Recent Observations at ESO of the Dwarf Novae VW Hydri and WX Hydri

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Observations of the mysterious dwarf novae are being pursued with great vigour at La Silla. In addition to earlier photometric observations (cf. Messenger *No. 5, p. 2, and No. 14, p. 15), Dr. Rolf Schoembs of the Institute for Astronomy and Astrophysics at the Munich University (FRG) has now obtained series of consecutive spectra and polarimetric data for two southern, prominent representatives of this stellar class. An early look at the polarimetry enabled Dr. Schoembs to set upper limits for the polarization, and the spectra showed unexpected changes from night to night.*

The group of SU Uma-type dwarf novae provides unusual problems for astronomers. Contrary to many other fields of research, where the most urgent task is to improve the quality of measurements, we have very clear and well-established observational facts, but no satisfactory model to explain the observed phenomena in these cataclysmic binaries. The results referred to are in particular the strange changes in the periodic light variations during normal light and superbursts.

One of the most well-known objects, VW Hydri, has a highly constant orbital period $P_0 = 107$ min during minimum light, whereas during superbursts a period of 110 min is observed which decreases quickly, but does not reach P_0 at the end of the outburst. A beat phenomenon is observed when the star is near its minimum. Similar phenomena have been observed for V436 Cen, WX Hydri and Z Cha. Different models have been proposed to explain these facts. Some assume spots on the red component (Warner 1975, Schoembs 1977, Haefner et al., 1978), some assume magnetic accretion poles on an oblique, nonsynchronous rotating or precessing white dwarf (Vogt 1978, Papeloizou et al., 1978). But none of these scenarios is capable of fully explaining the behaviour of all the well-observed objects.

Important information about the existence and, if present, the intensity of magnetic fields can be obtained from polarization measurements. Furthermore, as already shown in the case of Z Cha by Vogt (1978), spectroscopic observations with high time-resolution are of great value for the analysis of the dynamics and for understanding the physical conditions of the main radiation sources in these stellar systems.

Observations with the ESO 3.6 m and 1 m Telescopes

Using the 3.6 m ESO telescope, equipped with the Cassegrain image-tube spectrograph, it was possible to obtain spectra of about 3 Å resolution in only 10 min exposure time of VW Hyi and WX Hyi, at minimum brightness, about $14^m.5$. Photometric-polarimetric data in integral (white) light were obtained at the 1 m ESO telescope with a time resolution of 16 sec. The observations started on October 27, 1978 with photometry and polarimetry and continued with spectroscopy from November 4 until November 7.

A preliminary analysis has so far revealed no detectable linear or circular polarization for either of the two objects.

The upper limits in Table 1 are due to atmospheric scintillation and photon noise and therefore increase when the brightness of the object decreases. The detection limits will be considerably improved by statistical computer analysis. The light-curves were deduced from the polarimetric data. For VW Hyi (run 1–3 has not been analysed yet), they show the well-known superhumps and the rates of decrease of the periods were found to be consistent with earlier results.

