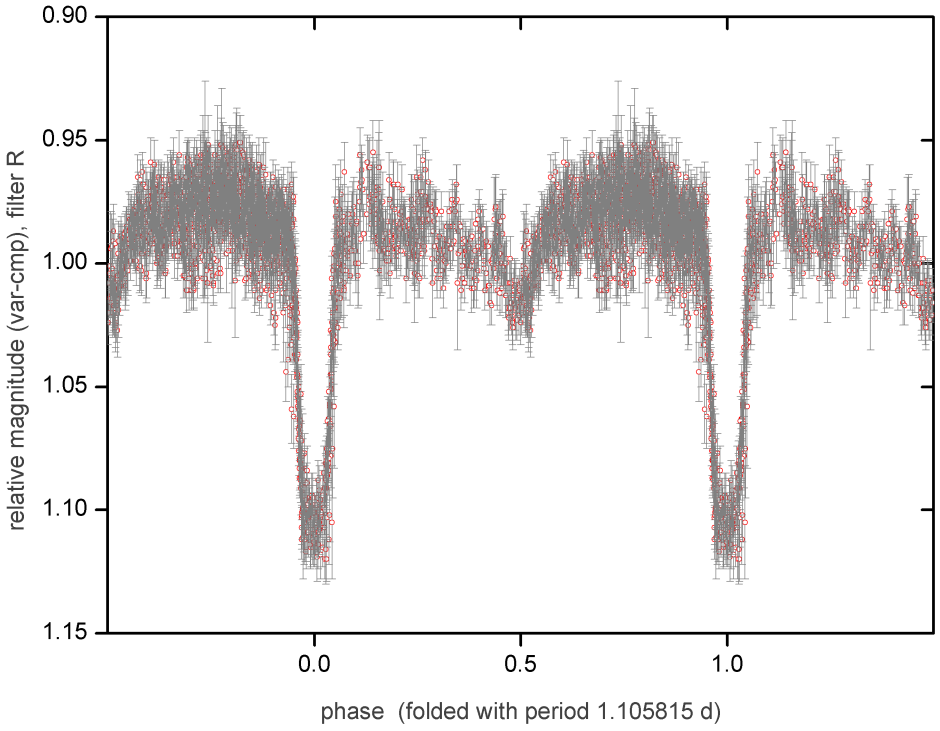

Figure 3. Phased CCD R band light curve of HKV6 Lac.

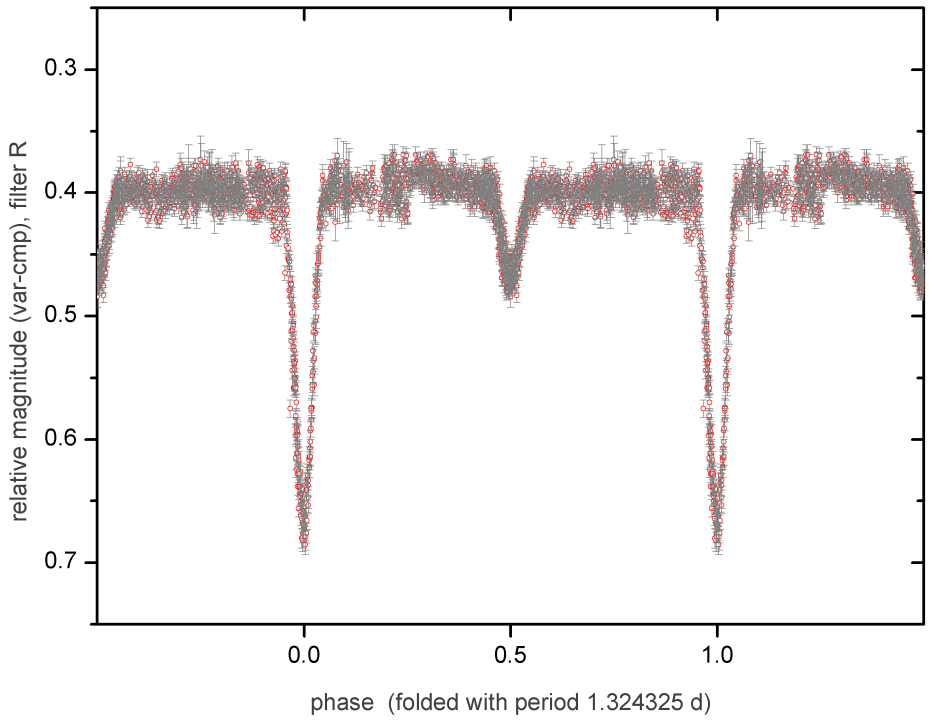

Figure 4. Phased CCD R band light curve of HKV7 Lac.

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