PHOTOMETRY OF THE ASYNCHRONOUS POLAR V1500 CYG AT VARIOUS PHASES OF THE SYNODICAL CYCLE IN 2005-2006 YRS

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ABSTRACT. We present photometry of the asynchronous polar Nova Cygni 1975 = V1500 Cyg in 2005-2006. The brightness of star in R in the 2006 was increased on 0.53^m in comparison with 2005. We constructed and analyzed the light curves of V1500 Cyg in the all intervals of phases of the cynodical cycle. Based on the photometric observations during 2005-2006 yrs, we confirmed that a modulation with the beat period is present (amplitude = 0.3^m). The orbital O-C shown of dependence from phases of beat period in minima and maxima, that point to existence of additional asymmetric irradiation. At the beat phase 0.73 we found that the profile of the "orbital" light curve of V1500 Cyg differs from the ordinary profile of orbital light curve caused by the reflection effect.
Key words: Stars: binary: cataclysmic; stars: individual: V1500Cyg.

1. Introduction

Nova Cygni 1975 (V1500 Cyg) is the fast nova. V1500 Cyg is the only recognized Nova and asynchronous polar. In its post-nova state (R = 17.5^m - 20^m) V1500 Cyg displays two prominent photometrical periods: the orbital period P1 = 0.1396129 day (Semeniuk et al., 1995) and the beat (synodical) period P2 = 8.4 day (Pavlenko et al, 2002). The orbital light modulation is caused by the strong reflection effect from the heated side of secondary arising as a result of the irradiation by the hot white dwarf. The early investigations of the asynchronous polar V1500Cyg (Pavlenko, 2003) shown that amplitude of the beat modulation has been changed from $0,5^m$ to vanishing small in 2000 - 2002. The beat profile also varied from one-humped to the two-humped shape for different years, pointing to the one-pole or two-pole accretion onto the white dwarf. We considered the pequliarities of V1500 Cyg behavior in 2005-2006 yrs in different beat phases.

2. Observations

The present CCD R observations of V1500 Cyg have been carried out in the Crimean astrophysical observatory in the primary focus of the 2.6-m Shajn telescope and with the 1.25 meter ZTE telescope of the Crimean Laboratory of the Sternberg Astronomical Institute in 2005 - 2006.

3. Results

3.1. Beat period

For all data we calculated the phases of beat period using ephemeris: HJD=2452370.30+8.438E. The original data folded on the beat period are presented in Fig.1 (upper panel). The scattering is caused by the orbital light modulation. Some of the nightly observations of 2005 are on the identical beat phases with data of 2006 but are systematically brighter on 0.53^m, possibly caused by the mean brightness increase. It is clearly seen in the middle panel of Fig.1, where the averaged data are given. Suggesting this, we shifted data of 2006 on the 0.53^m. The all data normalized to the mean for 2005 year level are shown in Fig.1 (the lower panel). Despite the some scattering we have seen that the beat modulations is present but with respectively small amplitude 0.3^m similarly to the beat amplitude detected in 2002. The observations are in the agreement with one-hump model.

3.2. Atypical orbital light curve

The typical orbital light curves of V1500 Cyg resemble the curves caused by reflection effect. However the times of maxima and minima could be slightly shifted. Sometimes the deviation from the typical profile could be observed. In Fig.2 we show the example of the orbital light curve (21 October 2006) with a 0.4^m - bump in the vicinity of minimum. This light curve we observed at the beat phase 0.73.

3.3. O-C

We calculated the times of minima and maxima of the V1500 Cyg brightness variations in R using the Pogson's method of chords. They age given in Table 1. The O-C was calculated using the ephemeris:

HJD (min) = 2453534.430+0.139613∗E

HJD (max) = 2453534.369+0.139613∗E

The dependence of orbital O-C on the phase of beat period is presented in Fig.3. One could see that O-C display the same sine-like dependence on the beat phase. The times of maxima are of the better accuracy.

