

Two new variable stars in the field of the Transiting Extrasolar planet TRES-1 (GSC 2652-1324)

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Abstract: Two new variable stars (HMB09 = USNO-B1.0 1265-0306001 and HMB10 = USNO-B1.0 1267-0324775) have been identified in the field of the host star of the transiting Extrasolar planet TRES-1 (GSC2652-1324). The third star showing variability is already known under the abbreviation Pej025 = IBVS 5700-40 as found in the VSX database of the AAVSO. Full light curves for all the three stars are presented. The form of the light curve indicates that all the three stars are EW type variable stars.

For HMB09 a period $P = 0.579289 \pm 0.000056$ [d] with the epoch $E_0 = \text{HJD } 2454249.977$ and an amplitude of the light variation of $\Delta m = 0.400 \pm 0.005$ mag. has been found. For HMB10 a period $P = 0.337262 \pm 0.000037$ [d] with the epoch $E_0 = \text{HJD } 2454249.940$ and an amplitude of the light variation of $\Delta m = 0.25 \pm 0.05$ mag. has been found. And finally for Pej025 a period $P = 0.300374 \pm 0.000021$ [d] with the epoch $E_0 = \text{HJD } 2454249.495$ and an amplitude of the light variation of $\Delta m = 0.30 \pm 0.02$ mag. has been found. For the latter the period has been significantly improved compared to the one given in VSX.

Following the light curve variation of the host star of the transiting Extrasolar planet TRES-1 (GSC2652-1324) in the constellation Lyra has resulted in several data sets during 79 days of CCD observations of the field using a 50 cm f/8.2 Ritchey Chrétien telescope and the STL11000XM CCD camera with a clear filter. The field covered by this CCD is 30×20 arcmin². During inspection of the stars in the field with the program package C-Munipack (Motl, 2006) three other stars showing variability were detected. The first new variable star HMB09 = USNO-B1.0 1265-0306001 (average R-Mag. 13.30 from the USNO-B1.0 catalog) is at position Right ascension: 19h 04m 20.54s and Declination: +36 30' 56.8". The star has been observed during 11 nights between May 28 and August 15, 2007, a time span of about 79 days. This resulted in 2954 CCD observations. No filter was used during the investigation. The image exposure was 60 sec. As comparison star the star USNO-B1.0 1266-0312664 was used. Its position and magnitude (based on data from GUIDE8 (Gray, 2006) are:

19h03m32.24s +36 37' 37.8" 13.7 (average R-magnitude 13.7).

The check star has been the star USNO-B1.0 1265-0305498. A finder chart is given in Fig. 1. The resulting light curve of the new variable star is given in Fig. 2. Relative magnitude differences are given. A very symmetric light curve is visible. The secondary minimum is not as deep as the primary one by about 0.05 mag. The period was found with the period analysis software Peranso 2.2 (Vanmunster, 2006). The method used employs periodic orthogonal polynomials to fit observations, and the analysis of variance (ANOVA) statistic to evaluate the quality of the fit. This method was proposed by (Schwarzenberg-Czerny, 1996). It strongly improves peak detection sensitivity and damps alias periods.

The derived elements for the minima of this star are the following:

$P = 0.579289 \pm 0.000056$ [d] with the epoch $E_0 = \text{HJD } 2454250.555$ and an amplitude of the light variation of $\Delta m = 0.400 \pm 0.005$ mag.

The following minima for this star could be deduced:

Delta Mag.	Type of Minimum	HJD	Error
0.29	secondary	2454250.8287	0.0031
0.35	primary	2454325.8540	0.0038
0.30	secondary	2454327.8788	0.0061
0.36	primary	2454328.7542	0.0036

