

NOTES: STAR FORMATION

From Dust to Dawn

WHERE DO STARS BEGIN?

- All stars begin as a nebula
 - Nebula- a cloud of gas & dust particles in space.
 - Hydrogen makes up ~97% of a nebula
 - Helium makes up ~3% of a nebula
 - All other elements make up less than 1% of a nebula

NEBULAE



Horsehead Nebula



Crab Nebula

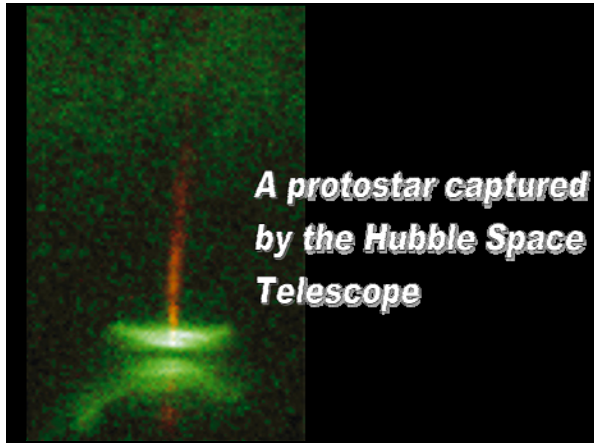
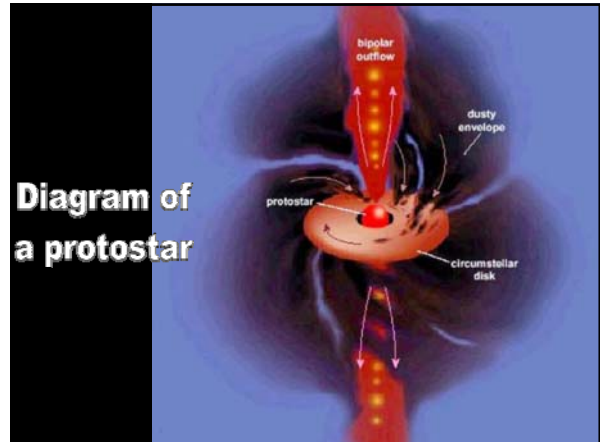
▣ Star Formation

HOW DO STARS BEGIN?

- **Gravity** begins pulling the particles in the nebula together.
- Law of Universal Gravitation
 - All objects with mass in the universe attract each other with an invisible force called gravity.
- How strong gravity is depends on two things:
 1. **The mass of the objects**
 - The larger the mass, the larger the pull of gravity
 2. **The distance between the objects**
 - The closer the objects the greater the pull of gravity

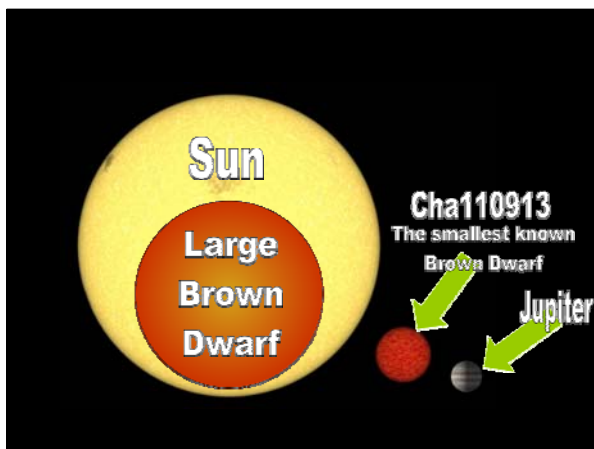
WHY DO STARS BEGIN?

- The cloud of particles in a nebula begins to collapse because of gravity.
 - As the cloud collapses its temperature and density increase.
 - Temperature and density are the highest in the center of the cloud.
 - protostar- a dense area of gasses in a nebula that might become a star.



WHY DO STARS BEGIN?

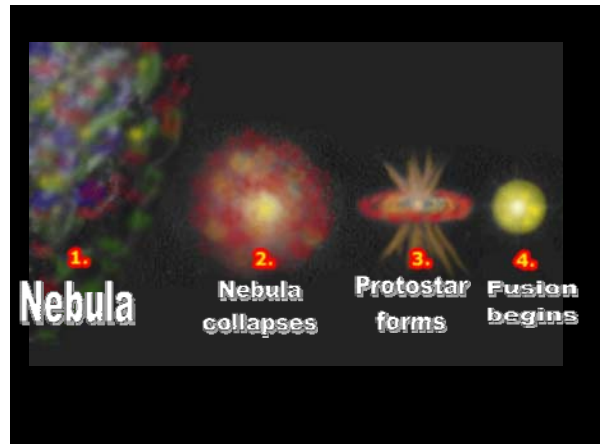
- If a protostar never gets larger than 1/10th the size of the Sun:
 - It becomes a Brown Dwarf
 - Brown Dwarfs don't get hot enough to start fusion.
 - They shine dimly, but slowly cool off.



WHY DO STARS FORM?

- If a protostar gains enough mass:
 - The temperature & pressure keeps increasing
 - Hydrogen begins to fuse together
 - The protostar officially becomes a star once fusion begins.
 - The star is now in the Main Sequence
 - 90% of stars are in the main sequence
 - All main sequence stars fuse hydrogen

- ▣ [Star formation by collapse of molecular clouds.mp4](#)



HOW LONG WILL THE SUN BURN?

- The lifespan of a main sequence star depends on its mass
 - Very large main sequence stars fuse hydrogen very quickly
 - These stars may run out of hydrogen in 20 million years
 - Medium sized stars (like the Sun) fuse hydrogen at a slower rate
 - The sun will burn for a total of 10 billion years
 - It only has about 5 billion years left!
 - Small main sequence stars fuse hydrogen very slowly
 - They may last 1 trillion years!

