Planets & stars form differently: stars simply by the collapse of a large enough mass of gas & dust; planets start with the formation of a solid core.

**Planetismal hypothesis**

- start with the solar nebula, a disk of gas & dust surrounding the Sun, with a temperature gradient.

- microscopic grains condense out of nebula as temperature allows:
  - silicates and iron compounds
  - $H_2O$ & other ices

size of grains $\sim \mu m$
Even distribution of gas and dust

Temperature decreases with distance

Volatile elements blown away

High condensation temperature elements remain

Volatile elements remain

Terrestrial planets

Jovian planets
• Grains settle to midplane of nebula; collide, agglomerate, grow

• In of order $10^4$ years, end up with km-size objects — "planetismals"

• Velocity distribution & orbits of planetismals determine how they grow; collisions can either fragment or agglomerate

Evidence for collisions: at current meteor impact rate, over life of Solar System, Moon & Mercury would not be so very cratered
Q: Which orbits would favor planetesimal growth? Which orbits would favor destruction?
in late stages of formation, have
- giant impacts
- catastrophic destructions
- large radial migrations

simulations often produce planets at regular intervals of radius

**Question**

6 of 8 major planets have obliquity less than 30°, which is unlikely to occur randomly; but it is rarely zero.

How would you explain this in terms of the above theory?