P036-P015 Time: May 27 17:00-18:30

Effects of dust particle size distribution on the thermal structure of protoplanetary disks

Taishi Nakamoto[1], Taku Takeuchi[2]

[1] CCP, Univ Tsukuba, [2] Lick Obs., Univ. of California, Santa Cruz

It is considered that in a protoplanetary disk dust particles collide each other, stick together, and grow. This growth of dust particle size can change the radiation field in the protoplanetary disk because, generally, optical properties of a dust particle depend on the size of the particle. In this study, how the thermal and density profile of a protoplanetary disk are affected by the dust size distribution and what the disk looks like are examined.

A protoplanetary disk accompanying a T Tauri star is studied. Since the internal energy source at this phase of the disk is negligible, we can consider that the dust and the gas temperatures are determined by the radiation equilibrium; the radiation comes from the central star. The thermal coupling of dust particles with radiation is stronger than that with gas collision in a region further than around several or 10 AU, because in the region the gas number density decreases and the collision rate also decreases. That means the temperature of the dust particles is determined only by the radiation. In this study, we focus on this kind of disk and investigate the thermal structure along the direction perpendicular to the midplane. We calculated the thermal structure using 1-dimensional plane-parallel radiative transfer and radiative equilibrium calculations. In the calculations, followings are assumed: incident radiation comes from the top of the column, the frequency dependence of the incident radiation, size distribution of dust particles, spatial dependence of the size distribution, absorption and scattering by the dust particles, the frequency dependence of absorption and scattering as a function of the dust particle size, and the hydrostatic equilibrium along the direction.

Some obtained results are as follows.