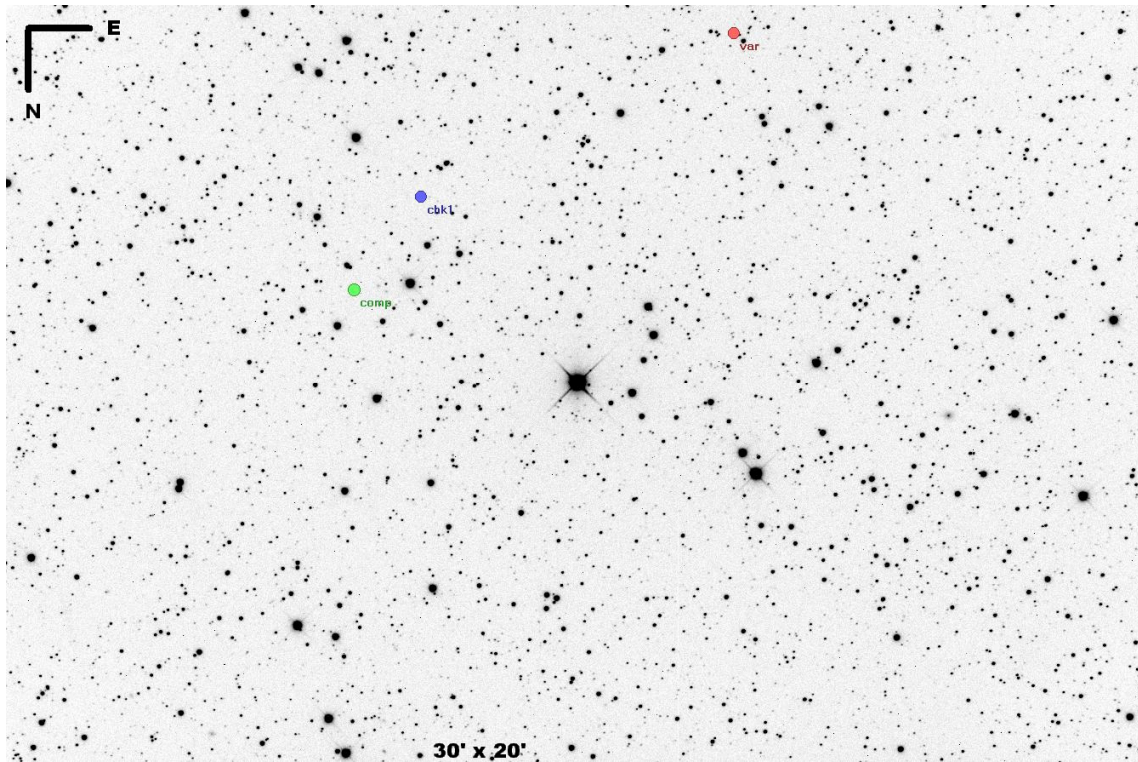


Fig. 1. Finding chart of the star HMB09 = USNO-B1.0 1265-0306001. The star is indicated by the red circle. Comparison star (green circle) and check star (blue circle) are also given.

