Interstellar Ices: From Clouds to Disks to Comets

Erika Gibb[1]

[1]*University of Missouri – S. Louis, USA*

Icy mantles on interstellar dust grains are the repository for a significant amount of the oxygen and carbon in dark molecular clouds and star forming environments. Much of the chemistry of these regions, where gas phase reactions are expected to be inefficient, is thought to occur in the icy mantles. Spacecraft missions, such as Spitzer and the earlier workhorse of interstellar ice observations, the Infrared Space Observatory, have dramatically improved our understanding of how ices form and evolve. In general, ice evolution can be divided into an early phase of hydrogenation reactions, a CO freeze-out phase, and a phase of UV and/or thermal processing in a protostellar environment. Observations of complex molecules in the gas phase around protostars suggest that production of complex species also occurs on grain surfaces. There is also evidence that ices are present in the midplanes of protoplanetary disks, though it is often to disentangle the signal from intervening cloud material. In the case of our solar system, comets are thought to retain a record of the midplane ices during the planet formation time, though the extent to which cometary ices have been reprocessed in the protostellar disk is unclear. In this talk, I review what is known about ices in the various environments and how it is thought to evolve from initial freeze-out and formation in the dark cloud through the star formation process and potential incorporation into comets.