# Solar Observing

# Beginners 21st April 2021

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The ideal thing to observe during the summer, when the nights are short, is the Sun.

Of course we must take great care in how we observe the Sun as it can be very dangerous if not done correctly.

A telescope or binoculars must never be used to look directly at the Sun.

The instruments are designed to gather as much light as possible from faint objects and direct that light into our eyes.

However the Sun produces a lot of light and heat so directing this light and heat into the eye will cause permanent damage and blindness.

## Solar Observation and imaging

The Sun can be observed safely

Binoculars or a telescope can be used

There are two safe ways to observe the Sun

The image can be projected on to a screen

The Sun can be observed directly using a Solar Filter

The filter must be proper dedicated Solar Filter

Binoculars can be used but it can be a little difficult and the image will quite be small

A telescope can be converted for Solar observing

There are two ways to observe the Sun safely these are to use a special Solar Filter or to project an image of the Sun on to a screen.

If we do have a telescope or binoculars we can use a piece of white card as a screen and project the light from the Sun on to the card.

If binoculars are to be used be sure to cover one of the lenses with the dust cap.

Place the card in a suitable supported position so its flat surface is facing the Sun.

Hold the binoculars about 300mm above the card in the direction of the Sun.

Move the binoculars around until the projected image can be seen on the card.

The process can be improved by supporting the binoculars using an improvised stand to support the binoculars and screen.

# Binoculars can be used to project the Sun's image

Most telescopes can be adapted for observing the Sun 'SAFELY'

There are two ways to observe the Sun safely these are to project an image of the Sun on to a screen or to use a special Solar Filter.

The image above shows a pair of astronomical binoculars mounted on a photographic tripod.

These binoculars have a built in mounting thread so they can be easily mounted on the tripod.

Ordinary binoculars don't have this facility so another means of attaching supporting them must be found.

This can be achieved quite easily be done using elastic 'bungee' straps and sticky tape.

A small set of steps or a stool can be used to support the binoculars.

# Binocular Mount and Tripod attachment

The image above shows the binocular mount supplied with the astronomical binocular.

Also the ‘quick release’ camera mounting plate used to attach a camera to the tripod.

So the binocular mount is attached to the camera mounting plate.

Then the mounting assembly is attached to the binocular and attached to the tripod.

As shown in the pictures.

# My binoculars mounted on a tripod

This picture shows the astronomical binocular attached to the tripod using the binocular mount and camera mounting plate.

In the image the binocular lenses are covered by the dust caps for safety while setting up.

A cardboard mask can be fitted over the lens to be used to reduce the intensity of the sunlight.

This will help protect the lenses from overheating and potential damage.

The white cardboard screen will need to be supported some how behind the binocular perhaps using a chair.

The image of the Sun will be quite small so the position of the screen can be move to produce a larger image.

After refocusing the binocular any sunspots should be visible on the screen.

Further improvements can be made by fitting a box around the screen to provide shade around the projection.