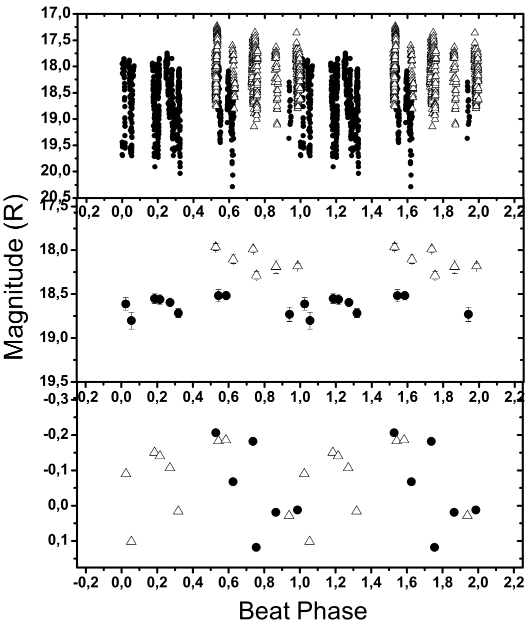

Figure 1: The 2005-2006 R-band data folded on the current 8.438 day beat period. Data of 2005 are marked by black squares and data of 2006 - open triangles. Upper panel: original data; middle panel: averaged data; lower panel: normalized averaged data.

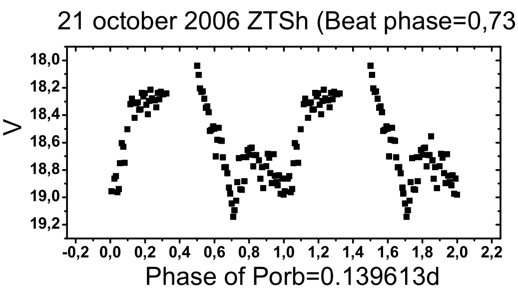

Figure 2: The orbital light curve showing strong discrepancy with reflection effect.

3. Conclusion

We have shown that the orbital light curve sometimes appears in the form differ from the pure reflection effect. The O-C residuals display the dependence on the beat phase.

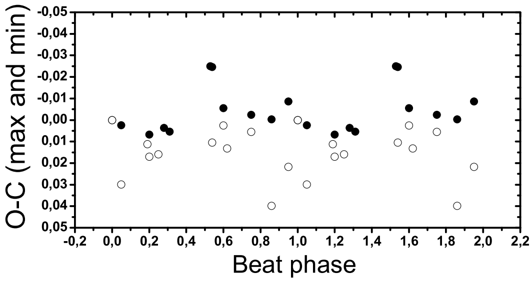

Figure 3: The dependence of orbital O-C on the phase of beat period. Minima are marked by open circles and maxima - by filled.

Table 1: Timings of Maxima and Minima for V1500 Cyg in 2005-2006

JDHel(max)	JDHel(min)
53534,369	53534,430
53560,479	53560,428
53562,438	53585,400
53585,471	53587,500
53612,418	53612,350
53613,365	53654,368
53615,320	53683,260
53683,191	54062,320
54062,383	54063,150
54064,200	54064,720
54065,169	54065,400

There could be two reasons, which promote appearance of the O-C variations:

1. The asymmetric and beat pase-depending heating of the red dwarf by the asynchronously rotating source of irradiation (accretion columns)

2. The "orbiting debris" around white dwarf may absorb an ultra-violet radiation of the white dwarf and reduces its heating effect on the secondary.

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References

Kaluzny Ja., Semeniuk I.: 1987, *AcA.,* **37**, 349.

Pavlenko E.P. et al: 2002, *ASP Conf. Ser.,* **261**, 651.

Pavlenko E.P.: 2003, *Odessa Astron. Publ.,* **16**, 41.

Semeniuk I., Olech A., Nalezyty M.: 1995, *AcA.,* **45**, 747.

Schmidt G.D., Liebert J., Stockman H.S.: 1995, *ApJ,* **441**, 414.

Litvinchova A.A., Pavlenko E.P: 2006, *Abstract Book of the XXVIth General Assembly,* 225.