

COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 3725

Konkoly Observatory
Budapest
11 May 1992

HU ISSN 0374 - 0676

HV And: a peculiar non- or weakly-magnetic CV

Earlier reports on this blue variable were given in IBVS by Meinunger (#1795), Andronov & Banny (#2763) and Andronov & Meinunger (#3015). Based on plate photometry and single spectra obtained at Tautenburg observatory and the SAO Selenchukskaja they suggested that HV And belongs to the strongly magnetic cataclysmic variables, the so called AM Herculis stars or polars.

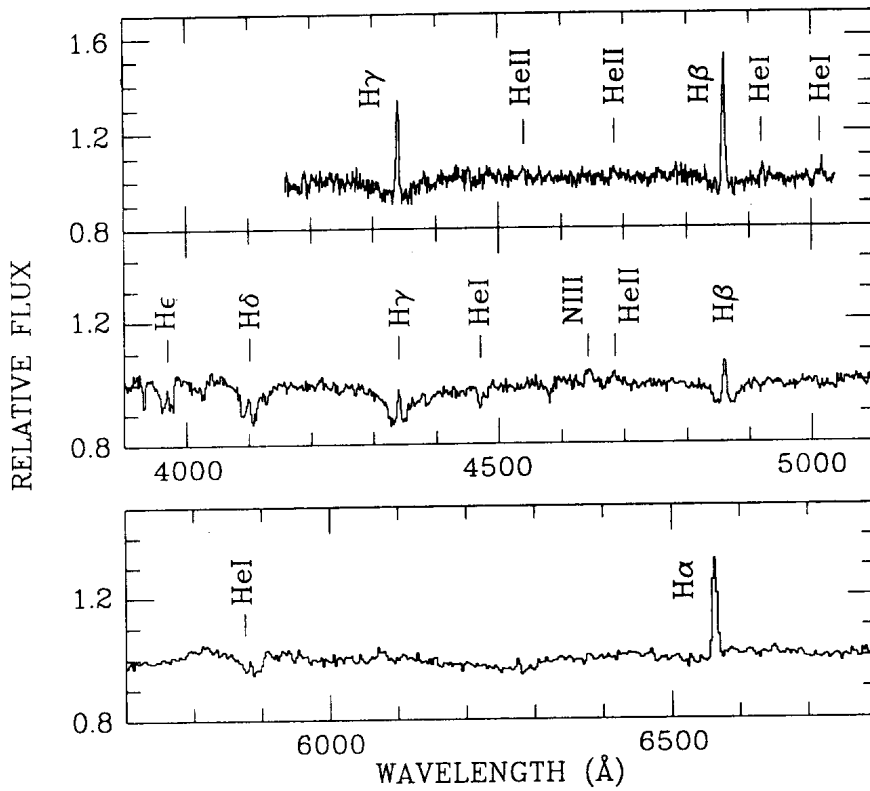
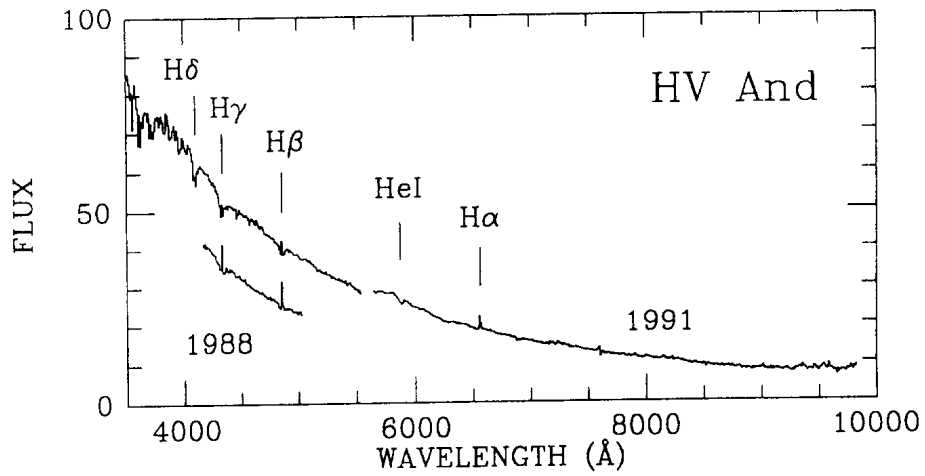
We obtained a short (1^h4) sequence of circular and linear polarimetric observations on June 17, 1988, using the 2.2m telescope situated atop Calar Alto. With the 3.5m telescope at the same observatory we obtained single high-resolution (60Å/mm, $\lambda\lambda 4150 - 5050$ Å, $T_{\text{int}} = 30$ min, Nov. 1988) and low-resolution spectra (144Å/mm, $\lambda\lambda 3500 - 5500$ Å, 160Å/mm, $\lambda\lambda 5600 - 9800$ Å, $T_{\text{int}} = 15$ min, July 1991). The original spectra are shown in Figure 1. In Figure 2 we show the spectra normalized to a smooth continuum on an expanded scale.

