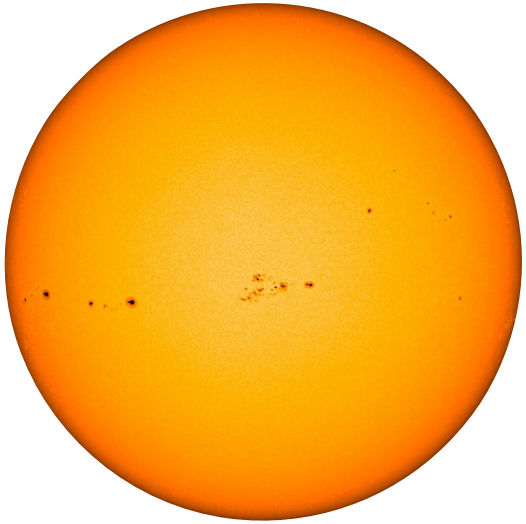
Solar Observing in Schools

Basic solar observations and photography



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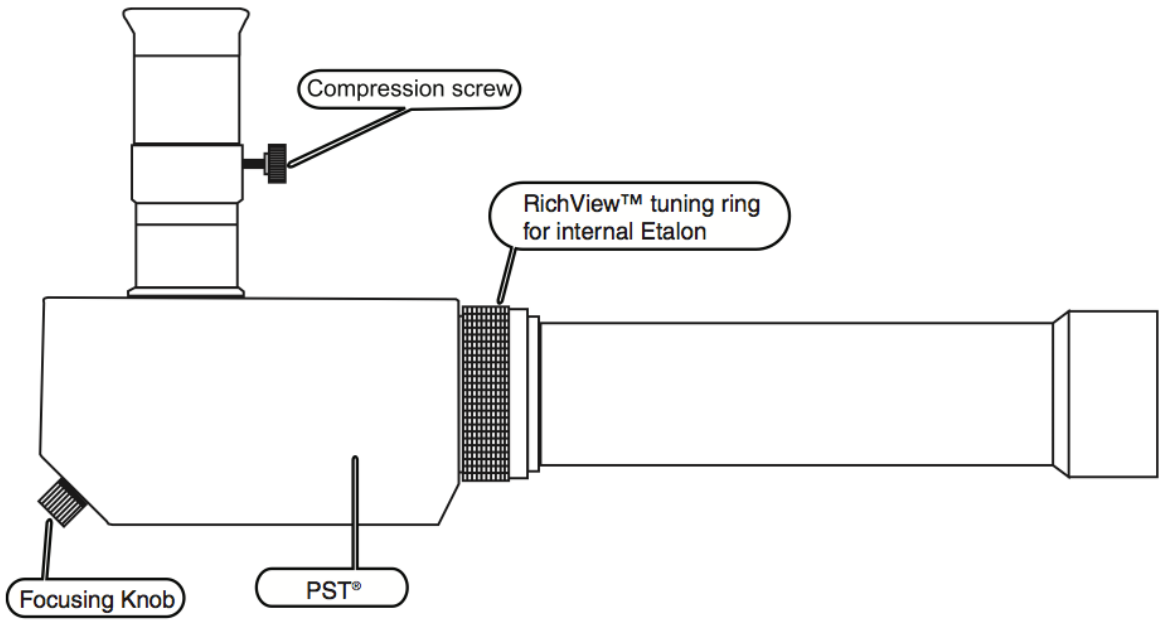
Observing the Sun

- First choose a good spot to view the Sun, clear of obstructions blocking your view (trees, buildings etc). If it is particularly cold outside it is possible to use the Coronado PST through a window, though best results will be achieved from outside.

- Set up the telescope mount and telescope as shown by the instructor.

- Ensure that the eyepiece is firmly attached, by turning the compression screw (see diagram below), though be careful not to over-tighten.