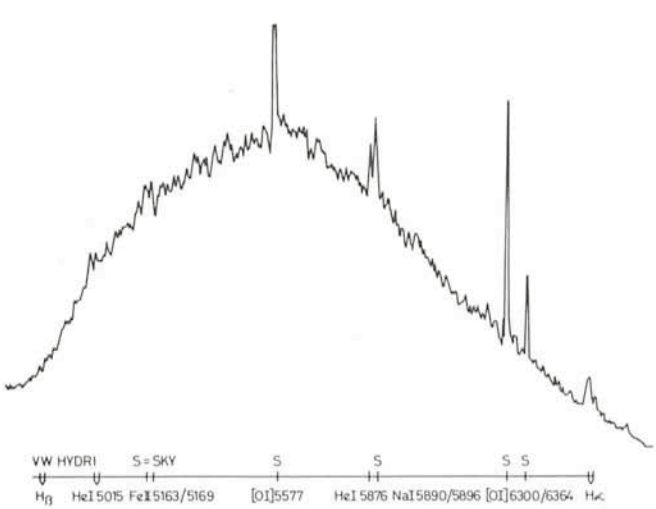

Fig. 1a: *Spectrum of VW Hydri taken on November 5, 1978, at 7^h22^m UT.*

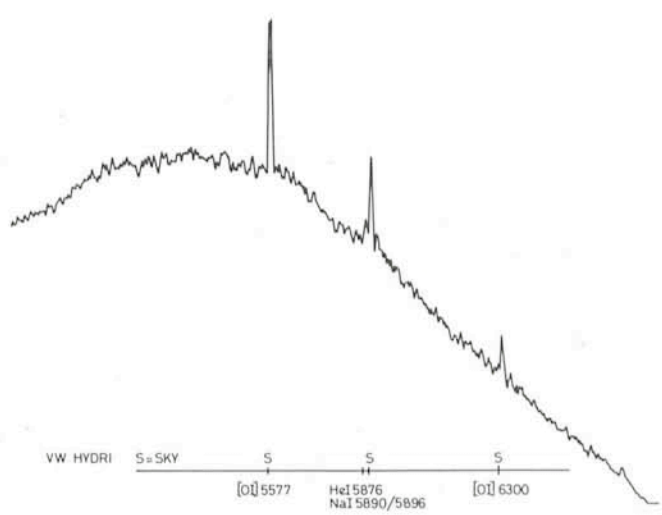

Fig. 1b: *Spectrum of VW Hydri taken on November 6, 1978, at 1^h54^m UT.*

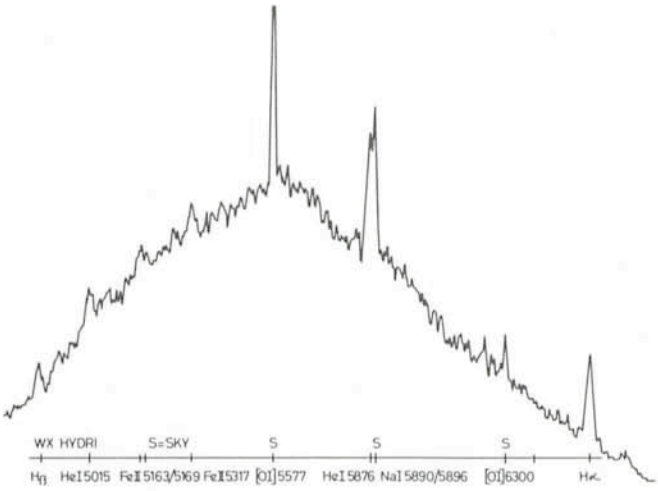

Fig. 2: *Spectrum of WX Hydri (November 7, 1978 at 2^h26^m UT).*

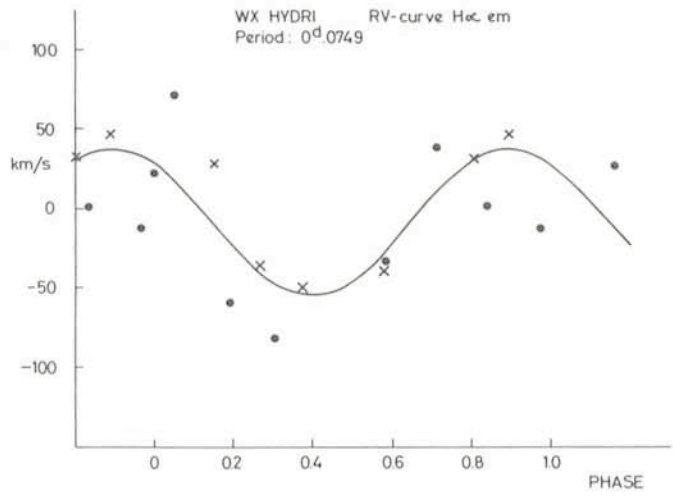

Fig. 3: *Radial velocities of WX Hydri from November 7, 1978 folded with a period of 0.0749 day.*

Table 1. Polarimetric results

Object	Run	Date	m (white light)	P %	Θ_p
VW Hyi	4	1978-10-31	9.5	.06 L	random
	5	1978-11-1	9.6	.08 L	random
	6	1978-11-2	9.9	.1 L	random
	7	1978-11-3	10.7	.15 C	random
	8	1978-11-3	10.7	.15 L	random
	9	1978-11-4	12.6	.4 L	random
WX Hyi	1	1978-11-3	13.2	.5 C	random
	2	1978-11-4	13.4	.6 L	random

L = linear, C = circular polarization.

However, for a final determination, all observations, including those from other observers will be taken into account. A search for high-frequency oscillations will also be carried out.

Strong erratic variations occur in the light-curve of WX Hyi, but no clear periodic feature could be detected which would permit a determination of the orbital period.

The Spectra

The spectral variation of VW Hydri during the superburst is remarkable. At minimum light, broad, double Balmer emission lines were detected by Vogt (1974, private communication). A spectrum taken on October 27, 1978, 3 days after the beginning of the outburst (m = 9), showed broad, shallow Hα and Hβ absorption lines, as expected from previous results, also by Vogt and from spectroscopic observations of other objects. In a series of 9 spectra on November 5 (m = 13.3), Hα was a double emission feature, emerging from a shallow and even broader absorption (fig. 1a). He I 5875, 5015, Fe II 5163, 5169, 5316 were also in emission. This suggested that the normal minimum spectrum was already taking over again. But the following night (Nov. 6, fig. 1b), a series of 7 spectra did not show any distinct line feature except very weak He I 5875 emission!

WX Hyi was also declining after an outburst. 15 spectra of the Hα-to-Hβ region were obtained within 3.5 hours and showed single emission lines of Hα, Hβ, He I 5875, 5016, Fe II 5817, 5163 (fig. 2). No pronounced intensity or profile variations were found in a first survey. The radial velocities of Hα (fig. 3), as measured from the outer edges of the line, fit quite well to a periodic variation of 0d0749 which is half the period proposed by Walker et al. (1976).

These are only a few, early results of the observations. A more sophisticated analysis will undoubtedly reveal more interesting features of these strange objects.

References

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