



CORONADO®

A Meade Instruments Company

P.S.T.® Personal Solar Telescope

Hydrogen-Alpha Solar Telescope





WARNING!



Looking at the Sun can be very dangerous unless the proper precautions are taken and specialized solar viewing equipment, like Coronado Solar filters and telescopes are used. Never look at the Sun directly with your eyes. When using Coronado filters on a telescope not designed specifically for solar viewing, be sure to block all non-filtered optical components such as viewfinders to prevent the sun's light from passing through. An inadvertent glance through an unfiltered or improperly filtered optical system can cause immediate and permanent damage to the eye. Never allow unattended children to operate or be near a solar telescope system.

Coronado hydrogen-alpha telescopes and filters are designed and tested to provide safe viewing of the Sun. These systems consist of two critical parts: The etalon filter that may be mounted at the front of the telescope or internally inside the telescope tube and the blocking filter that is mounted at the back of the telescope. Both of these components must be properly installed to provide safe solar viewing. Most Coronado blocking filters (BF filters) are installed in a special diagonal that mounts at the rear of the telescope and holds the eyepiece. Do not replace this diagonal with any other diagonal. Without the blocking filter inside the dedicated Coronado diagonal, light from the sun is not fully filtered and looking through the system can result in eye damage even with a quick glance.

READ THIS MANUAL COMPLETELY BEFORE ATTEMPTING TO USE YOUR NEW CORONADO PRODUCT. IT CONTAINS SPECIFIC INSTRUCTIONS REQUIRED FOR THE SAFE USE OF YOUR PRODUCT.

Meade Instruments has night and day covered for the amateur astronomer. Meade is the leader in night time astronomy with the most advanced optical, mechanical and electronic systems for viewing the night sky. With Coronado and the development of the SolarMax, Meade is the clear leader in solar day time observing as well. Whether you are imaging deep sky objects with your Meade astronomical telescope or gazing at our nearest star through a Coronado SolarMax telescope, keep an eye on the Meade team to provide you with the most technologically advanced and innovative product to enhance your enjoyment of astronomy. No matter where, or what time of day your interest in astronomy calls to you, we will be there with you.

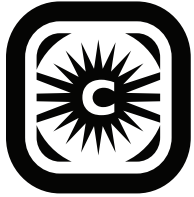
Night and Day, we've got you covered.



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About Coronado®



Coronado® was founded in 1997 by David Lunt and Geraldine Hogan as Coronado Technology Group. David Lunt's 40 plus years experience at the forefront of optical design and innovation translated into patented technology allowing the classical Fabry-Pérot etalon to be constructed in a novel way. Tremendous demand changed the initial concept of producing a few hydrogen-alpha (H- α) telescopes a month for the advanced solar amateur. As word got out that these telescopes and filters produced amazing views of the Sun, Coronado grew rapidly. As demand vastly exceeded the small company's ability to produce, the owners of Coronado decided to sell their operation to a company with the experience in higher volume manufacturing but still had then dedication to quality and detail that Coronado was known for. That company is Meade Instruments.

In June of 2010 Meade Instruments announced the introduction of the revolutionary SolarMax II line of solar observing telescopes and filters. The new SolarMax II was a breakthrough in solar observing with the new RichView™ tuning system. This patented system allows direct tuning of the primary etalon filter. No other commercially available H- α telescope can provide the tuning range and accuracy of the SolarMax II. Observers can now tune for the highest contrast views of active regions, flares, filaments, and other surface detail, or quickly and easily re-tune for prominences on the solar limb.

We continue to maintain the founders philosophy for building filters — Safety, Quality, and Performance. You can be rest assured that your new instrument has been hand assembled and tested before being sealed in the box. In fact, every telescope and filter is field tested on the Sun so we are confident you can look forward to a lifetime of fantastic H- α views of our dynamic Sun. If you have any questions please do not hesitate to contact us.