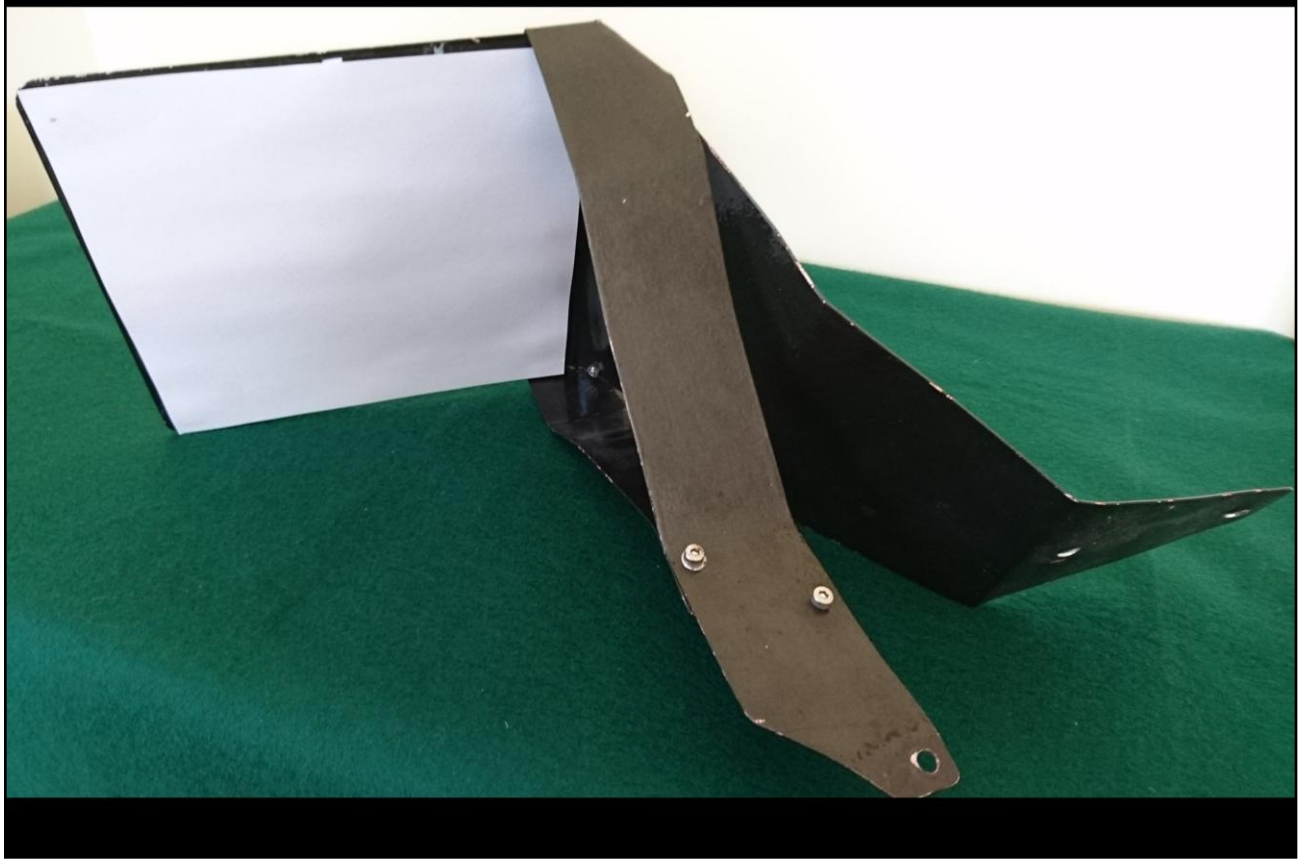

Most telescopes can be adapted for observing the Sun ‘SAFELY’.

There are two ways to observe the Sun safely these are to project an image of the Sun on to a screen or to use a special Solar Filter.

The image above shows a simple basic refracting telescope used and adapted by Steve Harris for Solar Observation.

The following slides show how both methods have been used on the same telescope.

# My home made projection screen support



A simple rig can be assembled to support a screen can be made from and piece of white card.

A ‘matt’ rather than ‘glossy’ card is better.

It is best if a simple rig is constructed to attach it to a telescope. Its design must be adapted to fit the telescope to be used.

The example telescope has two camera thread holes on the telescope mounting cradle and a smaller threaded hole for the focus lock screw.

Aluminium sheet was shaped to utilise these holes and to provide support for the screen.

It was shaped to allow the image of the Sun to be projected on to a screen from the eyepiece.

The picture above shows the homemade rig that was fitted to the refracting telescope.

# The projection screen support mounted

The screen support was secured to the screw threads on the telescope cradle and the focuser lock screw.

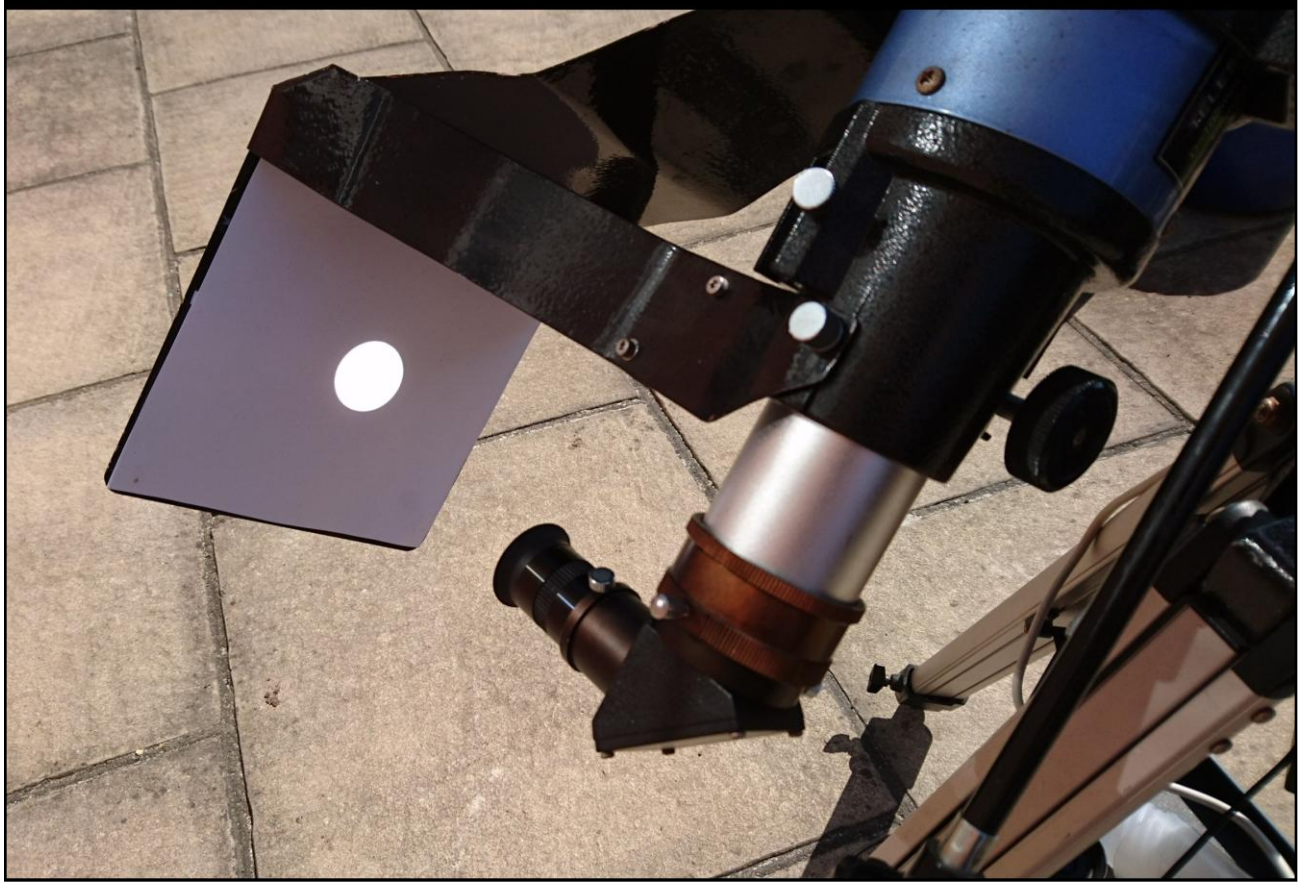
The image above shows how the screen support was attached to the telescope.

