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NEW PHOTOELECTRIC PHOTOMETRY OF THE YOUNG STAR LO PEGASI

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The single, young K8 V star LO Peg (Bowyer et al., 1996) is a member of the Local Association (Jeffries and Jewel, 1993; Montes et al., 2001) and it has a high projected equatorial velocity of 69 kms^{-1} (Jeffries et al., 1994). LO Peg is an active star showing strong Hα and Ca II H, K emission lines (Jeffries et al., 1994). It has generally been chosen as a target star for Doppler imaging studies due to its short period. There are a few photometric studies on this active star up to now. So, we observed it as a part of our observing program on the young, solar type stars.

The photometric observations were carried out using SSP-5 photometer equipped to the 30 cm Schmidt-Cassegrain type telescope of Ege University Observatory between July 24 and October 31, 2002. BD +22°4417 (G0, V=$9\overset{\mathrm{m}}{.}03$) and BD +22°4377 (K0, V=$8\overset{\mathrm{m}}{.}27$) are chosen as the comparison and the check stars, respectively. The nightly mean differential V magnitudes and standard deviation are $0\overset{\mathrm{m}}{.}806$ and $0\overset{\mathrm{m}}{.}014$, ensuring the constancy of both comparison and check stars at this level. We obtained a total of 655 differential magnitudes (in the sense variable minus comparison) in Johnson B and V filters during 18 nights and, corrected for atmospheric extinction. The extinction coefficients were calculated for each band using the observed magnitudes of the comparison star. The times were also reduced to the Sun's center. The standard deviation of each observed point is approximately $0\overset{\mathrm{m}}{.}018$ in V band and $0\overset{\mathrm{m}}{.}028$ in B.

Jeffries et al. (1994) proposed six probable rotational periods and they stated that the periods of $0\overset{\mathrm{d}}{.}38417$ ($9\overset{\mathrm{h}}{.}22$) and $0\overset{\mathrm{d}}{.}42375$ ($10\overset{\mathrm{h}}{.}17$) are the more likely periods. Robb and Cardinal (1995) eliminated completely the possibility of the $0\overset{\mathrm{d}}{.}38417$ period. We used the following ephemeris to compute the phases of observations:

$$\mathrm{HJD} = 24\ 48869.93 + 0\overset{\mathrm{d}}{.}42375 \times \mathrm{E}$$

It appears that the shape and the amplitude of the light curve are changing during the observing season. Therefore, we divided our data into five different groups. The light curves and $B-V$ colour curves obtained in this study are shown in Figure 1. The phases of minima are determined by representing the light curves with free hand curve, and the properties of the light curves are given in Table 1.

The light curves show wave-like distortion that is a good indicator of the spot activity. The colour curves of the first three groups do not indicate a significant variation, while

Table 1. The properties of the light curves.

Data Groups	JD range (24 52000 +)	Amplitude (mag)	θ_{min} (I)	θ_{min} (II)
I	480 − 488	0.080	0.8	0.1
II	495 − 507	0.067	0.0	
III	511 − 512	0.070	0.0	0.7
VI	536 − 542	0.069	0.7	
V	549 − 579	0.046	0.4	

those of the last two groups show remarkable changes. As can be seen from Figure 1 the light curves have three properties clearly seen: (1) Generally, they show strong asymmetry which implies the effect of the second starspot (θ_{min} II), its traces are quite obvious in Groups I and III. (2) The amplitude of the light curves slightly decreases from the beginning of the observing season to the end of it. These amplitudes are much lower than those given in the literature (the amplitudes of $0\overset{m}{.}15$ and $0\overset{m}{.}20$ were given by Jeffries et al. (1994) and Robb and Cardinal (1995), respectively). (3) It can be clearly seen that there is a shift at the phase of the wave-like distortion. When we compare the light curves presented in Groups I and V, this phase shift is quite evident. Robb and Cardinal (1995) mentioned about the amplitude variation on a daily timescale, but there is no comment about shifting at the wave minimum in the literature. The cycle-to-cycle variation of both the amplitude and the phase of the wave minimum were also reported for some rapidly rotating, young stars like FR Cnc (Pandey, 2002), AB Dor (Bos, 1994; Donati and Collier-Cameron, 1997) and Speedy Mic (Barnes et al., 2001). We need more photometric observations to determine the activity nature of LO Peg.

