OBSERVING THE SUN

You have probably heard an old astronomy joke that involves the trick question "Name the closest star to the Earth." Most people immediately name some member of the Centauri system, forgetting completely that our Sun is a star and is a lot closer to us than any other star in the Universe. Solar observing is a specialized aspect of amateur astronomy that allows us to study this star up close and in great detail. This section of the BSIG certification program introduces you to solar observing and a couple of popular ways to view the Sun in complete safety.

But first, a bit about how *not* to look at the Sun.

Many beginning telescope kits include a so-called "sun filter" that screws into an eyepiece, just as so many light pollution and neutral density lunar filters do. Placing such a filter near the focal point of a telescope, where the already intense light and heat of the Sun are concentrated onto a very small spot, is not an appropriate way to reduce the energy of the Sun to a level safe enough for viewing. The concern is that this intense heat could crack the filter, allowing the light blinding light of the Sun to pour through the crack would damage the observer's eye. While tales of actual injury are anecdotal, these filters have in fact been known to crack under the strain of being heated in this fashion. ***THEY MUST NOT BE USED UNDER ANY CIRCUMSTANCES.*** If you own such a filter, discard it.

Another popular means for studying the Sun is through solar projection. This is safer for the observer, but can be rough on equipment. In any case, it is a method best suited to use with a small refractor, and since we want this program to be equally accessible to all participants, not just refractor users, we will not make use of projection. (If your telescope is suited to this method and you want to give it a try, *The Sun Observer's Guide* by Pam Spence - Firefly Books, contains a very good description of how to use projection.)

If you own a white light solar filter designed to fit over the aperture of your telescope, this is an excellent way to start out. It is also the most commonly used method by amateur astronomers for solar observing. These filters are available in sizes that accommodate most small to medium sized telescopes. Some are made of heavy, durable glass, while other are made with a specially coated film (which can be purchased separately for those who want to save money by building filters of their own.) Both reduce the amount of light reaching the eye of the observer by approximately 99.99%, rendering the Sun safe to view and showing features such as sunspots very well. Although such filters are not exactly inexpensive, they are the most affordable means of filtered solar viewing available to the amateur.

Another popular, but rather expensive, way to view the Sun is through a filter that passes only hydrogen alpha (Hα) light wavelengths. You may have had an opportunity to view the Sun through such a filter before now. If so, then you saw the Sun as a sullen red ball, perhaps with strange bright marks here and there across the surface, and loops or streamers of red material extending from the edge of the disk. This is an amazing way to

view the Sun, and although we include it in the program, you need not be concerned with the expense. The TAAA includes members who own such gear, and arrangements will be made to view the Sun as a group activity that allows participants the opportunity to view the Sun in Hα and white light.

Of course, you can purchase whatever solar viewing equipment you can afford, and fulfill the requirements for this section on your own. Alternatively, you can buy (or build) a white light filter and use the Hα equipment brought to a solar observing event. One way or another, there will be opportunities to make the necessary observations to complete the solar observing requirements for this program.

Regardless of the filter technology you use, be absolutely certain it is intact and properly in place over the aperture of your telescope before you so much as lean toward that eyepiece! Check before you observe. And then check again!

White Light Observations

You will need two white light views of the Sun. First of all, view the Sun at relatively low power, low enough that the entire solar disk is visible. Using a copy of the attached observing log sheet (or the log template of your choice) draw a circle and record the locations of any sunspots you can see. Next, using a higher power eyepiece, focus on one sunspot or sunspot group and sketch what you see (the same type of log sheet should work for this). Be sure to depict and label the contrast between umbra and penumbra in your sketch. If by chance the Sun is not very active the day we gather to observe it – or worse has no spots at all! – make note of this in your observing log. An observation is an observation, even if the gist of that observation is "No sunspot activity on this date." It counts.

In your notes, in addition to the usual notations regarding day and date, comments on weather conditions, and what sort of telescope and filter you use, record such things as the color your filter gave the view of the Sun, how many sunspots you saw, how many were in groups, and how many were isolated individuals. As an option, should you have the opportunity to observe the Sun over several days, repeat your observations so you can track the apparent motion of the sunspots due to the Sun's rotation. This is not required, but it is an interesting thing to see and worth the effort if you have a filter of your own and can observe on your own schedule.

Hα Observation

For Hα you will need a low power, overall view of the Sun's disk, and a detail from the edge of the solar disk. Using the same circle on paper idea from white light observation, roughly sketch whatever surface features you see on the Sun. Dark marks or lines are known as filaments (which are called prominences when visible along the edge of the disk). Bright areas visible around the locations of sunspots are called plages.

(To sketch a plage you need only use a circular line of the right shape and extent around the sunspot.) When you have your full disk observation completed, switch to a higher magnification and sketch a portion of the edge (limb) of the solar disk that has at least one prominence, assuming there are any. To get the curve of the Sun's edge regular enough, simply draw a half circle using a suitable template such as a jar lid. In either case an indication of the shape of the prominence, in proportion to the curve of the half circle you use, will be good enough to represent the features you see. Of course, you can make any sketch as detailed as you wish, but as always an artistic rendering is not required. And as was the case for white light observations, if the Sun is not showing any visible activity on a BSIG solar observing date, note this and count it as an observation. If at a later date you have the chance to observe the Sun again in either white light or Hα, and it is more active, feel free to supplement the original observation with the more interesting one. You do not need to replace it.

These exercises in no way describe the limits of solar observing. (The same comment applies to all the sections in this workbook.) This is a specialized aspect of astronomy that has far more to offer than what we can realistically cover here. An excellent way to develop an interest in solar observing would be to participate in the Astronomical League's "Sunspotters Club."

Introductory Solar References

Sun Observer's Guide by Pam Spence (Firefly Books)

How to Observe the Sun Safely by Lee Macdonald (Springer)

The Backyard Astronomer's Guide by Dickinson and Dyer (Firefly Books)

Observe and Understand the Sun ed. Richard E. Hill (Astronomical League)