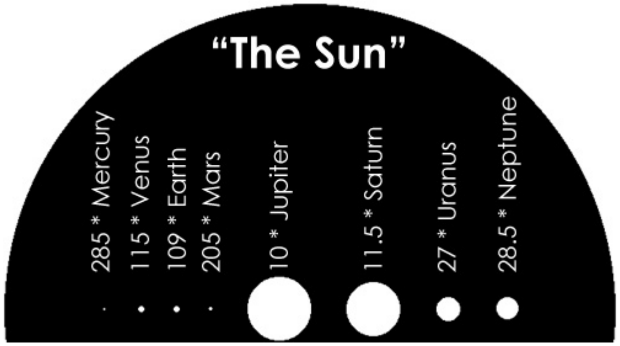
* The Solar System To Scale

The solar diameter in "planets" is listed below:



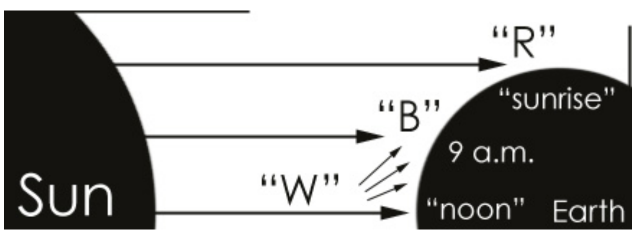
* More Information About The Sun

The Sun is the reason why we're here! Learn more about the Sun, its current activity, its history, and its future at the following websites (PDF-clickable):

* solarchat.natca.net/index.php/en/ - **Solar Chat**
* en.wikipedia.org/wiki/Sun - **The Sun @ Wikipedia**
* sohowww.nascom.nasa.gov - **NASA SOHO Obs.**
* www.nso.edu - **National Solar Observatory**
* solar-center.stanford.edu/observe/ - **Stanford Solar**

* And Just Why Is The Sky Blue?

Scattering! Directly around the Sun ("up" at "noon"), the sky appears as its natural color (white-yellow, "W"). Blue light is scattered by ("bounces off of") air molecules more than other wavelengths, making up the majority of the light that reaches our eye during the day ("tiny arrows" & "B") between sunrise and sunset. At sunrise and sunset, most of the blue light has been scattered by air molecules, so more of the Sun's longer wavelength light (red and orange) makes it to our eyes ("R").



* Solar Safety: Read Me First! *

* **NEVER** Look At The Sun Through **ANY** Eyepiece **Without Protection!** *

* **DAMAGE** To Your **RETINA** (And Your **VISION**) From Focused Sunlight Is **INSTANT** & **PERMANENT**! *

* Pre-Observing Observing Tips

The Sun is a blindingly bright object all by itself - and your observing session has you constantly looking in its direction! As with any Sun-related outdoor activity, **protection is key**. Beyond the obvious recommendation of **sunblock**, the top of your head will likely be pointing at the Sun as you look through an eyepiece, so have a **hat** handy for long sessions. A **reflective material** (or piece of **cardboard**) held over your head reduces the glare (and radiation) from above as you stare in the eyepiece.

* Solar Cross Section - 697,000 km Radius

Heliosphere: "charged bubble" around the Sol. Sys.

Solar Corona (SC): plasma (up to 1 million K) extending out millions of km into space; the SC is the ring observed during a solar eclipse.

Chromosphere (C): 2000 km thick, this cooler region (4,400 K at edge of P, 25,000 K at beginning of SC) is the home of **filaments** & **prominences**.

Photosphere (P): 500 km thick and 4500 to 6000 K, home of **sunspots** and origin of **solar flares**.

Convective Zone (CZ): 171,000 km thick, location of plasma motion (energy transfer by convection)

Tachocline: transitional region between CZ and RZ.

Radiative Zone (RZ): 348,000 km thick, energy from the core passes through as photons (light) - and it takes thousands of *years* for light to pass through it!

Core: 174,000 km radius, home of nuclear fusion.

Originally Developed By:

cnyo.org
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Promoting Amateur Astronomy & Space Science In Central New York

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A Guide For Solar Observing (v7)

The Sun is an excellent observing target for amateur astronomers. Unlike most of what we observe, the Sun is (usually) easy to find! This brochure describes safe observing practices, information about the Sun's history and future, and information about common light filters used to study our nearest star.

