Stars and Stellar Evolution

How do we classify the billions of stars that exist in our galaxy and Universe?
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- **Star** - sphere of gas held together by gravity that produces tremendous amounts of energy and shines
  - Majority of known matter in the galaxy
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- Thermonuclear Fusion - a way to achieve nuclear fusion by using extremely high temperatures
- Manner in which stars create energy
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• Four hydrogen nuclei [each with a mass of about 4.030 mass units] join to form a helium nucleus with a mass of only about 4.003 energy units

• The mass that is lost is converted into energy and radiated into space as light and heat
Nuclear Fusion

Deuterium

Tritium

Energy

Helium

Proton

Neutron
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- Types and Parts of Stars:
  - **Nebula** - a cloud of gas and dust in outer space

![](Crab_Nebula.png)

Crab Nebula
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- **Main Sequence Star** - most common [90%] type of star that are average size, temperature and luminosity
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- **Red Giant Star** - a luminous easily seen star that is in a late phase of stellar evolution
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- **Super Giant Star** - star with an extremely high temperatures in the late stages of its stellar evolution
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• **Red Dwarf Star** - a small and cool star located on the main sequence
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- **White Dwarf Star** - Earth sized star with a low luminosity and a hot surface
How Big?
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• **Stellar Evolution** - process by which a star changes over the course of time
  • Dependent on the mass of the star
  • More massive stars have a lifespan of a few million years
  • Less massive stars have and lifespan of trillions of years
Stellar Evolution

- Clouds of dust and gas (nebula)
- Protostar (early stage of star)
- Main sequence star
- High-mass stars
- Medium-mass stars
- Supergiant
- Giant
- Supernova
- Black hole
- Neutron star
- White dwarf
- Black dwarf
- New nebula