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THE DWARF NOVA RX VOLANTIS IN QUIESCENCE

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The variable has been found as S 6185 Vol by Hoffmeister (1963). He also provided the finding chart which is given by Downes et al. (2001). Munari & Zwitter (1998) tried to take an optical spectrum with the ESO 1.5 m telescope, but found the system to be too faint. They give an upper limit for its brightness of $22^{\rm m}$. In May 2003, the system has been observed in outburst, reaching a magnitude of about 15. Superhumps where detected with a period of 0.06117 d which showed a brightening near the termination of the outburst, and a regrowth before the start of the final, rapid decline (Kato et al. 2003).

We performed spectroscopic observations using the ESO Faint Object Spectrograph and Camera (EFOSC2) at the 3.6 m telescope on La Silla, Chile. Three spectra, each of 30 min exposure time, have been obtained on 2005-02-15 starting at 02:47 UT using grism #6 and a $1''$ slit.

Standard reduction has been performed with IRAF. The BIAS has been subtracted and the data have been divided by a flat field, which was normalised by fitting Chebyshev functions of high order to remove the detector specific spectral response.

The three spectra have been combined and then optimally extracted (Horne, 1986). Wavelength calibration yielded a final FWHM resolution of 1.2 nm and a spectral range of 390 nm to 790 nm. The spectrum has been corrected for the instrument function and was flux–calibrated using the spectrophotometric standards LTT 2415, LTT 3218, and LTT 3864. From the variation between the three standard stars we estimate the uncertainty of the flux–calibration as 3%.

The finding chart in Fig. 1 shows two stars at the position of RX Vol with a separation of $2\farcs3$. We first took the spectrum of the brighter one in the west, which turned out to be an early K-type star. The spectrum discussed in this paper is the one of the fainter star, which is marked in the chart.

This spectrum is plotted in Fig. 2. It is dominated by the Balmer lines and He I lines in emission. Also present, but very weak, is Fe II at 516.9 nm. No indication for any high excitation lines like He II are found. The properties of the identified emission lines are listed in Table 1.

In order to derive information on the possible temperature range of the disc of RX Vol, we have measured the Balmer decrement, which is defined as ratio of line intensities $H_\alpha : H_\beta : H_\gamma$. In the case of RX Vol, we find $H_\alpha/H_\beta = 1.74$ and $H_\gamma/H_\beta = 0.67$. A comparison of these ratios, as well as the equivalent widths of the lines with the model

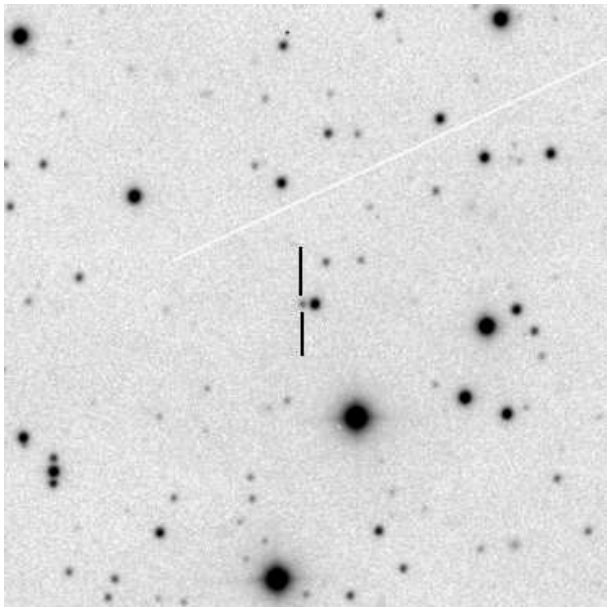

Figure 1. The R image of a $2'' \times 2''$ region around RX Vol. North is up, east is left. The one star of the older finding charts actually resolves into two, the fainter one being the variable.

