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Emission from the head of comet P/Halley during post-perihelion

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Abstract. Spectral scans of the head of periodic comet Halley (1982i) covering the wavelength range $\lambda\lambda$ 320 – 700 nm, are presented for five nights during the months of April an May, 1986. These observations were made when the heliocentric distance of the comet varied from 1.57 – 1.82 AU. Bright emission features due to CN band at λ 388 nm ($\Delta V = 0$), CH + C_3 band at λ 405 nm ($\Delta V = 0$) and Swan band sequence of C_2 at λ 474 nm ($\Delta V = +1$), λ 516 nm ($\Delta V = 0$) an λ 564 nm ($\Delta V = -1$) have been identified. The fluxes at each emission bands have been measured.

Key words : comet – molecular emissions

1. Introduction

Comet P/Halley was recovered on 16 October, 1982 (r_H = 11.04 AU; V = 24.2) by Jewitt & Danielson (1982); more than three years earlier to its perihelion passage (Feb. 9, 1986). This is the earliest recovery ever made on a periodic comet. Since its recovery a large number of professional and amateur astronomers observed this most fascinating object with a variety of sophisticated instruments. So far, it has completed 29 recorded apparitions till 1986. Its shortest period between returns being 74.42 years and the longest being 79.25 years. Because of the favourable weather conditions the comet was observed extensively from large number of observatories.

2. observations an reduction

The basic data on comet P/Halley is given in Table 1. The comet was observed from the Uttar Pradesh State Observatory, Nainital, India on five nights during the month of April and May, 1986; at the Cassegrain focus (f/13) of the 104-cm reflector. The instrumentation is same as described earlier (Goraya *et al.* 1984). The Hilger and Watts spectrum scanner giving a dispersion of 70Å mm^{-1} in the first order was used. For obtaining the spectral scans of the

comet circular diaphragm of 3 mm corresponding to 45 arcsec as projected on the head of the comet was used. An exit slit of 0.7 mm corresponding to 50 Å band pass was used for allowing the spectrum to fall on the photomultiplier tube. The cooled (–20 C°) EMI 9658 B photomultiplier tube and standard d.c. techniques were employed for detecting and recording the signal. Three or four spectral scans of the comet were obtained every night and were reduced to instrumental magnitudes separately at a step of 25Å. Finally, the mean instrumental magnitudes were derived. Scans of the neighbouring sky were also taken before and after each comet-scan, to eliminate the contribution due to the background sky.

Table 1. Geocentric distance, heliocentric distance and predicted total magnitude (m_1) of the comet.

Date (U.T.) 1986	Geocentric / distance (Δ) AU	Heliocentric distance (r) AU	Predicted m_1
Apr. 27.64	0.69	1.57	5.6
May 2.64	0.83	1.65	6.2
May 3.62	0.86	1.66	6.3
May 8.64	1.02	1.74	6.8
May 14.65	1.21	1.82	7.4

Table 2. Observed emission and fluxes.

Date 1986	(AU) I	(AU) Δ	Total apparent flux (ergs cm^{-2} s^{-1})				
			CN (0 – 0) (λ 3883)	CH (0 –0)+ C_3 (λ 4050)	C_2 (1– 0) (λ 4734)	C_2 (0 – 0) (λ 5165)	C2 (0 – 1) (λ 5635)
Apr. 27.64	1.57	0.69	4.98×10^{-11}	7.22×10^{-11}	2.72×10^{-11}	9.90×10^{-11}	6.18×10^{-11}
May 2.64	1.65	0.83	9.14×10^{-11}	1.31×10^{-10}	5.44×10^{-11}	1.56×10^{-10}	6.26×10^{-11}
May 3.62	1.66	0.86	5.82×10^{-11}	7.20×10^{-11}	5.26×10^{-11}	1.01×10^{-10}	4.78×10^{-11}
May 8.64	1.74	1.02	5.32×10^{-11}	6.22×10^{-11}	5.12×10^{-11}	7.04×10^{-11}	5.16×10^{-11}
May 14.65	1.82	1.21	1.52×10^{-11}	1.70×10^{-11}	1.74×10^{-11}	3.18×10^{-11}	1.40×10^{-11}

Table 3. Observed relative fluxes of emission bands.

Date (U.T.) 1986	Apparent flux (F) in the C_2 (0 – 0) band (ergs cm^{-2} s^{-1} $\times 10^{-10}$	F/F [C_2 (0 – 0)]				
		CN (ΔV=1)	CH (ΔV=0)+ C_3 (ΔV=1)	C_2 (ΔV=1)	C_2 (ΔV=0)	C_2 (ΔV=–1)
Apr. 27.64	0.99	0.503	0.729	0.275	1.000	0.624
May 2.64	1.56	0.586	0.840	0.349	1.000	0.401
May 3.62	1.01	0.576	0.713	0.521	1.000	0.473
May 8.64	0.704	0.576	0.884	0.727	1.000	0.733
May 14.65	0.318	0.478	0.538	0.547	1.000	0.440

