PHOTOMETRIC EVOLUTION OF THE ORBITAL LIGHT CURVES OF THE SLOW NOVA V723 CAS

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Abstract. UBVRI photoelectric and CCD photometry of the slow nova V723 Cas obtained in the years 1995–2003 is presented. The evolution of light curves in 1-year intervals, folded with the orbital period 0.69326 days, shows an increase of the amplitude of the wave-like variations from 0.07 to 1.3 mag during the years 1997–2003. The fact that the shape and amplitude of the orbital light curves does not depend on wavelength is most probably related to the geometry of eclipses combined with the distribution of circumstellar matter in the system.

Keywords: stars, binaries, novae, photometry

1. Introduction

Novae are semi-detached binaries, in which the red dwarf transfers matter to the white dwarf component. The nova outburst is a thermonuclear event on the surface of the white dwarf. As a result, the nova brightens and ejects the envelope.

V723 Cas (Nova Cas, 1995) was discovered by M. Yamamoto on August 1995 (Hirosawa, 1995). It reached the maximum brightness at $V = 7.1$ mag, $R = 6.5$ mag on December 17, 1995. Chochol and Pribulla (1997) classified it as a slow nova with $T_{3,V} = 173^{\mathrm{d}}$, $T_{3,B} = 189^{\mathrm{d}}$. In 1996–1998, the decline was interrupted by small flares on 180-day scale (Chochol and Pribulla, 1998). The orbital period of 0.69325 days was derived by Chochol et al. (2000) by the analysis of photometric observations.

2. Our Photometry and Results

We present our extensive UBVRI photoelectric and CCD monitoring of V723 Cas carried out at the Sternberg Astronomical Institute, Astronomical Institute of the

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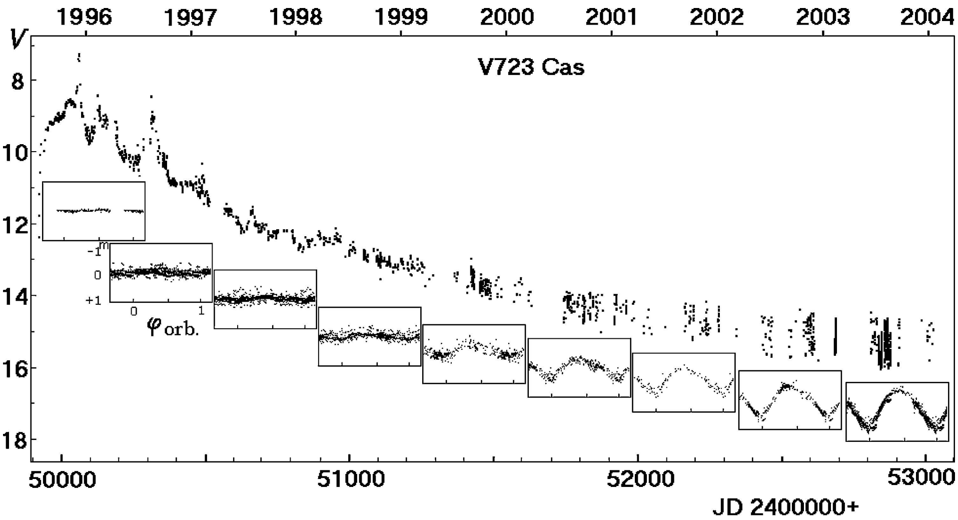

Figure 1. Long-term and orbital light curves of V723 Cas in V band.

