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FOUR NEW SHORT-PERIOD ECLIPSING BINARY STARS

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Four new eclipsing binary stars were discovered by the Semi-Automatic Variability Search¹. Basic data for new variables are collected in Table 1. The observations were made at the Astronomical Observatory of the Mikołaj Kopernik University in Piwnice with the semi-automatic CCD camera equipped with a 135/2.8 telephoto lens. As a detector SBIG ST-7 CCD camera with KAF 400 chip was used. All brightness measurements were made in near-Johnson V filter. No transformation to a standard system was done. All given magnitudes are determined against comparison stars, which estimated V magnitudes were calculated from TYCHO-2 Catalogue (Høg et al., 2000) with formula: $V = V_T - 0.090(B_T - V_T)$. Times of minima were determined with the Kwee-van Woerden method (Kwee, van Woerden, 1956). Periods were found with the ANOVA method of Schwarzenberg-Czerny (1996). All four stars were also observed with the 0.9m Schmidt-Cassegrain telescope equipped with the Richardson spectrograph and Wright CCD camera. With 600 gr/mm grating we obtained spectra between 3500 and 5500 Å with 2 Å/pix reciprocal dispersion. These spectra, after standard reduction performed with IRAF package were used for spectral classification.

Table 1. Basic data for new eclipsing variables

Star name	R.A. (J2000)	DEC. (J2000)	Comp. stars	Type
HD 65498	08 ^h 00 ^m 45 ^s .955	+42°10'33".07	HD 66174 GSC 02976-00001	EA
HD 67894	08 ^h 11 ^m 53 ^s .503	+42°54'36".20	HD 67808 HD 68195	EB:
BD+20°2890	13 ^h 53 ^m 53 ^s .848	+20°09'43".18	HD 120831 BD+20°2887	EW
GSC 03472-00641	14 ^h 21 ^m 44 ^s .058	+46°41'59".37	BD+47°2136 BD+47°2141	EW

HD 65498 = BD+42°1795 = GSC 02976-01077 is recorded in Simbad database as a star of $V=9^m75$ with $(B - V)=0^m48$ and spectral type G. Our observations collected during 13 nights between February 23, 2003 and April 4, 2003 and consisting of 232 data points (Figure 1) show that HD 65498 is an algol-type variable (EA) with period of about 31.5 hour. In the primary minimum the observed brightness drops by $\Delta m_V=0^m43$. The secondary minimum is 0^m05 shallower and appears exactly in phase 0.5 indicating circular orbit of the system. Both minima are of equal duration and last for about

¹For further information on SAVS see <http://www.astri.uni.torun.pl/~gm/SAVS/>.

4 hours. Coordinates of HD 65498 coincide with those of an infra-red source 2MASS J0800459+421033. A preliminary ephemeris for the primary minimum is:

$$\begin{aligned} \text{Min. I} = & \text{HJD } 2452704.48836 + 1^{\text{d}}31324 \times E. \\ & \pm 0.00054 \pm 0.00006 \end{aligned} \quad (1)$$

Our spectrum of HD 65498 shows features characteristic for a F5V star (see Figure 5).

