Development of P^{3}T Code for Planetary System Formation: GPLUM

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In the standard theory of the formation of planets in our Solar System, terrestrial planets and the cores of gas giant planets are formed through accretion of km size objects (planetesimals) in the protoplanetary disk. The accretion process of the planets has been mainly investigated using the gravitational *N*-body simulations of planetesimal systems. However, the use of *N*-body simulations has been limited to idealized model (e.g., perfect accretion) and/or narrow radial range, due to limited number of particles available. We have developed a new *N*-body simulation code with particle-particle particle-tree (P^{3}T) scheme for planetary system formation, GPLUM. GPLUM uses a fourth-order Hermite scheme to calculate gravitational interactions between particles within cut-off radii of individual particles and a Barnes-Hut tree scheme for gravitational interactions with particles outside the cut-off radii. In existing implementations of the P^{3}T schemes, the same cut-off radius is used for all particles. Thus, when the range of the mass of the planetesimals becomes large, the calculation speed decreases. We have solved this problem by allowing each particle to determine its appropriate cutoff radius depending on its mass and distance from the central star.
GPLUM allows us to perform *N*-body simulations with ~10^6-10^7 particles. By using GPLUM, we will perform *N*-body simulations with wide range and high resolution and investigate various parameters by perform parameter studies with *N*-body simulations. By using GPLUM, we will perform *N*-body simulations with wide range and high resolution and investigate various parameters by perform parameter surveys with *N*-body simulations.

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