Stellar Evolution

The life cycle of stars...

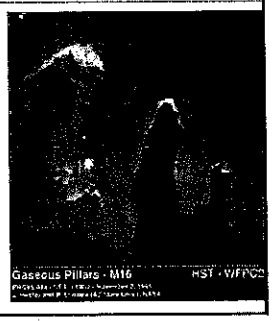
The Birth of Stars

- Nebula – a cloud of gas and dust in which a star's life cycle begins.

- composed of about 70% hydrogen 28% helium & 2% heavier elements
- particles in a nebula have a weak gravitational attraction for one another
- the smaller it gets, the faster it spins
- As it shrinks and spins it begins to flatten into a disk.

Protostar Stage

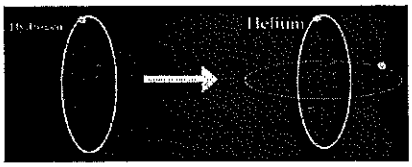
- The nebula begins to contract, the gravitational force increases, and it becomes a shrinking, spinning sphere
- Temperature , energy and pressure increases due to collisions



- collisions and pressure raise the temperature in the core of the protostar to over 10,000,000 °C.
- → nuclear fusion begins
- → protostar becomes a star

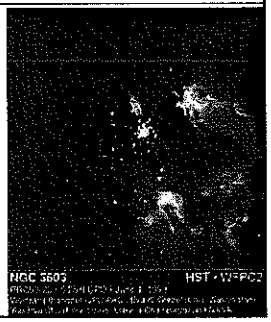
Hydrogen Fusion Begins... *a star is born*

- Fusion is a nuclear reaction joining 2 hydrogen atoms to create helium. This begins the longest stage of a star's life...



Main-Sequence Stage

- The longest stage in a star's life cycle.
- Hydrogen fusion is taking place.
- Stars are now "stable" because the force of gravity balances with the energy of FUSION.

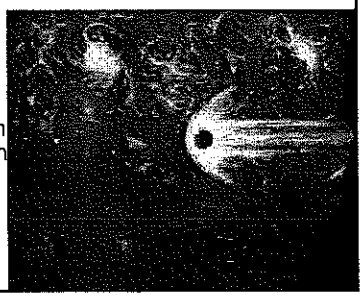


- fusion releases enormous amounts of radiant energy.

1g of hydrogen, converted into helium releases enough energy to keep a 100W light bulb burning for 3000 years.

Leaving the main sequence ...

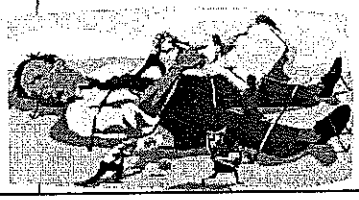
- When the Hydrogen runs out in the core...
- Helium fusion now occurs in core creating other elements.



- matter is pulled inward by the force of gravity
- star stays stable in size as long as it has hydrogen

Giants and Supergiants

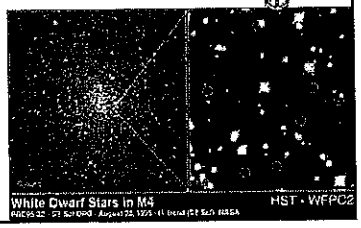
- The star begins to expand to a Giant or Supergiant.
- This depends on the MASS of the star.



- hydrogen fusion continues to take place in a shell surrounding the helium core.
- giants are 10 or more times bigger than the sun
- supergiants are at least 100 times bigger than the sun.

Leaving the giant stage
...where to next??

- LOW MASS
- The star starts to shed its outer shell, exposing a HOT, DENSE core.
- Turns into a White Dwarf



- A white dwarf is the final stages of a star
- White dwarfs shine for billions of years before they cool completely.

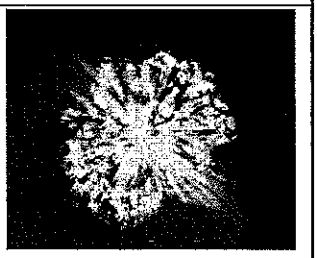
The end...
for most stars

- White dwarfs will either:
  - Become black dwarfs after cooling
  - Or, become NOVAS if an explosion occurs during cooling.

- a nova may appear to be up to 1 million times brighter than the sun.
- a white dwarf may become a nova several times

As for the big ones... *the supergiants*

- High Mass
- Explode as SUPERNOVAS
- Produce **heavier elements** such as iron and magnesium



- Fusion continues until the core is almost entirely iron.
- nuclear fusion stops
- the iron core collapses
- outer part of star explodes

After a Supernova

- The core may contract into a small, but incredibly dense ball of neutrons – a neutron star

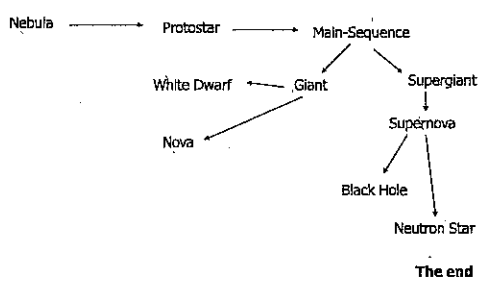
OR...

- If they are too massive to become neutron stars, they become

BLACK HOLES

- a spoonful of matter from a neutron star would weigh 100 million tons on the earth
- neutron stars rotate very rapidly
- neutron stars that emit 2 beams of radiation are called pulsars.
- black holes are found by the X-rays that are given off.
- astronomers speculate that massive black holes may be at the cores of many galaxies

To review.....



The end