(SUB)MILLIMETER AND INFRARED SPECTROSCOPY OF CIRCUMSTELLAR DISKS

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The role of high spectral and spatial resolution spectroscopy in understanding the evolution of the gaseous component of the circumstellar accretion disks encircling low mass stars is described. Millimeter-wave emission lines from trace constituents such as CO, CN, HCO^+, and HCN can be used to probe the kinematic and physico-chemical properties in the near-surface regions of disks beyond 50-100 AU, but, thanks to extensive molecular depletion in the midplane, they are not a reliable proxy for the disk mass. HD and the molecular ion H_2D^+ may provide more robust access to the outer disk mid-plane.

In the critical planet-forming region from 1 to 30 AU, mid-infrared observations of the rovibrational transitions of small molecules can be used to study the physical and chemical properties of accreting material near the disk surface, and so the high resolution M-band (5 μm) spectroscopy of CO in disks is outlined. Emission lines that are likely optically pumped by hot dust in the inner disk ($R \leq 1$ AU) are seen toward inclined systems, while the *absorption* spectra of edge-on disks clearly reveal the molecular depletion inferred at millimeter-wavelengths. A wide variety of molecules can be studied with high resolution spectroscopy in the near- to mid-infrared, and such observations would permit the first direct comparison of cometary and circumstellar ices.