

Update on the Hale/Cook Spectroheliograph at Stellafane Accomplishments during 2025

Several years ago, the *Springfield Telescope Makers (STM)* at Stellafane acquired a Hale spectrohelioscope (SHS; originally owned by Gustavus W. Cook; donated to the University of Pennsylvania upon Cook's passing; acquired by *STM* member Matt Considine who donated it to Stellafane). The purpose of a SHS is to allow the observer to safely view the Sun in any desired color of the visible spectrum, before modern solar filters were invented. Though the instrument can view the Sun in any color of the spectrum, it is most often used at the H-alpha wavelength (6,563 Angstroms; red) since that is the wavelength where much of the solar activity can most be easily viewed.

The *STMs* have spent the time since acquiring the SHS on refurbishing its intricate mechanisms, manufacturing replacements for some missing parts, building an observatory to house the apparatus, installing it and learning how its many, subtle adjustments can affect its operation. As of the beginning of 2025, the instrument was in good working order and has been used for many public viewing sessions, including the past few Stellafane Conventions. You can see how a SHS operates in Figure 1.

While the instrument is, in general, working well, there are always improvements that need to be made. A few of the improvements to the instrument that were made in 2025: (1) A light-baffle in the tube, where the image of the Sun enters the building, to reduce scattered light (Figure 3); (2) A baffle to prevent the eyepiece/camera from seeing the collimating mirror (Figure 4 and #5 in Figure 1); (3) A mount for the objective lens with fine adjustments so the image of the Sun can be properly directed to the first slit (Figure 5 and #2 in Figure 1), (4) A Wi-fi transmitter inside of the building to support real-time viewing of images of the Sun provided by satellites and professional observatories.

Another goal for 2025 was to improve the ability of the instrument to take images of the Sun, in addition to visual observing. This is accomplished by removing the prisms and replacing the eyepiece with a fast-readout, CMOS camera with a large imaging chip (Figure 6). In this configuration, the instrument is referred to as a spectroheliograph (SHG).

In this format, the instrument records the spectrum of the Sun at a single, one-dimensional, position. To make a two-dimensional image of the Sun, the tracking motor is turned off (#1a in Figure 1), letting the rotation of the Earth move the image of the Sun across the entry slit (#4 in Figure 1), while the camera continually records images, saving them into a video file. Specialized post-processing software then later reads this video file and constructs a "strip image" of the Sun. Since the image of the Sun is larger than the entry slit, multiple strips have to be made to cover the entire disk of the Sun. An example of a set of strip-images that cover the entire solar disk can be seen in Figure 7.

Plans for the 2026 observing season include: (1) Continued refinement of the data collection and post-processing software for improved image creation; (2) The installation of a computer and monitor so observers can view real-time images of the Sun provided by satellites and professional observatories; (3) Continuing to mitigate stray-light in the SHS building, etc.

We hope that you will have an opportunity to view the Sun through the SHS at Stellafane during the Stellafane Convention on August 13 to 15, 2026. If you have any questions about the SHS please contact us at: webmaster@Stellafane.org. Clear skies. The *STMs*.

Figure 1

An invention of George Ellery Hale, the **SPECTROHELIOSCOPE** allows the observer to examine an image of the sun in light of any selectable wavelength, from the Hydrogen-Alpha line to the Calcium-K line.

(This simplified diagram is not to scale and all angles are greatly exaggerated.)

