

Japan Geoscience Union Meeting 2011

(May 22-27 2011 at Makuhari, Chiba, Japan)

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PPS020-P16

Room:Convention Hall

Time:May 25 10:30-13:00

Planetary Embryo Growth with Atmosphere and Collisional Fragmentation

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In final stage of planet formation, planetary embryos grow through collisions with planetesimals. The gravitational scattering by the large embryo induces destructive collisions between planetesimals. Fragments produced by such collisions are ground down by successive collisions until the collisional velocities of very small bodies are

sufficiently damped by gas drag. They are consequently removed by the gas drag. As a result, the surface density of bodies around planetary embryos decreases. Since embryos grow through collisions with such bodies, their growth halts by collisional fragmentation. The final planetary mass, which is determined by the equilibrium between the growth of the embryos and the depletion of planetesimals by collisional fragmentation, is smaller than the critical core mass for gas giant formation through core accretion. However, since planetary atmosphere enhance their collisional cross section with small bodies, planetary embryo can exceed the critical core mass from large initial planetesimals in massive protoplanetary disks.

Keywords: Planetary formation, collisional fragmentation, planetary atmosphere