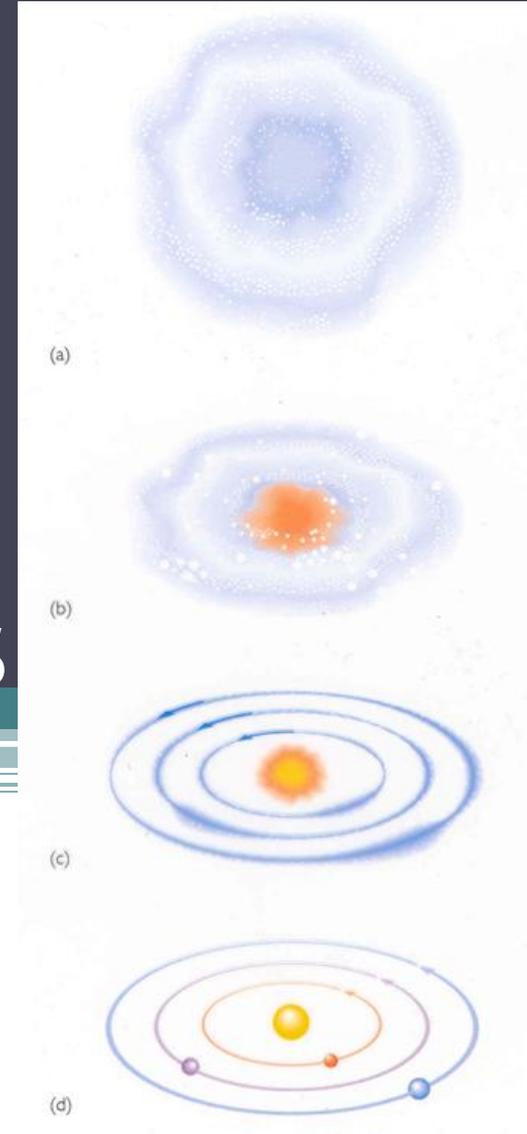
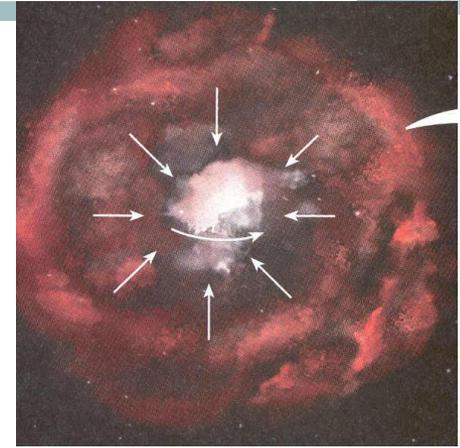


Solar Nebula Hypothesis

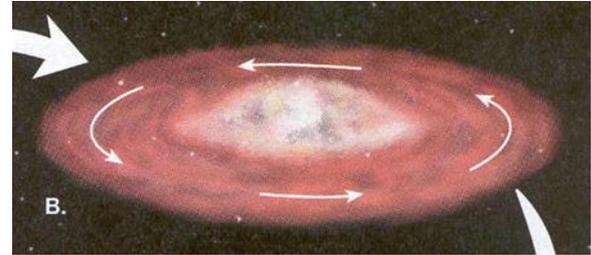


Recall...



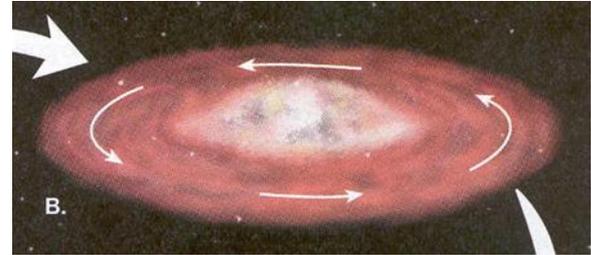
- Stars form within a large cloud of dust and gas called a nebula.
- The core of the nebula collapses inwards due to gravity, after some kind of “disturbance” (ie energy shockwave from nearby supernova).
- As the pressure and density increases eventually the temperature is hot enough for hydrogen fusion to occur.

Why do all the planets revolve in the same direction?



- The initial nebula rotates slightly, after being disturbed, in a uniform direction
- As nebula contracts, the speed of rotation increases (gravitational potential energy converted to kinetic energy). This is similar to a figure skater drawing their arms in to rotate faster. Important because with no velocity to revolve around star, all matter falls into star. Therefore NO PLANETS.

Mmmmm Pizza...

