

How to Build the Solar System

Start off with a gigantic cloud of gas & dust (the 'Solar Nebula'). Then:

1. Cloud Collapse

- a. Cloud collapses radially (due to gravitation)
- b. Cloud heats up as it collapses (like a compressor)
- c. Cloud spins faster as it collapses (like ice skater pulling in arms)
- d. Motion becomes less chaotic, more smooth (like pepper on water)

2. Condensation

- a. Rocks, metals, ices condense from gas → solid
 - i. Metals condense near Sun; ices far away; rocks inbetween
 - ii. Location depends on freezing point of each ingredient

3. Growth of Planets, Comets, Asteroids

- a. Grains collide & grow: mm → m → km → planetesimals → planets
- b. Cores of Jovian planets sweep up & attract gas
- c. Random collisions: flip Uranus, create Earth's Moon, etc.

4. Cleaning it Up

- a. Remaining gas & dust is blown by sun back into interstellar space

5. Denouement

- a. Still have ongoing collisions with leftovers: asteroids, comets, dust
 - i. Delivery of water to our oceans (We're drinking comets!)
 - ii. Spread of life throughout solar system? (Are we martians?)

Around a Larger Star...

If the early Solar nebula were hotter...

- Jovian planets would attract more gas
- Ices would form further out in the disk
- Pluto would be formed closer
- The Earth would have two moons

Alternate Models of Formation

The 'Solar Nebula Model' for the formation of our Solar System is successful in that it reproduces the observed characteristics of our own system. Other models have been proposed in the past. In groups of 3-4, decide what you think of these two alternate models. Which characteristics of our own do they reproduce, and which do they not?

1. **Planets Ejected from the Sun** The Sun was originally larger and spun faster, and its rapid spin 'spewed out' the planets from its dense core. They've now migrated outwards to their present locations.

2. **Captured!** The Sun formed alone, with no planets. The planets we have now were all captured from other solar systems.