

Stars

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1. Distances between stars are measured in light-years - the distance that light travels in one earth year (1 lightyear = 9.4605284×10^{15} meters)
2. The closest stars to Earth are 4.3 light-years away (closest are Alpha Centauri & Proxima Centauri)

Properties of stars

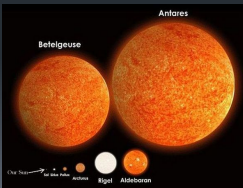
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- a. They produce their own light
- b. They radiate (give off) these types of energy: heat, electromagnetic and light
- c. Their surface temperatures are estimated based on their color
 - i. Hotter stars glow with light that is more intense at shorter wavelengths giving them a blue appearance
- d. Their apparent brightness is dependent on their temperature, distance from earth, and size

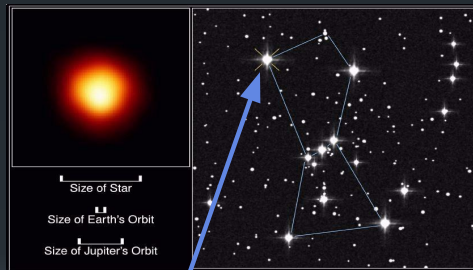


red giant

A star that has low surface temperature and a diameter that is large relative to the Sun.



Betelgeuse is an example of a red supergiant



Betelgeuse Star in Orion Constellation

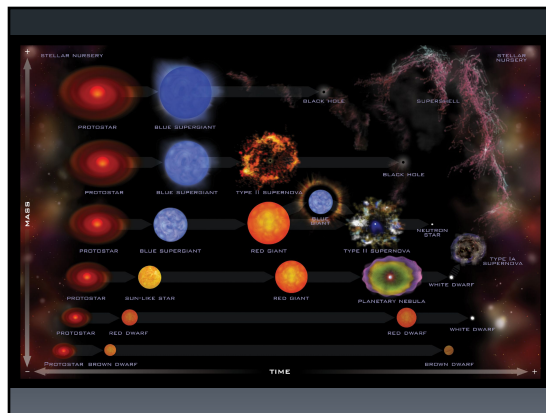
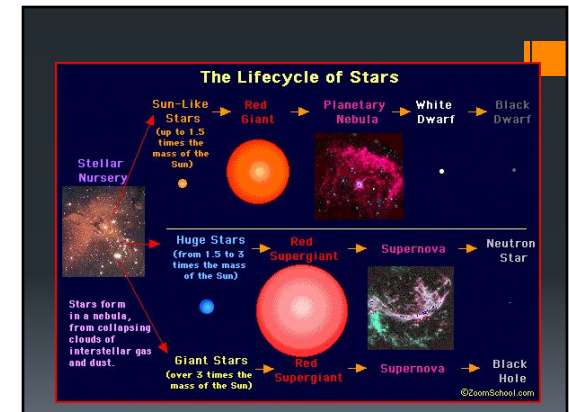
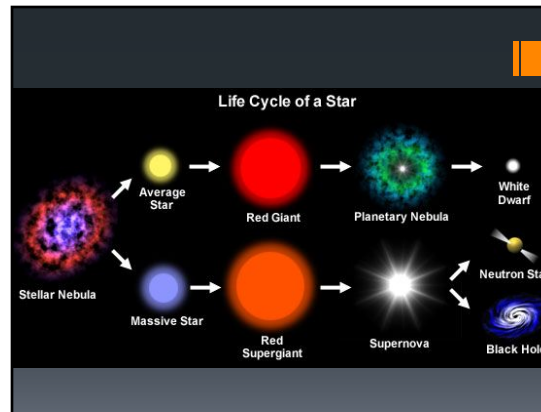
Stars, cont.