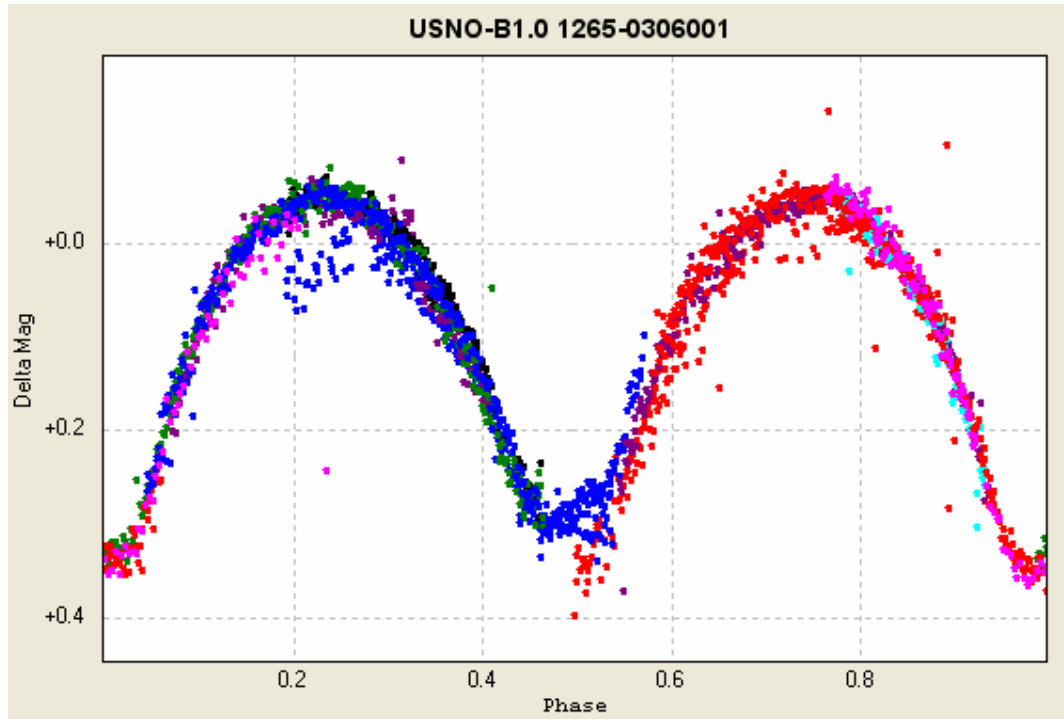


Fig. 2. Phase diagram for the star HMB09 = USNO-B1.0 1265-0306001. The different colours are the different observing runs covering a period of 11 nights.

The second new variable is the star HMB10 = USNO-B1.0 1267-0324775 (average R-Mag. 15.45 from the USNO-B1.0 catalog) at position Right ascension: 19h 03m 23.51s and Declination: +36 45' 35.1". The star has

been observed during 11 nights between May 28 and August 15, 2007, a time span of about 79 days. This resulted in 2954 CCD observations. No filter was used during the investigation. The image exposure was 60 sec. As comparison star the star USNO-B1.0 1266-0312664 as above was used. A finder chart is given in Fig. 3. The resulting light curve of the star is given in Fig. 4. Relative magnitude differences are given. A very symmetric light curve is visible. The secondary minimum is also for this star slightly shallower than the primary one. The period was found with the period analysis software Peranso 2.2 (Vanmunster, 2006). Also here the method to find the period as proposed by (Schwarzenberg-Czerny, 1996) was used. The derived elements for the minima of this star are the following:

$P = 0.337262 \pm 0.000037$ [d] with the epoch $E_0 = \text{HJD } 2454249.7721$ and an amplitude of the light variation of $\Delta m = 0.25 \pm 0.05$ mag.

The following minima for this star could be deduced:

Delta Mag.	Type of Minimum	JD	Error
2.72	primary	2454249.7721	0.0025
2.72	primary	2454250.7797	0.0028
2.72	primary	2454251.7953	0.0034
2.68	secondary	2454301.7092	0.0028
2.69	secondary	2454307.7799	0.0024
2.73	primary	2454320.7644	0.0025
2.67	secondary	2454325.6558	0.0034
2.72	primary	2454325.8215	0.0026
2.67	secondary	2454327.6802	0.0031
2.70	primary	2454327.8524	0.0033
2.68	secondary	2454328.6970	0.0023

