CHEMICAL CHARACTERIZATION OF THE FIRST STAGES OF PROTOPLANETARY DISK FORMATION

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Low mass stars, like our Sun, are born from the collapse of a molecular cloud, which is composed of interstellar matter. This matter (gas and grain) falls in the center of the cloud, creating a protostar and a protoplanetary disk. Planets and other solar system bodies will be formed in the disk, so the chemical composition of the interstellar matter and its evolution during the formation of the disk are important to better understand the formation process of these objects.

We study the disk chemistry using the gas-grain code Nautilus (Hersant et al. 2009) developed at the Laboratoire d'Astrophysique de Bordeaux, based on the models from the Ohio State University (Eric Herbst's team). The change in physical conditions during the formation of disk is not well constrained (by observations or theory) up to now. We thus assume several scenarii for the possible thermal and density history of the gas and dust during the formation of the disk, partly based on Visser et al. (2009). One goal is to understand the importance of initial conditions for disk chemistry and to quantify the fraction of the parent cloud material that survives the disk formation.

Our first results show that the disk chemical evolution will depend on the initial conditions (parent cloud composition). Changing for instance the age (10^4 to 10^6 yr) of the initial molecular cloud can modify by several orders of magnitude the chemical composition of ice mantles (CH_3OH, CH_3OCH_3, H_2CO, H_2O_2, H_2S...) in a 10^5 yr old protoplanetary disk.