Living Together: Planets, Host Stars, and Binaries
ASP Conference Series, Vol. 496
Slavek M. Rucinski, Guillermo Torres, and Miloslav Zejda, eds.

Multicolor Photometry of the Novae V339 Del and V2659 Cyg

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Abstract. We present $UBV(RI)_C$ photometry of the classical novae V339 Del and V2659 Cyg. The U-band data of the fast nova V339 Del were used to find a possible orbital period of $0^d.1314$. The time of a two-magnitude decline from maximum, $t_{2,V}$ = 65 days, was used to determine the basic parameters of the slow nova V2659 Cyg.

Observations. Our multicolor $UBV(RI)_C$ CCD and photoelectric observations of the classical novae V339 Del ($V_{\max}$ = 4.40 mag, $B_{\max}$ = 4.76 mag on August 16.47, 2013) and V2659 Cyg ($V_{\max}$ = 9.39 mag, $B_{\max}$ = 10.56 mag on April 9.1, 2014) were obtained using 0.5–1.0 m telescopes and 6/18 cm photo lenses at Stará Lesná Observatory in Slovakia and the Nauchny and Mt. Koshka Observatories in Crimea. Low dispersion spectroscopy of the novae was obtained with the 0.5 m telescope and an objective prism in Nauchny.

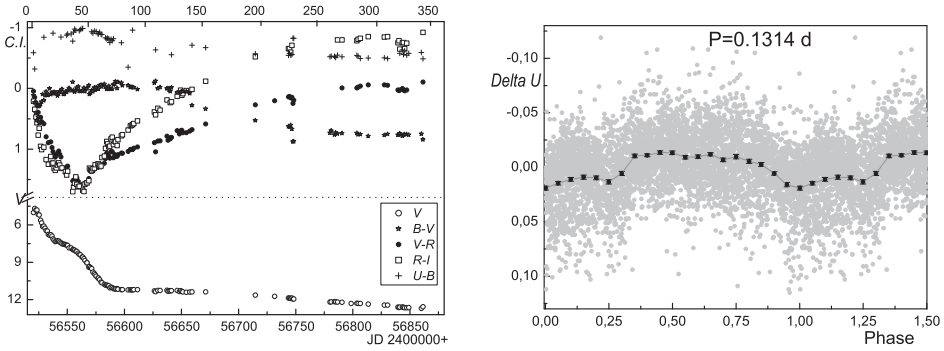

Figure 1.: *Left:* V-band LC and color indices of V339 Del in 2013–14. *Right:* The ΔU LC phase-folded with the ephemeris $\mathrm{JD_{Min}}$ = 2,456,589.324 + 0.13140(5) × E.

Classical Nova V339 Delphini – A Fast Nova. Multicolor photometry of V339 Del is presented in Figure 1 (left). The data obtained in the first month after the outburst were used by Chochol et al. (2014) to determine the basic parameters of the nova. We used all our U-band data, after the declining trend removal, to determine the ephemeris for the brightness minima of the nova: $\mathrm{JD_{Min}}$ = 2,456,589.324 + 0.13140(5) × E. The period is half of that reported earlier by Chochol et al. (2014). The phase-folded light curve (LC) is shown in Figure 1 (right). The light variations are probably caused by

orbital motion in a binary system, and irradiation of the secondary component by a hot white dwarf.

Classical Nova V2659 Cygni – A Slow Nova. Observations of V2659 Cyg, presented in Figure 2, show a large variability. The duration of the two-magnitude decline from brightness maximum was determined to be $t_{2,V} = 65$ days based on the V-band LC, so it is a slow nova. We estimated the absolute magnitude of the nova at maximum using the MMRD relations published by Downes & Duerbeck (2000) as $M_{V,\max} = -6.70 \pm 0.04$. Novae at maximum have an intrinsic color index $B - V = 0.25 \pm 0.05$, so $M_{B,\max} = -6.45 \pm 0.09$. This value and the relation of Livio (1992) provide the mass of the white dwarf in V2659 Cyg as $M_{\rm wd} = 0.65 \pm 0.02\, M_\odot$. The interstellar extinction can be estimated from a comparison of the intrinsic and observed color indices at maximum, giving $E(B - V) = 0.92$. Alternatively, using the relation of Van den Bergh & Younger (1987) and adopting the color index two magnitudes below maximum gives 0.85, and using the equivalent width of the interstellar Na I and K I lines gives 0.68 (Tomov et al. 2014) and 0.63 (Raj et al. 2014). The mean value is $E(B - V) = 0.77 \pm 0.06$, so the distance to the nova is $d = 5.5 \pm 0.3$ kpc. Low dispersion spectra of the novae, taken in July 2014, are presented in Figure 3.

