RECENT STUDIES OF THE SPECTRUM OF V1016 CYGNI

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Two coudé spectra of V1016 Cyg taken on June 24 and 27, 1979 were reduced, using a computer programme developed in Marseille. Radial velocities and full widths at half maximum were measured for the emission lines, and are summarized in the following table were VR is the mean radial velocity in km s^{-1}, DV the velocity corresponding to the mean FWHM and Xi the effective ionization potential for the ion.

Ion	Xi	Plate 4230 (June 24)		Plate 4239 (June 27, 1979)	
		VR	DV	VR	DV
ScII	6.54	-71.5	64	-70	74.5
TiII	6.82	-80.1±1.9	41.4±13.2	-78.8±3.7	34.4±14.1
FeII	7.87	-80.5±8.3	44.2±11.0	-82.6±5.8	32.5±14.0
H I	13.60	-82.6±3.8	77.7±12.4	-82.5±5.3	72.1±23.2
SiII	16.34	-74	63	-99	35
HeI	24.54	-78.4±4.5	60.4±17.4	-78.8±6.1	45.4±15.5
NIII	47.45	-78.7±3.2	56.3±18.4	-78.7±5.1	41.7±12.1
CIII	47.84	-82	58	-77	54
HeII	54.42	-74.0	71.5	-74.5	77.0
OIII	54.93	-76.5	63	-89	61.5
forbidden lines					
[NiII]	7.64	-37	25	-29	32
[FeII]	7.87	-77.6±4.1	45.8±7.5	-80.9±4.3	37.9±9.8
[FeIII]	16.16	-77.0±21.5	116±36	-66.7±8.5	133±32
[A IV]	40.74	-69	112	-110	136
[NeIII]	40.96	-67	134	-73	125
[FeV]	54.8	-72.6±5.4	140.8±17.7	-78.2±10.0	125.0±13.2
[NeIV]	63.45	-74	151	-81	152
[FeVII]	100	-85.5±6.1	132.5±9.7	-85.2±16.3	118.0±24.3

It will be seen that the mean width of all permitted lines of different ions, and of forbidden lines for effective ionization potentials needed

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to form ionization stage dominant in the line formation region below 10eV, are not more than 80 km s^{-1}. For forbidden lines of ions with Xi above 10eV, DV is however greater than 110 km s^{-1}. This may be understandable in an interacting wind model.

In addition observations of [FeVI] emission line equivalent widths with the Multiphot detector system of the Haute Provence Observatory in August 1980, can be used to estimate the electron density of its region of formation. Three different line ratios indicate electron densities of at least 10^7 or perhaps $10^8 cm^{-3}$ for assumed electron temperatures of $2\ 10^4$°K or less. The physical data used for this ion are from Nussbaumer and Storey (1978, Astr. Astrophys. 70, 37).

DISCUSSION ON V1016 CYGNI

Swings: In a paper by Y. Andrillat, F. Ciatti and J.P. Swings submitted to Astrophys. and Space Sci. we describe the recent spectral evolution of three peculiar emission line objects with IR excess: V1016 Cyg, HM Sge and MWC 349, on the basis of data obtained in the blue visible, red and near infrared (Reticon data for instance) regions. The main variations are the following (Andrillat and Swings 1980, and OHP and Asiago data): (a) V1016 Cyg: a conspicuous intensity increase of OI λ 8446 between 1979 and 1980; simultaneous presence in 1980 and 1981 of strong permitted emissions due to a hot star and of forbidden lines of FeII, V, VII.
(b) HM Sge: appearance of HeII λ 10123 in 1980.
(c) MWC 349 A: important increase of OI λ 8446 and slight strengthening of HeI λ 10830 between 1979 and 1980.

Nussbaumer: I have questions to the observers in the optical, infrared and radio domains: 1) What can be said about the TiO bands in V1016 Cyg; 2) Harvey's IR observations do not clearly establish a period. Have these observations been continued? 3) Have the radio data been extended beyond 100 GHz to establish clearly at which frequency the flux density becomes flat.

McCarthy: As an old M star observer I wish to point out that in the data displayed by Swings the strengths of TiO and VO bands were most indicative of the presence of a late type M star (> M6). I would also comment that since most late type M stars are variable in spectral type as well as in apparent magnitude, we should be ready to think that the M giant may be doing "its own act" in addition to interacting with the hot object.

Ciatti: In reply to the question by Nussbaumer on late-type features in V1016 Cyg: late-type features due to TiO and VO (like in M6-7

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stars) are reported e.g. by Mammano and Ciatti (1975, Astr. Astrophys. 39, 405). They are in any case barely recorded in the last years on plates obtained with the same instrument (Ciatti et al. 1978, Astr. Astrophys. 68, 251). These variations are also discussed by Andrillat, Ciatti and Swings (submitted). It would be interesting to compare them with the Mira-type photometric variations reported by Harvey.

Slovak: No systematic program of broad-band infrared photometry has been pursued for V1016 Cyg since Harvey's work. Such observations for V1016 Cyg and HM Sge are a definite desiderata and observers are encouraged to add these objects to their infrared programs.

Whitelock: The IR period and amplitude determined by Harvey is comparable to those of the symbiotic stars containing Mira variables which have been extensively stidied from SAAO. The variation in the molecular bands might be due to filling in by the dust emission or swamping by increased emission from the hot binary component. Variations in molecular bands are of course to be expected from a Mira variable.

Houziaux: We are carrying on an observing program of the near ultraviolet in symbiotic stars.

Cassatella: Observations near the Balmer Jump are certainly very important for the detection of the Balmer continuum emission which is useful for a correct diagnostic of the electron temperature which is often difficult to determine.

Kwok: The turnover of the radio spectrum of V1016 Cyg is now at 20 GHz. A question to IUE observers: from the emission lines one can evaluate the emission measures. What are the characteristic sizes of the nenebulae calculated from such emission measures?

Hack: Do you know which are the time scales for the transition stage from red giant to proto-planetary nebula?

Cassatella: 10^5 yr or less.

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