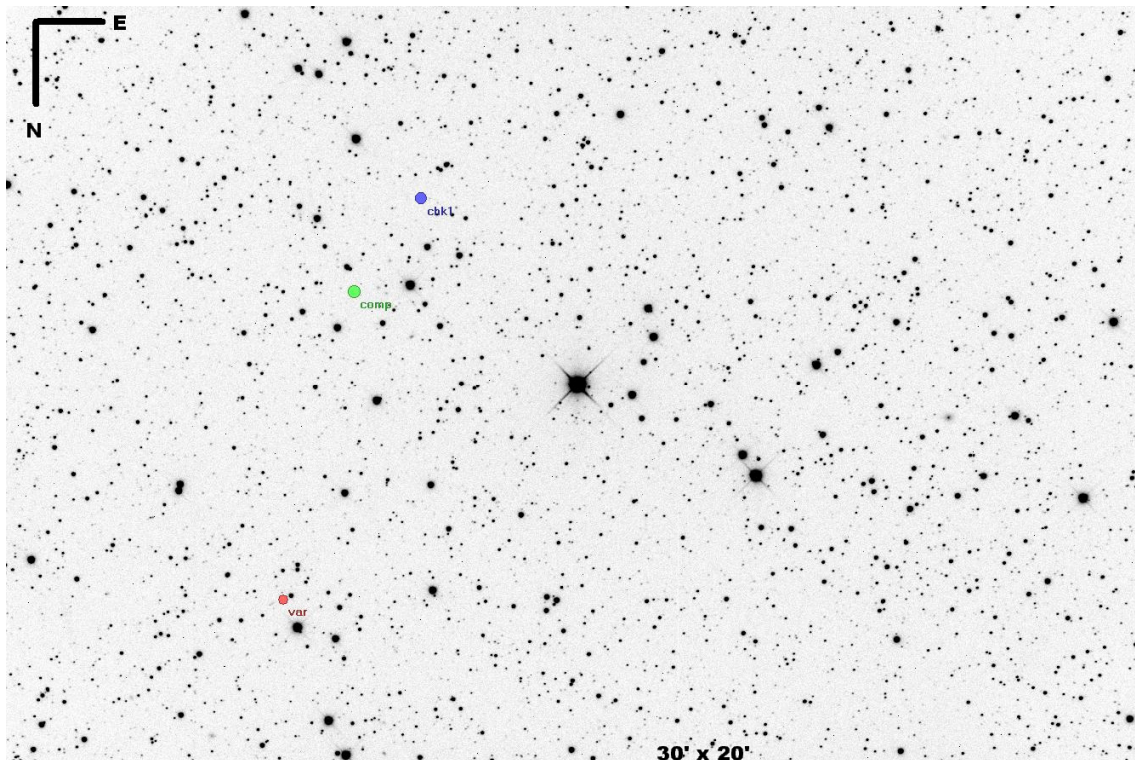


Fig. 3. Finding chart of the star HMB10 = USNO-B1.0 1267-0324775. The star is indicated by the red circle. Comparison star (green circle) and check star (blue circle) are also given.

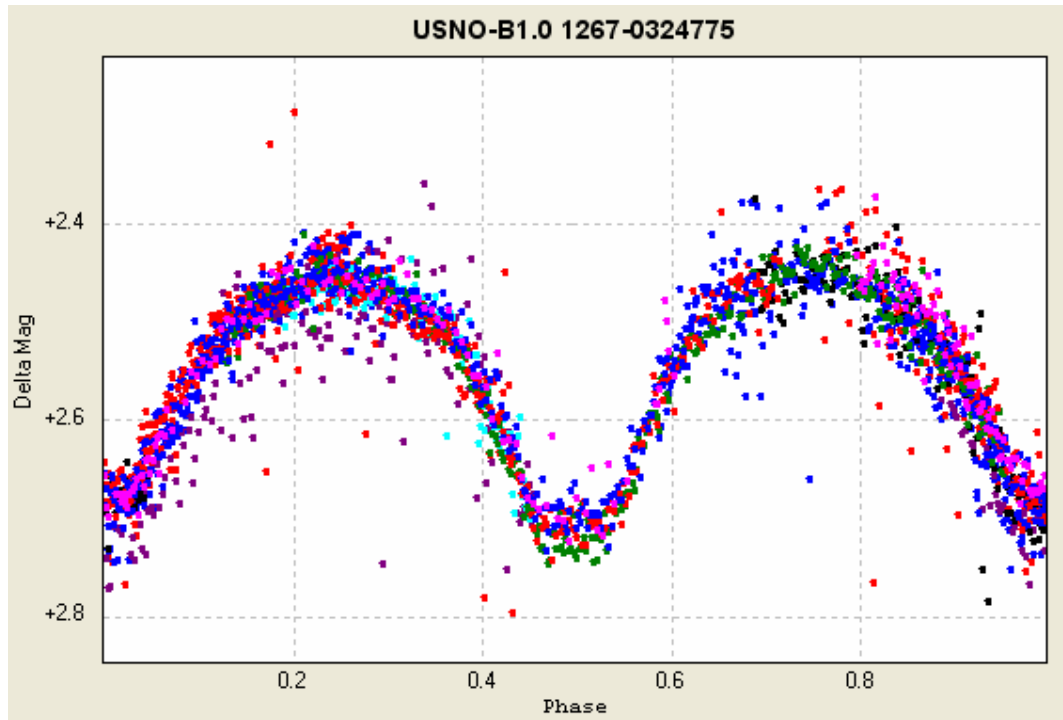


Fig. 4. Phase diagram for the star HMB10 = USNO-B1.0 1267-0324775. The different colors are for the different observing covering a period of 11 nights.