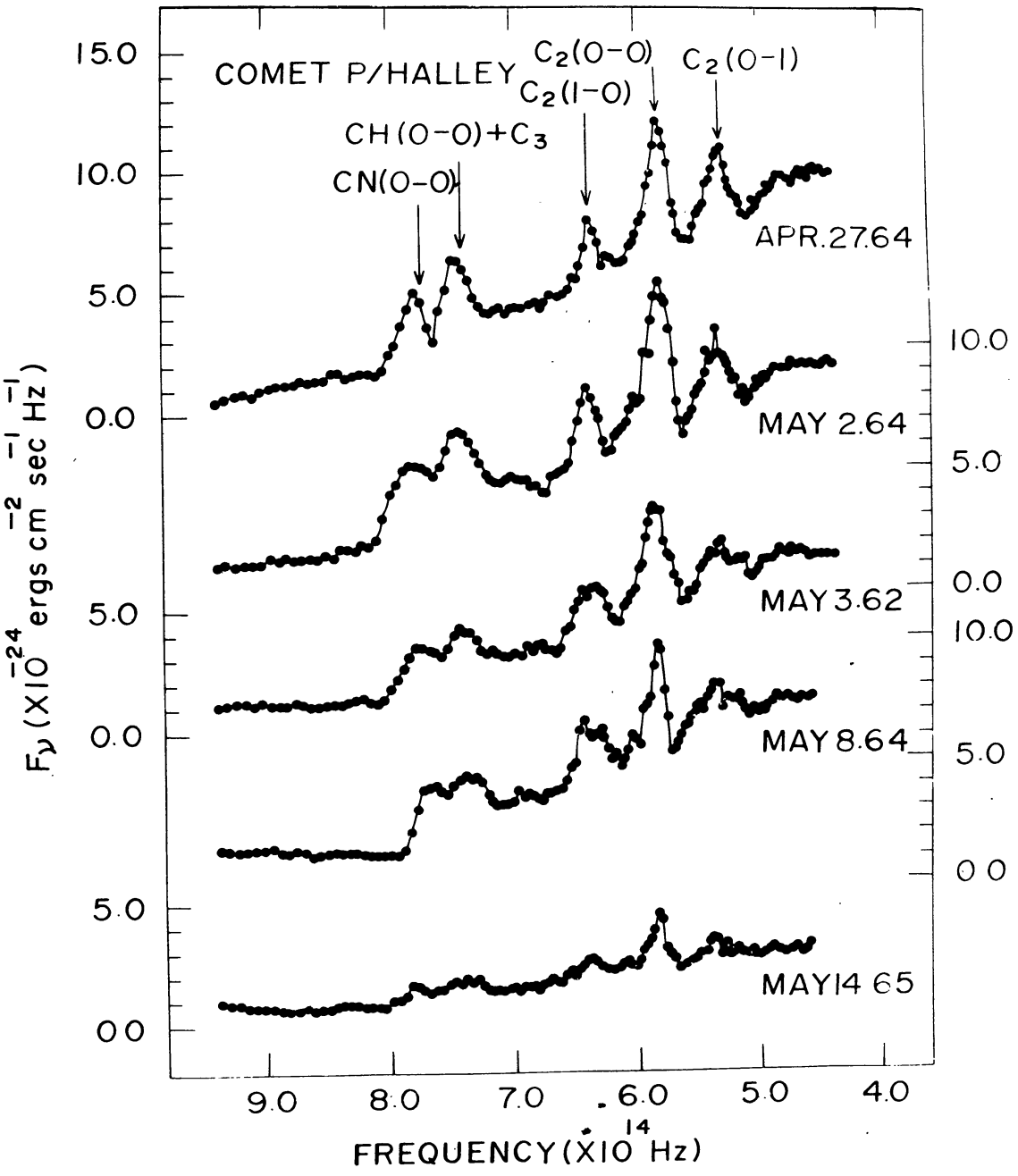

Figure 1. Emission features of Comet P/Halley

Alongwith comet P/Halley the standard star α Leo was observed many times for deriving atmospheric extinction correction and to convert instrumental magnitudes of the comet to standard magnitudes. The absolute magnitueds thus obtained correspond to the calibration of the standard star by Taylor (1984). The standard monochromatic magnitudes (m_λ) were converted to fluxes (F_υ) by using the relation :

$$\log F_\upsilon = -19.447 - 0.4\, m_\lambda \qquad (1)$$

The spectral scans of the comet are displayed in Figure 1.

3. Emission bands

In Figure 1 different emission bands are indicated by the vertical arrows pointing downwards. The emission featured are due to CN (0 – 0) l 388_{nm}, c4 (0 – 0) + C3 λ 405 nm and Swan Band Sequence C_2 (1 – 0) λ 474 nm, C_2 (0 – 0) l 516 nm and C2 (0 – 1) λ 564 nm. To know the strength at each emission band we have measured the total area under different emission bands relative to the continuum. The area was converted to flux. The total apparent fluxes measured for each band are listed in Table 2. In Table 3 three are listed the observed relative fluxes of emission bands.

References

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