The 1991 low-resolution spectrum: HV And displayed the spectrum of a typical disk-CV. The continuum slope follows a power law, $F_{\lambda} \propto \lambda^{-\alpha}$, $\alpha = 2.6$, with broad Balmer absorption lines and narrow emission lines superimposed. The higher excited lines are stronger in absorption and weaker in emission. Due to the rather low resolution ($\sim 6 - 7$ Å in the blue, ~ 8 Å in the red) the narrow emission lines are not or only barely resolved. Further lines which are clearly recognizable are HeI $\lambda\lambda 4471, 5876$ (absorption and emission) as well as CIII/NIII 4643 and HeII 4686 in emission. We did not find any features of the secondary star. Rough Johnson brightnesses are $B \simeq 15^{\text{m}}.3$ and $V = 15^{\text{m}}.2$.

The emission lines of H and He display peculiar radial velocity shifts. While the H-Balmer lines appear slightly blueshifted, $v \simeq -10 \dots -160$ km s⁻¹, the HeI lines are clearly redshifted with $v(\text{HeI}4471) \simeq +155$ km s⁻¹, and $v(\text{HeI}5876) \simeq +420$ km s⁻¹. On the other hand, the weak emission of HeII 4686 appears slightly blueshifted, $v \simeq -110$ km s⁻¹. The complete information about the individual lines may be found in the Table.

The 1988 high-resolution spectrum: Compared with the 1991 observation the continuum brightness was reduced by ~ 0.5 mag while its slope remained approximately unchanged. The decrease of the continuum flux is accompanied by an increase of the Balmer emission line flux and a weakening of the corresponding broad absorption (equivalent widths of Balmer emission lines are given in the Table). Our spectral resolution was sufficient to resolve the emission cores. The FWHM of these lines is ~ 340 km s⁻¹. The intrinsic width of the lines might be smaller, considering the possibility of radial velocity variations during the (long) integration time of 30 min. Weak emission of HeI 4921, 5015 and HeII 4686 (4541?) is present, too. Again, the narrow emission of H and HeII appears blueshifted and that of HeI redshifted. The radial velocities differ from those obtained in 1991.

Polarimetric observations: The Calar Alto polarimeter allows circular and linear polarization to be determined simultaneously, the latter with reduced efficiency. Results of our polarimetric observations are shown in Fig. 3. During the 1^h4 interval of observation HV And varied photometrically by about $\sim 20\%$. A possible polarimetric event with maximum circular polarization of $P_{\text{CP}} \simeq (3 \pm 1)\%$ and linear polarisation $P_{\text{LP}} \simeq (4 \pm 1.5)\%$ was observed around HJD 244 7329.59. This event corresponds to the clustering of the polarization angle ψ at $160 - 170^\circ$ at that time, whereas ψ displays a large scatter otherwise.



