P136-008 **Room: 304** **Time: May 28 9:00-9:13**

Numerical simulation of planetesimal-forming gravitational instability using a thin dust layer model. II Pitch angle of waves

Shigeru Wakita[1]; Minoru Sekiya[2]

[1] Dept. Earth Planet. Sci, Kyushu Univ.; [2] Earth and Planetary Sci., Kyushu Univ.

The growth of the gravitational instability in the dust layer of a protoplanetary disk is investigated. In order to see the effects of only the gravitational instability, we assume a laminar disk which has no radial pressure gradient as an unperturbed state so that the shear and the streaming instabilities do not grow. We neglect the relative velocity between the dust and gas parallel to the disk plane assuming that the dust and gas couple firmly by the mutual friction. However, we take account of the dust settling by using an analytic solution of dust density growth, thus the dust density increases as time passes.

We construct a two-dimensional thin disk model in which the radial and azimuthal directions in the midplane are taken as independent variables. Self-gravity of the dust layer is solved by the Fourier transform method and the hydrodynamic equations of the dust are solved using multi dimensional CIP method (Yabe et al. 1991).

When a perturbation is only given at the beginning, the growing modes vary by the initial Toomre self-gravity parameter Q; in case of starting with Q=5 axisymmetric modes arise, conversely in case of starting with Q=2 nonaxisymmetric ones arise. This come from that the Keplerian shear converted leading waves to trailing waves, and the leading waves lose their amplitudes before the dust layer becomes gravitationally unstable by the dust settling. In order to keep a certain amount of a disturbance, which is considered to exist not only at the beginning but all through time evolution, we give perturbations repeatedly per a Keplerian shear in a local frame of reference. We find that the gravitational instability grows nonaxisymmetrically independent of initial Q values.

To confirm these results, we calculate the pitch angle, which is the angle between the wave vector and the radial direction, using the auto-correlation function of the dust surface density. When perturbations are given repeatedly, nonaxisymmetric modes surely grow and the pitch angles are in very narrow range between 8 and 9 degree; on the other hand, when perturbations are only given once initially, the pitch angles scatter in wide range between 0 and 7 degree.