The third star Pej025 = IBVS 5700-40 = USNO-B1.0 1266-0313413 (average R - Mag. 15.0 from the USNO-B1.0 catalog) in the list is at Right ascension: 19h 04m 29.16s and Declination: +36 39' 49.2". The star has been observed during 11 nights between May 28 and August 15, 2007, a time span of about 79 days. This resulted in 2954 CCD observations. No filter was used during the investigation. The image exposure was 60 sec. As comparison star the star USNO-B1.0 1266-0312664 as above was used. A finder chart is given in Fig. 5. The resulting light curve of the star is given in Fig. 6. Relative magnitude differences are given. A very symmetric light curve is visible. The secondary minimum is slightly shallower compared to the primary one. The period was found with the period analysis software Peranso 2.2 (Vanmunster, 2006). Also here the method to find the period as proposed by (Schwarzenberg-Czerny, 1996) was used. The derived elements for the minima of this star are the following:

$P = 0.300374 \pm 0.000021$ [d] with the epoch $E_0 = \text{HJD } 2454249.7964$ and an amplitude of the light variation of $\Delta m = 0.30 \pm 0.02$ mag.

The following minima for this star could be deduced:

Delta Mag.	Type of Minimum	JD	Error
1.98	primary	2454249.7964	0.0043
1.99	primary	2454250.6970	0.0037
1.96	secondary	2454250.8457	0.0019
1.97	primary	2454301.7624	0.0027
1.99	primary	2454307.7674	0.0020
1.99	primary	2454317.6800	0.0025
1.99	primary	2454320.6827	0.0023
1.98	secondary	2454320.8340	0.0018
1.95	secondary	2454325.6413	0.0026
2.00	primary	2454325.7900	0.0022
1.97	primary	2454327.7436	0.0018
1.95	secondary	2454328.6445	0.0023
1.97	primary	2454328.7922	0.0033

The period could be improved compared to the one given in the VSX database.