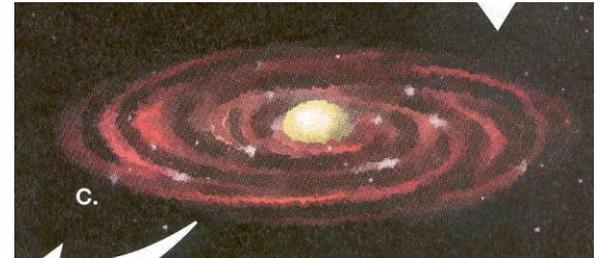


- The nebula continues to rotate and due to centrifugal forces, flattens out (like pizza dough flattening out when being spun in the air)

How did planets form?

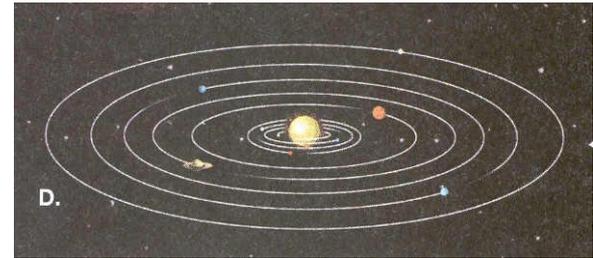
- Early theory #1: Rapid Spinning.
 - Large chunks of sun broke off of sun due to rapid spinning (like you on merry-go-round as a kid)
 - NOT ACCEPTED because of composition of sun vs. planet
- Early theory #2: Capture.
 - Planets/objects came within Sun's gravitational pull and they were not able to escape orbit of sun. Formation of planets the occurred from these objects.
 - NOT ACCEPTED because material of that size/magnitude not just floating around in interstellar space

Accretion!



- temperatures within the rotating disk dropped and small particles such as iron and nickel rock started to form
- these particles collided for millions of years and accreted to form the planets, moons, and other small bodies

Clean-Up



- Finally, with enough gravitational pull, planets were able to clean up their orbital neighbourhood. Space in between planets starts to clear!
- Once Fusion begins in sun/star, a blast of energy is emitted from sun and further cleans up solar system of debris

The 4 steps in the Solar Nebular Theory are...

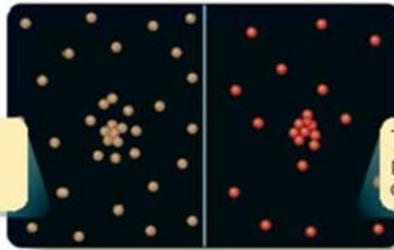
- 1) Nebula Collapse, proto-star formation
- 2) Rotation in same direction around star
- 3) Accretion
- 4) Clean-up

How does Accretion occur?

- Particle of rock and or metals collect together due to gravity.
- As more particles are attracted to proto planet, its gravity increases
- Radioactive decay of elements AND energy released due to objects collisions with other objects increases temperature and differentiation of densities can occur (heavy elements drawn inwards; lighter element move outwards. Iron and other metals make core, silicon, carbon, nitrogen make up crust.
- Outgassing of oxygen and other gasses eventually forms atmosphere

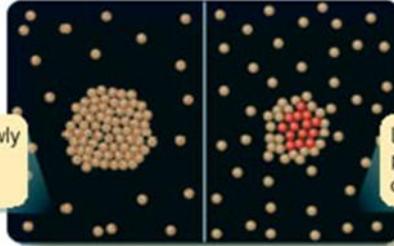
Two Models of Planet Building

Planetesimals contain both rock and metal.



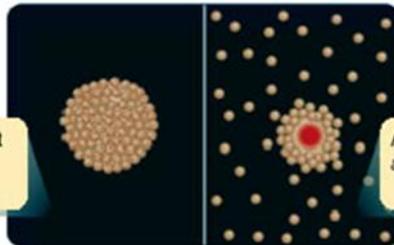
The first planetesimals contain mostly metals.

A planet grows slowly from the uniform particles.



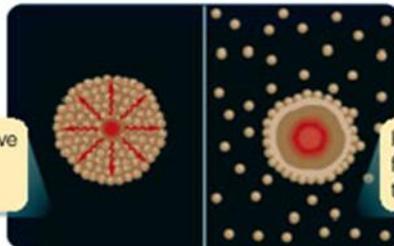
Later the planetesimals contain mostly rock.

The resulting planet is of uniform composition.



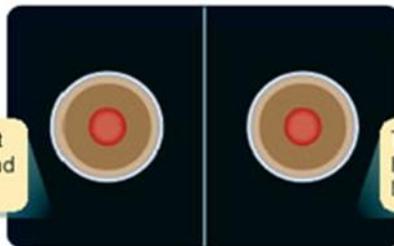
A rock mantle forms around the iron core.

Heat from radioactive decay causes differentiation.



Heat from rapid formation can melt the planet.

The resulting planet has a metal core and low-density crust.



The resulting planet has a metal core and low-density crust.