## The projection screen support fitted

The focuser was rotated to project the image of the Sun on to the screen.

It is necessary to focus the image to produce a sharp image on the screen.

# The Sun using 25mm eyepiece (500÷25= 20x)



It is best to use a cheap or spare eyepiece as there is a risk that the heat from the Sun might crack the lens.

There will probably be too much light so the Dust Cover can be fitted over the lens of the telescope and the small light reducing cap removed.

This will reduce the glare on the screen and help protect the eyepiece from overheating and damage.

The image above was produced using a 25mm eyepiece that produced a small but bright image of the Sun.

Replacing the eyepiece with a 10mm will give a larger and less bright image.

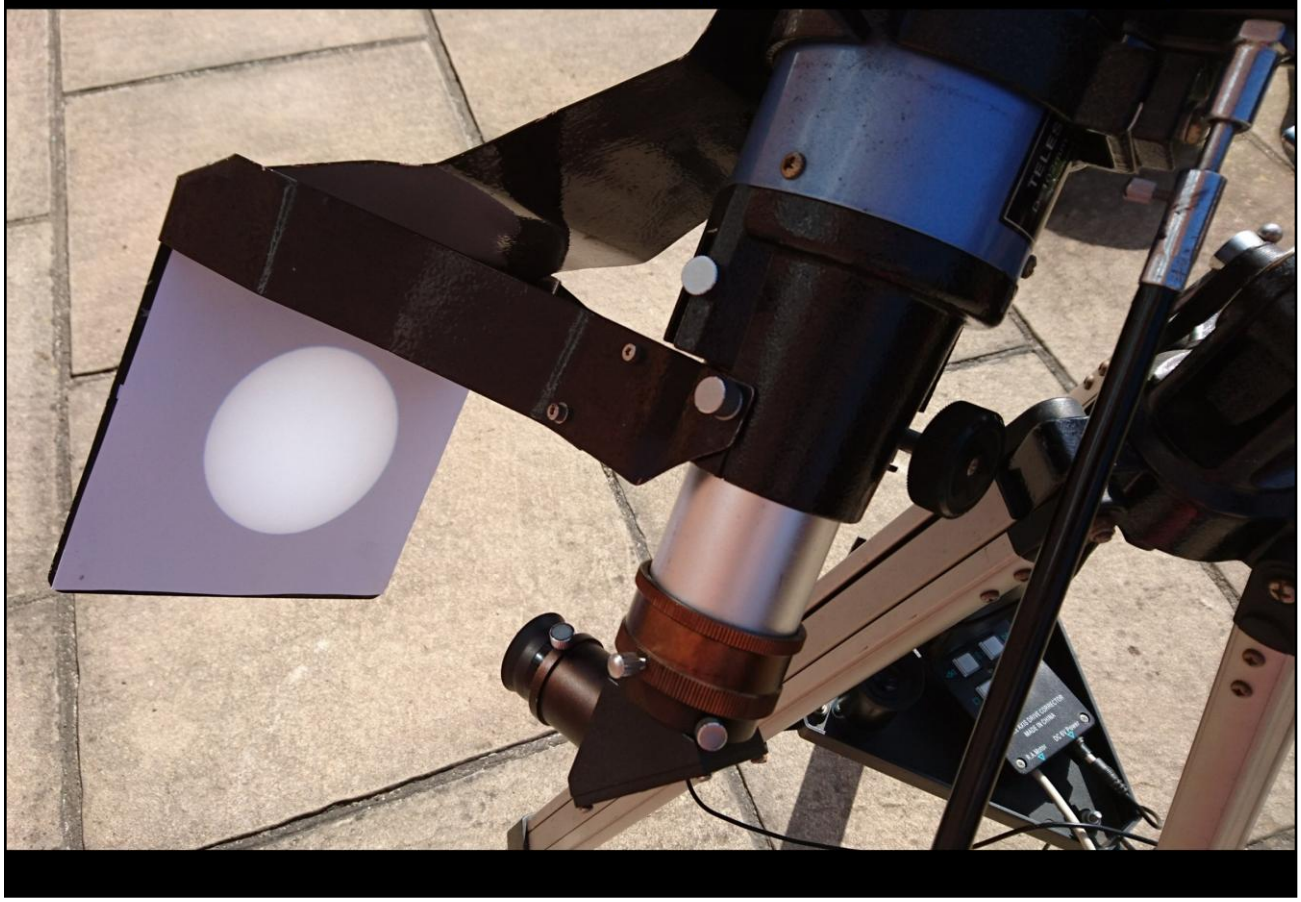
# The Dust Cap and light reducing removable cap

If there is too much light so the Dust Cover can be fitted over the lens of the telescope and the small light reducing cap removed.

