Notre Dame Science
Department of Physics

THE OBSERVATION OF PLANETS FORMING IN DISKS

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One of the central goals of observational studies of planet formation is the development of reliable signposts of planet formation and ultimately the direct detection of forming gas giant planets. Among the most promising methods of accomplishing these goals is the use of high resolution spectroscopy of warm molecules. Models of gas giant planet formation and concomitant planet-disk interactions predict two observables that can be used to ascertain the presence of forming gas giant planets. Firstly, as gas giant planets form, they are predicted to form circumplanetary disks with radii as large as 0.5AU. Secondly, gas giant planets with masses greater than 3MJ can induce eccentricities as high as e=0.025 in the innermost annuli of the disk.

The signatures can be identified with high resolution spectroscopy of warm molecules in the disk. As the planet-forming region of disks is generally spatially unresolved, high-resolution spectroscopy becomes a surrogate by spectrally resolving the velocity of gas. Assuming Keplerian rotation, spatial information can be extracted if the stellar mass and disk inclination is known. Additionally, spectro-astrometric measurements of the emission lines provide a means to acquire milli-arcsecond scale spatial information about gas in the disk.

As an example of these methods, I will present multi-epoch observations of CO emission and a spectrum of OH emission from the Herbig Be star HD100546. I will show how the line profile of the OH emission is indicative of an eccentric inner annulus. I will also show how the variation of the v=1-0 emission lines of CO relative to the hot-bands is due to emission from a circumplanetary disk.

Astrophysics Seminar

All interested persons are cordially invited to attend.