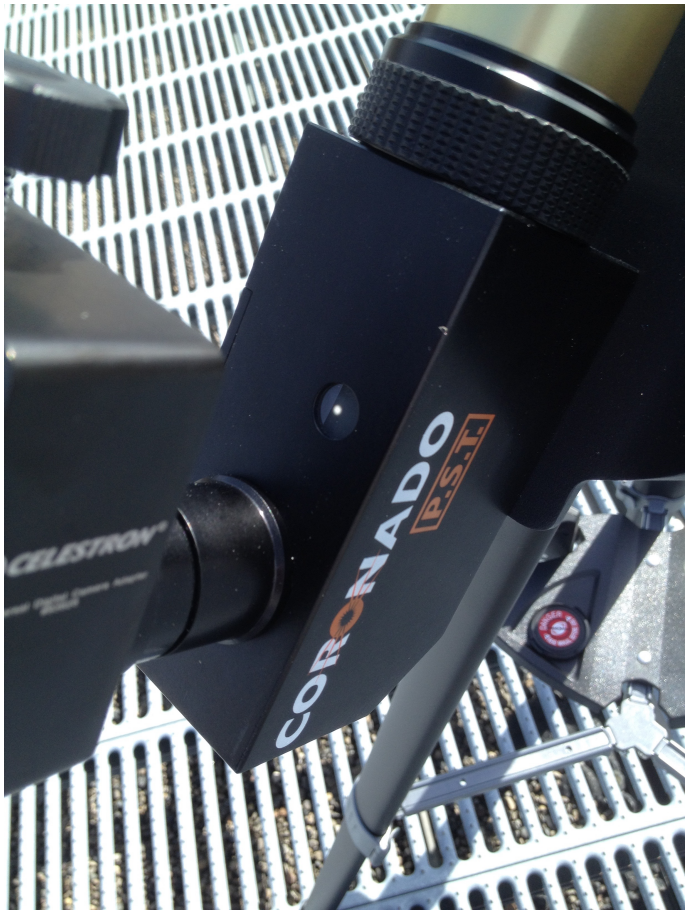
Pointing the PST at the Sun

- The PST is designed with an internal Sun spotting device. There is a small pinhole on the front face of the PST body and a small opaque window on the top, near the eyepiece holder.

- When properly aligned on the Sun, the pinhole will let in light that will be projected onto the opaque glass in the form of a small harmless ball (see image). It is NOT necessary to put your eye up to the opaque glass.

- Best alignment will be found when this ball of light is near the center (but not always dead center).

- Move the telescope to point at the Sun, and use the spotting device to align precisely with the Sun. *Tip:* when setting your telescope on the ground, you can align it approximately using shadows



A small white spot appears on the glass when properly aligned

Viewing the Sun

- If properly aligned, when you look in the eyepiece you should see a deep red Sun (the color of Hα) filling most of the view. If it is slightly off-center, adjust the telescope pointing slightly to center the image.

- Remember you can change the speed at which the telescope slews by pressing the numbers of the Autostar handset. Number 5 or 6 are probably slow enough (but not too slow!) for careful adjustment

- Note that the Sun moves in the sky throughout the day, and the Sun will drift out of view within a few minutes, so frequent small adjustments to the pointing are necessary, unless you set the telescope up to track the Sun

- The image can be **focused** using the focusing knob on the bottom of the PST (see the figure on page 6). Twist the focusing knob slowly until the edge of the solar disk appears sharp.

- Be aware that it can take a little while to get used to looking at the Hα view of the Sun. If you can't instantly see features on the Sun's surface make small adjustments to the focus.

- Gently and slowing turning the **tuning ring** (see figure on page 2), allows different features to appear/disappear. Some positions are better for prominences, others for sunspots. If you cannot see any features, please ask the instructor for help.

Recording your observations

- You should hopefully be able to see some **sunspots** on the Sun's disk. Make a sketch of what you see (to scale). Estimate the size of the biggest sunspot as a fraction of the Sun's diameter.
- Look at the edge of the Sun's disk. Can you see any **prominences** jutting out from the Sun? If so, add them to your sketch.
- Can you see any **other features** (filaments, plages)? If so, add them to your sketch.

