Safely Observing the Transit of Venus

by Lesa Moore

The Transit of Venus is a daytime event, visible to anyone on the daytime side of the Earth during the transit time. Luckily, eastern Australia gets to see the whole thing.

The first rule of any solar observation is:

NEVER LOOK DIRECTLY AT THE SUN!

There are several ways to safely observe the Sun, depending on your budget and what equipment you have. These methods are: projection method; unmagnified observation using eclipse shades; and telescopic observation using a full-aperture solar filter.

1. PROJECTION METHOD

If you already happen to have a pair of binoculars, you don't need to spend much to be able to enjoy the transit.

The technique involves mounting your binoculars on a tripod using a bracket available at the camera shop (about $25). Any tripod will do (such as a camera tripod), but one with slow-motion controls makes it a little easier to centre the projected image and track the Sun as the Earth spins. The binoculars must be aimed at the Sun with one side capped (see Figure 1). This is accomplished by angling the binoculars to make the smallest shadow, WHILST YOU ARE LOOKING AT THE SHADOW ON THE GROUND. Once you are able to see any sort of projected image on the ground, lock off the tripod and install the baffle around the binoculars - this casts a shadow, making the projected image easier to see.

You'll also want a projection screen. The baffle and the screen can be made from cardboard or corrugated plastic available from stationers.

You may have to fiddle a bit and repeat the process a couple of times to allow for sag in the equipment. Once you have the image nicely centred on the screen, remember to focus the binoculars until you can see a clean edge on the Sun's limb. You may at this point also pick up any sunspots. Venus will appear as a distinct black indent when it first imposes on the Sun's limb.

Figure 1: Binocular Projection. Image by the author.

The same method applies if you have a reflecting telescope, though you may have to figure out a way to mount a screen on the telescope using metal rods (see figure 2).

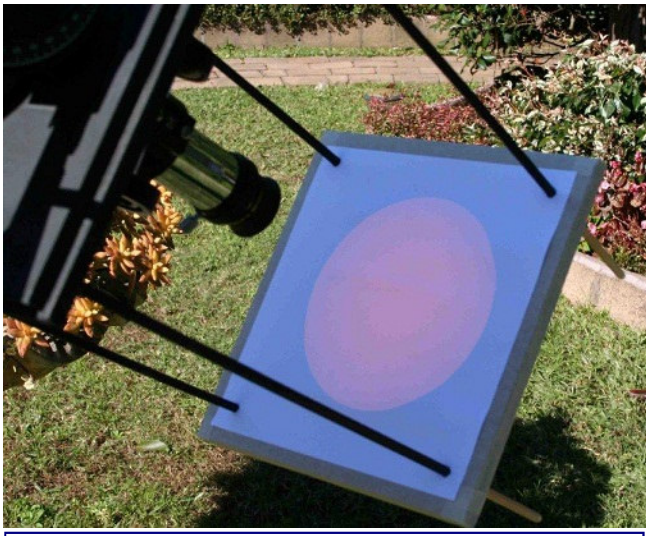

Figure 2: Telescope Projection. Image courtesy John Flavin.

Projection is not advised for compound telescopes (e.g. Schmidt-Cassegrain types) where optical elements (glass and mirror) seal the interior space, possibly causing a heat build-up. Projection method is PERFECTLY SAFE because you never, at any time, look towards the Sun.

PLEASE NOTE that you should never leave your equipment unattended because unknowing observers may attempt to look THROUGH the binoculars or telescope - the second rule of safe solar observing is:

NEVER, NEVER,EVER LOOK AT THE SUN THROUGH AN UNFILTERED INSTRUMENT!!

2. ECLIPSE SHADES

Eclipse shades are commercially available (e.g. from Sydney Observatory). They cost about $5 a pair. To test their integrity, hold them in sunlight over a piece of white paper.

If you see any bright spots on the paper, the glasses may have scratches or

Figure 3: Author with eclipse shades.

pinholes, meaning that they are damaged and should NOT be used. If they are in good condition, simply don the glasses, then pan your head towards the Sun and you should be able to see the Sun's disc. Venus will be easily visible as a small black dot at naked-eye magnification during the transit.

3. FULL-APERTURE SOLAR FILTERS

a) Optical filters

If you have a telescope, you may want to invest in a solar filter. There are various types. Expensive ones have a metallic film sandwiched between layers of glass. Cheap ones can be made from mylar or other types of film sold specifically for the purpose of making a solar filter.

The risk with these filters is that if they are not securely fastened, and they blow off while you are observing, you will sustain INSTANT AND PERMANENT EYE DAMAGE. Ensure that the filter makes a tight fit over the end of the telescope. For added safety, you may even want to tape the filter in place.

Again, there is the integrity test, described earlier for the eclipse shades. Inspect for pinholes, scratches and any leaking sunlight before use.

If you are making your own filter from mylar or film, you may need two or more layers. The test in this case is to see if you can see any light other than sunlight through the filter when you hold it up to your face. If you can see fluoro or dichroic lights, for example, then the filter is not dark enough to be used on a telescope for solar viewing. Try a double layer and test it again.

For a commercially-made filter, it is likely that you will not have a filter for the eyepiece as well. If that is the case, you will need to align your telescope using the "smallest-shadow" method. You can remove the lens cap off the spotter scope to assist in this process, but it is very important to replace the lens cap once you are aligned, to prevent any wandering observers trying to sneak a look through the spotter. If you have made a filter using film, then it is usually a simple process to make one for the spotter as well.

If you are satisfied that your filter is suitable, undamaged and securely fastened to the front end of the telescope, you may observe with safety through the eyepiece. Glass-type filters will usually produce an orangey image (refer Figure 4), whilst mylar results in a bluish image of the Sun's photosphere (the visible surface of the Sun). Focussing will reveal any sunspots.

It's best to start with low magnification to display the whole disc of the Sun until the transit has begun. If you are only looking at a portion of the limb, you may be looking in the wrong spot!

The only non-specialist substitute for a specifically-designated solar filter is a #14 welding glass. DO NOT attempt to make a filter with sooty glass, photographic film, polaroid lenses or any other type of light-reducing system. This is not safe and may result in permanent eye damage. Solar eyepiece filters supplied with some imported telescopes are also unsafe, due to the risk of cracking, and should be discarded.

b) Hydrogen-alpha filters

These solar filters are much more expensive than any other type, but will reveal prominences off the Sun's limb and features in the chromosphere (upper atmospheric layer) of the Sun, as seen in Figure 5. The PST (Personal Solar Telescope) is a small, portable telescope purpose-built for H-alpha observing. The filter is built-in and alignment on the Sun is performed by adjusting to get a bright spot of sunlight on the alignment window. There is an excellent illustrated how-to document at:

http://astronomy.neatherd.org/northandsouth/PST_instructions.doc .

Now, you're ready, we just have to keep our fingers crossed for clear skies on 6th June! Why not come and join us at Tara, where ASNSW members will be showing the Transit of Venus to the students. More details p19 or contact starrylady@hotmail.com.

Figure 4: Telescope fitted with optical filter and (inset) image through optical filter. Image by the author, inset by Catherine Braiding.

Figure 5: H-alpha image of Sun during Venus transit. Image by Fred Espenak, http://www.MrEclipse.com