

## **The Formation of Planets**

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The terrestrial planets are universally believed to have formed through the collisional accumulation of successively larger solid bodies – micron-sized dust grains, kilometer-sized planetesimals, and Moon-sized planetary embryos, culminating after about 100 Myr in the formation of the Earth and other terrestrial planets. The conventional wisdom is that gas giant planets form by the process of core accretion, where a roughly 10 Earth-mass solid core forms first by collisional accumulation, and then accretes disk gas. Alternatively, gas giant protoplanets might form rapidly through a gravitational instability of the gaseous portion of the disk, outracing the core accretion mechanism. Core accretion and disk instability might both be able to form gas giant planets, depending on the circumstances in different protoplanetary disks – ALMA will help to decide the issue by searching for gas giant protoplanets and their associated spiral density waves and disk gaps. The ice giant planets are believed to have formed by collisional accumulation of icy solids, but the theory of their formation must still be considered to be in an embryonic stage. ALMA will be able to map the physical and chemical structure of protoplanetary disks with higher spatial resolution than ever before, placing crucial constraints on planet formation theories.

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