Geophysical Research Abstracts
Vol. 20, EGU2018-19347, 2018
EGU General Assembly 2018

The role of initial size of protoplanetary disk on the volatile transport

Hiroko Nagahara
Earth-Life Institute, Tokyo Tech., Tokyo, Japan

In order to understand the transportation of volatile components to the inner region of protoplanetary disk, the role of initial disk size was investigated with a dust transport model. The model is advection-diffusion equation with chemical equilibrium calculation, and the initial spatial size and initial mass of the disk are parameters.

At first, initial density and temperature gradient are obtained, for which dust grain transport calculation was performed for 10̂6 years. Individual grains have its own trajectory in the disk, that is, thermal history. We assume that the grains are evaporated when they experience its evaporation temperature. Bulk chemical composition of certain region of the disk is obtained by summing up the dust grains contained in the region, which have different chemical compositions depending on the thermal history.

We found that the chemical composition of the disk is largely dependent on the initial disk size; chemical composition of a certain region varies significantly with time due to mixing of chemically highly fractionated materials transported outward from the inner region and unfractionated materials transported inward from the outer region.

Comparing the calculated chemical composition of the disk, which is a function of time and space, and chemical composition of chondrites, we conclude that Comprehensive presence of high-temperature components in comets suggests mixing of outward transported grains with a considerable amount of H_2O ice beyond tens of au, which is possible for a disk with the initial mass of $\sim$0.1 solar mass and the initial spread to tens of au. The volatile element depletion in chondrites were achieved at the early stage (earlier than 105 yrs). The present study predicts the importance of the initial conditions of the protoplanetary disk for its chemical evolution; in other words, planetary system chemistry is highly related to the star formation.