Evolution of Volatile CO from Protostellar Disks to Protoplanetary Disks

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We will discuss how to link the chemical structure in planet-forming disks to the expanding field of exoplanetary atmospheric characterization. In planetary atmospheres equilibrium chemistry will redistribute elements into specific carriers depending on local conditions. Therefore to draw a link between planet formation and end-state composition, we need to measure absolute abundances and trace the bulk carriers of key elements. I will discuss methods to determine bulk abundances, relative to hydrogen, within protostellar and protoplanetary disks to provide grounding data on the disposition of elemental C during the phase of giant planet formation. Crucially current data suggest that at least in protoplanetary disks there is significant evolution in the gaseous carbon content, traced by CO, with much of the CO missing from the gas phase, even in layers above its sublimation temperature. We will report the results from a recent IRAM/NOEMA study of the CO content in protostellar disks. Analysis of these data hint at rapid evolution of the CO gas phase abundance from ISM levels in the protostellar stage to reduced levels in the main phase of giant planet assembly. We will end with a discussion of chemical and physical models to explore the central mechanisms that alter the observable CO content with implications for subsequent planet formation.