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Observations of Formaldehyde and Search for Cyanoacetylene in Comet Brorsen-Metcalf (1989o)

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The VLA was used in 1989 September to search Comet P/Brorsen-Metcalf (1989o) for the 1_{11}-1_{10} transition of formaldehyde (H_2CO) at 4,829.659 MHz (6.2 cm λ) and for the J=1-0, F=2-1 rotational transition of cyanoacetylene (HC_3N) at 9098.3321 MHz (3.3 cm λ).

An emission line of H_2CO was detected from Brorsen-Metcalf which was approximately as strong as the H_2CO emission from comets Halley and Machholz that we observed earlier (Snyder, Palmer, and de Pater, 1989, A. J., **97**, 246; 1990, Icarus, **86**, 289). For Comet Brorsen-Metcalf, we used a new technique for reducing the data. Data blocks which were either 3x3 pixels, 5x5 pixels, or 9x9 pixels were examined for a signal from H_2CO. Using this approach, different pixel clusters within the field of view can be sampled to optimize the coupling of the synthesized beam to the gas distribution. This illustrates one of the strengths of using arrays which is particularly important in the case of comets: small pointing errors caused by an inaccurate ephemeris can be corrected after the array observations have been made -- a feat which is impossible with single dish radio observations. In general, the centimeter wavelength H_2CO detections place important constraints on the partition function and excitation of cometary H_2CO; these constraints are essential for interpreting observations at shorter wavelengths and, in particular, for deriving the correct H_2CO production rate from radiative transfer models.

HC_3N is of immediate interest as a cometary molecule because it may be a reservoir of carbon and a source of cometary CN. Our search for HC_3N emission at 3.3 cm wavelength demonstrated that for this molecule the VLA can be expected to reach significant levels of sensitivity in many comets.