

Our Home Star: The Sun

Physical Sciences

Broward College

Prepared for AST 1002

Horizons in Astronomy

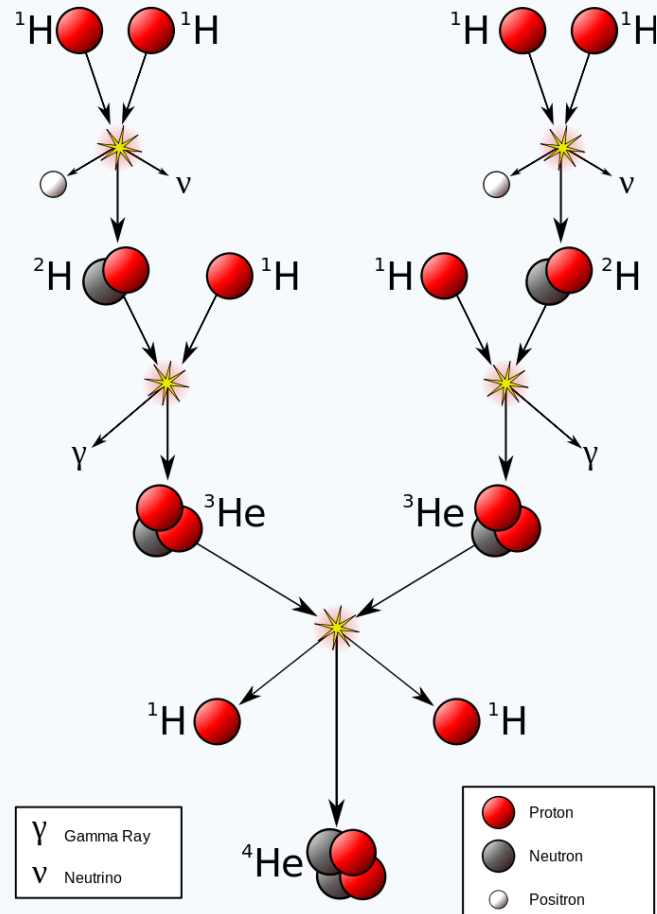
What is the Sun?

- Our nearest star.
- The center of our Solar System.
- The main engine for all the heat produced in the solar system.

Solar Properties and the Calculation

Property	Calculation
Distance: 1.49×10^8 km = 1 A.U.	<ul style="list-style-type: none">• Aristotle was the first person to consider the problem. But Kepler was the first to obtain a precise measurement.• Recent measurements use radar bouncing off other planets to obtain more precise measurements.
Size: 1.4×10^6 meter = 0.5°	<ul style="list-style-type: none">• Aristarchus was the first to consider the size of the Sun.• The modern method involves the angle of the light rays.• 150 Earths would fit across the diameter of the sun.
Mass: 2×10^{30} kg	<ul style="list-style-type: none">• Newton was the first person to find accurately the mass of the sun with his theory of gravitation and the periods of the planets.• 300,000X more massive than the Earth.
Density: 1.4 g/cm^3	<ul style="list-style-type: none">• The density is simple calculation of the mass over the volume.• The density is only 40 percent higher than water suggesting a gaseous composition.

The Energy Production of the Sun



- The Sun's core is dense enough to overcome the atomic forces due to great gravity. This allows two hydrogen to form a bond to make deuterium (hydrogen with an extra electron). Then two deuterium combine to create a light helium (helium with one neutron). Finally two light heliums combine to make a regular helium with a hydrogen to restart the cycle.
- The process creates a gamma-ray that is highest energy of light that we observe. It takes the light 100,000 years to escape the Sun as a visible photon.

Figure 1. Solar Fusion (Wiki)

Cross Section of the Sun

- Core: 8,000,000K
- Radiative Zone: ~100,000K
- Convective Zone: ~500,000K
- Photosphere: 5,700K
- Chromosphere: 4,300-40,000K
- Corona: 2,000,000K