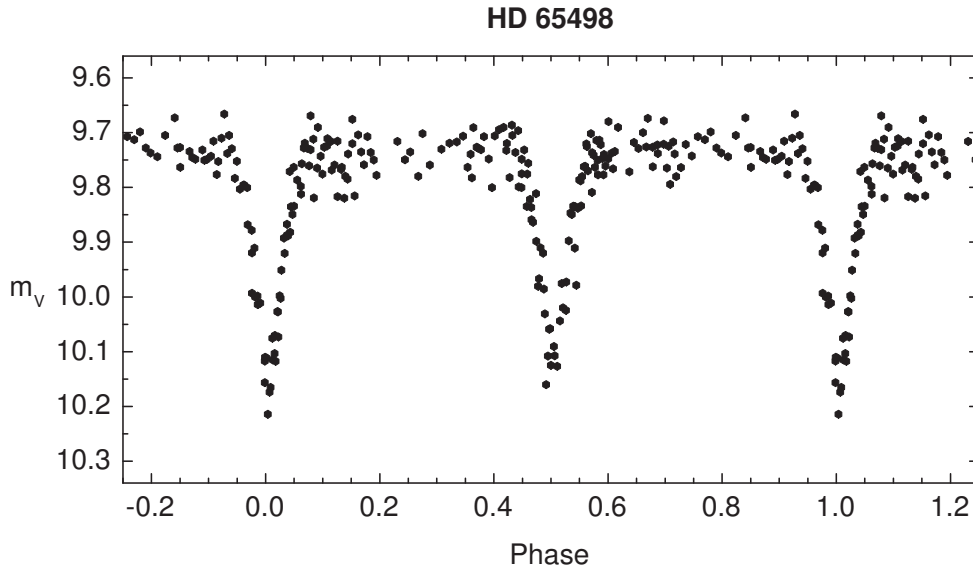


Figure 1. CCD light curve of HD 65498

Variability of HD 67894 = BD+43°1775 = GSC 02979-02218 was discovered during 23 nights between October 23, 2002 and April 10, 2002. 278 data points were collected in total. HD 67894 has $V=9^{\text{m}}98$ and $(B-V)=0^{\text{m}}40$, and is classified as a star of spectral type of G0 in Simbad. As it is seen in Figure 2, the difference between minima is considerable. The depth of the primary minimum is $\Delta m_V=0^{\text{m}}28$ and an amplitude of the secondary minimum is $0^{\text{m}}18$. Therefore, despite of a short period and a late spectral type, we classified the system basing on the light-curve morphology as an eclipsing variable of β Lyrae type. Due to positions coincidence we identify HD 67894 with the IR source observed within 2MASS survey - 2MASS J0811535+425436. A preliminary ephemeris is:

$$\begin{aligned} \text{Min. I} = & \text{HJD } 2452722.47342 + 0^{\text{d}}378018 \times E. \\ & \pm 0.00035 \pm 0.000015 \end{aligned} \quad (2)$$

Basing on spectrum presented in Figure 5 we classify HD 67894 as a F3V star.

BD+20°2890 = GSC 01473-01049 was noted as a variable star with an amplitude about $0^{\text{m}}2$ by Oja (1985) during a photoelectric UBV photometry survey for stars located near the North Galactic Pole. The V magnitude for the star of interest is 10.4 and color indices $(B-V)=0^{\text{m}}38$ and $(U-B) = -0^{\text{m}}02$ (Oja, 1985). Our photometric data (Figure 3) show that BD+20°2890 is an eclipsing binary of W UMa type changing its brightness with an

