

OBSERVATIONS OF THE HCN MOLECULE IN COMET HALLEY

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We report here the detection of the J 1-0 rotational line at 88.6 GHz of hydrogen cyanide in comet Halley. Six observational runs were made in the Nov. 19-Dec. 3 1985 period with the IRAM 30-m millimetre radio telescope at Pico Veleta (Spain), when the comet was at $r_h \sim 1.56$ AU from the Sun and $\Delta \sim 0.63$ AU from the Earth.

At 88.6 GHz, the telescope HPBW is 26 arcsec. The spectra were obtained with a position-switching technique and using a 128x100 kHz channel filter bank. The spectrum averaged over all observations except the first day is shown in Fig. 1. The F 2-1 and F 1-1 hyperfine components are clearly detected, but the weak F 0-1 line remains within the noise. The signal is also detected in the spectra of individual days, but evidences of intensity variations are present; for instance, on the first day (Nov. 20.0), the F 2-1 peak intensity was 0.300 ± 0.045 K, more than twice the mean value of Fig. 1. The two hyperfine components of Fig. 1 have central velocities which coincide with the comet rest velocity, and their widths are consistent with a coma expansion velocity of 0.85 ± 0.20 km s⁻¹.

This detection is a confirmation of the presence of HCN in comets, which was first suggested by the observations of Huebner et al. (1974) in comet Kohoutek 1973 XII. Applying the excitation model developed by Bockelée-Morvan et al. (1984) leads to a mean HCN production rate of $\sim 3 \times 10^{25}$ s⁻¹. At the same time, the OH production rate was $\sim 6 \times 10^{28}$ s⁻¹ according to the Nançay radio observations. This leads to an abundance ratio [HCN]/[OH] $\sim 1/2000$ in the inner coma while the [HCN]/[H₂O] abundance ratio is probably lower. This is notably less than the CN-parent relative abundance of ~ 0.0013 determined from the visible spectra of typical comets (A'Hearn, 1982) and suggests that other CN-parents also exist, as was previously shown by the HCN upper limits and tentative detections obtained in comet IRAS-Araki-Alcock 1983d. (Irvine et al., 1984; Bockelée-Morvan et al., 1984; Bockelée-Morvan and Crovisier, 1985).

A detailed account of these observations and their interpretation will be published elsewhere.

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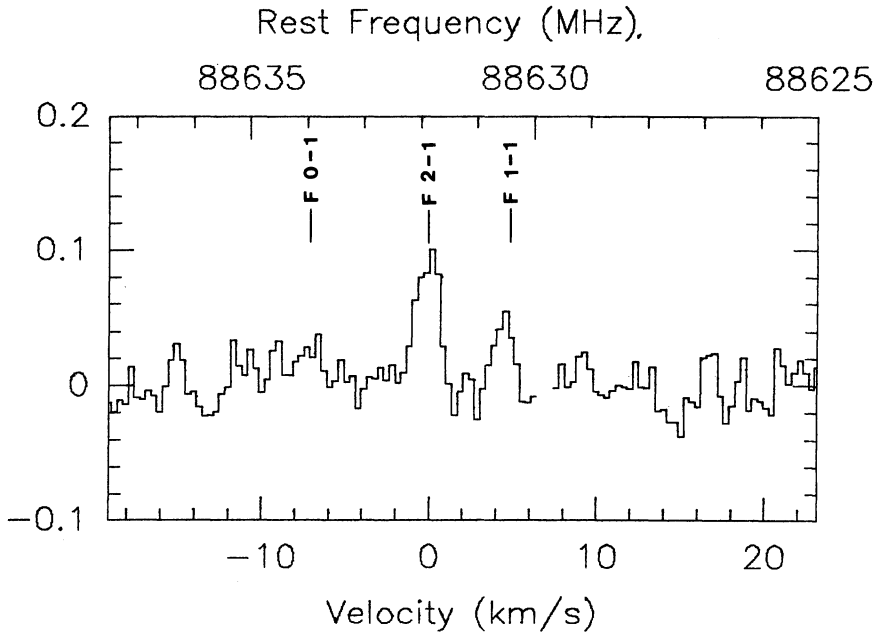


Figure 1 : The HCN J 1-0 spectrum observed in P/Halley, averaged over five days in the Nov. 19-Dec. 3 period. Intensity scale is main-beam antenna temperature in K. The velocity scale is with respect to the comet rest velocity and refers to the F 2-1 main hyperfine component.