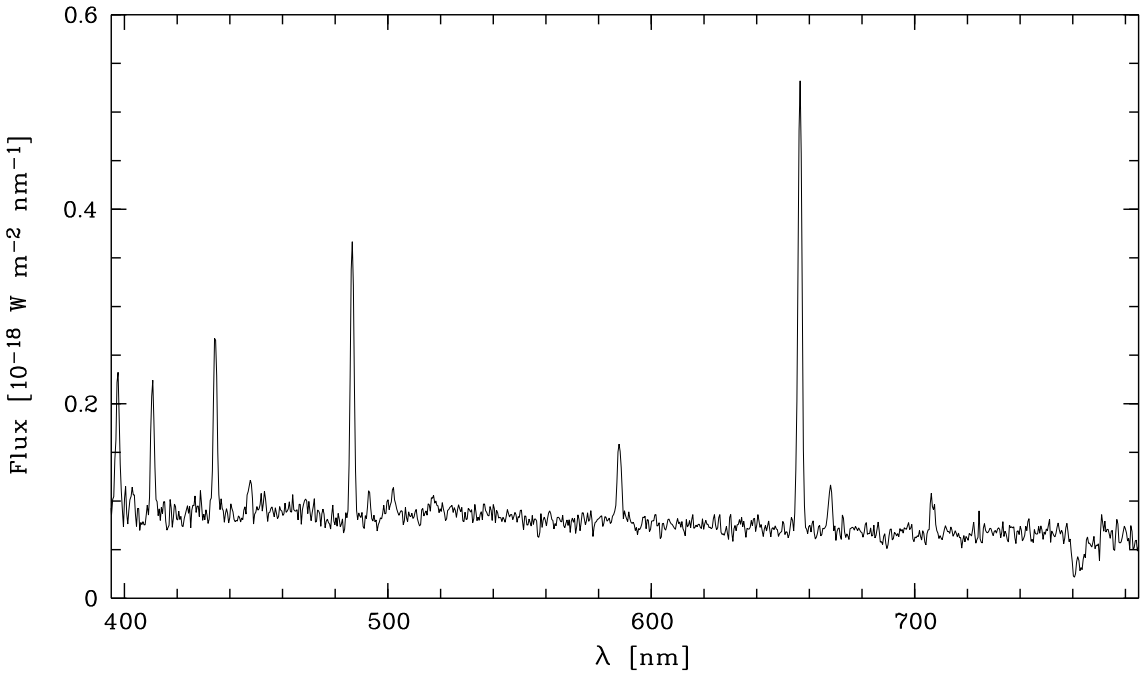

Figure 2. The optical spectrum of RX Vol, dominated by Balmer lines and He I in emission is typical for a dwarf nova in quiescence.

Table 1: Measured line width, computed velocity, and measured line flux and equivalent width are given for the major emission lines in the spectrum of RX Vol.

Transition	λ [nm]	FWHM [nm]	$v_{\rm rot} \sin i$ [km s^{-1}]	F [10^{-18} W m^{-2}]	$-W$ [nm]
Hα	656.2	1.7245	789	0.875(4)	12.57(8)
Hβ	486.1	1.5903	981	0.503(3)	6.40(4)
Hγ	434.0	1.5521	1072	0.337(7)	3.97(7)
Hδ	410.2	1.4650	1072	0.241(5)	2.91(3)
He I	447.1	1.6221	1088	0.072(3)	0.85(3)
He I	492.1	1.1239	685	0.047(2)	0.60(2)
He I	587.6	1.8518	946	0.180(9)	2.35(9)
He I	667.8	1.6041	721	0.101(8)	1.53(10)
He I	706.5	1.9725	837	0.085(7)	1.38(15)

data from Williams (1991) yields moderately high temperatures and densities. We find the best match for a disc temperature of 8000 K, a density Log$N$ = 12.5, and an inclination of 34°. A temperature up to 10000 K is still in agreement with our data but yields a slightly lower density and higher inclination.

The high Balmer decrement, the presence of H I and He I emission lines and the absence of high excitation lines agree very well with the classification of RX Vol as a dwarf nova of SU UMa subtype.

On average we find a projected rotation velocity of about 1000 km/s. From this moderate value, we conclude that RX Vol is seen at rather low inclination. This agrees with the average line profile, a single peak, as well as with the relatively high values of the equivalent widths. However, the Balmer lines seem to be slightly broader than the He I lines. We have previously found a similar effect for the emission lines of other cataclysmic variables, eg. AG Hya (Tappert & Schmidtobreick, 2005) and V842 Cen (Schmidtobreick et al, 2005). It probably indicates that the lines origin in different regions of the accretion disc.

We measured the actual brightness of the star on our acquisition file (Fig. 1). By comparison with the magnitudes of USNO 0237-0126168, 0237-0126141, 0236-0127843, and 0236-0127895, we derive R = $20\overset{\rm m}{.}0(1)$.

References:

Downes R.A., Webbink R.F., Shara M.M., Ritter H., Kolb U., Duerbeck H.W., 2001, *PASP*, **113**, 764, living edition.
Hoffmeister C., 1963, *Veroeff. Sternw. Sonneberg*, **6**, 1
Horne K., 1986, *PASP*, **98**, 609
Kato T., Nogami D., Moilanen M., Yamaoka H., 2003, *PASJ*, **55**, 989
Munari U., Zwitter T., 1998, A&AS, **128**, 277
Schmidtobreick L., Tappert C., Bianchini A., Mennickent R.E., 2005, A&A in press
Tappert C., Schmidtobreick L., 2005, IBVS **5587**, 1
Williams G.A., 1991, *AJ*, 101, 1929