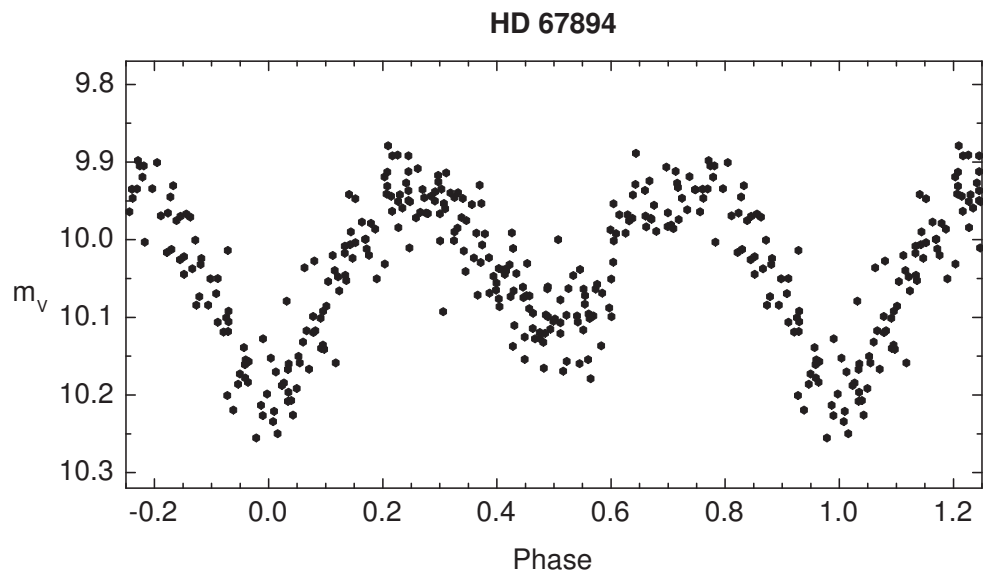


Figure 2. CCD light curve of HD 67894

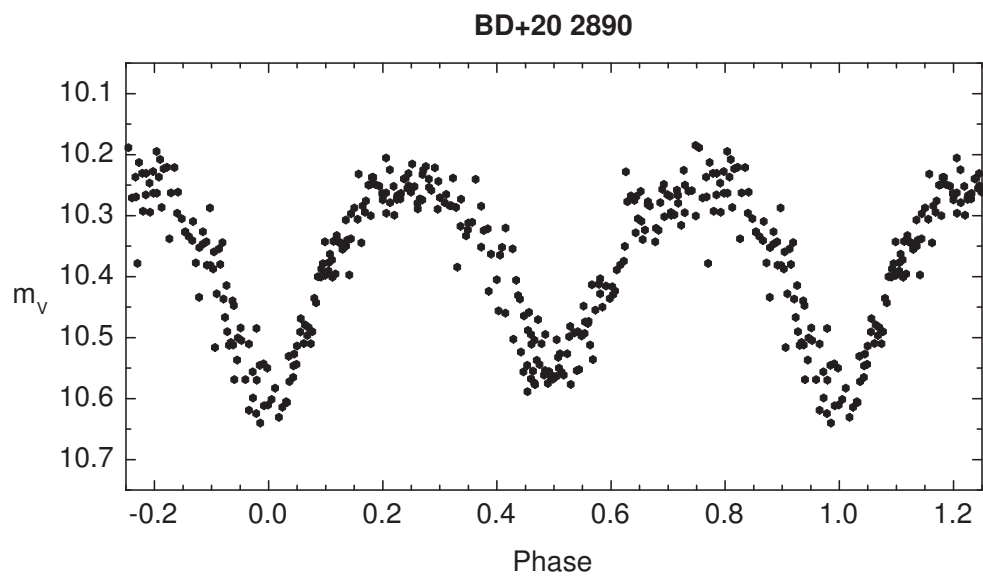


Figure 3. CCD light curve of BD+20°2890

amplitude in the primary minimum by $\Delta m_V = 0^m37$ and with a period of just over a half of a day. The secondary minimum is 0^m07 brighter. Observations were performed during 14 nights between April 21, 2003 and June 1, 2003. 309 single photometric measurements were collected. In our data the object is blended with its fainter companion located 20 arc seconds south. The ephemeris of a primary minimum is given by formula:

$$\begin{aligned} \text{Min. I} = \text{HJD } 2452788.42371 + 0^d53158 \times E. \\ \pm 0.00025 \pm 0.00002 \end{aligned} \quad (3)$$

Optical spectrum (Figure 5) allows us to assign the A9III spectral type to BD+20°2890.

GSC 03472-00641 is the last new variable presented in this paper. Photometry from to TYCHO-2 Catalogue (Høg et al. 2000) gives $V=11^m32$ and $(B - V)=0^m45$. Our 214 data points collected during 12 nights between April 19, 2003 and May 7, 2003 show that GSC 03472-00641 is a W UMa system with a period of almost 8 hours. The obtained light curve is presented in Figure 4. The primary and secondary minima have an amplitude of $\Delta m_V = 0^m50$ and $\Delta m_V = 0^m39$ respectively. Due to positions coincidence we identify GSC 03472-00641 with the infra-red source 2MASS J1421440+464159. A preliminary ephemeris for the primary minimum is following:

$$\begin{aligned} \text{Min. I} = \text{HJD } 2452764.50965 + 0^d318618 \times E. \\ \pm 0.00030 \pm 0.000081 \end{aligned} \quad (4)$$

Presented in Figure 5 spectrum of GSC 03472-00641 is most similar to G5III type.

