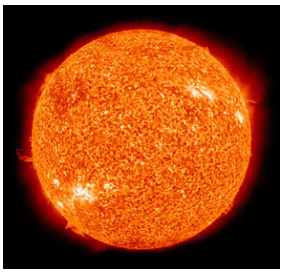
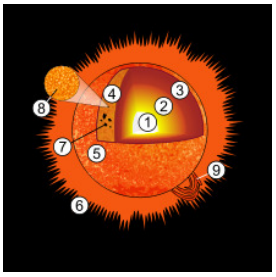
Fun Sun Facts!

Facts and Figures



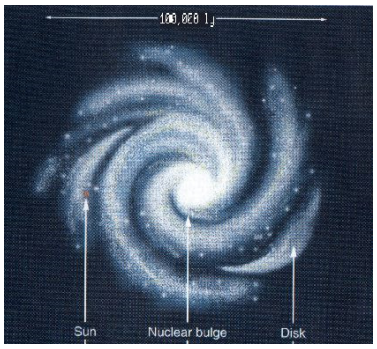
- Diameter: 865,000 miles (109 times diameter of the Earth).
- Mass: 330,000 times mass of Earth (99.86% of the mass of the solar system).
- The Sun rotates in 25.6 days at the equator and 33.5 days at the poles.
- Earth-Sun distance: 93,000,000 miles (also called one astronomical unit).
  - Earth-Sun distance was first estimated by Aristarchus of Samos, 310-230 BC!
- The Sun does not have a solid surface but is composed of hot gas and plasma.
- The Sun's surface temperature is 9940^{o} F.
- About 3/4 of the Sun's mass is hydrogen and most of the rest is helium; less than 2% is heavier elements.
- The Sun generates energy by fusing hydrogen nuclei into helium.
  - Equivalent of 4.3 million tons mass-energy are produced each second – 9.1x10^{10} megatons of TNT!
- The Sun is composed of many layers: core, radiative zone, convective zone, photosphere, chromosphere, corona, magnetic field.



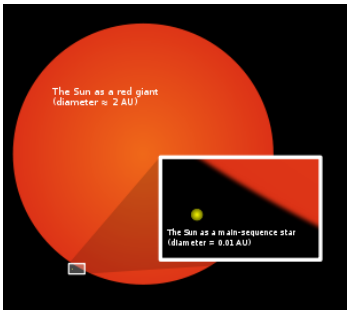
1. Core
2. Radiative zone
3. Convective zone
4. Photosphere
5. Chromosphere
6. Corona
7. Sunspot
8. Granules
9. Prominence

The Sun's Place

- The Sun is a type-G (yellow-white) main sequence star and, while not large, is brighter than 85% of the stars in the Milky Way, most of which are red dwarfs.



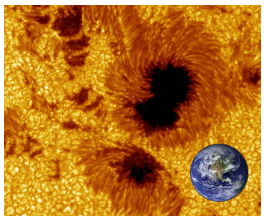
- The Sun is located 25,000-28,000 light years from the center of the Milky Way, which is 100,000 light years in diameter.
- The Sun was formed about 4.57 billion years ago when a hydrogen molecular cloud collapsed, possibly due to a nearby supernova explosion.
- The Sun is a Population I or metal-rich star, meaning that the Sun formed from a nebular cloud rich in heavy elements produced by early supernovae, elements needed for the formation of planetary systems.
- The Sun is in the galactic habitable zone: close enough to the center to be rich in heavy elements and far away enough to avoid high-frequency radiation from the central super massive black hole.
- The Sun is not massive enough to collapse at the end of its life and explode as a supernova. Instead, in about 5 billion years it will end as a white dwarf.
  - First, the Sun will enter a red giant phase. As the hydrogen in the core is consumed, the core will contract and heat up and helium fusion will begin, producing carbon. As a result, the outer layers will expand, forming a red giant.