Slovak Academy of Sciences and Tel Aviv University in the period 1995–2003. The long-term V light curve (LC) of V723 Cas is presented in Figure 1. Inserted windows display the evolution of the orbital LCs constructed from non-flare observations in 1-year intervals using the ephemeris:

$$\mathrm{JD}_{\text{min.hel.}} = 2450421.48 + 0^d.69326 \times E.$$

Regular orbital variability with an amplitude 0.07 mag started to become evident in 1997. The saw-tooth shaped LC was formed in September 1998. The maximum of the orbital LC occurred at orbital phases 0.3–0.4. A dip-like feature resembling a secondary minimum was sometimes detected near phase 0.6, suggesting a high inclination angle of the system. The quasi-periodic oscillation, found by Goranskij et al. (2000), which caused the distortions of the orbital LCs, disappeared in 2000. New observations demonstrated the stable shape of the orbital LC and a gradual increase of its amplitude up to 1.3 mag reached in 2003. At early stages, the luminosity of the envelope exceeded the luminosities of both components and prevented the detection of brightness variations caused by their orbital motion. At later stages, the dissipation of the ejected envelope was responsible for the increase of the amplitude of orbital wave-like variations.

Figure 2 displays the evolution of the multicolor (IRVBU) orbital LCs constructed from non-flare observations in 1-year intervals. They exhibit a slightly asymmetric shape. The fact that the shape and amplitude of the orbital LCs do not depend on wavelength is particularly striking. Such a behaviour cannot be explained by a simple irradiation effect. It is most probably related to the geometry

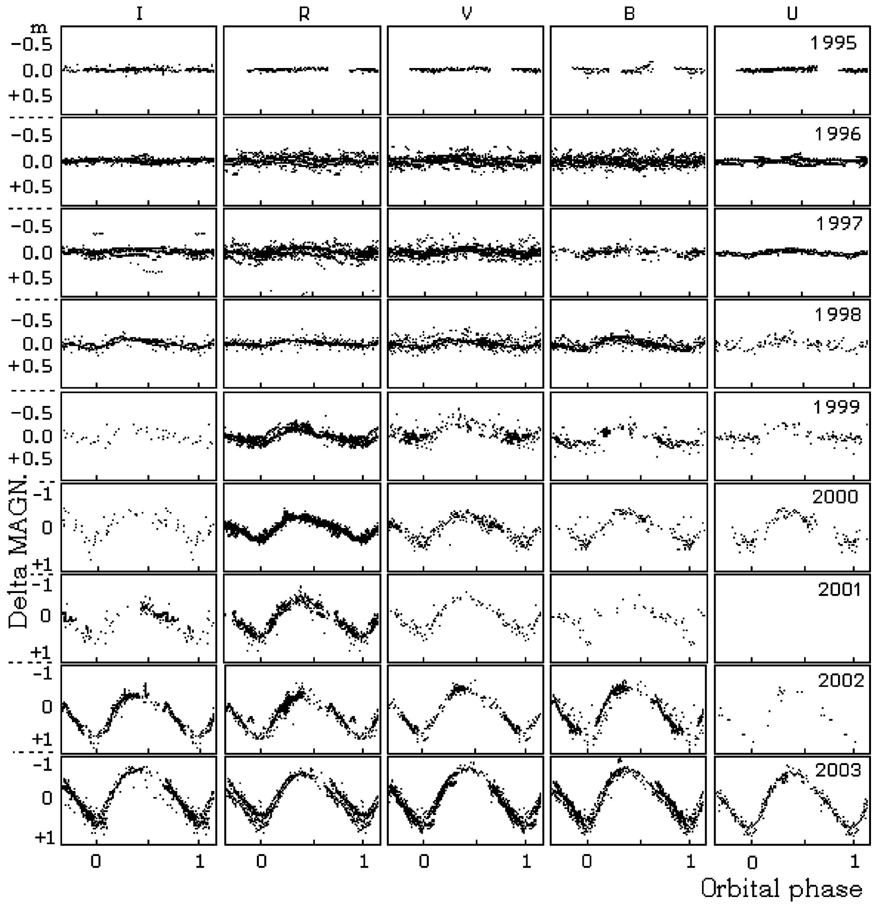

Figure 2. IRVBU orbital light curves of V723 Cas in 1-year intervals.

of eclipses combined with the distribution of circumstellar matter in the system, consisting of a mass transfer stream, a quasi-elliptic accretion disk and a part of the stream moving around the system, as was found by three-dimensional numerical simulations of gaseous flows in semi-detached binaries by Bisikalo et al. (1998).

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