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Radiative Transfer in Planetary Atmospheres . . . . . F. P. Schloerb

Submillimeter-wave Spectroscopy of Comets

Knowledge of the molecular composition of comets has long been a goal of planetary scientists. However, the realization of this goal has been frustrated by the fact that cometary spectral lines in the optical and uv portions of the spectrum are generally due to fragments of the molecules that actually make up the nucleus. For many years, astronomers have had to be content with solving a complicated molecular "jigsaw" puzzle to learn about the composition of comets, even though a better strategy would clearly be to observe the primary constituents of the nucleus directly as the cometary ices sublimate. Radio astronomers have sought to achieve this through the use of the low energy radio and millimeter wavelength rotational transitions of candidate cometary molecules, but unfortunately, this work has been difficult since the cometary spectral lines are intrinsically very weak. As the technology of radio astronomy at millimeter and submillimeter wavelengths continues to improve, however, these observations should become increasingly important as a means to probe the chemistry of the coma.

During 1990, a significant step was made in this pursuit by our Planetary Astronomy group at the University of Massachusetts. We obtained several exciting new detections of submillimeter-wave spectral lines from molecules in the coma of Comet Levy (1990c) using the 10m telescope of the Caltech Submillimeter Observatory, located on Mauna Kea. The molecules HCN, formaldehyde, and methanol were all detected in abundances that make them important minor constituents of the nucleus. Moreover, the emission was so strong that, for the first time, it was possible to map the distribution of these species in the coma and study their behavior as they flow outwards from the nucleus. It is clear that, with sensitive submillimeter-wave systems like the CSO, the study of the molecular composition of the cometary nucleus has finally come within the reach of the ground based astronomer. We eagerly look forward to the opportunity to continue this work on a future bright comet.