* What You'll Observe On The Sun

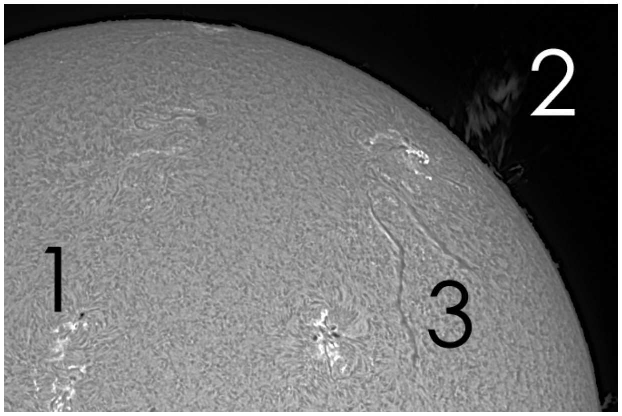


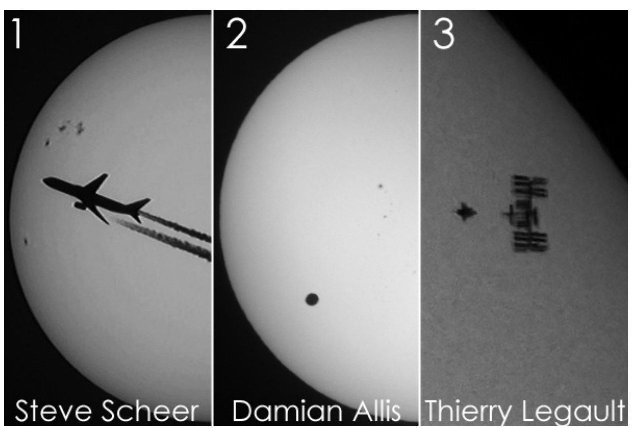
Photo by Alfred Tan, Singapore, 26 April 2012

1. Sunspots – magnetic activity leads to solar "cold" spots (still very bright, but giving off less light than the surroundings - this makes them visible with **Baader filters**). High magnification reveals differences in darkness and additional structure in these regions.

2. Solar Flares – massive plasma releases, visible as prominences along the Sun's edge. When ejected towards us, they interact with the Earth's magnetic field to produce *aurora* (Northern & Southern Lights).

3. Surface Features – the surface is not a smooth uniform ball of light, but instead an ocean of plasma. This detail is easy to see near sunspots.

4. Other – Savvy (or lucky) observers may see a plane (1), satellite, planet (a "transit" of Venus (2) or Mercury), or the International Space Station (3).



* About The Sun (History & Future)

Details: The Sun is a spectral type G2V star in the Orion Arm (Orion Spur) of the Milky Way, some **25,000 light years** from the Milky Way's center and, on average, **8 light minutes** away from Earth (if it goes out *now*, we will not know for 8 minutes). It revolves around the Milky Way at an average velocity of **828,000 km/hr** and takes **230 million years** for **one revolution** - it has revolved around the Milky Way center almost 20 times since its formation. The Sun contains **99.86%** of all of the mass of the entire Solar System - it is currently **73.5%** hydrogen, **24.9%** helium (from hydrogen fusion), and **1.6%** "everything else" (oxygen, carbon, iron, etc.).

Energy released by the Sun is the result of nuclear fusion at the core. Two pairs of hydrogen (two protons each) combine to form one helium nucleus through a complex fusion process. **600 million tons** of hydrogen (a great Pyramid's worth) are converted into helium **EACH SECOND**. At its core, the Sun's temperature is 15,600,000 °C (at its edge, it is *only* 5,800 °C)!

Solar Cycles: The Sun undergoes an 11-year Solar Cycle from Solar Min (less energy output, few sunspots) to Solar Max (more energy output, more sunspots).

Eclipses: The "apparent" diameter of the Sun and Moon are nearly identical. The Sun is 400 Moons across, but the average Earth-Moon distance (384,400 km) is 1/400th the average Sun-Earth distance (149,600,000 km). This can result in *Total* (Moon directly in front of the Sun) or *Partial* (any other arrangement of the Moon in front of the Sun) **Solar Eclipses**.

History: The Sun formed approximately **4.57 billion years ago** in an interstellar cloud of hydrogen and helium, likely triggered by the shockwave of a (then) nearby supernova. The Sun is currently in its **Main Sequence** stage (a reference to the current model of *stellar evolution*) and will remain as we now know it for at least **2 billion more years**.

Future: After two billion (or so) years, the Sun will gradually expand as hydrogen supplies are used up. In approximately **5 billion years**, the Sun will be a Red Giant with a radius nearly out to the Earth's orbit. At its end, the Sun will produce a **Planetary Nebula** (spherical cloud of ejected material) - like the Ring Nebula, **M57** - and become a **white dwarf**.

* What You'll See Through Solar Filters

Any solar observing will involve some kind of filter. The solar detail you will see with three of the most common filters is described below.

Baader - The Baader ("*Bah-der*") filter works by reflecting 99.999% of all of the incoming light (almost a mirror), leaving you with a pale yellow disk. You'll see no prominences or fine surface detail, but Baader filters are excellent for observing sunspots.

All other filters work by picking out a single wavelength (shade of one color) from the entire visible spectrum (ROYGBIV - red, orange, etc.), allowing only that color to pass through to your eye. As a result, you see the detail of atomic processes that produce wavelengths of light at that color.

CaK (Calcium K-line) - The CaK filter lets through a wavelength corresponding to the 393.4 nm Ca K-line transition (you see it as violet). These filters provide excellent surface detail.

H-alpha (Hydrogen-alpha) - This filter lets through a hydrogen electronic transition corresponding to a wavelength of 656.28 nm (you see it as a rich red). H-alpha filters are excellent for prominences and good for surface detail.