

From planetesimals to planets in turbulent protoplanetary disks

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In turbulent protoplanetary disks, planetesimals are stirred by turbulence, resulting in orderly growth. As planetesimals grow via collisions, the escape velocities of planetesimals increase and therefore gravitational focusing becomes important, which ignites runaway growth. The onset of runaway growth modifies the size distribution of planetesimals; the total mass of planetesimals is in the size of planetesimals at the onset of runaway growth. The planetesimal size determines the final mass of planets and the formation timescale. We derive the size of planetesimals at the onset of runaway growth as a function of the turbulence strength, the surface density of the disk and distance from the host star. Using the result, we discuss constraints on the solar system formation.

Keywords: planet formation, planetesimal, turbulence