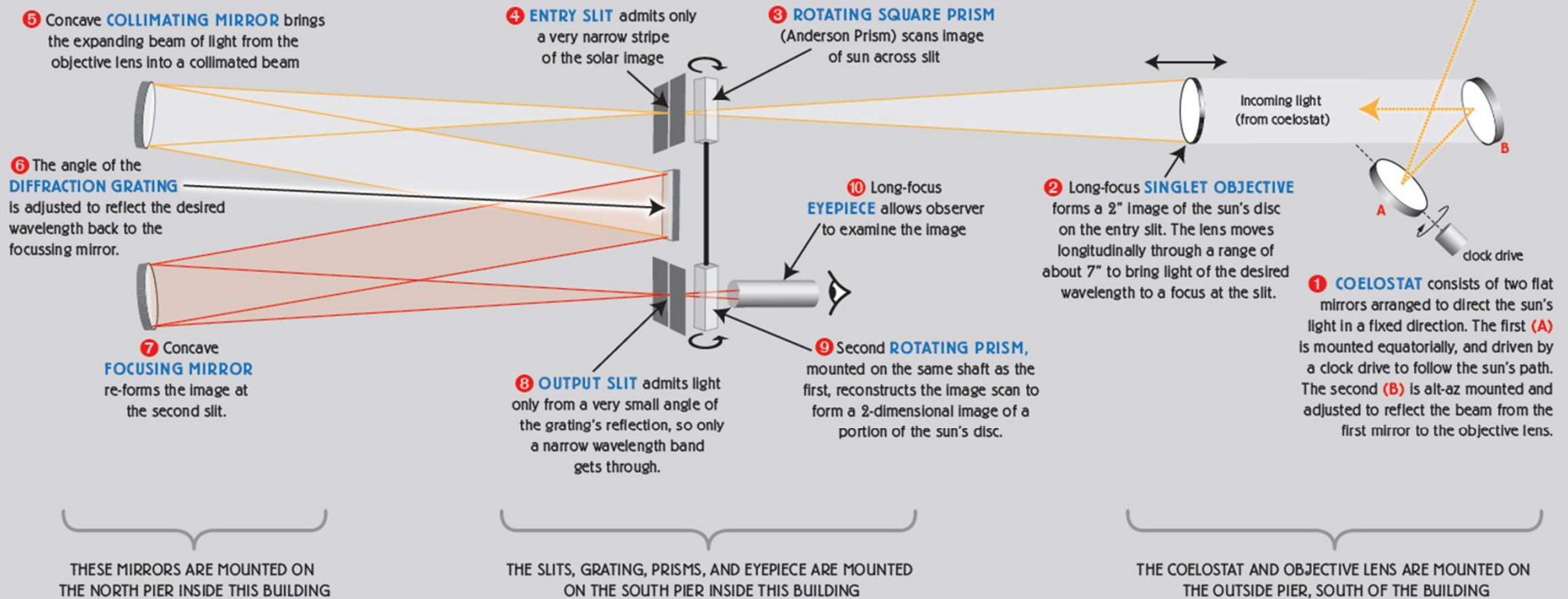


Figure 2: View looking north of the coelostat and objective (foreground) and the SHS building which houses the rest of the instrument (background).



Tube in the south wall through which the solar image enters the building from the coelostat.

Objective (#3 in Figure 1).

Steering flat (#1b in Figure 1).

Tracking flat (#1a in Figure 1).

The yellow arrows show the path of the sunlight, from the Sun (upper right) into the building.

Tube in the south wall through which the solar image enters the building from the coelostat.

Baffle to reduce scattered light.

Figure 3

Figure 4

Baffle to prevent the eyepiece/camera from seeing the collimation mirror (#5 in Figure 1).

Figure 5

Jim Daley; master telescope maker.

Mount for the objective with fine adjustments.

Solar spectrum projected on wall. Only the portion that is reflected by the focusing mirror (#7 in Figure 1) is used to create the solar image.

