# Numerical simulation of dust coagulation and settling in a protoplanetary disk

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Collisional growth of dust particles to planetesimals in a protoplanetary disk is one of key issues in planet formation. We performed numerical simulation of dust growth through coagulation equation with settling and radial migration of dust particles.

When a protoplanetary disk evolves from active stage to passive one, dust particles in the disk may start settling to the midplane and growth to larger dust aggregates. Since the velocities of settling to the midplane and inward migration to the central star depend on dust size, dust coagulation should be solved coupled with settling and inward migration processes.

Using meshes in cylindrical coordinates, we simulate time evolution of dust density and size distributions in each mesh, with the moving batch method (Wetherill 1990) for dust coagulation and 3rd order upwind scheme for advection. Both lamilar and turbulent disks are examined.

We calculate SEDs (Spectrum Energy Distribution) of dust emission from the disk with the simulation results. As long as sticking probability of dust collisions is close to unity, the calculated SEDs have too rapid depletion in high frequency regions to be consistent with observed SEDs, which suggests that the sticking probability is much smaller than unity.

We also perform calculations with small sticking probability.
In some cases, we use the sticking probability modeled according to the results by Kouchi et al.(2002, ApJL, in press), which shows that the sticking probability takes a non-negligible value only in the asteroid belt.