Taking a picture of the Sun

To start taking pictures of the Sun, attach the digital camera to the Celestron Digital Adaptor, and then gently fit the adaptor to the eyepiece

Tips for solar photography

- It can be tricky, but with a small amount of patience you can get great photos
- Do not put the camera lens touching the eyepiece. The eyepiece is designed for the image to be in focus for your eye. This means you need to camera to be a small distance (less than a couple of cm) away from the eyepiece. You will need to experiment to get this distance right. If you get it slightly wrong the picture you take will be out of focus.
- Take lots of photos - you can delete the bad ones
- If you see lots of features (sunspots, prominences) when looking with your eye, and none in your pictures, you are probably out of focus - adjust the distance of the camera from the eyepiece
- Use the fine adjustments on the adaptor to center the image in your picture. You may also need to move the telescope slightly to help better center the Sun.
- Setting the camera's focus to infinity (see next page) prevents it from trying to focus on any reflections on the eyepiece
- The Sun almost fills the eyepieces field of view, and so sometimes all of the Sun is not in focus
- You can adjust the exposure time (see next page) - making it shorter prevents it from being overexposed

Adjusting the settings on the Canon Powershot ELPH 135

- Deactivate the flash

Press the <▶> button several times until [⚡] is displayed.

- To change other settings, you need to change to [P] mode: Press the <▲> button several times until [P] is displayed

- Setting the focus to infinity

Press the <FUNC. SET> button, choose [▲] in the menu, and then choose the [▲] option

Once the setting is complete, [▲] is displayed.

