Dependence of Central star mass on Protoplanetary disk evolution

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More than 4000 outer planets have been discovered in recent years. The discovery of rocky planets such as the Earth is increasing with this. On the other hand, how such a planetary system was born and evolved has a big uncertainty factor. Understanding the evolution of protoplanetary disks are fundamentally important in considering the formation and evolution of planets. The disk is made of dust and gas and plays a central role in the formation and evolution of rocks and planets, but in order to clarify the dynamics and growth of dust, it is necessary to understand the physical state of the background gas component. It is still unknown how the dissipation of the disk is done by photoevaporation from the central star and by the wind of the magnetically driven disk wind but how they contribute over time and also depend on the difference in mass of the central star.

In this study, a one-dimensional radial simulation of gas components of protoplanetary disks was done in consideration of photoevaporation by X-ray (Owen et al. 2010) and magnetically driven disk wind (Suzuki & Inutsuka et al., 2009). We investigated how the evolution of the disk changes by the difference of the central star mass.

We performed the evolution of protoplanetary disks with different masses of the central stars. If we define the evaporation time at 1au as the time when the surface density there falls below the observable level, it is shorter for a more massive central star, because the photoevaporation is more efficient.

In contrast, the evaporation time at the snowline shows the opposite trend; the evaporation is more rapid for disks with less massive central stars. This is because the location of the snowline has a very sensitive dependence on the mass of a central star.

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