

# Millimeter-wave Observations of Gaseous Species in Disks

Geoffrey A. Blake<sup>1,2</sup>

<sup>1</sup>Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA 91125, USA

<sup>2</sup>Division of Chemistry and Chemical Engineering, California Institute of Technology, Pasadena, CA 91125, USA

## Abstract.

Infrared and millimeter-wave continuum surveys have placed strong constraints on the evolutionary timescales of circumstellar disks and any attendant planetary system. Rather less is known about the nature of the gas in protoplanetary accretion disks and how it may evolve with time. This talk will summarize recent millimeter-wave single dish and aperture synthesis studies of several molecules in the disks encircling T Tauri and Herbig Ae stars, and highlight future possibilities in both the near- and far-term. In particular, the combination of the sub-km/s kinematic resolution of heterodyne spectroscopy with the near- and sub-arcsecond imaging capabilities of (sub)millimeter arrays has provided the most stringent measurements of the outer disk ( $R \geq 50$  AU) physical and chemical properties to date. Such data have been analyzed with detailed radiative transfer codes in a number of objects, and the results of these analyses will be compared with the predictions of theoretical chemical models of protoplanetary disks.

**Keywords.** astrochemistry, molecular processes, ISM: molecules, stars: planetary systems: protoplanetary disks

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