SPECTROPHOTOMETRY OF COMET WEST (1975n) AFTER THE PERIHELION PASSAGE

U. S. CHAUBEY
Uttar Pradesh State Observatory, Naini Tal, India

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Abstract. In the wavelength range 350 to 650 nm, the flux distribution of comet West (1975n) is presented for various dates following perihelion passage. The variations with heliocentric distance, in the flux of the emission features of the CN band at 388 nm, the C_2 bands at 474 nm, 516 nm and 563 nm and Na at 589 nm, have been discussed. It is concluded that the comet was dust rich.

1. Observations and Reduction

The head of comet West (1975n) was observed at the Uttar Pradesh State Observatory in the post-perihelion phase on ten nights between 6 and 24 March 1976 when the heliocentric distance of the comet increased from 0.400 to 0.833 AU and the geocentric distance from 0.846 to 1.065 AU. A photoelectric scanning spectrophotometer mounted on the 52-cm telescope was used. The instrument and the observational procedures were the same as described earlier (Babu and Saxena, 1972; Babu, 1974). Light from the central region of the head was admitted into the spectrophotometer through an entrance window covering 93 arc-secs of the sky in diameter. The exit window corresponded to 3.5 nm of the spectrum while the scan covered the wavelength region 350 to 650 nm.

In addition, β Aql (G8V) and α Lyr were observed on each night to serve, respectively, as the comparison and the standard star. After correcting for extinction by the graphical method, the observations of the comet and the star (at intervals of 2.5 nm) were normalized at 479 nm so that m_λ (479) = $0^m\!.00$.

In order to get the normalized fluxes of the comet relative to β Aql, the differential magnitudes (Comet $-$ β Aql)$_\lambda$, were obtained and converted into intensity ratios for the wavelengths of interest. Figure 1 shows the relative flux distribution in the head of comet West on various dates.

2. Relative Flux Distributions

In Figure 1, the emission features of CN, C_2 and Na have been identified. After locating the continuum on the scans (following Swings and Haser, 1956) the areas of the emission band profiles were planimetered. These areas, which are identified with total band intensities of the related bands, are given in Table I along with the continuum intensities at 479 nm, relative to the C_2 band intensity at 516 nm and some

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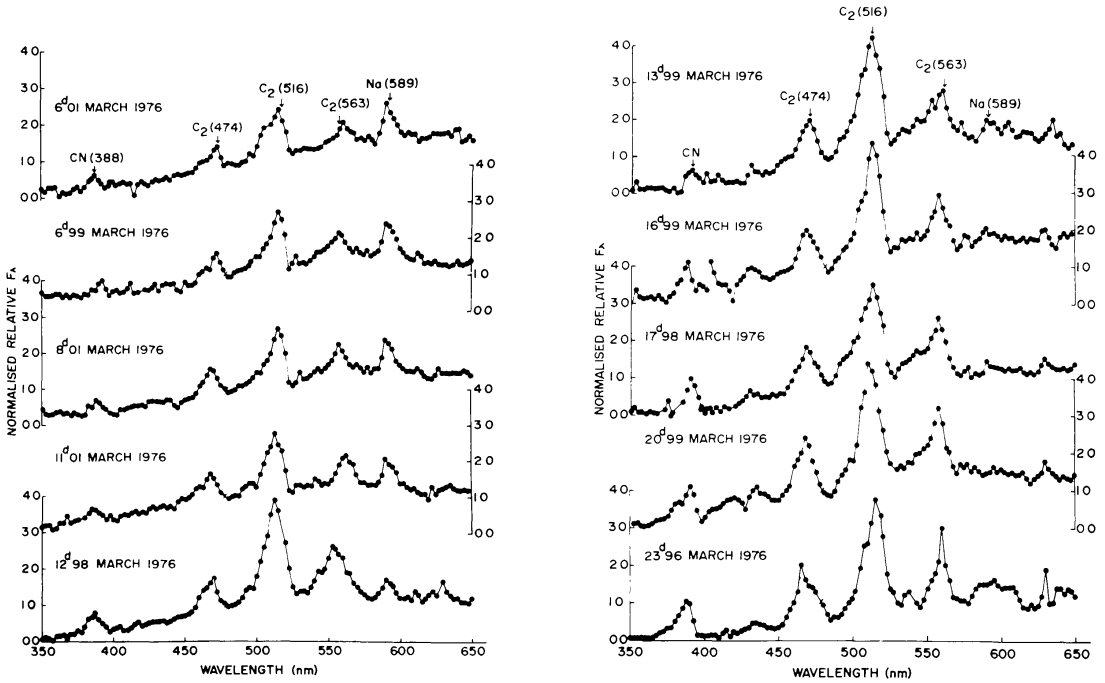

Fig. 1. Relative flux distributions in the head of comet West (1975n) on various dates normalized to 479 nm. The normalization point is shown as a cross.

other relevant data. From these, the absolute fluxes, at the distance of the Earth, were obtained after correcting for instrumental constants. The instrumental constants were determined through comparing our observations of α Lyr with its calibration given by Hayes and Latham (1975). The absolute fluxes and total energies in the C_2 ($\Delta V = 0$) band at 516 nm, streaming out of the head of the comet are also given in Table I.

It is clear from Figure 1 that the intensity of Na emission is steadily decreasing with increasing r, the heliocentric distance, during the period of our observations. This is different from the behaviour of the Na emission for comet Bennett (1969i) (Babu and Saxena, 1972).

