Observing the Sun

It is most important always to bear in mind that **the Sun should never be looked at through binoculars or a telescope.** The brilliant disk is so bright and hot that to observe it directly would result in permanent blindness. Even prolonged staring at the Sun with the naked eye can damage the sensitive retina. The dark 'Sun filters' supplied with some telescopes should never be used as **they are not safe**: they usually transmit harmful infrared and ultraviolet radiation, and have also been known to crack under concentrated solar heat in a telescope. Even when the Sun is low on the horizon at sunrise and sunset its infrared radiation may still be sufficiently great for it to be dangerous to use any optical equipment.

The Sun may be studied in perfect safety by adopting proper methods or by using special equipment. The simplest means is to project the solar image on to a white screen, preferably by using a proper projection box mounted on the telescope as illustrated on page 85: by preventing interference from stray light this makes the details much more easily seen. This method can be used with any telescope, even with one side of a pair of binoculars, but it is important to remember to cover the objective of any finder on a telescope, or the other half of the binoculars, to avoid any possibility of an accident. The shadow of a vane cast on to a suitably positioned target is a quite adequate, and safe, method of pointing the telescope in the right direction.

Of the special equipment which is used for observing the Sun brief mention may be made of the Herschel wedge, which reduces the intensity by a factor of between 10^3 and 10^4 – still not enough for safe viewing without filters or other devices – and of the use of specially prepared, uncoated mirrors which reduce the amount of light and heat. The intense heat of the Sun imposes a limitation on the size of telescope that can be successfully used, and those of 150mm aperture or more often have to be stopped down at the objective.

The greatest success and safety in direct viewing, and the greatest convenience, is achieved by the use of special reflecting solar filters. These consist of glass, or more commonly Mylar plastic film, coated with chromium or aluminium to reflect away the unwanted light and heat and only pass a small fraction into the telescope. As they are used over the objective, the whole telescope remains cool – a great advantage; and furthermore, quite large apertures may be used with the consequent gain in resolution. The coated film, which is somewhat similar to the thermal blankets used on spacecraft, must be of the correct type; sources of supply will be given by organizations which co-ordinate the study of the Sun.

Apart from examining the Sun in white light many amateurs study its features in the light of a single spectral line, usually Hα at 6536 A, either by using special – and expensive – filters or by means of a complex instrument known as a spectrohelioscope (illustrated on page 88). Essentially, this spreads the light into a spectrum and then uses a second slit to reject all light except one narrow spectral band. Spectrohelioscopes have the advantages over filters that they may examine any spectral region, not just one, as well as the fact that, although complex, they do not require accurate temperature control, which must be strictly observed in the case of filters.

The simplest and most obvious form of observation is to note or draw the distribution of sunspots on the solar disk. If the projection method is used it is simple to plot the positions of any sunspots or faculae on to a suitable sheet of paper. It is usual to arrange for the magnification provided by the optical train to be such that a standard-sized blank is used, with a fixed solar diameter. Made on a daily basis, such disk drawings enable the evolution of individual sunspot groups to be followed, and the adoption of a standard diameter means that records from different observers may be easily compared. An assessment of the level of sunspot activity can be competently made by the amateur and is usually expressed in terms of the Zürich relative sunspot number R, which is derived from the formula $R = k(f + 10g)$, where g represents the number of sunspot groups, f the total number of their component spots, and k is a constant which depends upon the estimated efficiency of a particular observer and the equipment he uses.

Hydrogen-alpha observations allow many fine

Opposite:
A composite of two photographs taken through a H alpha filter, one of the solar disc and the other of the prominences, taken by R. J. Poole, Canada, on 1980 August 16.

Below left:
The large sunspot of 1972 May 20, drawn by Harold Hill over the period 06.45 to 07.10 UT, using a 75 mm objective.

Below and opposite:
A fine series of drawings by Harold Hill, observing in hydrogen-α light showing the development of a large loop prominence.