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NEW PHOTOELECTRIC PHOTOMETRY OF THE NEGLECTED CONTACT BINARY EP And

PRIBULLA, THEODOR[1]; VAŇKO, MARTIN[1]; PARIMUCHA, ŠTEFAN[2]

[1] Astronomical Institute of the Slovak Academy of Sciences, 059 60 Tatranská Lomnica, Slovakia

[2] Faculty of Science, Department of the Theoretical Physics and Astronomy, University of P.J. Šafárik, 040 01 Košice, Slovakia

Contact binary EP And (GSC 2827-17, $1^{\rm h}42^{\rm m}29\overset{\rm s}{.}32$, $+44^\circ45'42\overset{''}{.}4$, 2000.0, $V_{\rm max} = 11\overset{\rm m}{.}9$) was discovered by Strohmeier et al. (1955). Due to high proper motion, the system was later misidentified and designated as NSV 598 (see Mánek, 1994). Its orbital period was recently studied by Qian & Yuan (2001). The authors concluded that the period of the system is increasing at the rate $dP/dt = 1.16 \times 10^{-7}$ day year^{-1} and gave the following quadratic ephemeris for the primary minimum:

$$\begin{array}{ccccc} \text{Min I} = 2\,442\,638.5134 & + & 0.404110940 \times E & + & 6.44 \times 10^{-11} \times E^2. \\ \pm 9 & & \pm 1 & & \pm 9 \end{array} \qquad (1)$$

Apart from two photoelectric (Hoffmann, 1983) and one CCD (Diethelm, 1997) minima no photoelectric or CCD light curve of the system has been published. Therefore we included the system into the photoelectric monitoring of contact binaries.

New BV light curves of EP And were obtained at the Stará Lesná observatory of the Astronomical Institute of the Slovak Academy of Sciences. The observations were taken on for nights August 15, 16 and September 19, 20, 2001. The 0.6-m Cassegrain telescope equipped with a single-channel photoelectric photometer was used. Data reduction, the atmospheric extinction correction and transformation to the standard international BV system were carried out in the usual way (see Pribulla et al., 2001). GSC 2827-575 and GSC 2827-2135 were used as the comparison and check stars, respectively. The comparison star was found to be stable with respect to the check star within $0\overset{\rm m}{.}015$ in the V passband. Our observations were used to determine 3 new minima times (Table 1) using Kwee & van Woerden method. All BV observations, shown in Fig. 1 (with respect to GSC 2827-575), were phased using linear ephemeris:

$$\begin{array}{ccccc} \text{Min (I)} = \text{HJD}\ 2\,452\,137.5293 & + & 0.40411056 \times E, \\ \pm 20 & & \pm 19 \end{array} \qquad (2)$$

determined from all available photoelectric ($w = 2$) and CCD minima ($w = 1$). The minima occur at present about 0.125 of the period later than predicted by ephemeris (1).

The shape of the minima (Fig. 1) indicates that the system is very probably totally eclipsing. Therefore we tried to found preliminary photometric elements. Since the binary is rather faint its spectral type is unknown. The Tycho Catalogue (ESA, 1997) gives

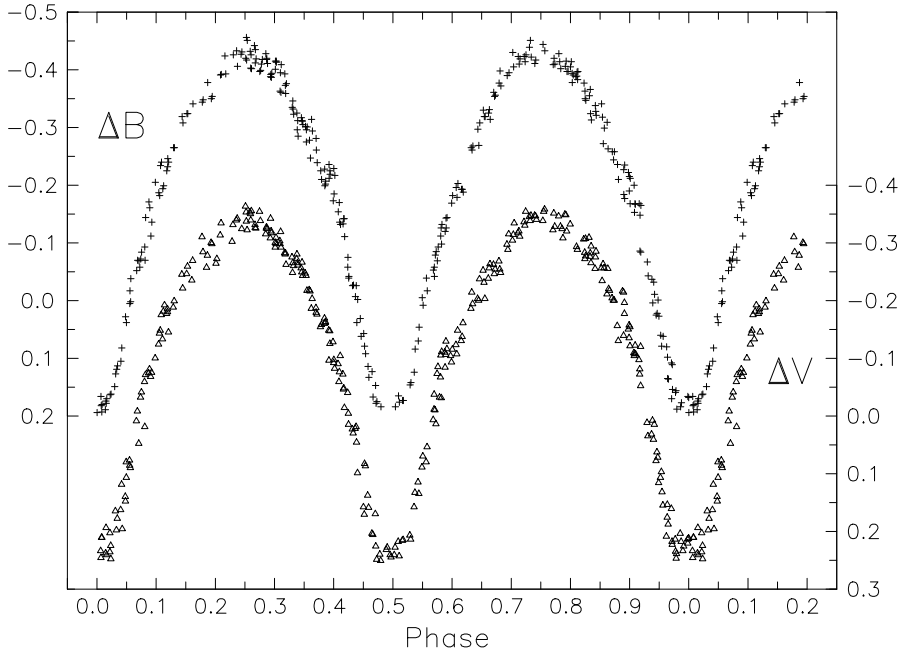

Figure 1. *BV* light curves of EP And with respect to GSC 2828-575 according to ephemeris (2)

