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EMISSION OBJECT V 1016 CYG (MHα 328-116)

As part of a continuing study of the emission object V 1016 Cygni we have obtained slit spectra at 12 and 40 A/mm at the David Dunlap Observatory on photometrically calibrated Kodak IIaO Plates, and at 130 A/mm on IaO plates at the Warner and Swasey Observatory. At the latter we have also obtained objective prism spectra on unfiltered IN plates. A report on the results of our studies from 1966 to 1968 will appear elsewhere (FitzGerald and Houk, 1970). Here we present preliminary data for four plates obtained at David Dunlap Observatory May 4, July 31, August 7, and August 28, 1969. The plates of July 31 and August 7 have been calibrated for spectral sensitivity from spectrograms of α Lyrae obtained on the same night. The absolute energy distribution used for α Lyrae is that of Code (1960). The results from a plate taken October 31, 1968 (FitzGerald and Houk, 1970) are included for comparison.

Table 1 gives the log intensities of the stronger lines, uncorrected for spectral sensitivity; corrected log intensities are given in brackets. The latter should be comparable with the intensities given by Kurpinska (1969), the former with those given by FitzGerald and Houk (1970), but not FitzGerald et al. (1966).

Table 1

Log Intensities of Plates Taken in 1969 (log $I_{H\beta} = 2.00$)

Measured λ	Identification	Oct.31 1968	May 4	July 31	Aug.7	Aug.28
3797.88	H 10	0.74			0.34(0.38)	1.05
3820.12	HeI-22	0.25				0.43
3835.41	H9	0.76			0.63(0.61)	1.15
3839.85	FeV-3F					0.77
3838.92	NeIII-1F	1.85	2.01	2.00(1.96)	1.86(1.81)	1.96
3888.91	H 8	1.45	1.12	1.03(0.98)	1.38(1.32)	1.70
3967.43	NeIII-1F	1.62)				
3970.2	Hε	1.19)	1.73	1.69(1.67)	1.82(1.74)	1.94
4026.42	He I-18	0.40		1.21(1.14)	0.30(0.20)	0.80
4068.66	S II-1F	0.60			0.36(0.25)	0.91
4070.84) 4072.06)	Fe III-4F	0.45			0.30(0.17)	0.95
4101.82	Hδ	1.49	1.44	1.56(1.45)	1.66(1.54)	1.76
4340.69	Hγ	1.81	.88	1.80(1.65)	1.96(1.77)	1.89
4363.21	O III-2F	1.92	2.08	2.09(1.94)	2.07(1.88)	2.06
4471.47	He I-14	0.82	0.54		1.01(0.81)	1.36
4641.17	N III-2	0.49		0.28(0.14)	0.47(0.28)	0.97
4686.17	He II-1	1.54	1.42	0.91(0.75)	1.53(1.35)	1.64
4713.51	He I-12	0.42			0.36(0.18)	0.74
4861.26	Hβ	2.00	2.00	2.00(2.00)	2.00(2.00)	2.00
4959.03	O III-1F	1.75	1.77	1.77(1.97)	1.79(2.13)	1.88
5006.62	O III-1F	1.97	2.08	2.13(2.50)	2.07(2.63)	2.02

On the whole the spectra show the same characteristics as previously reported (FitzGerald et al. 1966; McCuskey, 1967; and FitzGerald and Houk, 1970). However, there are some marked changes. As suggested by Kurpinska the strength of He II λ4686 decreased markedly in July 1969, but contrary to Kurpinska's report it remained sharp. This decrease in strength was accompanied by a smaller decrease in the Hydrogen lines H8 to H10, and by an increase in strength in the HeI lines λλ4026 and 4471. By August 7 He II λ4686 had returned to the intensity observed in 1967 and 1968; the other lines also returned to approximately the same intensities. Furthermore, the strengths of the lines of [Ne III], [O III], Hβ,

$H\gamma$, and $H\delta$ have shown no large change since 1967. (The observation of McCuskey (1967) comparing the [O III] lines λ4363 and λ5007 is with reference to uncalibrated plates. The absolute strength of λ5007 is greater than that of λ4363,and has been so since 1965). An objective prism plate taken August 4-5 indicates that the strength of He II λ4686 had returned to its 1968 strength by that time. Comparison of Table 1 with the observations of Kurpinska reveals other differences between our observations and his, especially at short wavelengths.Some,but not all, of these differences must be due to the different emulsions and/or reduction procedures used.

Our plate of August 28, 1969, is well exposed, showing a faint continuum and about 90 emission lines. No absorption lines are seen. Emission lincs of the following are observed: H, He I, He II, N III, O II, O III, O IV, [O II], [O III], [Ne III], [S II], [A IV], [Fe II], [Fe III], [Fe V], [Fe VI], and possibly [Ti III]. The latter has not been noted before and the identification is uncertain. The permitted iron lines are completely absent.

Table 2

Radial Velocity Measures

Date	Dispersion (A/mm)	Velocity (km/sec)
October 31, 1968	12	-62.1 $\pm$ 1.7
May 4, 1969	12	-50.3 $\pm$ 2.2
July 31, 1969	12	-60.1 $\pm$ 2.6
August 7, 1969	40	-49.8 $\pm$ 5.7
August 28, 1969	40	-72.3 $\pm$ 2.6

In addition to the short term changes observed in the helium line strengths, the radial velocity observations, Table 2, show that changes are occuring in the emitting regions. However, the line widths and profiles remain essentially unchanged from 1968, when the object exhibited a constant radial velocity of about -60 km/sec. A full discussion of this year's observations will be published later.

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