This will restrict the amount of light entering the telescope to reduce the glare on the screen and help protect the eyepiece from overheating damage.

The image above shows the telescope Dust Cap and the removable smaller central cap.

## The Sun using 10mm eyepiece (500÷10 = 50x)



The image above was produced using a 10mm eyepiece that produced a larger image of the Sun.

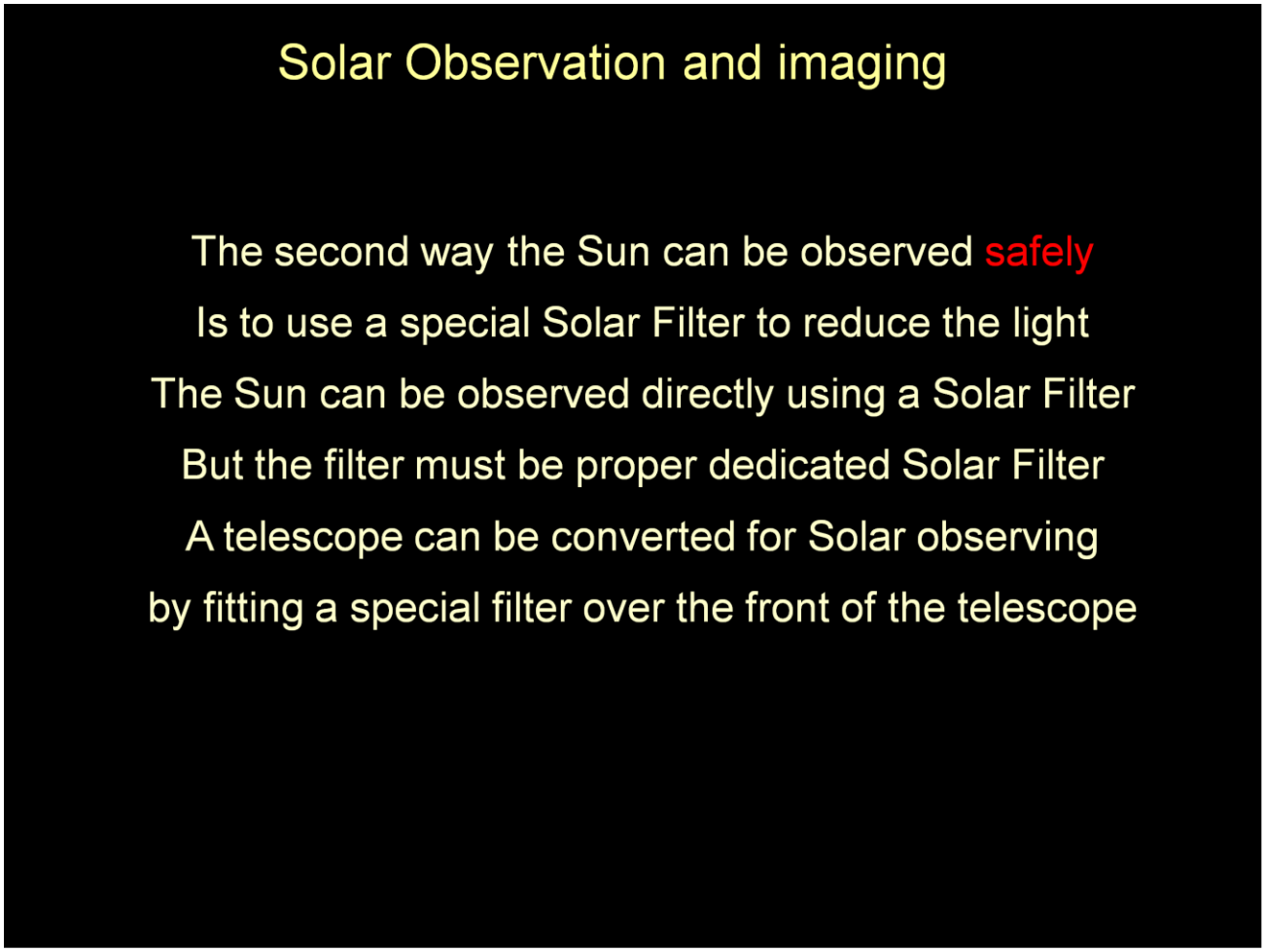
Using a 25mm eyepiece with the 500mm focal length telescope results in a magnification ratio of 500 ÷ 25 = 20 times.

Using a 10mm eyepiece with the 500mm focal length telescope results in a magnification ratio of 500 ÷ 10 = 50 times.

The image above shows the larger image of the Sun but there are no Sunspots to see.

# The Sun close up at using 50x

This is a closer image of the Sun.




Observing the Sun directly through the telescope will produce a much better view.

