

P226a Linear and Non-linear Instability of Protoplanetary Disks

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Our group have investigated the growth of planetesimals accumulated at the inner and outer edges of a turbulent-free zone (a quiescent zone), which appears in the middle region of protoplanetary accretion disk (Ebisuzaki & Imaeda 2017). A peak of the gas pressure distribution at the inner edge of the quiescent zone is formed in response to the reduction of the gas flow velocity by diminishing turbulent viscosity. Such pressure profile leads to accelerate the formation of rocky planets during the early stage of the accumulation of solid particles. However, the 1-D steady accretion disk model in the previous study is not sufficient to comprise the whole process of the protoplanetary formation. For more realistic scenario, the generation of turbulence and vortices in the accretion disks should fully be taken into account. It is therefore necessary to investigate the stability of protoplanetary disk in multi-dimension.

In the first paper of a series, we have constructed a 2-D model of protoplanetary disk by using an analytical solution for irradiated accretion disk in local thermal equilibrium (LTE), and have investigated the stability against non-axisymmetric perturbations. We will report how the disturbance grows in the inner turbulent zone and propagates toward the quiescent zone as a wave while being distorted by the differential rotation. As a result, the spiral structure of both gas density and temperature is generated in the protoplanetary disk. This study will be a theoretical basis in understanding the elemental and isotopic compositions on the rocky planets and meteorites.