

Chapter Twenty-Two: Stars and Galaxies

Lesson 2: The Sun and Other Stars

The hotter something is, the more quickly its atoms move.

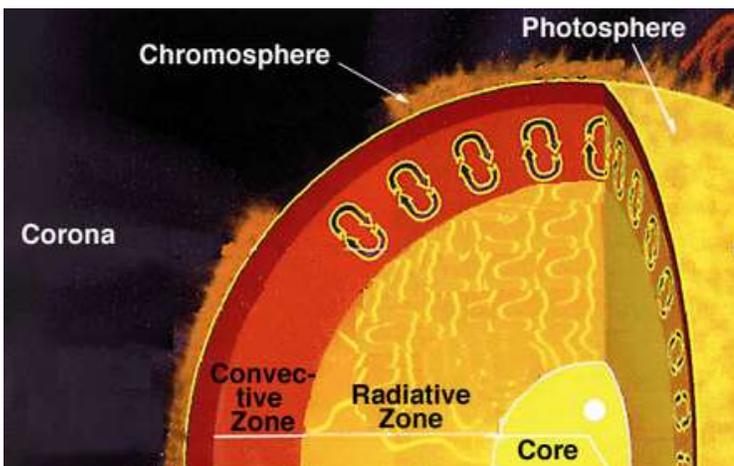
Nuclear fusion: a process that occurs when the nuclei of several atoms combine into one larger nucleus

Star: a large ball of gas held together by gravity with a core so hot that nuclear fusion occurs

- A star's core can reach millions or hundreds of millions of degrees Celsius
- When energy leaves, it travels through the star and radiates into space
 - The star shines
- Most stars are composed of hydrogen and helium
 - Slowly hydrogen fuses into more complex nuclei
 - Helium is denser than hydrogen, so helium sinks to the inner part of the core

3 interior layers of a typical star:

1. Core
2. **Radiative zone:** a shell of cooler hydrogen above a star's core
3. **Convection zone:** an area where hot gas moves up toward the surface and cooler gas moves deeper into the interior



3 outer layers of a typical star:

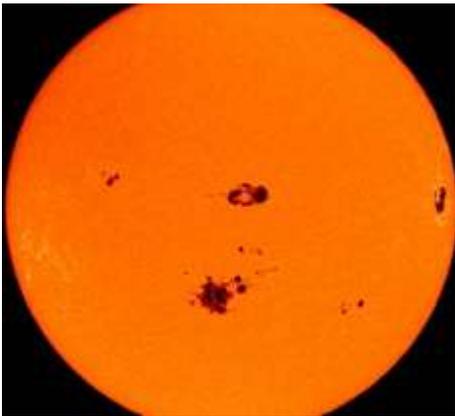
1. **Photosphere:** the apparent surface of a star
 - a. This is the bright part you see
 - b. This looks smooth, but like the rest of the star it is made of gas
2. **Chromosphere:** the orange-red layer above the photosphere
 - a. **Corona:** the wide, outermost layer

of a star's atmosphere

- b. The temperature is higher than that of the photosphere or chromosphere

c. It has an irregular shape and can extend for several million kilometers

Changing features of the Sun:



- **Sunspots:**

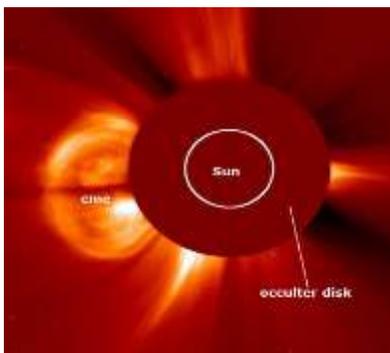
- Regions of strong magnetic activity
- Cooler than the rest of the photosphere, appear as dark splotches
- Peak in number every 11 years
- Average sunspot is about the size of the Earth



- **Prominences and Flares:**

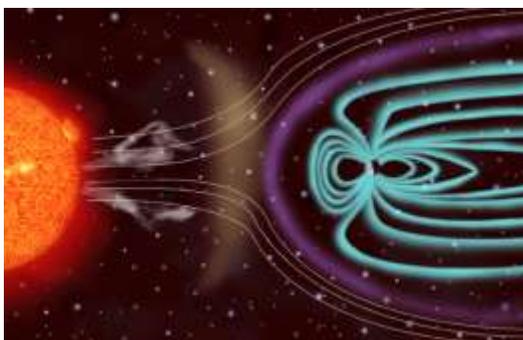
- Prominences: clouds of gas that make loops and jets extending into the corona
- Flares: sudden increases in brightness often found near sunspots or prominences

<https://www.youtube.com/watch?v=TWjtYSRIOUI>



- **Coronal Mass Ejections: (CMEs)**

- Huge bubbles of gas ejected from the corona
- Material can reach Earth occasionally causing a radio blackout or a malfunction in an orbiting satellite



- **The Solar Wind:**

- Charged particles that stream continually away from the Sun create the solar wind.
- The northern lights, auroras, are created when particles from the Sun interact with the Earth's magnetic field

Star systems:

- Binary system – where 2 stars orbit each other
- Clusters:
 - Open Clusters
 - Globular Clusters

Stars have different spectra and different colors depending on their surface temperatures.

- Blue-white stars are hotter than red stars
- Color in most stars is related to mass (there are exceptions though)
 - Blue-white stars tend to have the most mass, followed by white stars, yellow stars, orange stars, and red stars
- Scientists believe that most stars are smaller than the Sun
 - Smallest star is a red dwarf

Hertzsprung-Russell diagram - (H-R diagram): a graph that plots luminosity versus temperature of stars

- y-axis: displays increasing luminosity
- x-axis: displays decreasing temperature
- Named after 2 astronomers who developed it in the early 1900s
- Used to determine the distances of some stars
- Most stars spend the majority of its life on the main sequence
- Mass determines the temperature and luminosity
 - Higher the mass the hotter and brighter the star
 - Downside is that high mass stars have a shorter life span

