

Observing the Sun - Keeping safety in front

Seanie Morris, Irish Federation of Astronomical Societies Chairperson, February 2015.

For some people, when they get into Astronomy, it is always the thought of "what can I see at night?" and hardly ever consider the daylight hours. The truth is, with the right and varied equipment, Old Sol can prove to be a dynamic and interesting object to observe during the daytime, even during an eclipse.



Sequence up to Totality during the Total Solar Eclipse of Turkey, 2006. Ireland will get close to 90% of the disc covered on Friday March 20th. Photos by the author.

With the next eclipse visible from Ireland on the morning of Friday March 20th, offering maximum coverage of 90% at 09:26hrs, the aim of this article is to highlight what you can do to enjoy observing the Sun, and make sure you do it safely. Even though the path of totality lies closer to The Faroe Islands than Ireland, it doesn't mean you won't be able to enjoy the spectacle that will be on offer.

Below are the common ways to do all this.

1. Observe by Projection (during a Solar Eclipse)

This method uses no lenses or optical aids of any kind, and is probably the safest and easiest but is specific to observing during a solar eclipse. For anyone, all you need is something with a small circular aperture as the objective, and a screen to project the image onto.

A large sheet of heavy card with a hole punched through it in the centre using a pen for example, is all you need to create your objective. A sheet of white card, paper or even white perspex, acts as the screen. Hold the objective around 2 feet from the screen, and tilt it face-up towards the direction of the Sun. You should see the solar disc display on your screen. Adjust the distance to suit. During an eclipse, this will show the covered disc according to how much the Moon is in front.

You can use any device that has a circular hole (or series of holes) to project the solar disc like this. As an added tip during a solar eclipse, pay attention to the light passing through trees onto the ground and you will see an infinite number of eclipsed solar discs!

Different polymer materials give different colored views from white to light purple to orange. You might be able to see larger sunspots too. A sunspot is an area of magnetic activity that is cooler than the rest of the surface, hence why it is darker. They usually appear in groups of various sizes. Most sunspots are many times bigger than Earth.

Before going into the next point, remember that the materials used in eclipse shades ARE NOT SUITABLE for use with a telescope or binoculars as a filter over your eyes, and should not be considered for use at the focus.

3. Projection using a Telescope or Binoculars

This is where you must think 'safety first', as you are introducing tools that can do harm with the energy of the Sun. Using a refracting telescope, create a mask that fits over the objective (front) end but letting it poke through, and let the light shine all the way through to the eyepiece. If using 0.95 or 1.25 inch diameter eyepieces, use a 20mm or 15mm eyepiece.



Using a refractor telescope to project the solar disc. Note that the finderscope cap is also on! The solar disc displays numerous sunspots at the time. Photos by the author.

Using a white screen, try your best to orientate the telescope so that it is in a direct line of sight with the Sun, and the solar disc is displayed onto the screen. Adjust the distance between eyepiece and screen - and the focus of the eyepiece - as needed. You will see a natural white light image, and if the Sun is active, you will see tiny black dots - sunspots.

WARNING: DO NOT attempt to look through the eyepiece when aligning your telescope. Instant temporary pain followed by permanent blindness will be the result of any accidental viewing through the telescope.

4. Using properly filtered astronomical instruments

This can be subdivided into 2 areas: Baader Filters and Glass Filters

Baader Filters

Baader is a material that resembles plasticised tinfoil and is typically sold in A4 sheets. You can buy it, quite cheaply, and use it to make your own solar filters from materials at home (paper, card, glue and tape). Baader is non-perishable and scratch resistant, so as long as it has no pinholes in it, it will last for many years.



The author demonstrates his own home-made Baader solar filters. Note how the finderscope has been removed from the telescope assembly. Photos by the author.

A homemade Baader filter is applied like a cap over the front of the telescope and never at the focus. Always look through it towards a bright light source to check for pinholes. Using discarded 3D movie shades or damaged eclipse shades, Baader can become the filter and give them a second life. The idea of Baader is used before any magnification is applied, and it blocks 99% of the Sun's light and heat. It gives a natural white image. Sunspots are also seen.

Glass Filters

Made to specific apertures to fit the world's most commonly-sold telescopes, these filters are applied on the objective (front) end of the telescope, and like their more flimsy Baader cousins, block out 99+% of the solar heat and light.

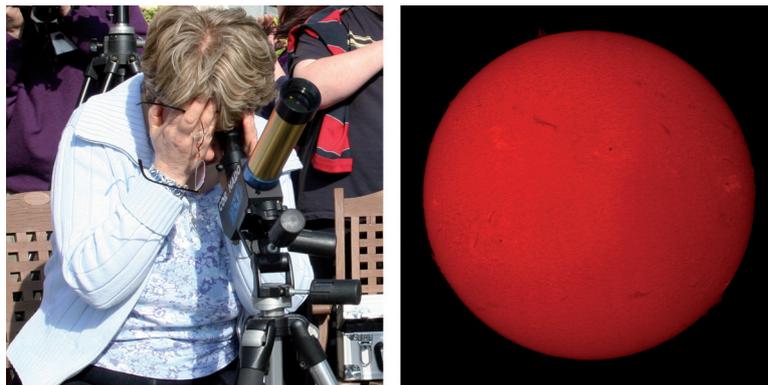
As well as white light filters, there are the hydrogen-alpha (H-alpha) filters (giving a deep red colour with surface granulation and prominences seen along the edge) and Calcium-K filters (giving a purple-white view, also with surface granulation).



Observing the Sun using a custom fitting glass solar filter at the objective. Often, a telescope user would remove the finderscope to prevent inadvertent stray light and heat from the Sun to cause damage. Photo by the author.

5. Using a dedicated solar telescope

These have become very popular in the past decade or so, as their cost due to demand has come down and the availability of second hand models on the market. Lunt and Coronado are the common market leaders.



Viewing the Sun with a Coronado PST (on the left) in H-alpha light (on the right) through a T-mounted Canon 350D. Photos by the author.

These narrowband instruments have a dedicated filtered objective and use interference filters, so the view of the Sun is one colour but made of numerous wavelengths combined at the focus, adding to surface and limb detail.



Irish solar observers using a variety of modified and proprietary instruments. The 2 scopes with the brass coloured bodies are Coronado PSTs. Photo by the author.

And there you have it!

Ways you can enjoy the Sun as an astronomical topic with safety in mind. For more information on this or any other topic, why not visit the IFAS website at www.irishastronomy.org and search the knowledgebase for tips and helpful hints. You can even register for free and take part, sharing your observations or even offering your own experiences and tips to those who ask. Enjoy!

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About the author

Seanie Morris is the current Chairperson of the Irish Federation of Astronomical Societies (IFAS, www.irishastronomy.org), a non-profit organisation promoting astronomy and similar sciences throughout Ireland, and Secretary of Midlands Astronomy Club (MAC). MAC is based in Tullamore, but is the only regional club in the Irish midlands, of which he has been a member of since 1990. His astronomical interests include just about anything, including telescope making and renovation. Seanie has presented lectures throughout Ireland to the many other astronomy clubs and other interest groups and societies.