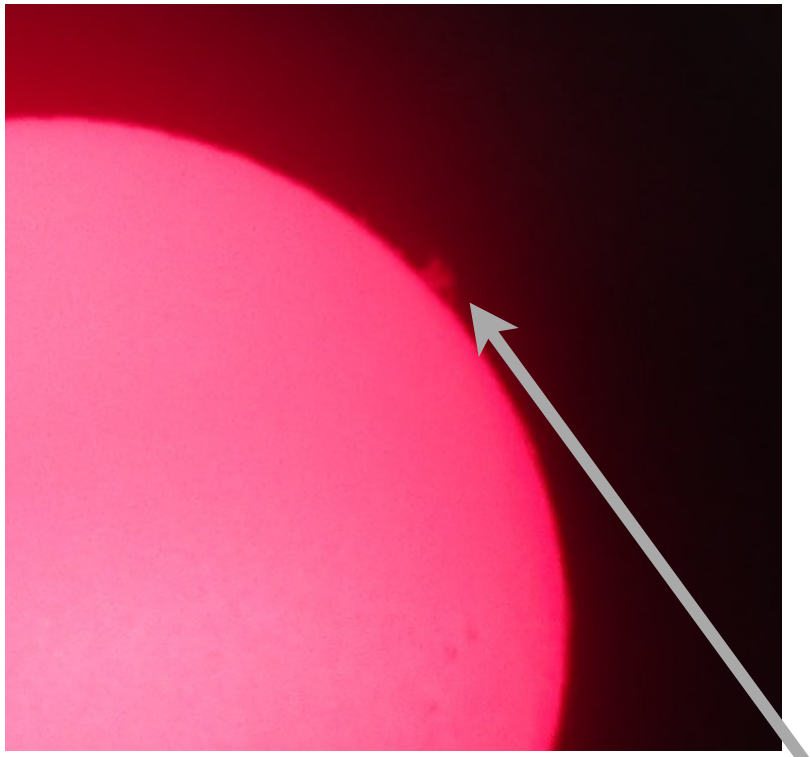
- Exposure compensation

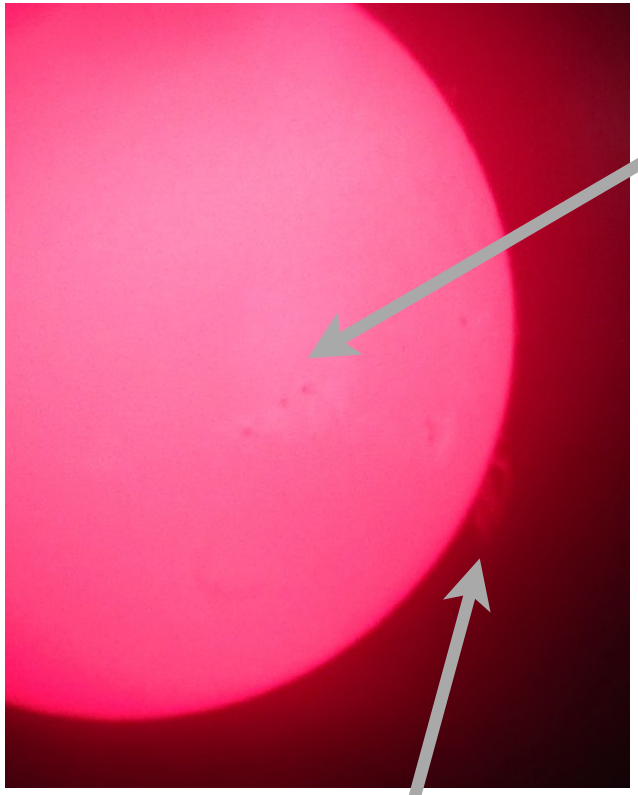
Press the <FUNC. SET> button and choose [±0] in the menu. As you watch the screen, press the <▲><▼> buttons to adjust brightness

- There are many other settings you can explore - see the manual, available online from Canon: http://www.usa.canon.com/cusa/consumer/products/cameras/digital_cameras/powershot_elph_135

Some example pictures

Cropped to show features





Small sunspots

Prominences

Pictures with a smartphone

While smartphones cannot be attached to this mount, it can be used to steady your smartphone while taking pictures. It is possible to get good photos with a smartphone. I took the picture to the right with a Coronado PST and an iPhone 4S on October 23, 2014.

Images can be easily washed out (overexposed), or not well focused (because of the phone's auto-focus) - play around with your phone camera's settings to change these things

Estimating the size of sunspots

- Based on your observations, write down your estimate for the size of the largest sunspot as a fraction of the Sun's diameter below.

  Size of sunspot as a fraction of the Sun's diameter = _____

- The Sun's diameter is 1,391,000 km. Multiply your fraction above by this number to get an estimate for the size of the sunspot:

  Size of sunspot in km = fraction $\times$ 1,391,000 = _____ km

- How big is this compared to the size of the **Earth**? Divide the size of the sunspot in km by the Earth's diameter (12,742 km).

  The sunspot size as a fraction of the Earth's diameter is: _____

The dynamic Sun

- The Sun changes daily as it rotates
- Prominences on the Sun change on timescales of days
- Observe the Sun and take pictures over a period of a week, and see how it changes

Advanced solar photography

- Single images can be greatly improved through image processing (e.g. Photoshop), and adjusting contrast etc.
- When looking through the eyepiece and turning the tuning ring slowly, you can see that it brings out different features.
- A single picture cannot capture everything
- One technique is to take many photos and stack them together
- Take a series of photos, stepping the tuning ring from one extreme through to the other
- You can also try changing the exposure time
- Use software to align and stack the images (e.g. Registax)
- This can be a very detailed process….see some of the references

Advanced solar photography: some good references

http://www.skyandtelescope.com/astronomy-equipment/capture-the-sun-with-your-pst/

http://www.photosbykev.com/wordpress/photography/pst-solar-imaging/

http://theonlinephotographer.typepad.com/the_online_photographer/2009/11/i-kan-haz-prominenzes.html