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V1500 Cyg: 25 years later

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Abstract. We present photometry of the asynchronous polar Nova Cygni 1975 = V1500 Cyg in a 25 years after its outburst. This binary clearly shows light variations both at the orbital period, and at the spin-orbital beat period, 8.4 d, which indicates asynchronous motion of the binary components. The orbital R amplitudes are practically constant over the beat period. This could be caused by the variable accretion rate/brightness of a ring surrounding the white dwarf depending on the orientation of the white dwarf magnetic pole in respect to the red dwarf.

1. Introduction

V1500 Cyg belongs to the asynchronous polars (Patterson at al. 1995), which consists of 4 binaries: V1500 Cyg, BY Cam, V1432 Aql and RX J2115.7-5840. The hot white dwarf in the binary V1500 Cyg (Schmidt et al. 1995) heats the side of the main-sequence companion facing the white dwarf, so the irradiated surface contributes most of the total light in the optical band. The changing aspect of the heated surface causes the optical light variations with phase of the orbital period $P1 = 0.1396$ d. The spin period $P2 = 0.137$ d of the white dwarf was discovered from polarimetry (Stockman et al. 1988). The spin-orbital beat period $P3 \sim 8$ d was found in the optical light by Pavlenko & Pelt (1988). An increase of P2 and P3 with time over several years independently indicated the fast synchronization of this binary with a typical time scale of 200 years. The physical nature of the beat period is still unclear. Earlier we suggested that the two beat-dependent processes in the binary simultaneously acted: a variable shadowing of side of the secondary facing the white dwarf by accretion structures and variations of the accretion rate and/or brightness of the accretion ring (Pavlenko & Postnov 2001). In 1978–1988 it seemed that the shadowing effect was the prevailing one. Here we present a photometric study of V1500 Cyg in 2000 based on CCD observations over 19 nights at the 60-cm and 125-cm telescopes in Crimea.

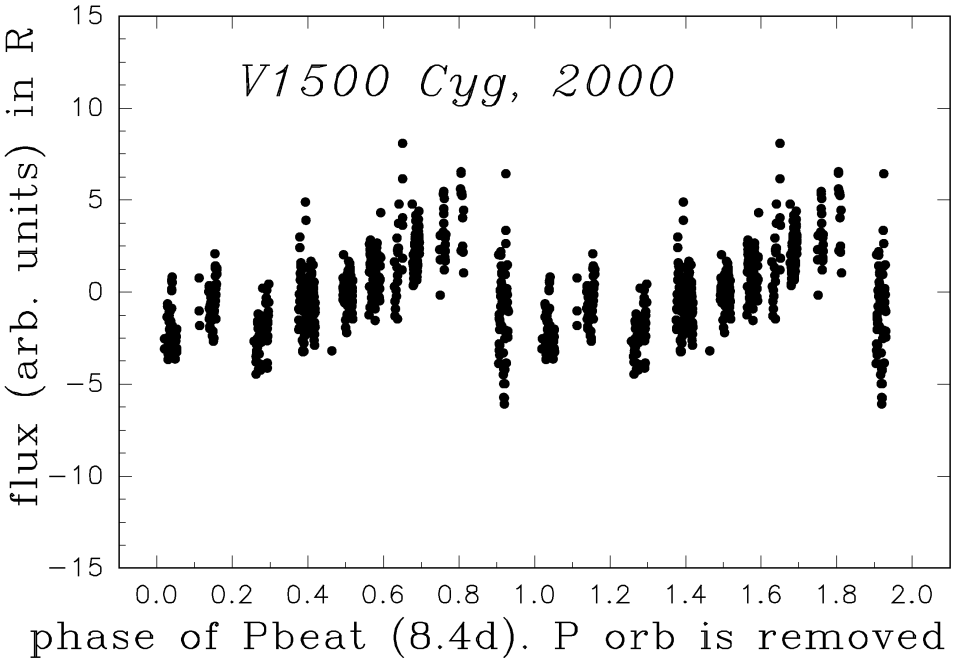

Figure 1. The data of V1500 Cyg folded on spin-orbital beat period $P_{\rm beat} = 8.4$ d.

2. Results

V1500 Cyg clearly shows the light variations with a phase of the beat period (8.4 d). The orbital variations have constant amplitude (in flux units). These variations were subtracted from the data, which were then folded on the beat period (see Fig. 1). The beat profile has a sine-like shape. The constancy of the orbital amplitudes over the beat cycle could be explained by the variation of the accretion rate and/or brightness of the accretion ring surrounding the white dwarf every beat cycle. We we can conclude that the source of the spin-orbit beat period changed over 25 years since Nova outburst. The "shadowing effect" (caused by the accretion structures), acted during the first $\sim$ 10 years and is replaced now by the "effect of brightening" produced by the variation of the accretion rate and/or brightnening of accretion ring around the hot white dwarf.

References

Patterson, J., Skillman, D.R., Thorstensen, J., & Hellier, C. 1995, PASP, 107, 307

Pavlenko, E.P. 1988, Izv. Krym. Astrofiz. Obs., 69, 103

Pavlenko, E.P. & Pelt, J. 1988, IBVS, 3252

Pavlenko, E.P. & Postnov, K.A. 2001, A&A, in press

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

Stockman, H.S., Schmidt, G.D., & Lamb, D.Q. 1988, ApJ, 332, 282