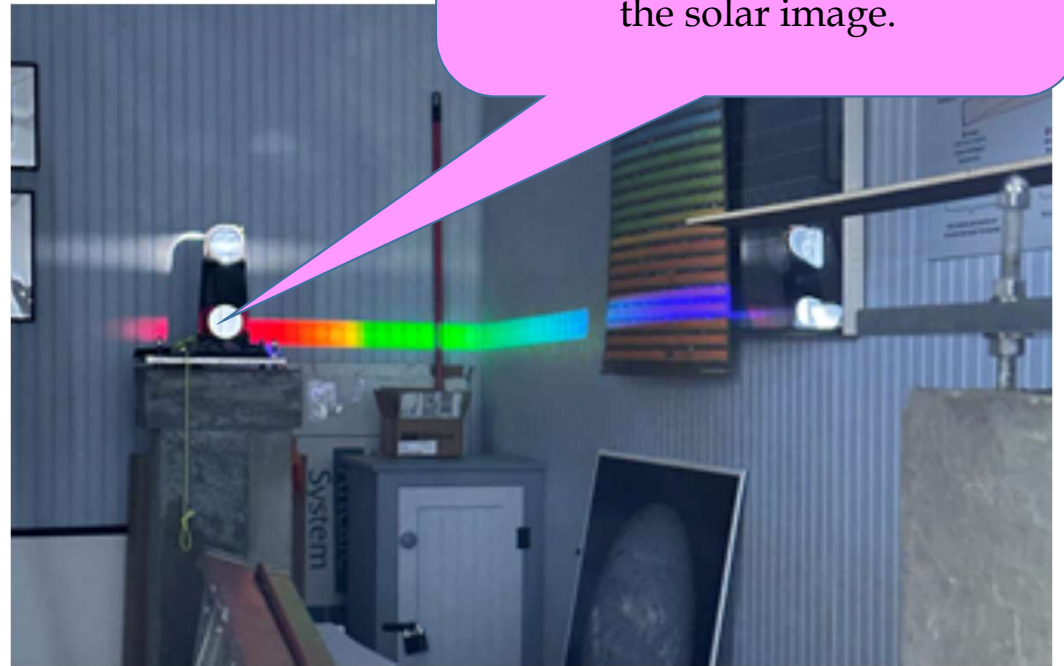
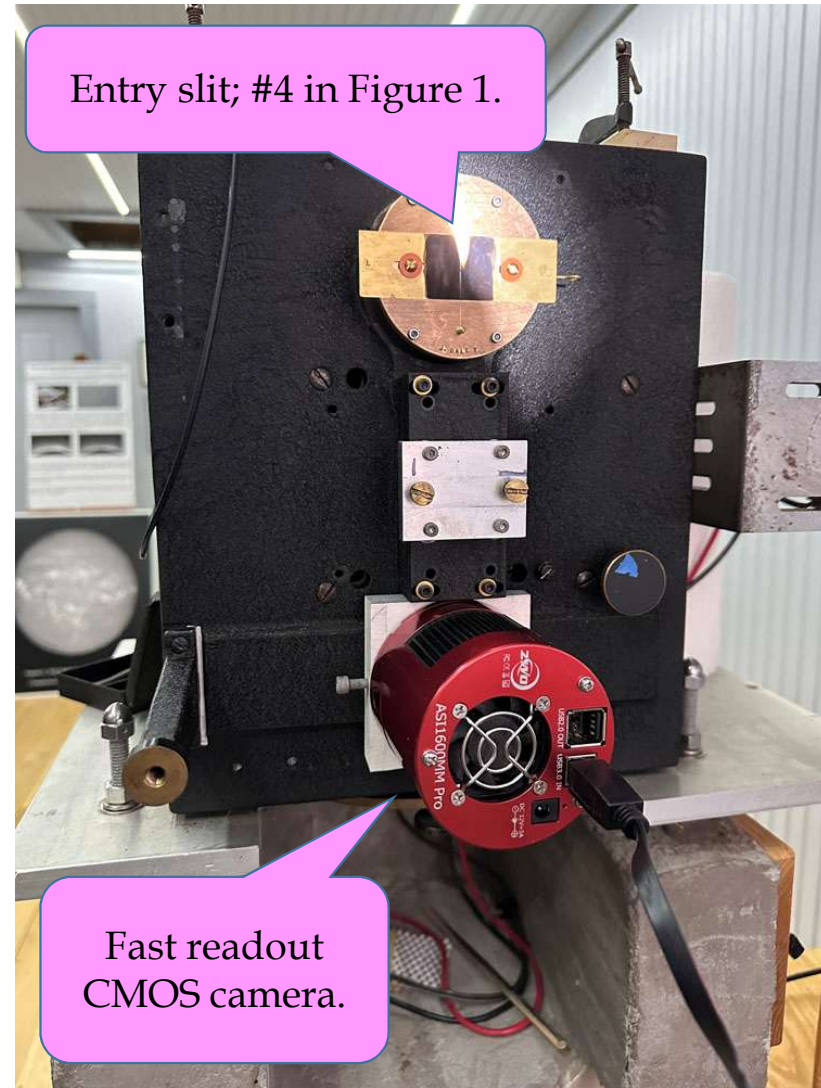
