THE PHOTOMETRIC INVESTIGATION OF THE ACTIVE POST-NOVA CP LAC IN HIGH AND LOW STATE OF BRIGHTNESS IN 2006-2008 YRS

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ABSTRACT. We present the result of investigations of the quasi-periodic and periodic light variations of the CP Lac connected with different sources in the binary system. We found that CP Lac in 2006 was brighter on $\sim 1^m$ in comparison with 2008. The amplitude of the light variations in 2006 is growing with decreasing of the wave-length. The amplitude in B = $0^m.3$, in V = $0^m.2$. The mean brightness of CP Lac in 2008 varies from night to night during all interval of observation with amplitude $0^m.5$ in unfiltered light. Data of observations in 2006-2008 have a general period 0.037(5) day that is possibly related to the period of rotation of white dwarf.

Key words: Stars: binary: cataclysmic; stars: individual: CP Lac.

1. Introduction

CP Lacertae=Nova Lac 1936 is a non-eclipsing close binary system consists of a late-type red dwarf secondary losses its matter onto a white dwarf primary component via accretion disk. This system showed small-amplitude outbursts of dwarf nova-type. Our photometric investigation this star in 2003-2005 did not shows period 0.127 day suggested by Rodrigues-Gil and all (2005). We found that 1/0.127 cycle/day photometrical frequency found by Rodrigues-Gil and Torres obviously is a one-day alias of the frequency that is very close to the orbital one (6.89 day) (Pavlenko et al. 2007). To study the photometric behavior of this star and confirm the orbital period we have undertaken the long-term observations between 2006-2008.

2. Observations and data reduction

The photometric observations of CP Lac have been carried out in the Crimean astrophysical observatory in the primary focus with the 2.6-m Shajn telescope (ZTSh) and with the Cassegrain 38cm (K-380) telescope between 2006 and 2008. The observations were made in the BV - Johnson system in 2006 November 20, in the V - Johnson system in 2007 August 29, without filter - white light in 2008 January-February during 11 nights and in 2008 May 21. The time scale of exposure was 5 sec for observations of the ZTSh, and from 60 sec to 180 sec for observations of the K-380. The data reduction was made using the aperture photometry package by Goranskij and program of MaxIm DL V4. The accuracy of a single observation varied from $0^m.01$ (ZTSh) to $0^m.05$ (K-380). We used the star from the catalogue USNO B1.0 1456-0394402 as the comparison star.

3. Analysis of the Light Variations of the CP Lacertae

Figures 1-4 show the nightly light curves for each of the year discussed here.

The examples of nightly light curves in 2006 are present in Fig.1. The light curves are dominated by intense and rapid variations (tens of minutes time scale). The amplitude of the light variations is growing with decreasing of the wave-length: amplitude in B-band = $0^m.3$, in V-band = $0^m.2$. For this data we calculated the color-index B-V (the amplitude is equal to the $0^m.2$). As decrease brightness of star its color index B-V is most blue.

The amplitude of the CP Lac light variations in 2007 is $0^m.35$ (Fig.2).

In Fig.3 the individual unfiltered light curves of CP Lac in 2008 are given. Light curves are highly variable from night to night. The amplitude variations could reach $0^m.5$ in some cases. All these data are combined together and shown in this plot. One could see that

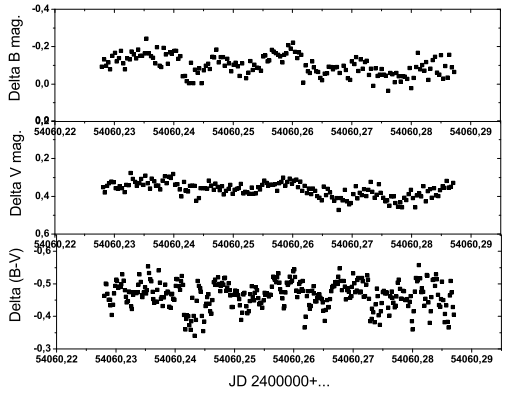

Figure 1: The example of the BV-data in 2006.

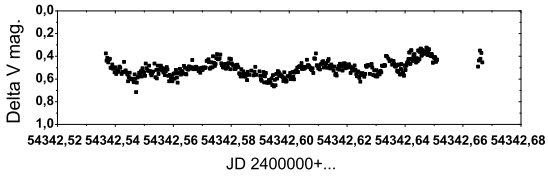

Figure 2: V-band light curve of CP Lac in 2007.

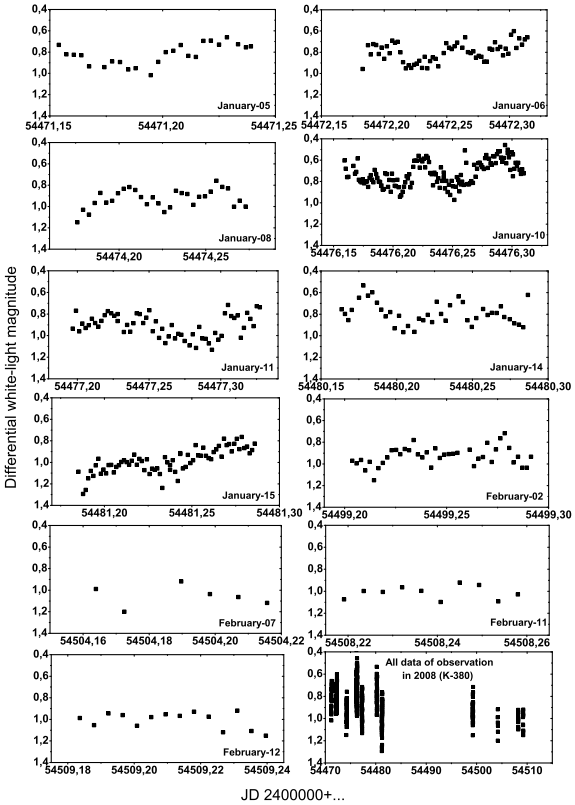

Figure 3: Unfiltered light curves of CP Lac obtained with the K-380 in 2008.