But a special Solar Filter must be fitted over the end of the telescope to vastly reduce the luminosity of the Sun.

A filter that fits over the front of the telescope must be used any filter that fits inside the telescope must be avoided at all cost.

# Solar Filters for the telescope


There are three types of filter that can be used to observe the Sun.

1 A specially coated glass filter that fits over the open end of the telescope.

2 The glass filters are expensive so a special Milar (plastic) film filter can be manufactured or bought.

3 A very special red filter called a Hydrogen Alpha Filter (H$\alpha$) can be used but these are very expensive.

The Hydrogen Alpha Filter type filters will be discussed elsewhere n a separate presentation.

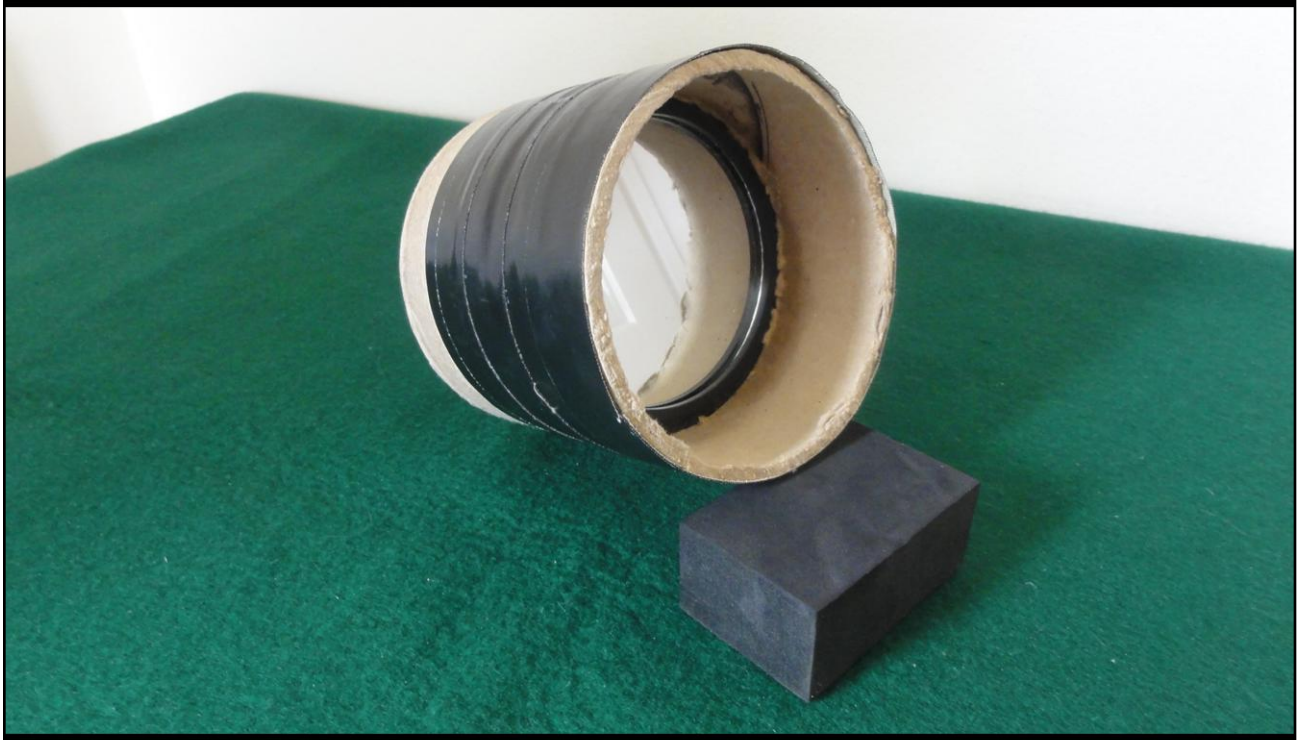
# My telescope converted for Solar Observing


The image above shows the Skywatcher telescope with a solar filter fitted.

Some other changes to improve solar observation have also been incorporated.

These additions will now be explained in detail.