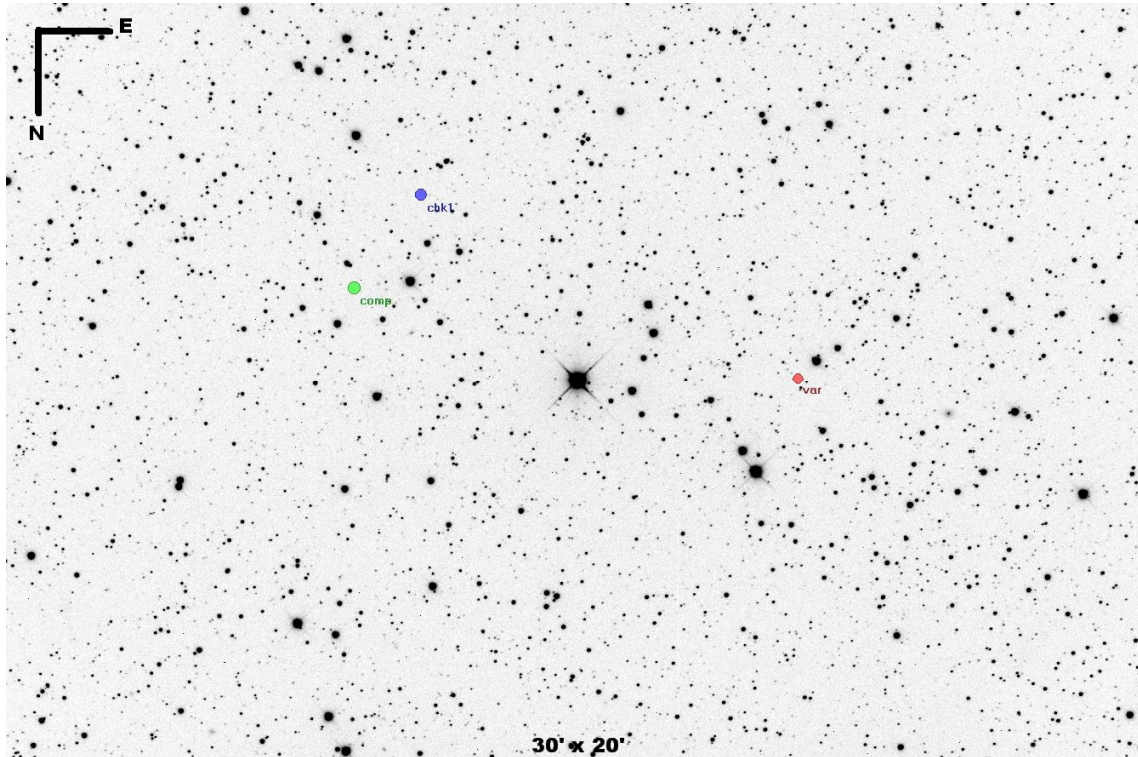


Fig. 5. Finding chart of the star Pej025 = USNO-B1.0 1266-0313413. The star is indicated by the red circle. Comparison star (green circle) and check star (blue circle) are also given.

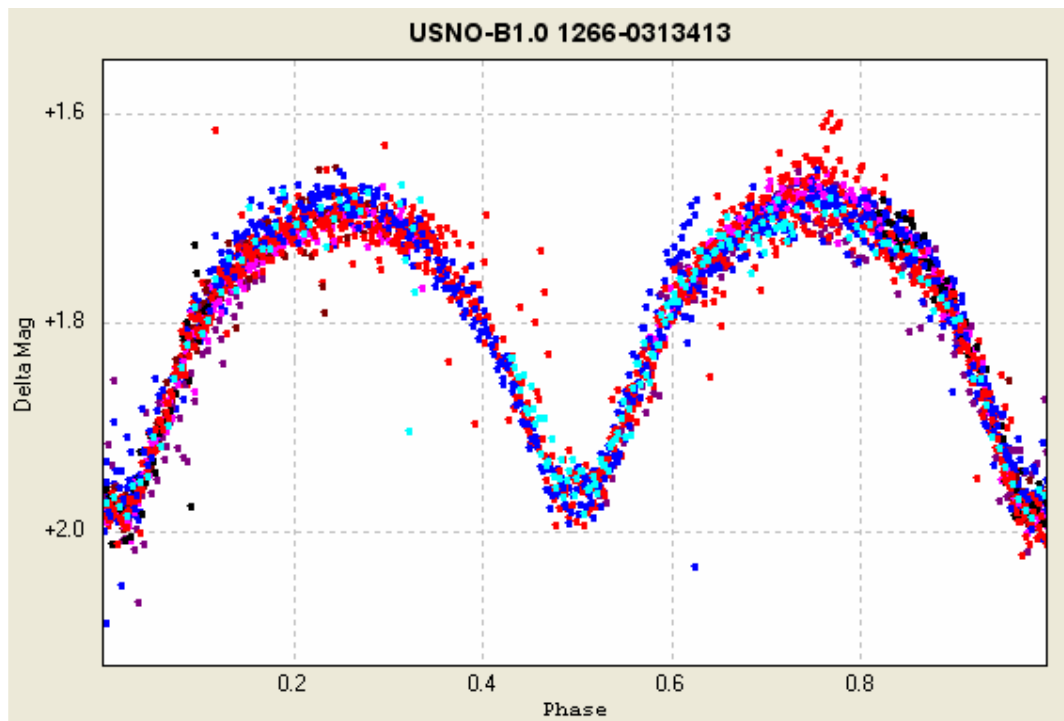


Fig. 6. Phase diagram for the star Pej025 = IBVS 5700-40 = USNO-B1.0 1266-0313413. The different colors are for the different observing covering a period of 11 nights.

The International Variable Star Index Database (VSX) of the AAVSO (AAVSO, 2006) has been consulted and checked whether the three mentioned variable stars are already known. This was not the case for two of them (HMB09 and HMB10). For the third one (Pej025) the period could be improved compared to the one given in the VSX database.

The following table gives a summary about the information of the observed variables:

Name	Magnitude	Delta-Mag.	Epoch (HJD)	Period [d]
HMB09	13.3 - 13.7	0.400 +/- 0.005	2454249.977	0.579289 +/- 0.000056
HMB10	15.45 - 15.70	0.25 +/- 0.05	2454249.940	0.337262 +/- 0.000037
Pej025	15.0 - 15.3	0.30 +/- 0.02	2454249.495	0.300374 +/- 0.000021

Acknowledgements:

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References:

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