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- e. Held together by gravitational forces
- f. Hydrogen combines to form helium on stars. This is called a fusion reaction and produces energy
- g. Our sun is a typical star

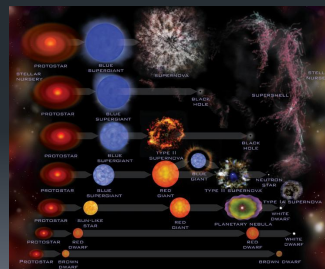
The life of a star

- About 90 percent of all stars are in the middle of their life cycles
- A star is born when gas and dust collapse inward
- Supergiant stars form supernovas
- Most of the stars in the Milky Way, which are relatively small, will end their lives as white dwarfs



Stellar Evolution

- Stars exist due to **gravity**



Birth of Star



- Begins as **cloud of dust and gas**
- Gravity affects **size, shape, position, and temp** of stars

Protostar

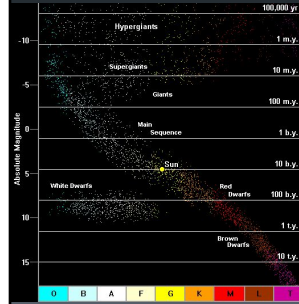
- Gravitational **contraction** of **gases**

- Core **heats** up immensely

- Pressure increases** but is balanced by **gravity**



Main Sequence Star



- Massive stars** use fuel **faster**

- Few million** years lifespan

Burnout and Death

- Low and Medium Mass Stars:**

- Evolves into **red giant**

- Becomes **nebula** – **expanding gas**

- Eventually becomes **white dwarf**

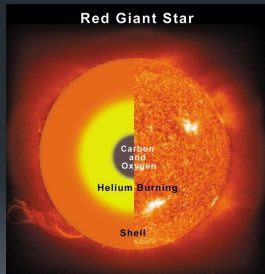


Red Giants

- Outer gas **expands**

- Surface **cools** and becomes **red** (*weak radiation*)

- Core **collapses** and gravity **crushes** star



White Dwarf

- Remains of **red giant** collapse → **nebula**

- Surface** of star = very **hot** (*blue star*)



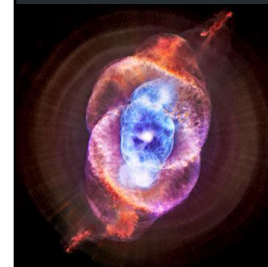
Burnout and Death

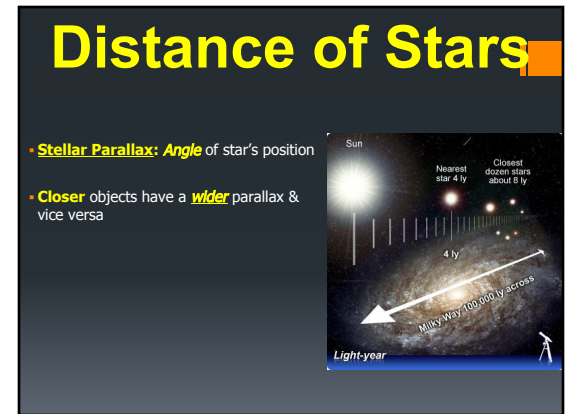
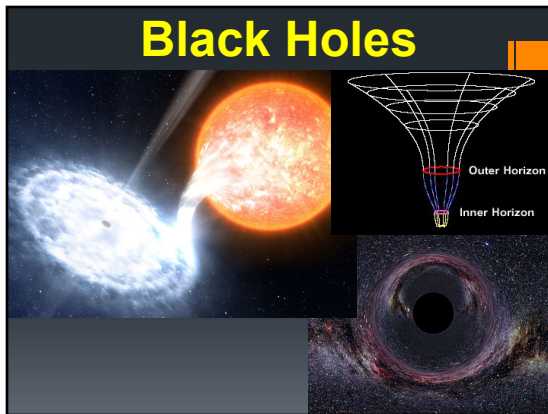
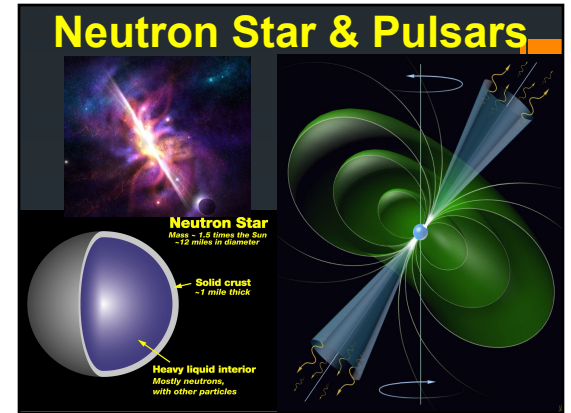
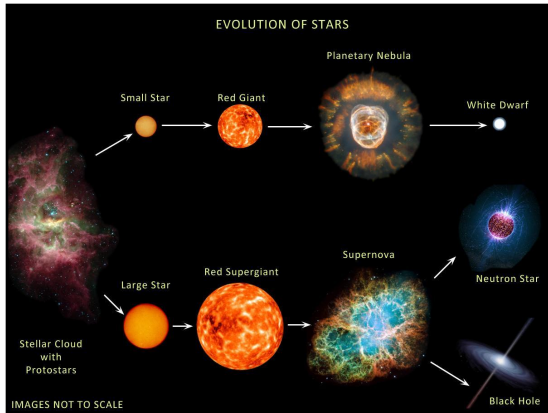
- Large Mass Stars:**

