SPECTROSCOPIC VARIATIONS OF THE SYMBIOTIC NOVA PU VUL

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ABSTRACT. Evidence for formation and subsequent expansion of an A-F supergiant envelope in the very slow symbiotic nova PU Vul caused by quasiperiodic injections of matter from M giant to the A-F supergiant is given.

INTRODUCTION

The very slow symbiotic nova PU Vul has been studied intensively since the outburst which started in 1979 and is still in progress. UBV photometry and spectroscopy of the nova taken by several groups of observers around the world support a suggestion that the binary system PU Vul consists of a massive mass-losing M6 giant ($M \sim 7.5\ M_\odot$) and a CO dwarf with mass $1.01\ M_\odot$ accreting hydrogen-rich matter at a rate $10^{-9}\ M_\odot$/yr. This dwarf mimics in outer appearance an F supergiant (cf. Kenyon, 1986; Chochol and Grygar, 1987 and references therein). Chochol and Grygar (1987) computed the elements of the spectroscopic orbit of the F supergiant. An orbital period of 3200 d and an eccentricity of 0.64 were found. Radial velocities, especially after periastron passage, display considerable oscillations. The aim of our paper is to show that the oscillations connect with formation and subsequent expansion of the A-F supergiant envelope due to the quasiperiodic injections of matter from the M giant to the A-F supergiant after periastron passage.

SPECTROSCOPIC DATA AND RESULTS

Spectra of PU Vul with a dispersion of 1.7 nm/mm were obtained at the Coudé focus of the 2-m telescope at the Rozhen Observatory on July 8/9, 1985, October 27/28, 1985 and September 20/21, 1986 exactly at the time when the O - C deviations on radial velocities curve published by Chochol and Grygar (1987) reached extremal values. The main

J. Mikolajewska et al. (eds.), The Symbiotic Phenomenon, 283–284.

differences between the spectra are as follows: in the spectrum from July 85 absorption shell lines of ionized metals (Mg, Si, Ca, Ti, V, Cr, Fe, Sr, Zr) are present. The mean radial velocity is (22.0 ± 1.5) km/s. The O - C deviation is 20.7 km/s. The second spectrum, from Oct. 85, exhibits mainly neutral metals (Mg, Al, Si, Ca, Ti, Cr, Mn, Fe). The mean radial velocity is (- 18.1 ± 1.5) km/s. The O - C deviation is - 14.5 km/s. The large differences between the radial velocities clearly connect with the expansion of an A-F supergiant envelope. The expansion is best visible in the profile of the Ca II - K line in Fig. 1. In

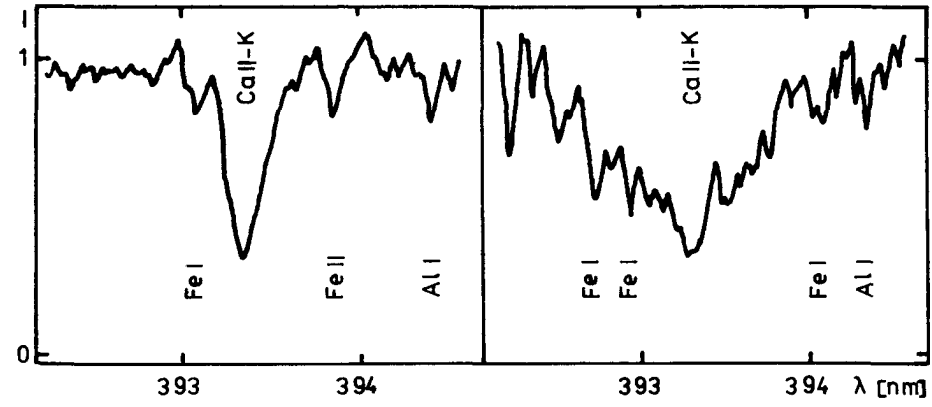

Figure 1. Ca II line on the spectra from July and Oct. 85.

the sp. from Sept. 86 both neutral and ionized metals are present. The mean radial velocity from all lines is (- 44.3 ± 2.9) km/s. The O - C deviation is - 53 km/s. The Ca II - K line decrease in intensity but is even broader than in the sp. from Oct. 85. Due to the fact that the radial velocities of neutral and ionized metals differ only in the range of errors we suggest that the expanding envelope is gradually ionized. We tried to find a periodicity in the O - C deviations of the RV curve in above mentioned paper by method of minimization of phase dispersion (Stellingwerf, 1978). A period of 263.5 d with statistical significance 0.692 was found. Observed RV changes clearly connect with physical processes in the interacting binary PU Vul and can be caused by a more or less periodic increase of mass transfer from the M6 giant to the A-F supergiant followed by an expansion of the envelope of A-F supergiant, after periastron passage.

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