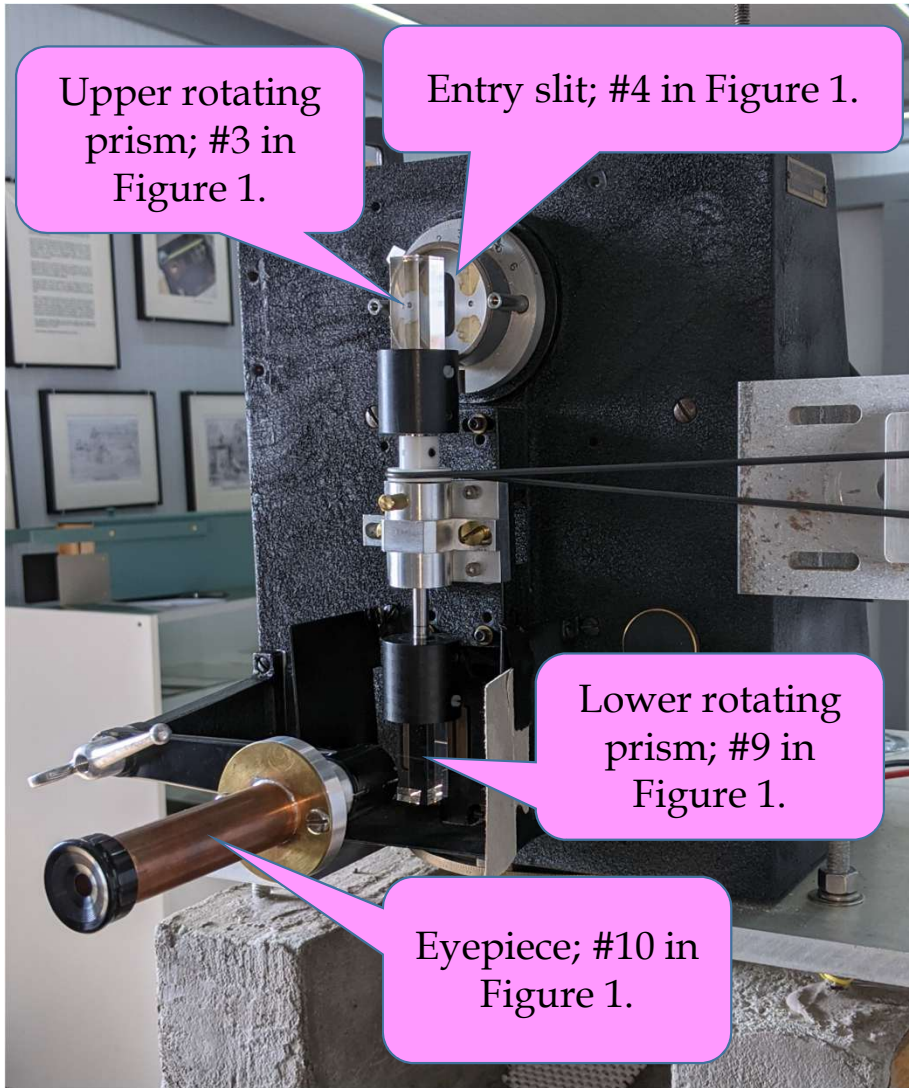


