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Jovian core formation at the boundaries of dead zone: dependence on the gas surface density ditribution

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In a protoplanetary nebula, dead zone is formed where the viscosity is low because of low ionization fraction. There is a large variation in viscosity at the boundary of dead zone. This variation leads to the formation of vortices which can trap dust aggregates. A protoplanet can be formed in short timescales in a vortex. Sandor et al. (2011) showed that a core of Jovian planet is formed within a few Myr at the boundaries of dead zone.

In this simulation, a gas surface density distribution obtained from Lyla et al.(2009) is adopted. We changed the heights of two peaks in the distribution and checked the dependence of the largest mass on the height. We confirmed that the migration timescale of a planet inversely proportional to the peak height. It has been shown that the largest mass depends on the migration timescale logarithmically. This result indicates that the time evolution of the gas surface density cannot be neglected in the formation of a core. We will present the simulation results taking account of the time evolution of gas surface density distribution.

Fig 1: Maximum mass at the inner (triangles) and outer (circles) boundary of dead zone. Error bars show the standard deviation for 100 simulation runs.

Keywords: jovian planet, core, dead zone, gas surface density distribution