INTENSIVE NARROW–BAND CONTINUUM PHOTOMETRIC MONITORING OF THE WN5+O6 BINARY V444 CYGNI: EVIDENCE FOR WIND COLLISION?

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Abstract. Narrow-band photometry of V444 Cyg shows evidence for a broad bump in the light curve near phase 0.5 for which different possible causes are considered.

V444 Cygni is the best known core-eclipsing WR+O binary in the Galaxy. The system has been the subject of many different studies (see, *e.g.*, Hamann & Schwarz 1992 for spectroscopy and photometry, Cherepashchuk *et al.* 1985 for photometry, St-Louis *et al.* 1993 for polarimetry). It is well known that V444 Cyg shows significant physical variability from one orbital cycle to another. For this reason, in most previous photometric studies the star has been observed during many orbital cycles to obtain a smooth mean light-curve reflecting some 'average' characteristics of the system. However, it is also interesting to obtain a 'snapshot' light-curve of the system, which would reflect its temporary state and, in particular, wind-wind interaction. The signs of such interaction have been recently found in the variability of He I lines of V444 Cyg by Marchenko *et al.* (1994).

With a period of $\sim 4^d.2$, it is only possible to obtain a full light-curve during a reasonably short period (say, two weeks) by observing from (at least) two observatories with appropriate longitude difference. For this reason, two telescopes in Uzbekistan (in the eastern part of the former SU) and Mexico were used. Observations cover about 5 weeks, starting from the end of June 1992. Narrow-band pure continuum filters were used (λ_o = 5185 Å, FWHM = 250 Å in Mexico and λ_o = 6012 Å, FWHM = 87 Å in Uzbekistan) to get light-curves that are free of the influence of emission lines. The light-curve is shown in Fig. 1. The ephemeris is taken from Khaliullin *et al.* (1984). From Fig. 1 it is obvious that the light-curve shows a broad 'bump' centered near phase 0.5, interrupted by the secondary minimum. Note the significant cycle-to-cycle variability of the secondary minimum, mentioned for the first time by Kuhi (1968). The first scenario which comes to mind is that we are seeing the effects of wind-wind collision in a binary. The 'bumps' are asymmetric; this could be connected to the fact that in a binary, the shock cone axis does not coincide with the line connecting the components, due to orbital motion of the components. If this interpretation is correct, we probably are seeing maximum light when the shock cone is 'most open' to

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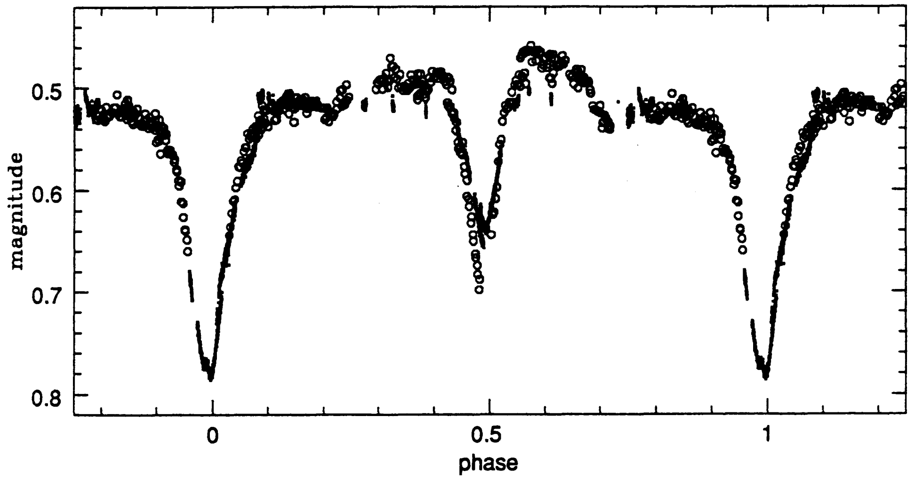

Fig. 1. Phase plot of V444 Cyg. Open circles: Uzbekistan data, filled circles : Mexican data.

the observer (so that we are looking nearly along its axis). The problem with this scenario is that, according to simple estimates, shocked material should be optically thin in the visible continuum. Thus, it is not clear why the continuum flux from the shock should have a fairly well-localized maximum centered near phase 0.5. Such a temporary increase in brightness of a shock could be connected to additional ejection of material by the WR star. Another possible explanation is that the observed effect could be caused by light of the O star back-scattered by the WR wind. An accompaning forward-scattering bump centered near phase 0.0 may also be present.

As a by-product of the current investigation, a small shift $\Delta\phi \simeq -0.01$, of the exact positions of the light-curve minima from the positions predicted with the nonlinear ephemeris of Khaliullin *et al.* (1984) has been measured. This leads to a lower value of the mass loss rate of the WR component compared to the value of Khaliullin *et al.* (1984): $\dot{M}_{\rm WR} = 1.0 \times 10^{-5}$ $M_\odot$ yr^{-1}. A new dynamical estimate is $\dot{M}_{\rm WR} = 0.7 \times 10^{-5}$ $M_\odot$ yr^{-1}, in good agreement with that of St-Louis *et al.* (1993): 0.75×10^{-5} $M_\odot$ yr^{-1}.

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