However, in the present case, the fluxes of the C_2 bands at 474 nm, 516 nm and 563 nm are increasing with r. This is similar to the case for comet Bennett (1969i). This increase in fluxes can be explained in terms of an increase in the abundances of C_2 in the head of the comet, which may be due to a recombination of C atoms that were formed through dissociation during the perihelion passage.

The intensity in the CN band at 388 nm shows a steady increase with increasing r. This is akin to the case of comets Seki (1962c) and Ikeya-Seki (1967n). This increase in fluxes can be explained in terms of an increase in the population of rotational level of the ground state of the CN radical in comets following a decrease in temperature with increasing heliocentric distance. Thus the behaviour of the CN band in this comet is in agreement with the numerical results of Arpigny (Arpigny, 1965; Gebel, 1970).

TABLE I

Relative fluxes of emission bands and the continuum in the head of comet West (1975n)

Date March, 1976 (U.T.)	Geocentric distance Δ (AU)	Heliocentric distance r (AU)	$F(C_2, \Delta V = 0)$; 516 nm (erg cm^{-2} s^{-1}) (in units of 10^{-7})	$F/F(C_2, \Delta V = 0)$					Total $F(C_2, \Delta V = 0)$ (erg s^{-1}) (in units of 10^{20})
				CN (388 nm)	C_2		Na (589 nm)	Continuum (479 nm)	
					$\Delta V = -1$ (474 nm)	$\Delta V = +1$ (563 nm)			
6^{d}01	0.846	0.400	9.016	0.060	0.383	0.586	0.821	0.511	1.390
6.99	0.859	0.427	10.608	0.065	0.443	0.600	0.689	0.422	1.675
8.01	0.872	0.455	10.784	0.076	0.527	0.645	0.300	0.401	1.751
11.01	0.914	0.535	12.552	0.102	0.590	0.635	0.273	0.360	2.225
12.98	0.941	0.587	14.320	0.106	0.580	0.669	0.147	0.311	2.831
13.99	0.954	0.613	15.216	0.110	0.585	0.531	0.055	0.208	3.476
16.99	0.991	0.689	18.740	0.127	0.590	0.673	0.044	0.245	4.152
17.98	1.003	0.713	20.155	0.130	0.598	0.680	—	0.227	4.601
20.99	1.036	0.786	23.798	0.133	0.602	0.684	—	0.194	5.734
23.96	1.065	0.833	23.868	0.138	0.607	0.701	—	0.184	6.058

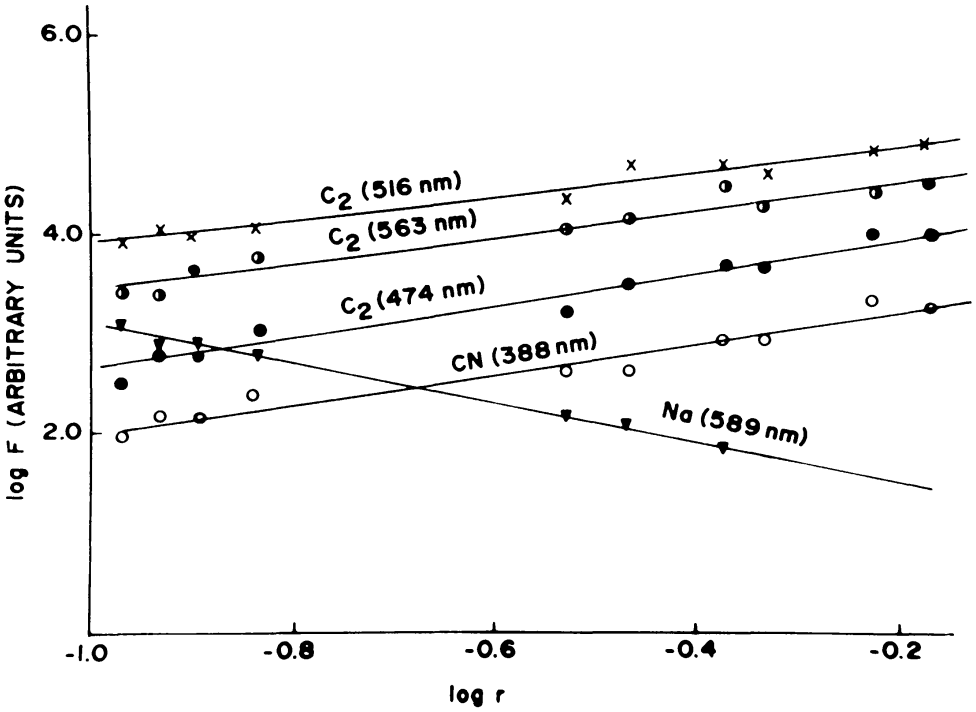

Fig. 2. The variations in flux of the various emission features in the head of comet West (1975n) with heliocentric distance.

3. Flux Variations

Assuming a law (Levin, 1966) of the form

$$\log I_\lambda(r) = \log I_\lambda(1) - \nu \log r,$$

we can estimate ν by determining the slope of $\log r$ versus $\log I_\lambda(r)$ plot, which is given in Figure 2. Among the features that were studied, the emission fluxes of C_2 (516 nm), C_2 (563 nm), CN (388 nm) and C_2 (474 nm) increase with r in that order while that of Na (589 nm) decreases.

The strong continuum along with strong sodium emission in the early stages of our observations indicate that the comet 1975n belongs to the class of 'dust rich' comets. This remark is confirmed by the fact that the comet showed a very strong and curved dust tail, in addition to a straight gas tail.

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