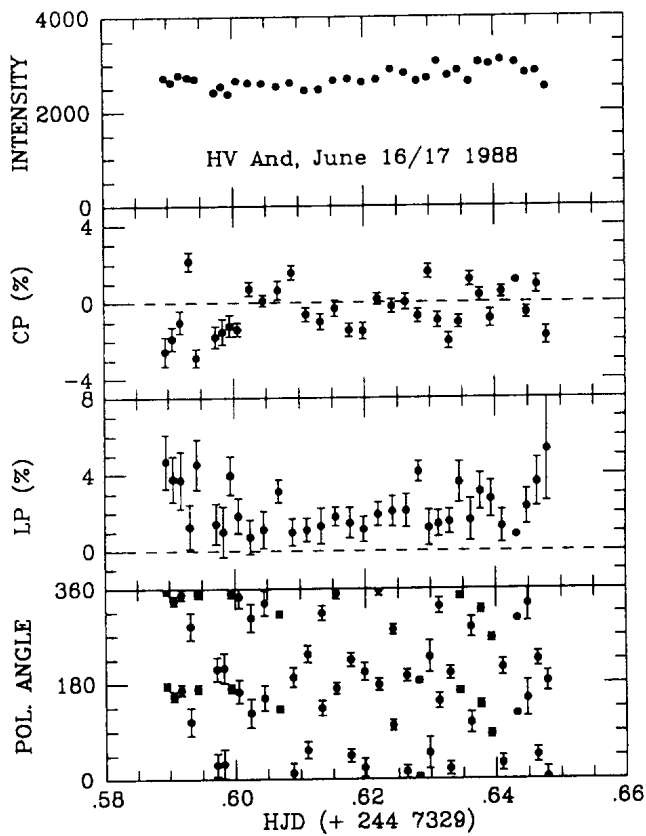


Fig. 3: Polarimetric observations of HV And. Shown are from top to bottom the white-light intensity, the degree of circular and linear polarisation and the linear polarisation position angle, respectively.

Fig. 1 (preceding page, top): Flux- and wavelength- calibrated spectra of HV And obtained on Nov. 18, 1988, and July 11, 1991. Flux units are $10^{-16} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ \AA}^{-1}$.

Fig. 2 (preceding page, bottom): The same spectra as in Fig. 1 are shown on an expanded wavelength scale after normalisation to continuum intensity 1. The 1988 spectrum is shown in the top panel.

Table I

Line	Absorption		Emission		Equi. W. (Å)	Line flux (10^{-16} erg cm $^{-2}$ s $^{-1}$)
	V_{rad} (km s $^{-1}$)	FWHM (km s $^{-1}$)	V_{rad} (km s $^{-1}$)	FWHM (km s $^{-1}$)		
<i>1991</i>						
H α	-230:	1200:	-10	< 380	3.1	58
H β	-80	2000	-84	~ 490	1.5	62
H γ	-130	2000	-82	~ 500	1.4	76
H δ	-107:	1400:	-157	≤ 500	0.7	45
HeI 4471	—	—	+155	"	0.6	30
HeI 5876	—	—	+380	"	0.3	10
HeII 4686	—	—	-110	"	—	—
<i>1988</i>						
H β	-13:	3400:	-24.8	350	3.3	85
H γ	-210:	4500:	-28.3	330	2.1	76
HeI 4921	+46:	1800:	+65	280	0.4	10
HeII 4686	—	—	-44:	290:	—	—

Discussion: HV And is clearly not a polar. It contains an (optically thick) disk which was seen at different brightness in 1988 and 1991. Its spectral appearance resembles those of a high-mass-transfer novalike CV, a dwarf nova in outburst, a VY Scl star or even an intermediate polar (IP). If the first case, HV And must belong to the long-period CVs and the suggested period of ~ 80 min (Andronov & Banny 1985) cannot be the orbital period. No dwarf-nova outburst of HV And has been reported so far. The possible detection of polarized light would be, if confirmed, strongly suggestive of the latter possibility (IP). The emission lines of confirmed intermediate polars, on the other hand, are much broader than those of HV And and may have complex structure. The case of HV And appears to be similar to that of TT Ari which was also classified as either novalike, subtype VY Scl, or as an intermediate polar. Its high-state spectrum resembles that of HV And in its 1991 high state. A detailed (high-speed) photometric investigation of HV And is necessary in order to derive the orbital and possible further photometric periods and to ascertain its subtype.

HV And seems to be a unique object with respect to the peculiar radial velocities found in H and HeII on one hand and in HeI on the other hand. It is clear that the lines of the different species origin at different places in the system. While the Balmer lines may be probably located in the disk the origin of the HeI lines remains unclear. Since they always appear redshifted they cannot be formed in a wind emanating the accretion disk.

Deeper insight into the physics of that puzzling system may be derived from a detailed radial velocity study which is strongly encouraged.

A.D. SCHWOPE and K. REINSCH
 TU Berlin, Sekr. PN8-1
 Hardenbergstr. 36
 1000 Berlin 12

References:

- Andronov I.L., Banny M.I., 1985, IBVS No. 2763
 Andronov I.L., Meinunger L., 1987, IBVS No. 3015
 Meinunger L., 1980, IBVS No. 1795