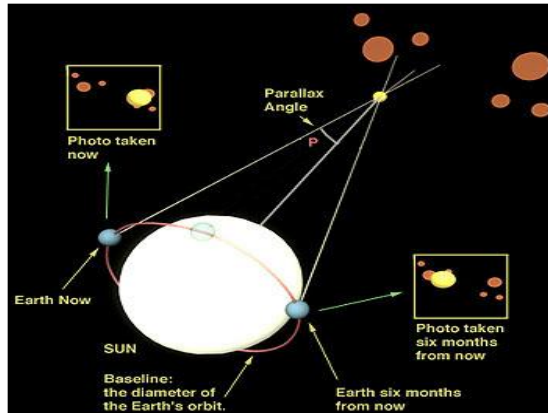
- Grows into **red supergiant**

- Massive explosion (*supernova*)

- Forms **neutron star** OR **black hole**







Stellar Brightness

- Depends on mass, temperature & distance
- **Apparent Magnitude:** Brightness when viewed from *Earth*
- **Farther** away = **less** bright
- **Absolute Magnitude:** "*True*" brightness at standard distance of **32.6 light-years**

Stellar Brightness



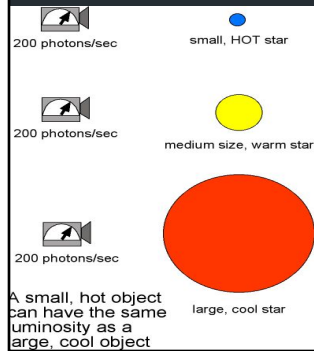
APPARENT MAGNITUDE



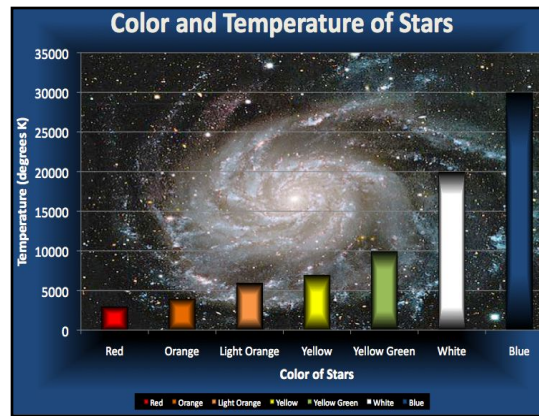
ABSOLUTE MAGNITUDE



Color & Temperature

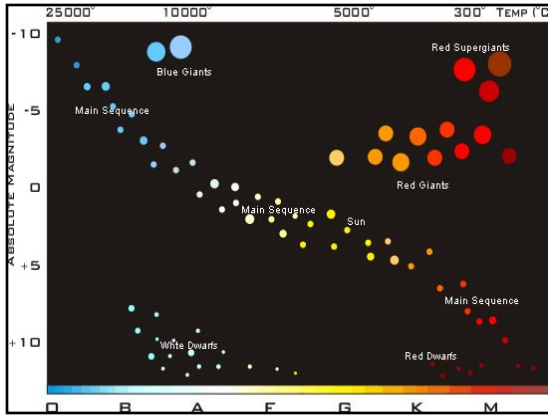


- **Hot Star:**
• Appears blue
- **Cool Star:**
• Appears red



Hertzsprung - Russell Diagram

- **Graph** between absolute magnitude (luminosity) and temperature
- **Hot** stars (Blue) are in upper left
- **Cold** stars (Red) are in lower right



Parts of a H-R Diagram

- **90%** of stars fall on **main sequence** line
- **Hotter** the star = generally more **massive**
- Our Sun is **midway (average)** on **main sequence** line