# My Solar Filter



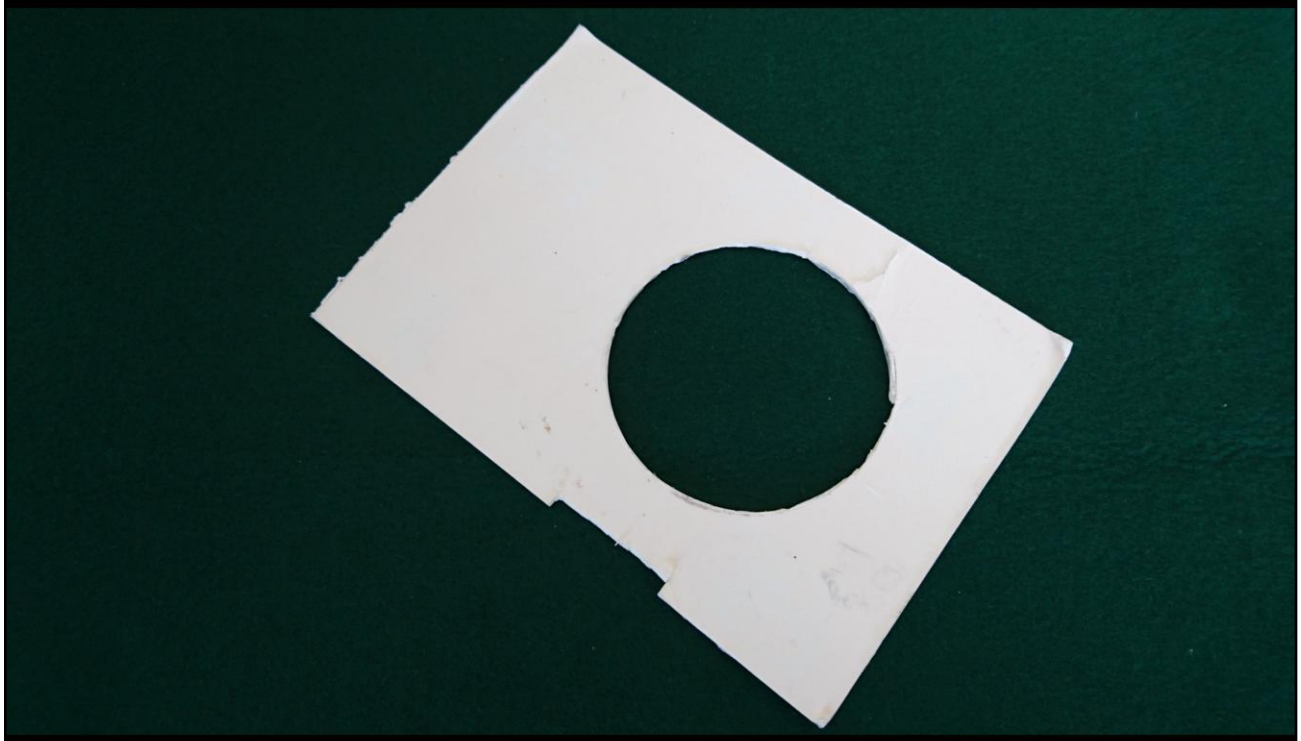
A Meade ETX90 glass filter in a cardboard tube

The Solar Filter shown above is the one used in the solar telescope shown above.

The glass solar filter is a special filter supplied by Meade for use with a Meade ETX90 telescope.

It is usually screwed into a special thread on the ETX90 but has been mounted into a cardboard tube to fit into the Dew Shield of the telescope.

# The Sun Shield



This is a cardboard shield fitted to the telescope tube

The Sun Shield shown above is the one used on the solar telescope shown above.

The Shield was cut from a sheet of white cardboard.

It is fitted to the telescope and held in place by the Dew Shield of the telescope.

This provides shade from the Sun when using the telescope at the eyepiece.

# My ‘hand made’ Solar Finder


Front screen with pin hole and back screen a white card

A special Solar Finder has been made and fitted to the telescope to help locate the Sun.

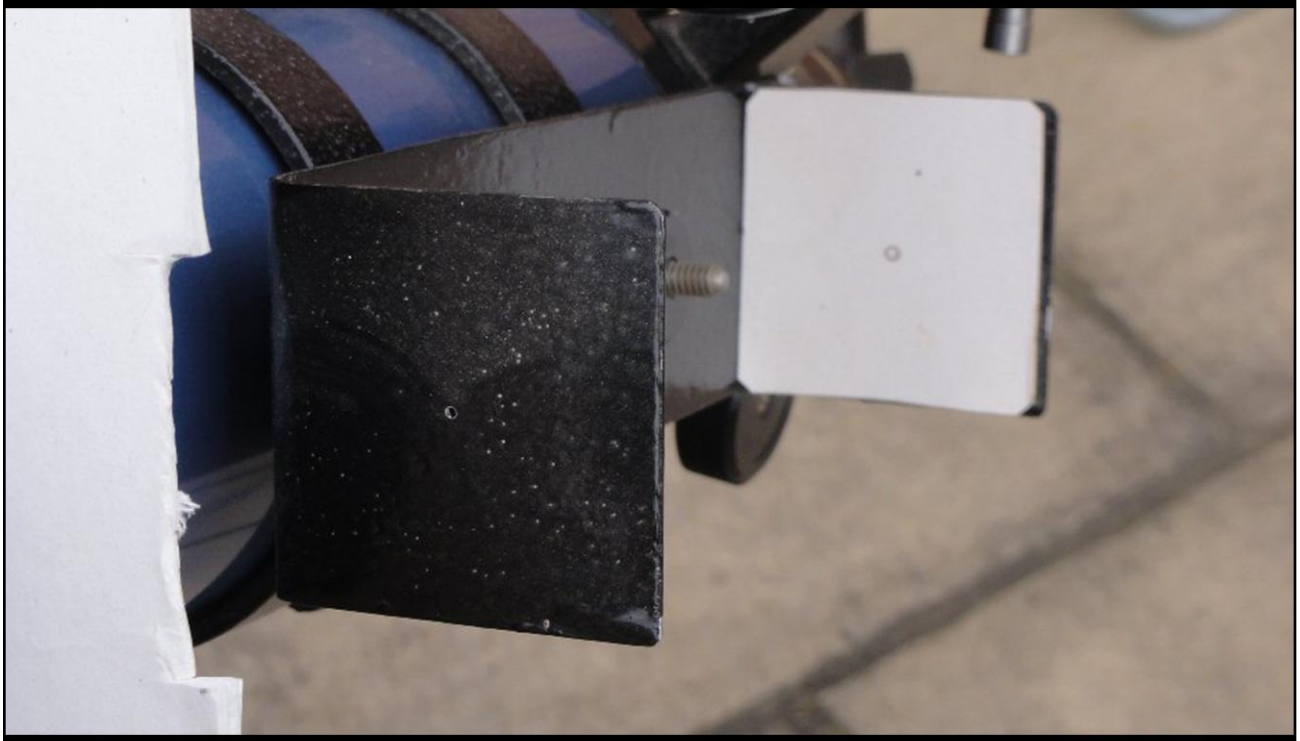
This is done by projecting the light of the Sun through a pinhole in the front (black) screen on to the white rear screen.