Figure 6



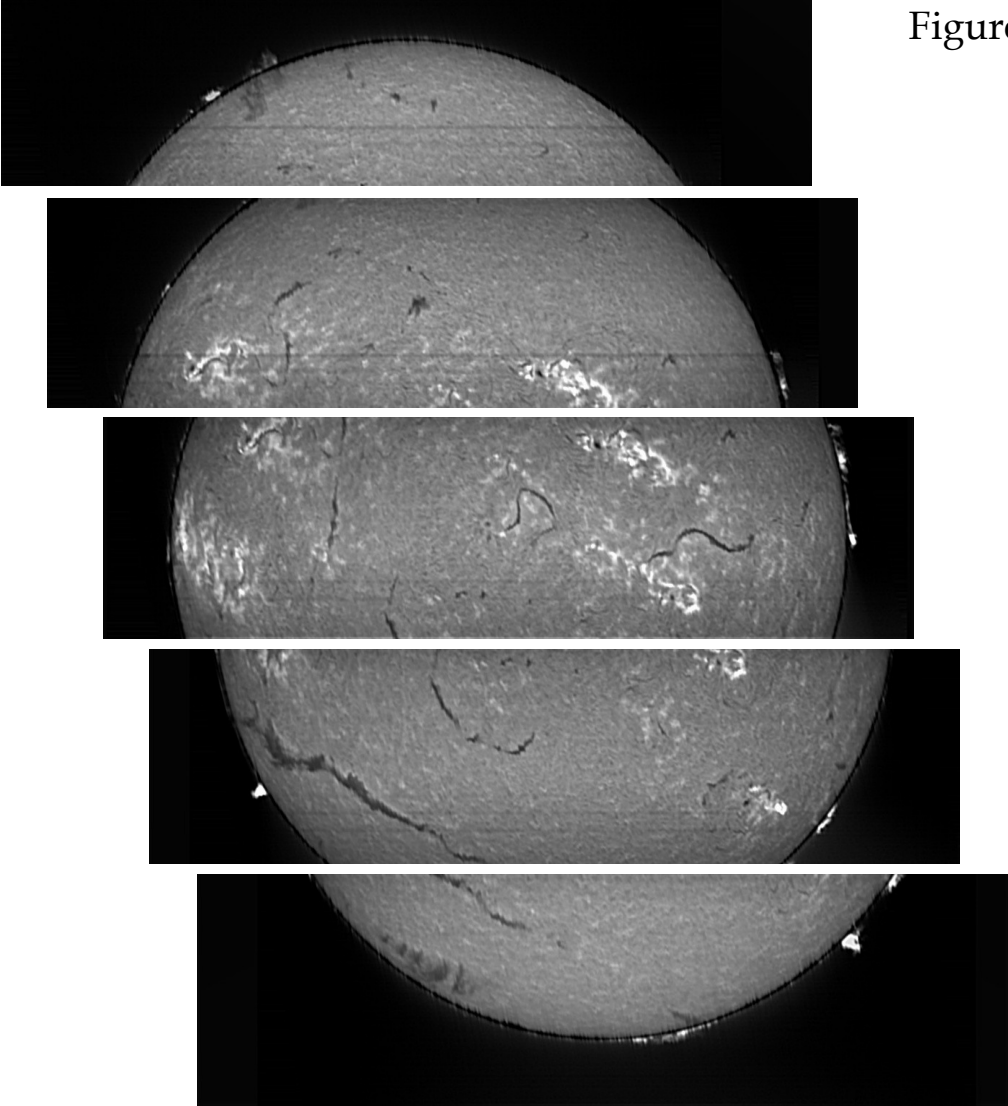
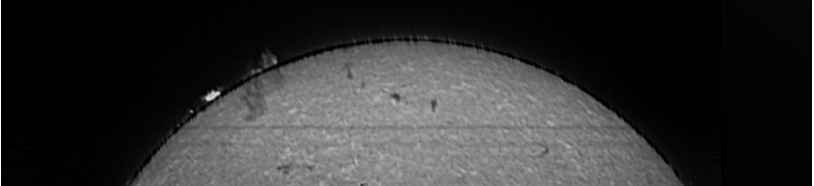


Figure 7: Sample set of strip images of the full solar disk in H-alpha light (6,563 Angstroms).

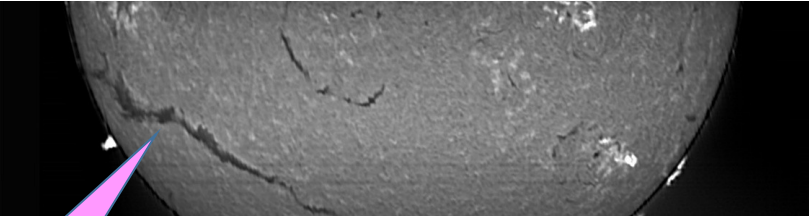
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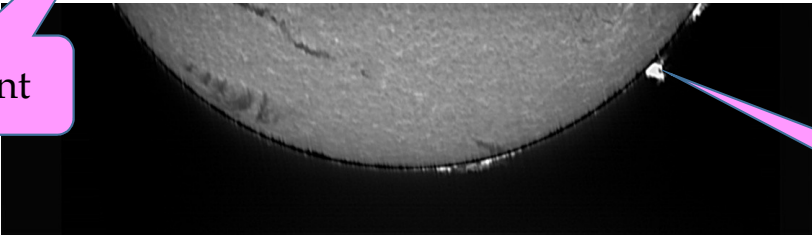
Strips overlap to ensure the capture of the entire solar disk.



Sunspot



Filament



Prominence

Figure 8: Sample set of strip images of the full solar disk in H-alpha light (6,563 Angstroms).