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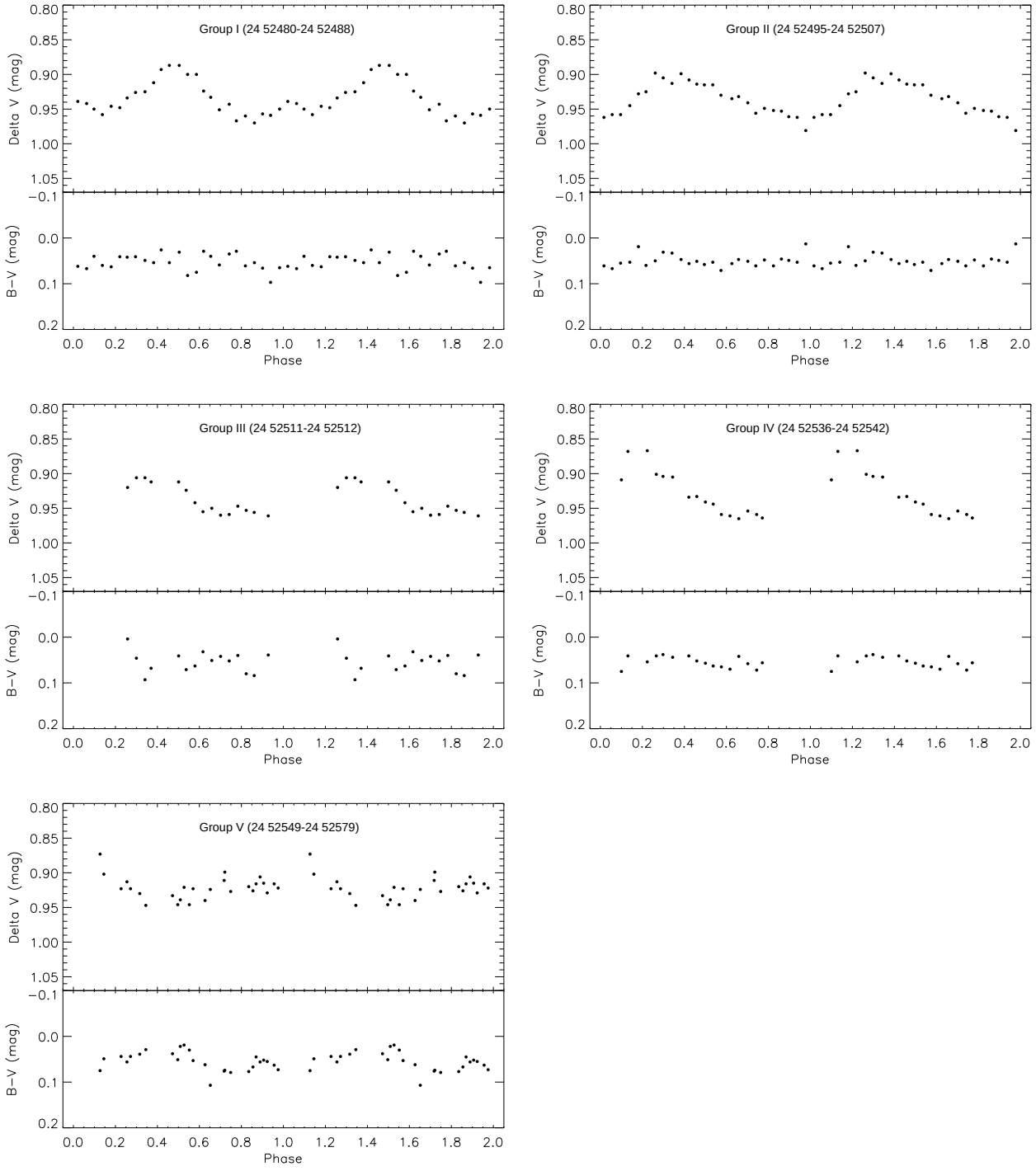

Figure 1. The light curves of LO Peg in V band. The data show the average observing points with 0.04 phase intervals.