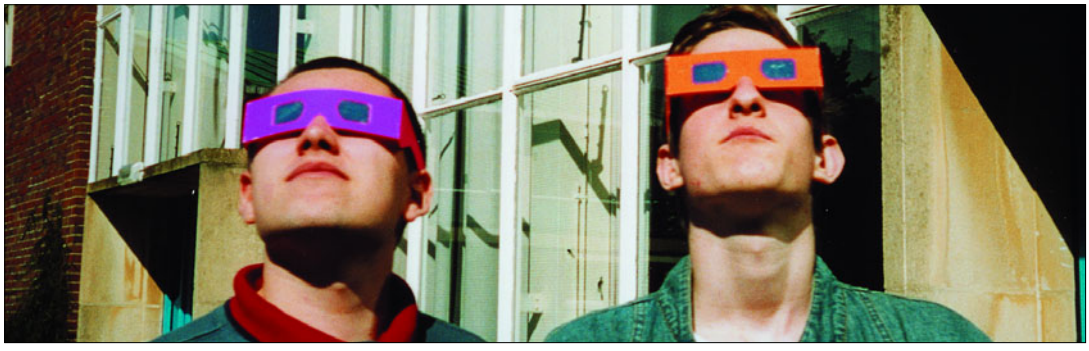
# The Sun can be viewed safely if you know how

*Teachers are strongly advised to check their local rules and regulations regarding allowing their students to view the disc of the Sun. These are the personal views of* **Roger O'Brien**, *a highly respected university tutor who has been demonstrating live astronomy for many years.*

Looking at the Sun through a telescope with solar filters firmly attached should only be done when the telescope is being supervised by a fully competent observer. If you're not experienced with the equipment and with children using it, then use the Internet instead. Here are some important pointers.

**Filters** There are now plenty of objective filters available for most popular makes of telescope. I have one for my 90 mm ETX and it is perfectly safe. You *do look directly through* the telescope at the Sun. I got mine from Broadhurst Clarkson and Fuller and it screws into the thread for the lens cap, so coverage of the aperture is both complete and secure. The filter is enclosed in glass or plastic, so it is much less likely to suffer damage than a simple reused sheet. I always advise students not to be the first to look through a telescope and filter at the Sun. At least 50 of my students have seen sunspots through my telescope and filter.

**Lining up** Some words of caution: getting the telescope lined up with the Sun is tricky until you are used to it and, of course, it's not safe to look through the finder unless that, too, has a solar filter. I use the shadow of the telescope (cast onto my hand) to see if it's roughly in line. The trick is to get the shadow as small as possible, which happens as the telescope becomes aligned. Then I move it until the little bright solar image cast by the finder shows up on my hand – then things are pretty well in line. It is a good idea at this point to cover the finder objective so that the



*Choose your eyewear carefully: eclipse glasses like these are next to useless for observing sunspots and transits because the disc of the Sun is far too small for observers to see the detail that is required.*

Sun's rays don't heat it too much.

**Sunspots** Sunspot observations can be made almost any time when the Sun is visible. They're very useful for making points about the rotation of the Sun, the nature of sunspots, etc. Such observations enable the user to get used to the procedure and be more confident in handling the filter and telescope.

**Projection** I have been told repeatedly, over the last several years, that projecting the solar image is not safe. The danger is from the eyepiece exploding as a result of heating due to absorption of the Sun's rays. I have never met anyone to whom this has happened nor read any documented account of it. However, it is firmly established in the canon of dangers and the British Astronomical Association will not countenance advice to use this method. I have used it often with three different telescopes and a pair of binoculars without any ill effects. I don't have a driven telescope, so the Sun soon moves out of the field of view and gives the telescope a chance to cool down, but I have yet to see any sign of the eyepiece getting hot (though this can happen). Projection has a considerable advantage in that it's possible to do it on an ordinary projection screen (shielding it so that the image is thrown into shadow is a good idea) allowing up to a dozen people to see the large image at once. Objective filters reduce the incident sunlight and infrared before it enters the telescope so the build-up of heat is avoided.

**Cooled filters** Some permanent solar telescopes, like the one at Bayfordbury near Hertford, use objective filters of a more advanced kind. These are cooled during operation and can be used safely for extended periods. I observed the transit of Mercury from Mill Hill. We used the old Fry Telescope with a cooled filter and watched the transit for more than two hours.

**Objective filters** A cheap alternative to buying a dedicated solar telescope is buying an objective filter, thereby leaving the general-use telescope available for other observations.

**Binoculars** I have projected an image through binoculars, but the optics of binoculars are complicated and involve a lot of bits of glass in a confined space. If anything is going to suffer from eyepiece explosion or the melting of the cement that holds lens-elements together, I think it would be binoculars.

**Camera obscura** Another excellent device for watching a transit is a camera obscura. Unlike in the case of an eclipse, during a transit the Sun is never seriously reduced in brightness so there is plenty of light available. The pinhole can be arranged to cast its image into a large box with one side removed. Thus the image is on the rear face of the box and is large, bright and in the shadow.

**Transits** It has to be said that it requires a certain connoisseurship to enjoy watching a transit – there are similarities to watching paint dry. A little black dot appears on the Sun and crawls across it very slowly. This one takes six hours in all. The dot is easily distinguishable from a sunspot because it is perfectly round and sharp-edged. Sunspots are inherently fuzzy, with a dark central umbra and a surrounding lighter penumbra. I found it quite moving to think that the tiny dot represented Mercury – a whole planet. This year's transit will give us a rough idea of what a transit of Earth would look like to an inhabitant of Mars. The small size of the dot also makes one realize just how big the Sun is.

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