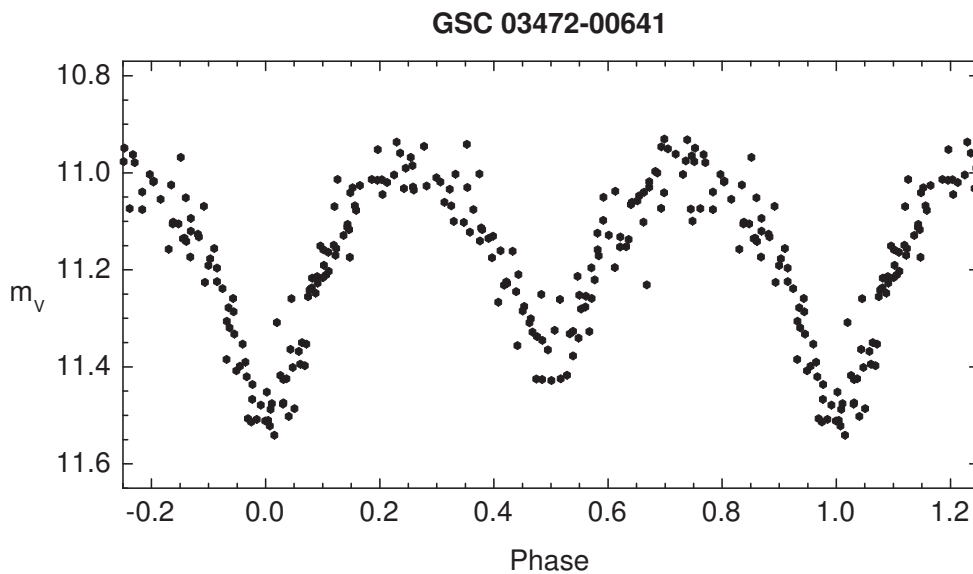


Figure 4. CCD light curve of GSC 03472-00641

Acknowledgements: This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France. This paper is based on observations collected at Piwnice observatory.

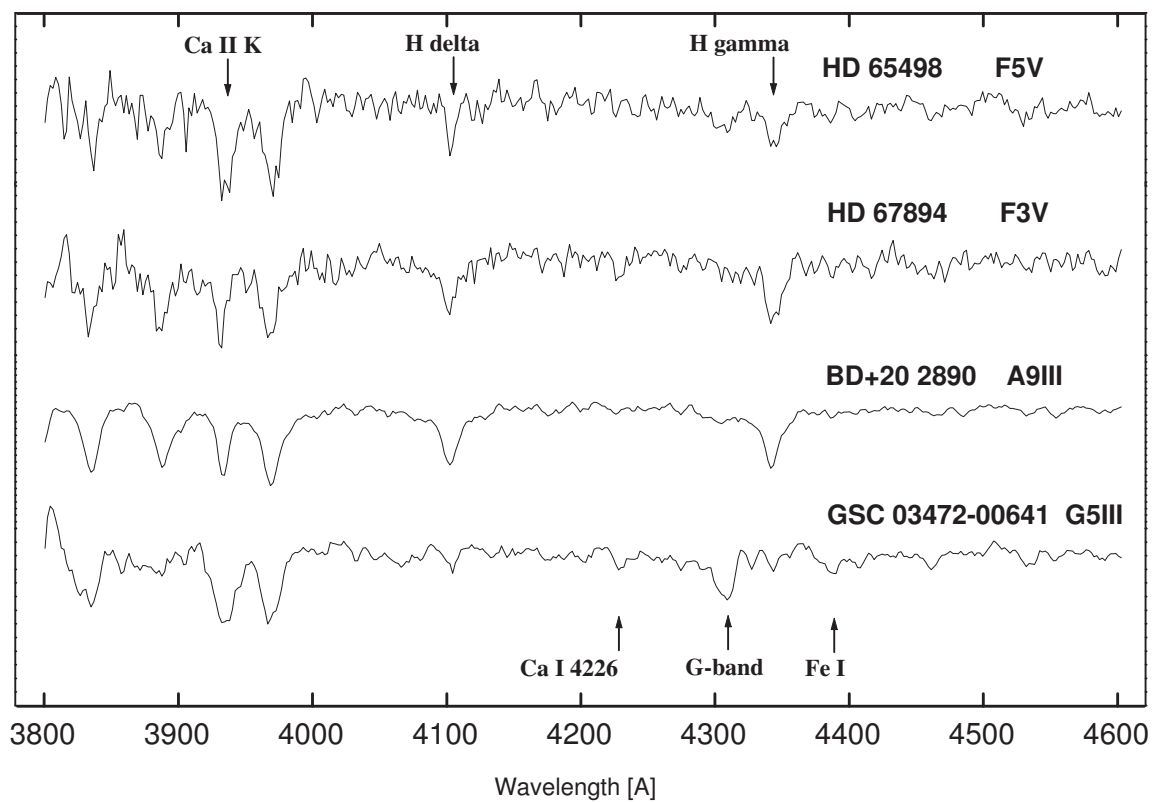


Figure 5. Optical spectra of the program stars in the blue. Positions of the most significant spectral features are indicated

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ERRATUM FOR IBVS 5431

Geert Hoogeveen reported the following error:

IBVS No.	item	printed	correct
5431	RA (BD +20°2890)	13 ^h 53 ^m 53 ^s .848	13 ^h 53 ^m 13 ^s .848