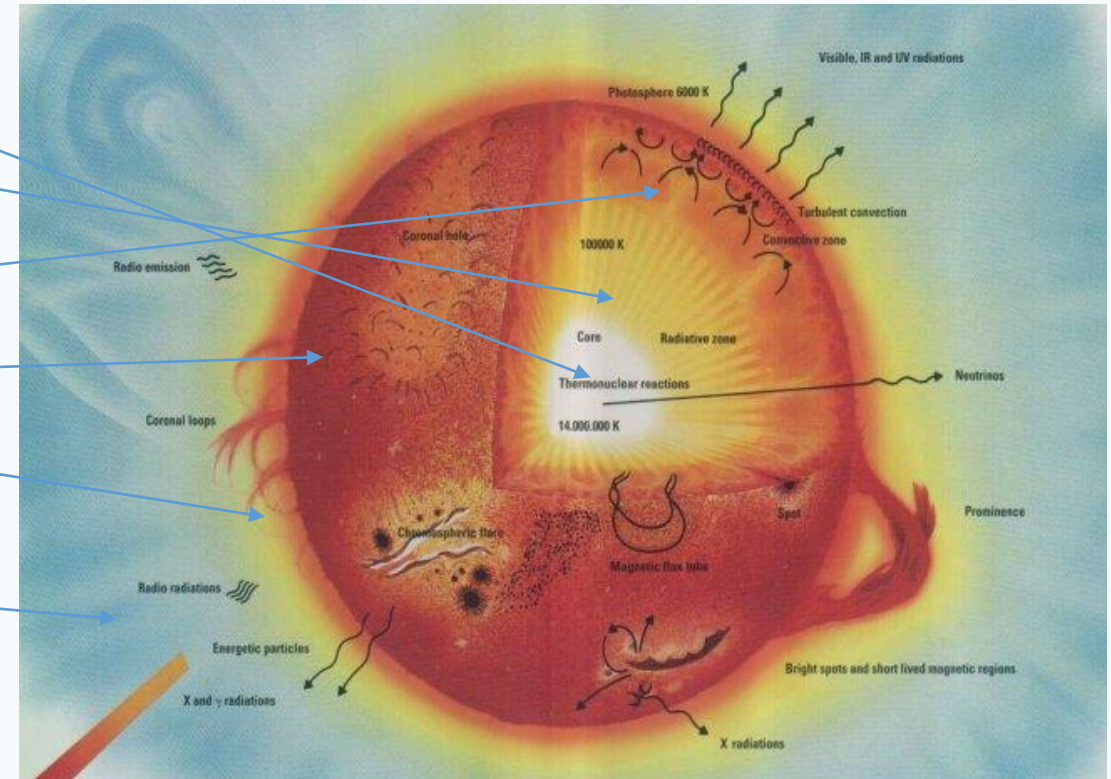


Figure 2. Sun's Cross Section (Wiki)

Surface Features of the Sun

- Prominences
 - Steam from the sun with some charge, can be large
- Flares
 - Associated with sun spots, charged particles driven out by magnetic field
- Spots
 - Cooler areas of the Sun due to solar flares
- Granules/Spicules
 - Larger/Smaller “bubbles” on the photosphere of the Sun