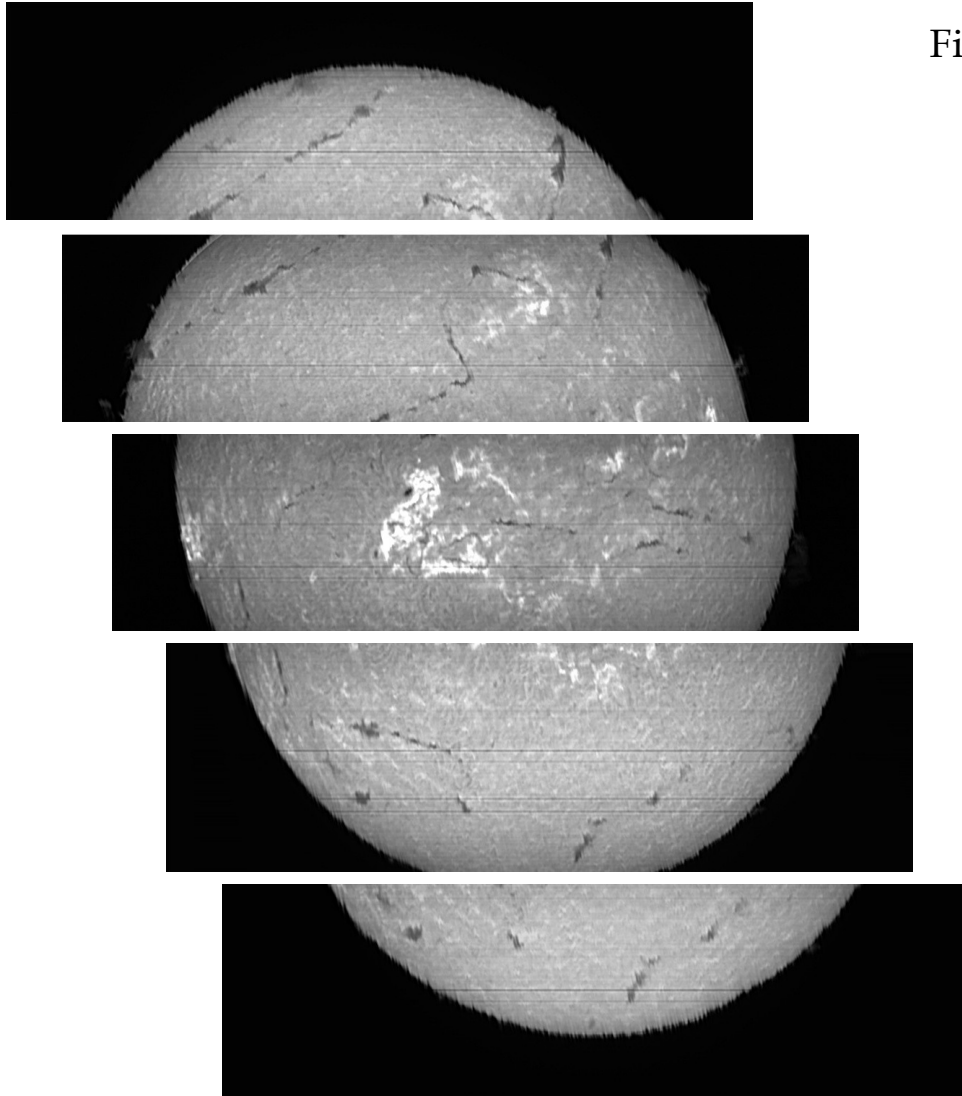
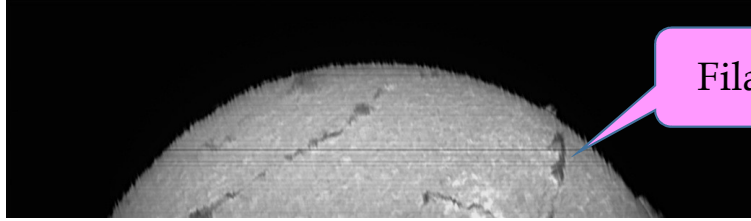
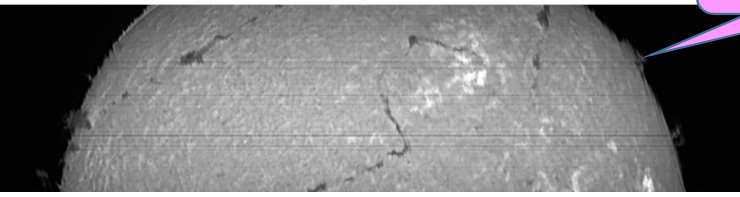


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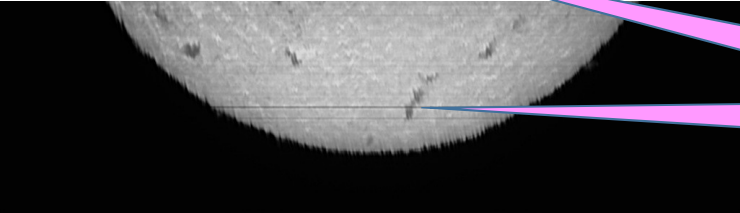
Filament



Prominence



Sunspot



Strips overlap to ensure the capture of the entire solar disk.