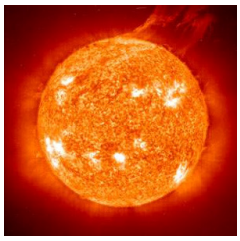
- Eventually the Sun's outer atmosphere may reach beyond Earth's orbit. Internal thermal instability and pulsations will cause the Sun to throw off its outer layers, forming a planetary nebula and exposing the central hot core.
- The remnant hot core will no longer be able to support nuclear fusion and will slowly cool and fade over many billion years, leaving a white dwarf composed largely of carbon.

NEVER OBSERVE THE SUN WITHOUT PROPER EQUIPMENT AND SUPERVISION BY AN EXPERIENCED OBSERVER. FAILURE TO USE SUITABLE EQUIPMENT WILL RESULT IN IMMEDIATE AND IRREVERSIBLE EYE DAMAGE.

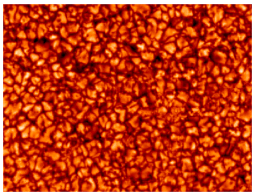
Observable Solar Phenomena



- **Sunspots & Plages** – Sunspots are relatively cool regions of intense magnetic activity, visible as dark spots compared to nearby regions of the Sun. They are cooler because the magnetic activity inhibits convective activity near the sunspot. Conversely, bright high temperature regions are called plages. Sunspots can be as large as 50,000 miles across, and can sometimes be seen with the naked eye if the Sun's light is attenuated by heavy haze, especially near sunrise or sunset. Sunspot minimums and maximums follow an 11 year cycle. The earliest surviving record of sunspot observation dates from 364 BC, by the Chinese astronomer Gan De.

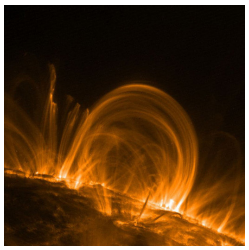


- **Prominences** – Prominences are large, bright features extending outward from the Sun's photosphere in the shape of giant flares or coronal loops. A typical prominence extends over many thousands of miles and may appear to detach from the photosphere and hover above the Sun.



- **Granulations** – Solar granulations are caused by convection currents (i.e. thermal columns) of hot plasma within the Sun's convective zone. The grainy, boiling appearance of the solar photosphere is produced by the tops of these convective cells. A typical granule has a diameter of 500 miles or more and lasts 8 to 20 minutes. Some can be up to 15,000 miles in diameter and last for 24 hours.

Hydrogen Alpha Solar Telescopes



- The Sun may be safely observed through specially built solar telescopes that transmit a single frequency of light, the hydrogen alpha line at 6562.8 angstroms, visible in the red part of the spectrum.
  - This frequency is a primary emission source for the Sun, and many of the Sun's features – such as sunspots, prominences and granulations – are visible in the H-alpha frequency.
- Solar telescopes employ a **Fabry–Pérot etalon**, a technology invented in 1899. The etalon drastically attenuates solar energy by a process called interference. The etalon is augmented by an energy rejection filter that removes harmful UV and IR frequencies. Finally, a blocking filter built into the right angle diagonal allows only the single H-alpha wavelength to pass through the telescope, rendering the view through the solar telescope safe for human observation. The bandpass of these telescopes is approximately 0.7A. For a good tutorial, visit: http://www.sungazer.net/ha/ha1.html.

- Several companies manufacture solar telescopes based on the Fabry–Pérot etalon technology. Since the underlying technology is similar, no brand is recommended over any other, and a decision to purchase can be based on cost, convenience, ease of use, build quality, accessories, features, etc.
  - Before purchase, consult with any of the many reputable merchants who specialize in quality astronomy gear. For more information, contact your local astronomy club.
- **A solar telescope should never be used without ALL of its components since each component is an essential part of the observing protection that the telescope provides.**
- **A solar telescope should never be disassembled or repaired by the owner. All repairs and upgrades should be performed by a qualified factory technician and with factory specified parts; else the telescope will no longer perform as it was designed to do.**