MOLECULES IN DISKS AROUND YOUNG STARS

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To determine the nature of the disk environments around protostars, it is critical to obtain high resolution spectral information that can be used to constrain the abundance and location of gas phase molecules prior to and during planetesimal formation. Theoretical models of disks predict that dust preferentially settles to the midplane, leaving behind a predominantly gaseous atmosphere at higher vertical scale heights. These theoretical predictions set the stage for models of planet formation – but have not been observationally tested. The vertical distribution of dust and gas in disks can be assessed by simultaneous comparison of infrared CO *absorption* lines with infrared extinction. We will present results for ^{12}CO, ^{13}CO, and C^{18}O line absorption in two young disks; their chemical abundances demonstrate closer parity to solar system abundances than their ISM values. The absorbing gas is determined to be cool and located at larger radii, where the line of sight apparently intersects the flared portion of the disk(s). Interestingly, the dust extinction is insufficient to explain the very large columns of absorbing gas. The most straightforward interpretation of the existing data would confirm the stratification of dust and gas in circumstellar disks as predicted by theoretical models.

We also present near infrared high-resolution spectra of CO and H_3^+ from the circumstellar protoplanetary region around the HAeBe star HD141569. The CO observations constrain the mass of the remnant gas and suggest most of the gas has been radiatively cleared from the inner disk out to a distance $>$17 AU. The minimal amount of CO indicates the inner disk is past the early phase of gas accretion and planetesimal building. We also present observations of two H_3^+ emission lines from the disk; prior to these observations, H_3^+ in emission has only been detected in the upper atmosphere of the Jovian planets. CO effectively destroys H_3^+, thus, we explore the potential source and location of these molecules.