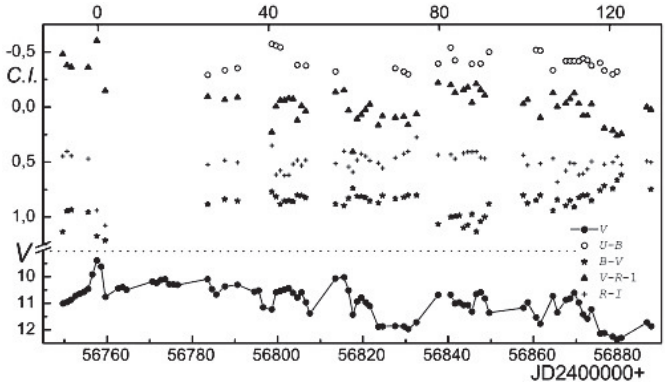

Figure 2.: The V-band LC and color curves of V2659 Cyg during its outburst in 2014.

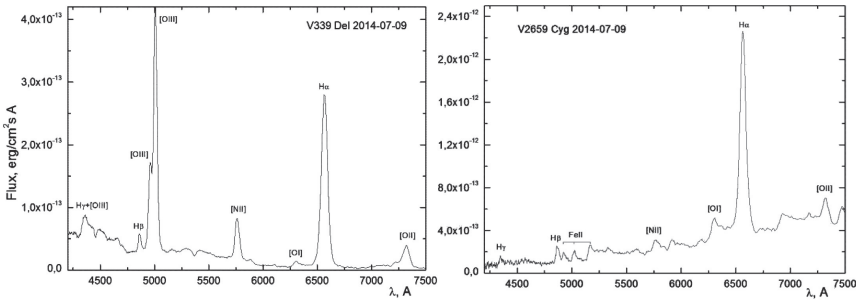

Figure 3.: Low dispersion spectra of V2659 Cyg taken in July 2014.

Acknowledgments. This work was partially supported by the VEGA grant No. 2/0002/13, RFBR grants No 14–02–00825,11–02–01213 and NSh–1675.2014.2.

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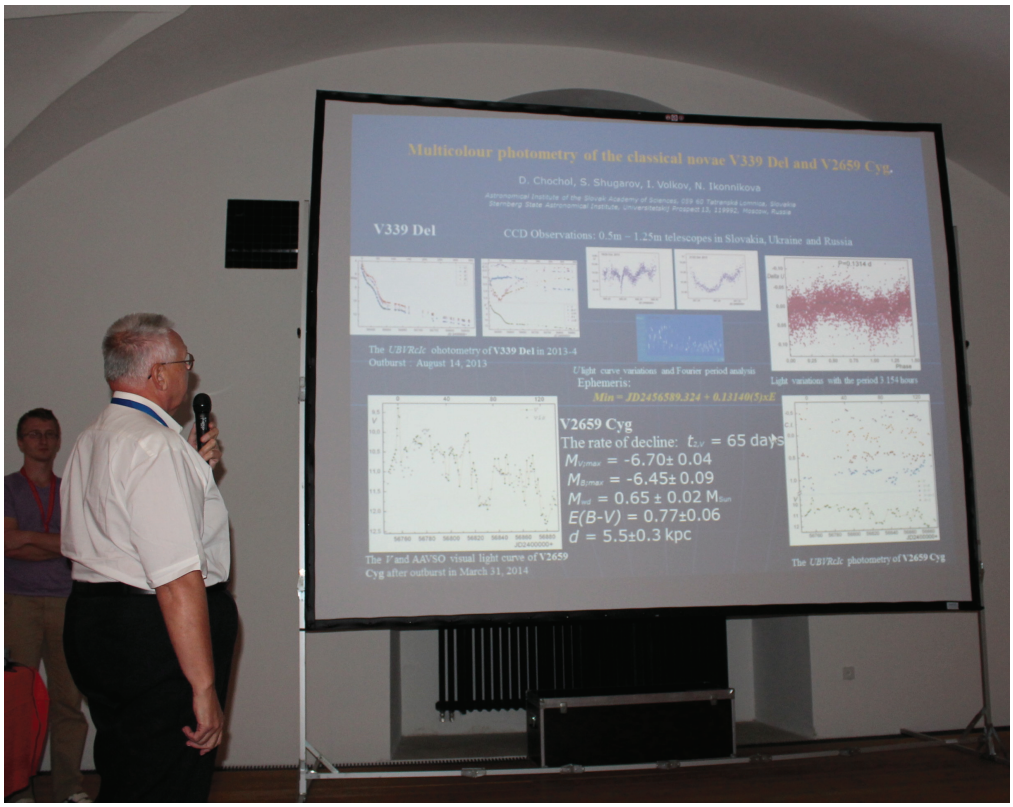

Drahomír Chochol presenting his poster paper.