P32a CEPD - Chemical Evolution of Protoplanetary Disks

○ Heinzeller Dominikus, 野村英子 (京都大学)、Millar Tom J. (Queen's University Belfast)

Protoplanetary disks represent a natural and active environment for the creation of simple and complex molecules which may ultimately lead to the evolution of life. Recent observations of protoplanetary disks around T Tauri stars reveal an active organic chemistry and important molecules such as H_2O, OH, CO_2 and CO being abundant in the inner disk (e. g., Carr & Najita 2008, Salyk et al. 2008). Observations probe the chemical composition close to the disk surface, where these molecules are photodissociated mainly by stellar radiation. A steady supply of the inner disk with these molecules might be required to account for the observations.

We present a new project on the chemical evolution of protoplanetary disks. In a first step, we calculate the mid-infrared molecular line emission of the inner 20AU of a stationary protoplanetary disk. The gas and dust temperatures in the disk model are obtained by solving the 2D radiative transfer with consideration for the stellar irradiation (Nomura et al. 2007). We calculate the chemical evolution within the disk using the UMIST Database for Astrochemistry 2006 (Woodall et al. 2007). We also include the effects of accretion motion on the chemical composition, which may supply the inner disk with molecules from the outer regions where they are frozen onto dust grains. We compare our synthetic spectra to current observations and discuss possible reasons for discrepancies between them. For example, our results show that the H_2O abundances depend strongly on the H_2 abundances in the mid and upper layers of the disk. An accurate modeling the H_2 formation on grains is therefore a key issue for predictions of water in the inner disk. We further study the capability of future missions (e. g., SPICA) to detect such mid-infrared molecular line emission from protoplanetary disks.