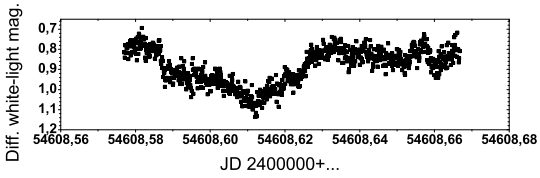

Figure 4: Periodograms computed from all the CP Lac light curves in 2006-2008

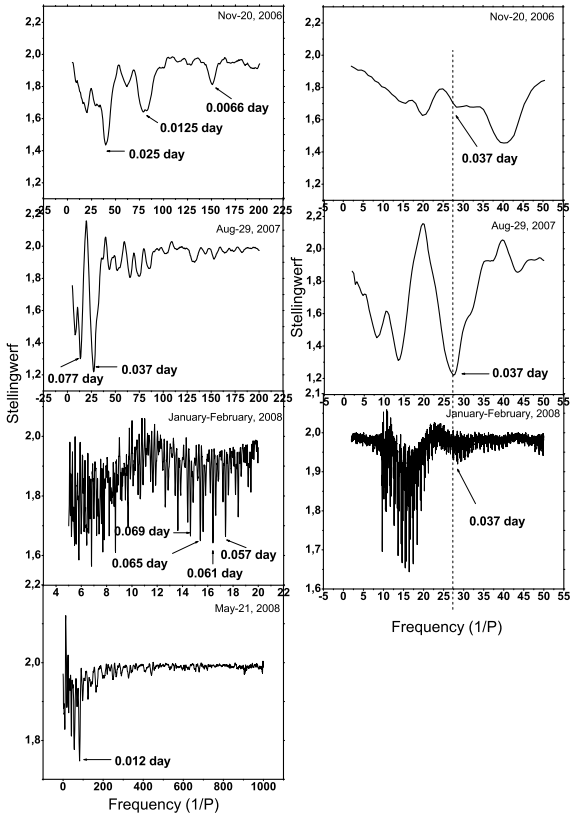

Figure 5: Unfiltered light curves of CP Lac obtained with the ZTSh in 2008.

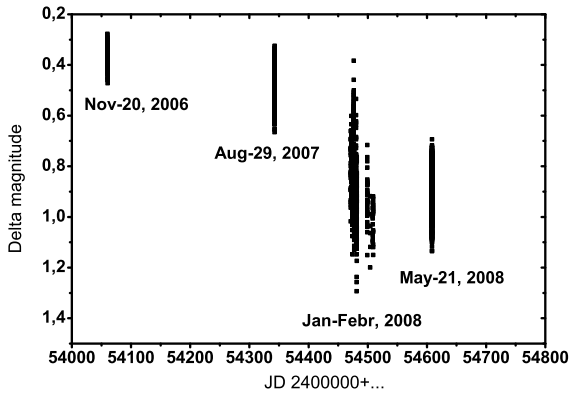

Figure 6: Long-term light curve of CP Lac. The plot shows a variation of the mean brightness from year to year.

the mean brightness varies from night to night during all intervals of observation in 2008. High-amplitude light curve for May 21 in 2008 is present in Fig.4. The amplitude of the light variations is $0^m.4$.

To search for periodicities in the light curves, we computed periodograms with ISDA package (Pelt 1992) using the Stellingwerf method after subtracting the nightly average trend. The resulting Fourier transform is present in Fig.5. The periodogram was constructed in the region of the 0.005-0.2 days for 2006-2007 years; in the region of the 0.05-0.2 days for January-February 2008. For construction of periodogram for May 21, 2008 we subtracted a period 0.084 day with four harmonics (Fig. 5, left panel). Right panel shows low-frequency part of spectrum (in the region of the 0.02-0.5 days).

The periodorams displays the series of significant peaks separated by day^{-1}, where the most significant peaks were marked by arrows for each year. The period 0.037 day (53 min) is present on all data observations of CP Lac between 2006 (ZTSh), 2007 (ZTSh), 2008 (K-380) (Fig.5, right panel). We supposed that this period to connected with the period of rotation of the white dwarf. Within the limits of errors this period coincides with period registered by Rodrigues-Gil et al (0.0435+/- 0.0002 d)(2005).

The long term light curve of CP Lac is shown in Fig.6. The mean brightness is modulated with a periodicity of a few years. CP Lac in 2006 was brighter on $\sim 1^m$ in comparison with 2008.

Acknowledgements. This work was partially supported by the grant of the Ukrainian Fund of Fundamental Research F 25.2/139 and F28.2/081.

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