Rocky Planetesimal Accretion under a Realistic Accretion Condition

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Terrestrial planets, ice giants, and the cores of gas giants are thought to be formed by the accretion of planetesimals. The limited numbers of planetesimals around the proto-sun grow rapidly because of their self-gravity. The growing mode is named runaway growth. The scattering planetesimals by runaway growing planetesimals heat up the planetesimal system and the numbers of the planetesimal collisions on the runaway growing ones decrease. This phase is named oligarchic growth of planetesimals. To know these accretion processes are necessary to know the whole view of planet formation. There is no research on the planetesimal accretion process correctly considering the realistic merging criteria to distinguish merging and hit-and-run at the time of the planetesimal collision. The hit-and-run is going to affect the accretion process significantly. Although there are several previous studies to know the accretion process of planetesimals using *N*-body simulation, they used not realistic merging criteria such as that for protoplanets. Thus, we need to know the realistic merging criteria. And we have already studied the criteria in the previous paper. Now we study the accretion process under the realistic accretion condition by using *N*-body simulation. We use the *N*-body simulation code that is named GPLUM (Global PLanetary system simulation code with Mass-dependent cut-off method). The method is useful to know the evolution of mass, velocity, and spatial distribution of planetesimals during the accretion process since the method calculates the orbit of planetesimals directly. We apply to GPLUM the merging criteria necessary to distinguish merging and hit-and-run of planetesimals. We set two hundred thousand rocky 100km-sized planetesimals as a narrow ring around the sun and calculate the orbits of the planetesimals. We compare the results of the imperfect merging case that considers hit-and-run and perfect merging case where all colliding planetesimals merge. Planetesimals grow similarly in each case but the time for sweeping surrounding planetesimals elongates in the imperfect merging case. The mass distribution is polarized since the growth of planetesimals is prevented by the hit-and-run. Then, runaway growth and oligarchic growth becomes more prominent than the perfect merging case. We will show the result of accretion of spin angular momentum on the planetesimals and additionally discuss the spin properties of protoplanets in this speech.

Keywords: Formation of Planets, Planetesimal Accretion, Merging Criteria of Planetesimals

