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The slow nova V475 Sct (Nova Scuti 2003) - ejected envelope and variability

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Abstract. We discuss the $UBVRI$ photometry and the 4600-9000 Å spectroscopy of the slow Fe II nova V475 Scuti obtained after its 2003 outburst.

The classical nova V475 Sct was discovered by Nishimura (IAUC 8190) on August 28, 2003. It reached a maximum $V_{\rm max} = 8.43$ mag, $B_{\rm max} = 9.33$ mag on Sept. 1, 2003. We did not identify the precursor on the POSS prints, implying an outburst amplitude > 12 mag.

Photometry. We performed $UBVRI$ photoelectric and CCD observations with seven 0.38-1.25 m reflectors at Stará Lesná (Slovakia), Nauchnyj and Simeiz (Ukraine) and Moscow (Russia) during 88 nights between August 30, 2003 and July 8, 2004. Our CCD images taken with the 0.6m reflector in Nauchnyj revealed that V475 Sct is a member of an optical pair. The brightness of the optical companion, located at 3.3" from the nova, was found to be B=17.44(8), V=16.35(3), R = 15.50(2), I = 14.82(3). Our photometry of V475 Sct (Figure 1) was corrected for the light of this component.

Spectroscopy. We obtained 11 CCD spectra of V475 Sct at the Coudé spectrograph of the 2 m reflector in Ondřejov observatory (Czech Republic) between Sept. 15 and Sept. 25, 2003, with dispersions of 8.5 Å/mm (4754-5006 Å) and 17 Å/mm (5470-5983 Å, 6257-6770 Å, 7503-8013 Å and 8148-8657 Å). We also used 4600-9000 Å spectroscopy of V475 Sct obtained between Sept. 2 and Oct. 10, 2003 by Christian Buil, an amateur astronomer at Castanet Tolosan (France), available at http://www.astrosurf.com/buil/us/nscuti.

Expanding shell. The spectrum of the nova allows to classify it as a Fe II class object (Williams 1992) with an emission spectrum showing also Na I D, O I, Ca II, Mg II and Balmer H I lines accompanied by two sets of P Cyg absorptions, arising in the inner and outer envelope of the expanding shell ejected at maximum brightness. Between Sept. 14 and 25, their radial velocities increased from – 480 to –640 km s^{-1} and from –1140 to –1370 km s^{-1}, suggesting an acceleration of the envelope by a continuous wind.

Basic parameters. The V and B light curves were used to find decline rates of $t_{2,V} = 48$ d, $t_{3,V} = 53$ d, $t_{2,B} = 50$ d, $t_{3,B} = 58$ d and to estimate the absolute magnitudes of nova at maximum $MV_{\rm max} = -7.16 \pm 0.15$, $MB_{\rm max} = -6.96 \pm 0.39$

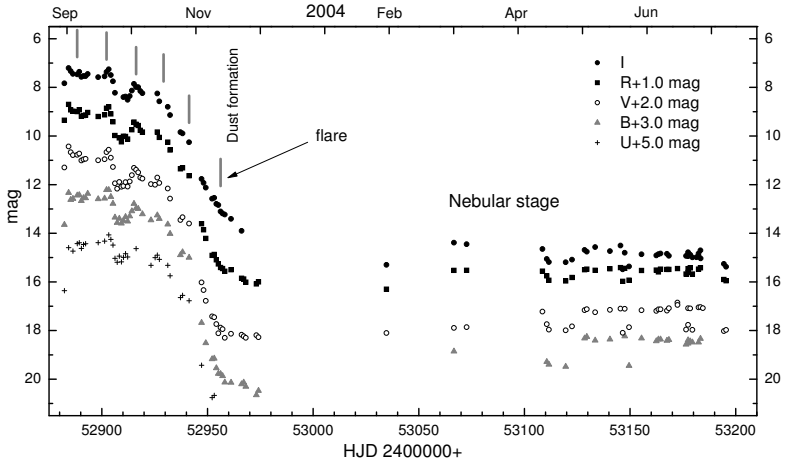

Figure 1. *UBVRI* photometry of V475 Sct.

using various maximum magnitude-decline rate relations gathered at Chochol & Pribulla (1997) and Downes & Duerbeck (2000). The interstellar reddening $E(B-V) = 0.69 \pm 0.05$ was found by comparison of observed and intrinsic colour indices as well as by using the equivalent width of the interstellar K I (7699.0 Å) line, indicating a distance of 4.8 kpc.

Brightness maxima - flares. Periodic 13.4-day maxima of activity (flares) are present on the light curve during standstill and decline and are best detected in $V - I$ indices. They can be interpreted as pulsations of the nova envelope as discussed by Schenker (1999) or as mass transfer bursts from the red to the white dwarf caused by the periastron passage of a third body in the system. The same mechanism was proposed by Chochol et al. (2000) to explain a 180 days periodicity in flares of the classical nova V723 Cas.

Dust formation phase and nebular stage. The rapid fade in the optical and increase of $V-R$ and $V-I$ indices which started 57 days after the maximum could be caused by dust formation in the nova ejecta. The nebular stage started in March 2004 when, according to Stringfellow & Walter (2004), very strong emission [O III] 4958.9 Å and 5006.9 Å lines had developed. These lines are located just at the edge of the transmission curves of B and V filters and are responsible for the discrepancy of B and V magnitudes determined from our observations taken by different instruments.

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