A spot of sunlight can be seen on the white screen.

The Sun can then be centred ready for observing with the telescope.

The Finder Telescope would normally be removed for open public viewing events.

## The front screen with 1.6mm hole



The image screen has a small circle

This is a close up view showing the pinhole in the front (black) screen.

The telescope is adjusted until the spot of sunlight is located in the small circle drawn on the white screen.

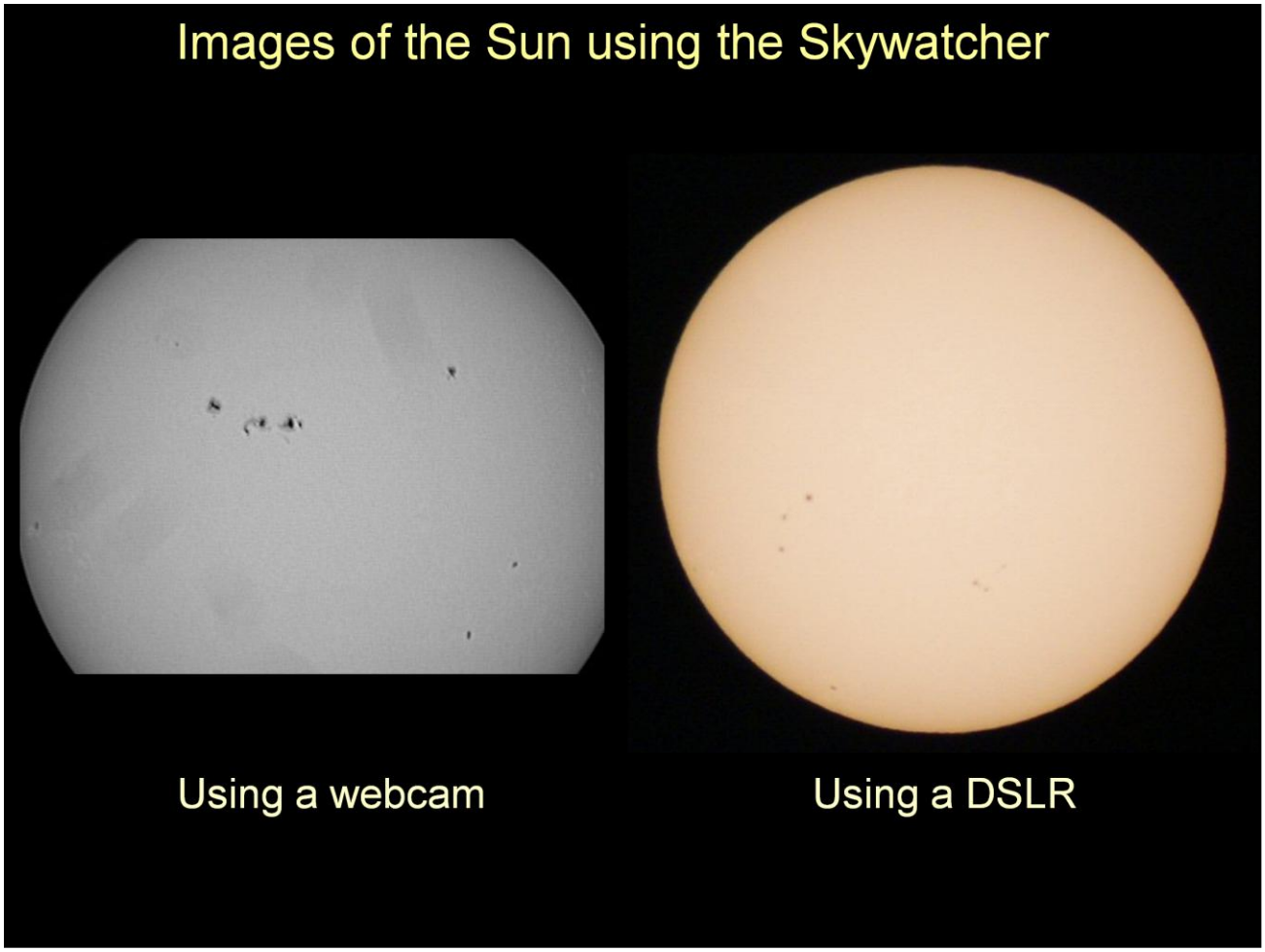
The Sun will then be in the centre of view and ready for observing through the telescope.