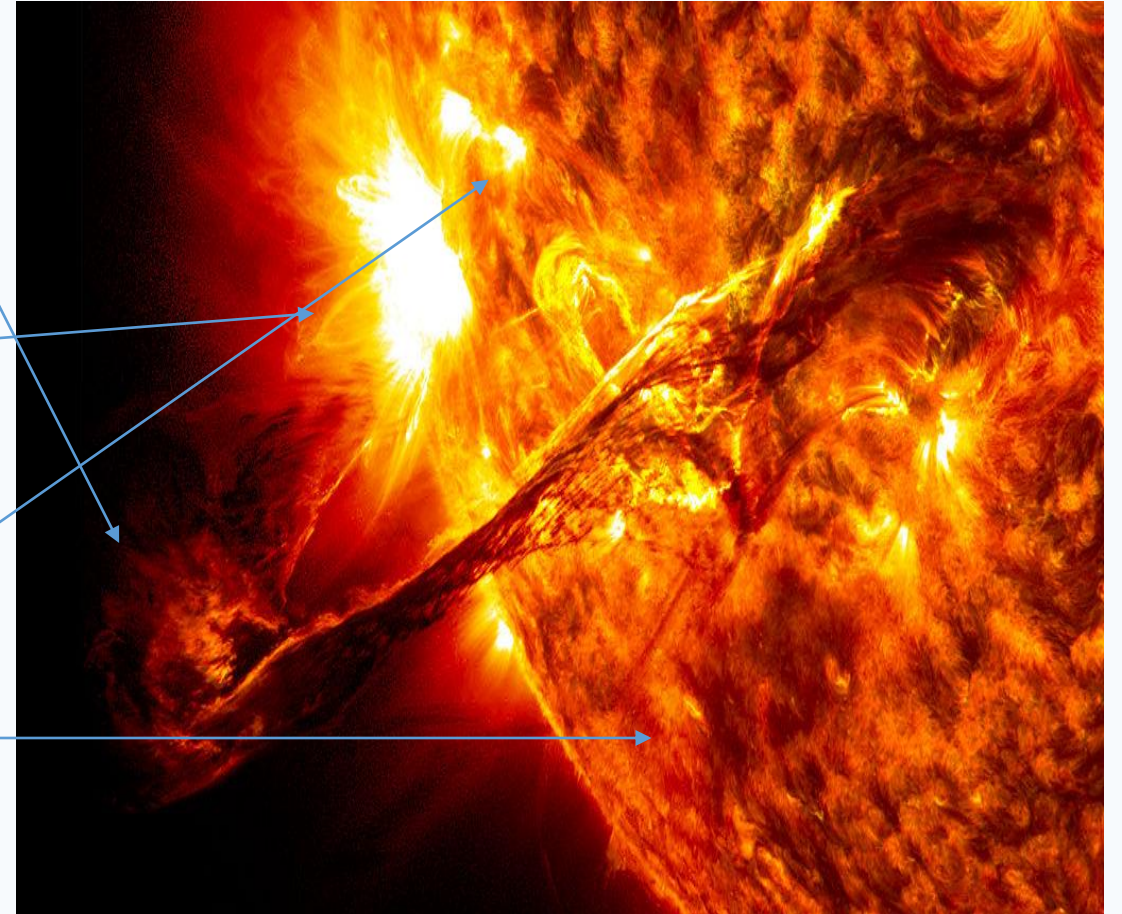
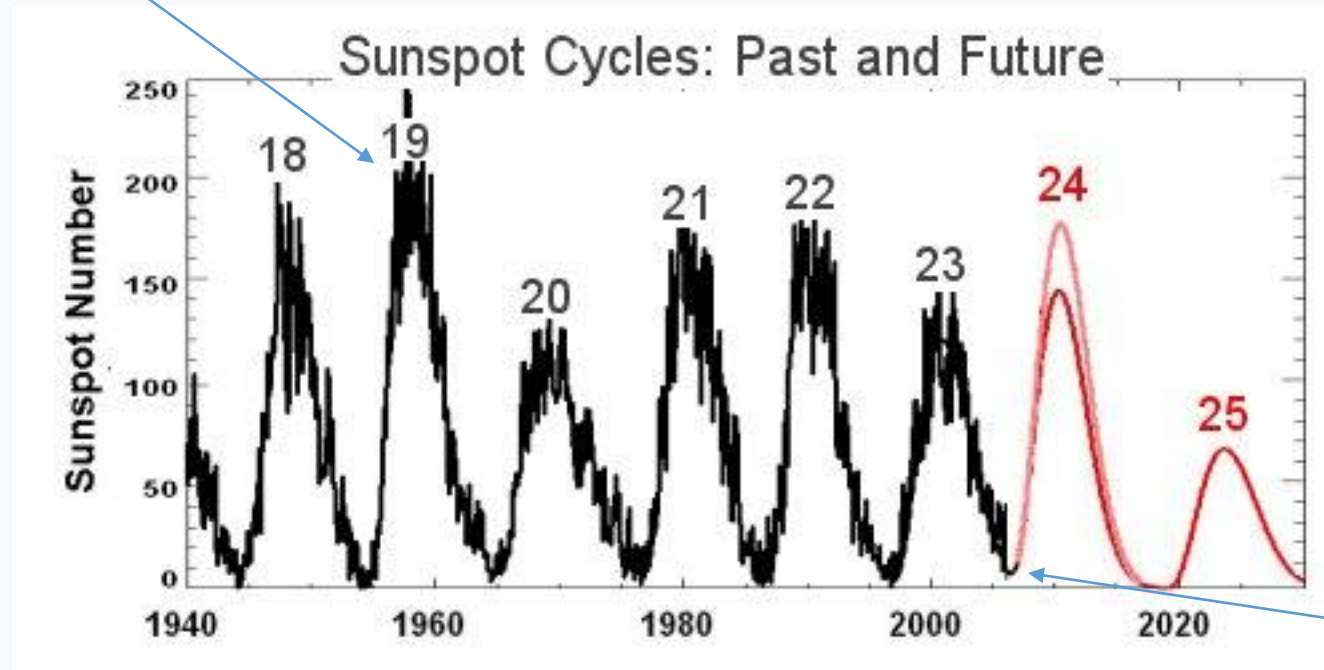


Figure 3. Surface of the Sun with a Prominence (Wiki)

Sunspot Cycle

Maximum – Magnetic Field Flipping



Minimum – Magnetic Field Stabilizing

Figure 4. Sunspot Cycle (Wiki)

Wiki Commons/Wikipedia Image References

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- Sun Cross Section: "Sun parts big" by Project leader: Dr. Jim Lochner; Curator: Meredith Gibb; Responsible NASA Official:Phil Newman - Diagram of a solar-type star from the Imagine the Universe web site, High Energy Astrophysics Science Archive Research Center, NASA Goddard Space Flight Center.. Licensed under Public Domain via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Sun_parts_big.jpg#/media/File:Sun_parts_big.jpg
- Sunspot Cycle: "Predictions3 strip" by Scientific data, based on prediction by David Hathaway - http://science.nasa.gov/headlines/y2006/images/longrange/predictions3_strip.jpg on http://science.nasa.gov/headlines/y2006/10may_longrange.htm. Licensed under Public Domain via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Predictions3_strip.jpg#/media/File:Predictions3_strip.jpg
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