

Chapter Twenty-Two: Stars and Galaxies

Lesson 3: Evolution of Stars

Like all living things, stars have life cycles. A star is “born” and after millions or billions of years the star “dies”.

- Stars die in different ways depending on its mass.

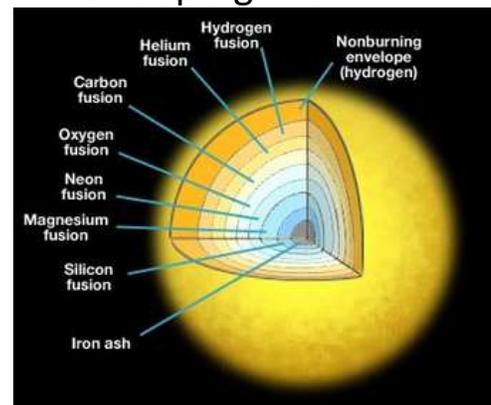
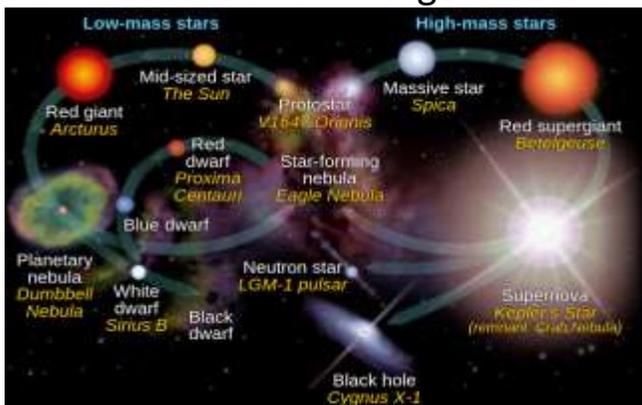


Nebula: a cloud of gas and dust

- This is where stars form.
- Gravity causes the densest parts to collapse forming a region called protostars.
- They continue to contract and pull in surrounding gas until the cores are hot and dense enough for nuclear fusion to start.
- As they contract, they produce enormous amounts of thermal energy
- During the formation, the nebula glow brightly,
- Eventually, the dust and gas blow away and we see it as a star

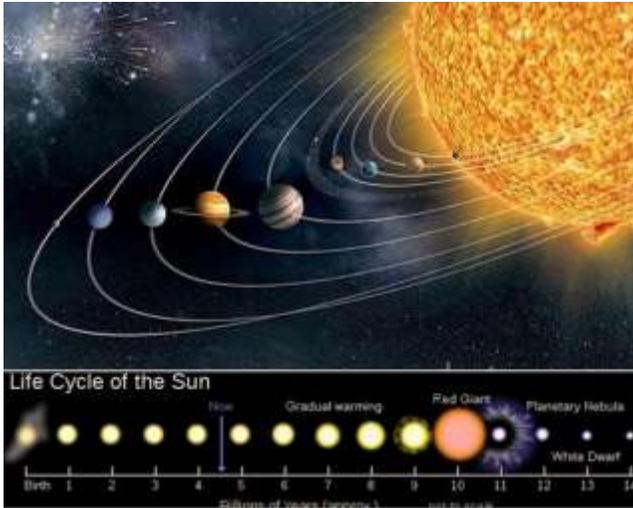
A star becomes a main-sequence star as soon as it begins to fuse hydrogen into helium.

- Low-mass stars (such as the Sun) stay on the main-sequence for billions of years.
- High-mass stars stay for only millions of years.
- When a star’s hydrogen supply is nearly gone, the star leave the main-sequence...not all stars go through all the phases.
- Star → Red Giant → Larger Red Giant → Red Supergiant



- Massive stars collapse and explode. Low-mass stars die more slowly.
- Low-mass stars don’t have enough mass to fuse elements beyond helium.

White dwarf: a hot, dense, slowly cooling sphere of carbon



- In about 5 billion years, the Sun will run out of hydrogen. It will become a Red Giant.
- It will absorb Mercury, Venus, and Earth. It will push Mars outward.
- Eventually, the Sun will become a white dwarf.
- It will be the same mass but squeezed into the size of the Earth.



Supernova: an enormous explosion that destroys a star

- Occurs when iron forms in the star's core
- Iron is stable and does not fuse. Because of this, it loses its internal energy source. The core collapses.
- Energy is released and the star explodes.

Neutron star: a dense core of neutrons that remains after a supernova

Black hole: an object whose gravity is so great that no light can escape.

- It doesn't suck matter in like a vacuum cleaner
- Gravity is very strong since all of its mass is concentrated in a single point
- You can't see a black hole, but can observe light traveling around it and concluding that there must be something there.

At the end of a star's life cycle, the gas and dust is recycled for future generations of stars and planets.

During a supernova, a massive star comes apart. This sends a shock wave into space...this expanding cloud of dust and gas is called a supernova remnant.

- In a supernova, a star releases the elements that formed inside.