It is best to start observing using a low power eyepiece (~25mm).

A higher power eyepiece can then be used to obtain a closer view (~10mm).

If there are sunspots and the image is steady then a Barlow Lens can be used for even higher magnification.

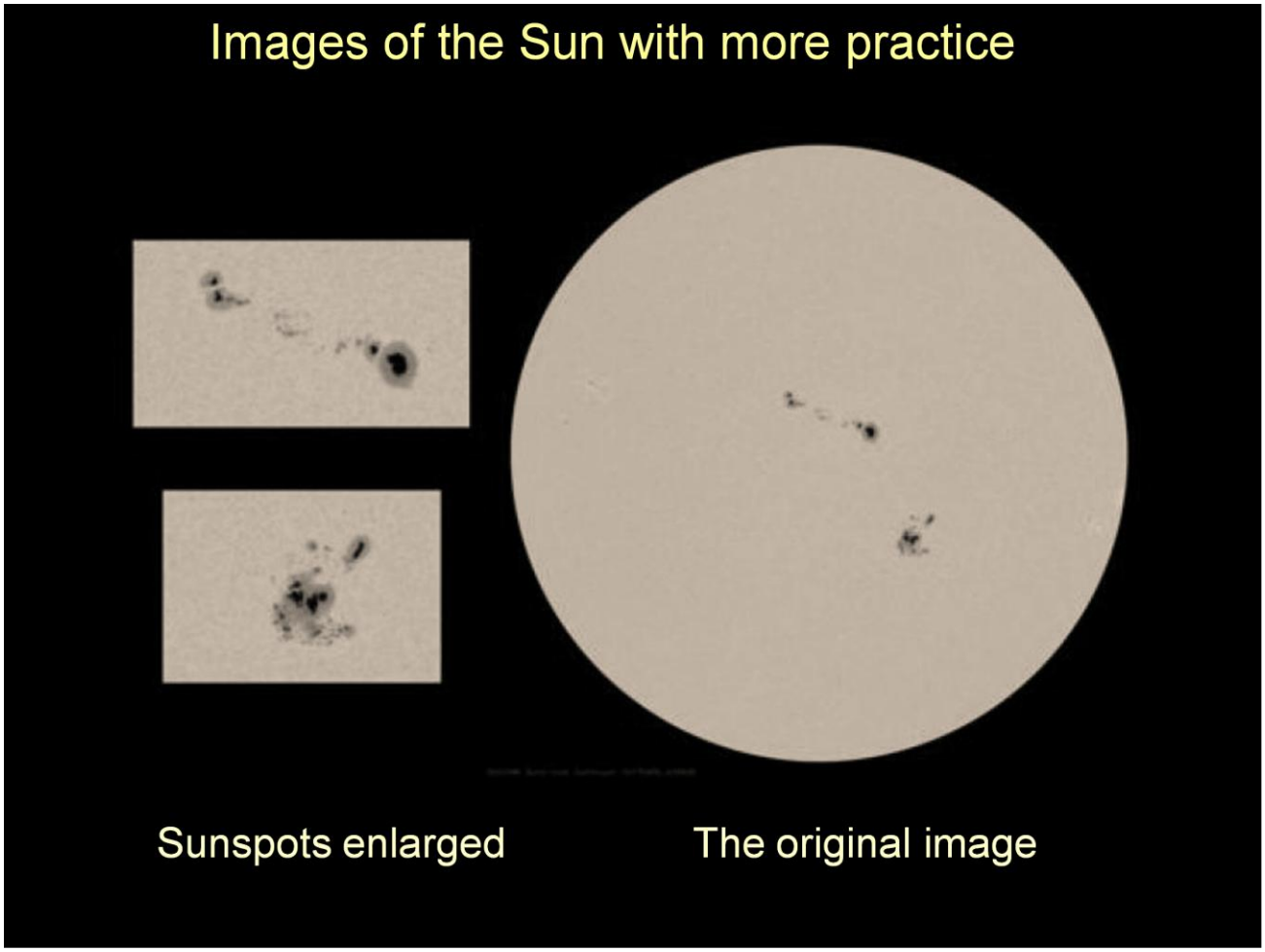
On a really good day quite a lot of detail can be seen using this simple set up.




Here are two images of the Sun taken with the Skywatcher telescope.

The left image was taken using a webcam type camera.

The right image was taken using a DSLR mounted in place of the eyepiece.




With more practice really good images can be produced using similar equipment.

## Advantages of using a Projection Screen

It is cheap and easy to make

It is easy to use

A group of people can see the image

The image can be magnified using different eyepieces

The Sun's image can be photographed using a camera

## Disadvantages of using a Projection Screen

The image is not so clear

It may damage the eyepiece

There is a chance of burning someone's skin

## Advantages of using a Solar Filter

The Solar Filter gives a true view of the Sun

It gives the same colours as the naked eye

The image is clearer than the projected image

The image can be magnified using a Barlow Lens

The Sun can be imaged directly using a DSLR or webcam

The observer can be seated and more comfortable

## Disadvantages of using a Solar Filter

The glass type filter can be a bit expensive

Only one person can look at the Sun at a time

This presentation is available

(with notation) on the:

Beginner's Website naasbeginners.co.uk