$B-V = 0.626 \pm 209$. Due to the large error (caused by the variability of the system) and interstellar absorption we have estimated the intrinsic colour index from the period-colour relation of Wang (1994): $(B-V)_0 = 0.062 - 1.31 \log P$. The resulting intrinsic colour $(B-V)_0 = 0.577$ corresponds to the F9V spectral type and $T_{\rm eff} = 5960$ K (Popper, 1980). The depth of the minima $\approx 0\overset{\rm m}{.}60$ limits the possible range of the mass ratios to $m_2/m_1 > 0.3$. For $q > 0.35$ because of the observed depth of the minima, the eclipses would be partial. The photometric elements were determined using the 1992 version of the Wilson & Devinney (1971) code. The limb and gravity darkening coefficients as well as bolometric albedos were fixed appropriate to the convective envelope and mean effective temperature. The resulting photometric elements are: $q = 0.34$, $i = 80\overset{\circ}{.}4$, fill-out = 0.39, $T_2 = 6073$ K. The corresponding fits are depicted in Fig. 2. Although the secondary component is slightly hotter and the system is probably of W UMa type, the minima are of the same depth (due to the limb darkening). The secondary minimum (corresponding

Table 1: New times of primary (I) and secondary (II) minima obtained at the Stará Lesná observatory. The standard errors of the minima are given in parentheses. The $O-C$ residuals are given with respect to ephemeris (1)

$\mathrm{JD_{hel}}$ 2 400 000 +	Filter	Type	$O-C$
52137.5286(1)	B	I	−0.0521
52137.5292(1)	V	I	−0.0515
52138.5379(4)	V	II	−0.0531
52138.5380(1)	B	II	−0.0530
52173.4966(3)	V	I	−0.0503
52173.4969(2)	B	I	−0.0500

to accepted ephemeris for this system) is the transit.

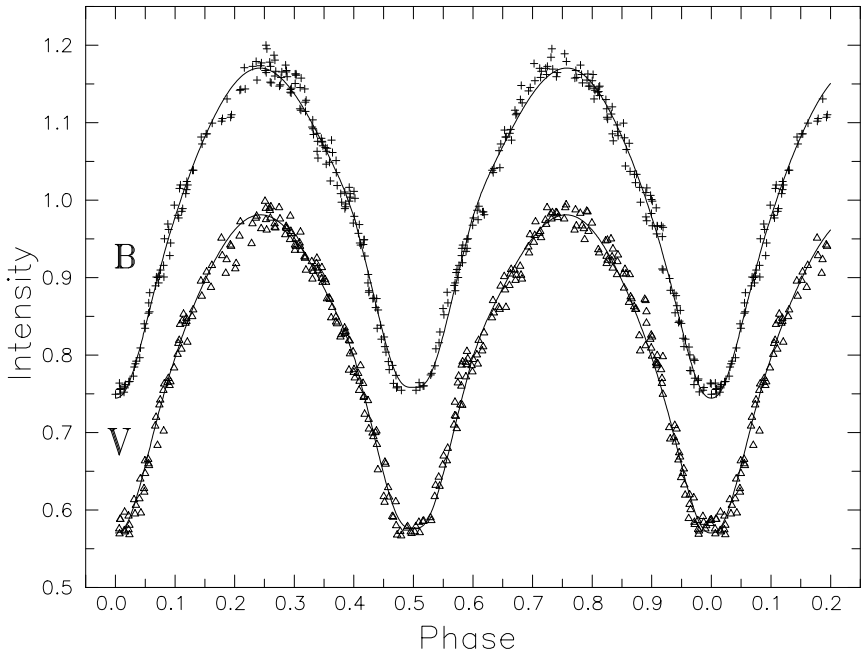

Figure 2. The best fits of BV observations for $q = 0.34$. The B passband observations are shifted by 0.2 in intensities for clarity

The conclusive determination of the photometric elements, reliable classification of the light curve and type of the eclipses would require more numerous and precise observations.

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