Filter Safety

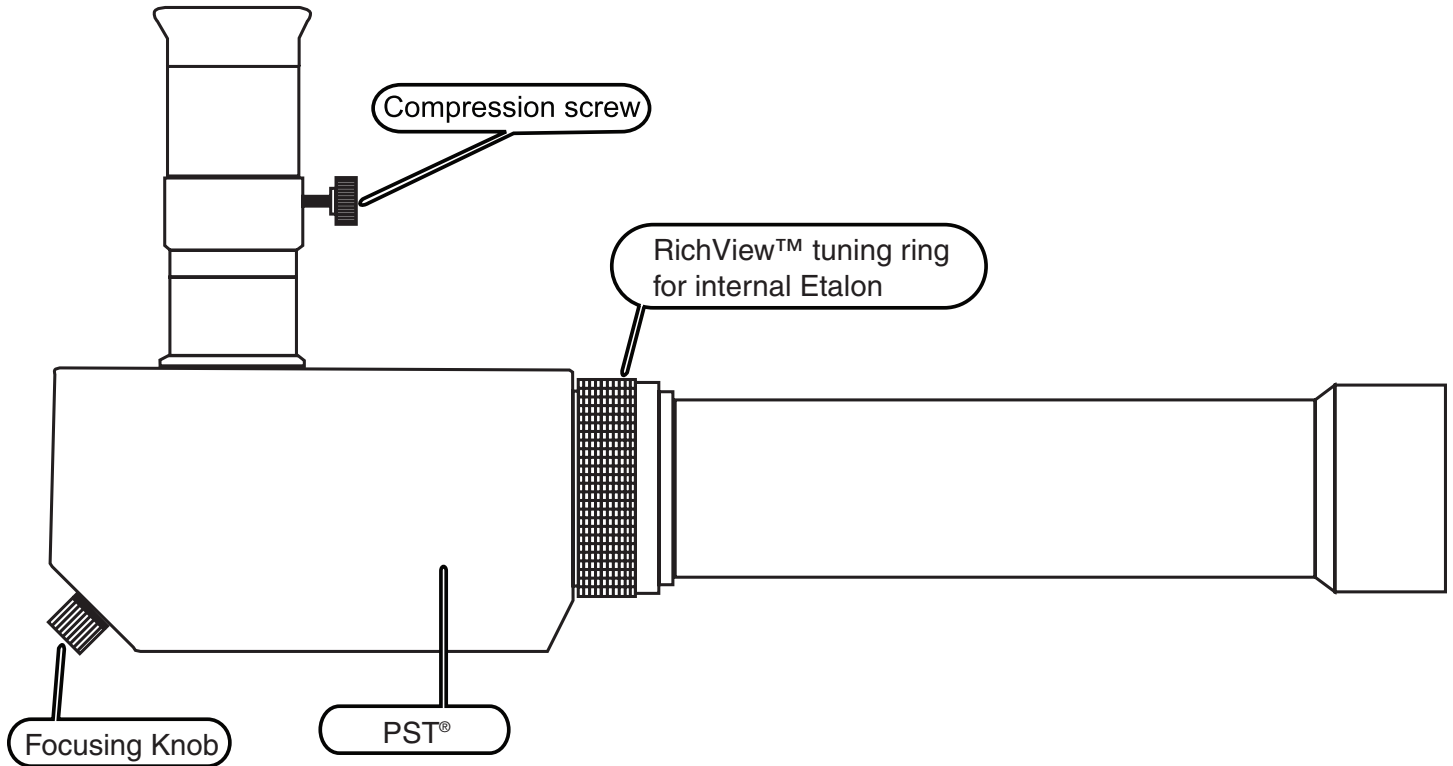


Safety - It is widely known that there are inherent dangers involved with observing the Sun. Meade Instruments has always been, is, and always will be, obsessed with the safety of its products. A proposed new product is not released until it has been fully proven that it can be made completely safe for the user. All Coronado instruments are tested and sealed at our facilities as complete, safe, and working units. Do not attempt to disassemble any Coronado product, doing so will void your warranty and could compromise your safety. Before each use

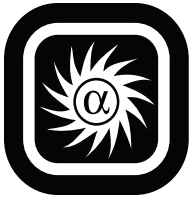
make sure your filter does not appear damaged in any way. If you have any doubts please call our customer support. Meade is obsessed with safety and you should be too.

We recommend you establish a safety checklist for each viewing session, ensuring that all adaptors, filters and blocking filters are installed and secure before aligning the system to the sun. Make this safety check part of your observing routine. Never leave a solar telescope unattended.

An additional safety consideration is exposure to the Sun. Always use sunscreen, and wear a hat and long sleeved shirt while observing.



PST® Personal Solar Telescope



Congratulations on your purchase! Meade Instruments has shipped your Coronado PST dedicated H- α telescope fully assembled and ready for use. Be sure to read the safety and cleaning instructions on

page 13 before using your PST telescope. You can refer to the diagrams below for questions regarding the components of your system. Please read these instructions in full before setting up your new PST telescope and contact customer service if you have any questions.

Mounting

The threads on the bottom of the PST are compatible with any $\frac{1}{4}$ -20 thread. Most standard photographic mounts and mounting hardware can be used to provide a safe, stable, and reliable set up. This is also compatible with piggyback mounting systems.

A vixen-style dovetail rail (#07932) can also be attached to the bottom of the PST using the $\frac{1}{4}$ -20 mounting threads and allows use of the PST on mounts with a vixen-style dovetail receiver.

WARNING!

Do not insert your eyepiece until you have confirmed that the telescope is securely mounted and all filter elements attached and secured.

Finding the Sun

The P.S.T.[™] has been designed with an internal Sol Ranger[™] Sun spotting device. There is a small pinhole on the front face of the P.S.T.[™] 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. 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 center but it is not always dead center. Adding a SME-40 with T-Max[™] double stacking filter will obstruct the Sol Ranger- Do not put your eye up to the opaque glass.

Tuning and Focusing the PST

Because different features on the Sun are moving toward or away from the Earth, their light is Doppler shifted off the hydrogen-alpha line of 6562.8 Angstroms, you will need to adjust the tuning slightly

to get the best high-contrast views of the features you want to observe. The PST is equipped with a tuning mechanism that allows the user to adjust performance of the solar filter. The purpose of this adjustment is to compensate for possible detuning of the filter due to the change in operating conditions (such as barometric pressure that can change with elevation changes.) The adjustable tuner is located right at the end of the optical tube assembly where it merges to the rectangular body of the PST, and is easily recognized by the knurled rubber ring (see Pg. 7). The minute spectral adjustment of the etalon filter is accomplished by simply rotating this knurled ring in either direction. In most instances the filter adjustment will not be required – the PST is delivered properly tuned by Meade engineers. The judgment about occasional adjustment is made based on overall image quality and the ability to see the image details with a satisfactory contrast.

NOTE: The maximum possible extent of a (relatively tight) rotation of the adjustable tuner is approximately 130°. No excessive force should

be applied in an attempt to rotate the knurled ring further than mechanically allowed. The best achievable contrast of the image will be found within the limits of adjustment, and, once such image is obtained, no further improvement of the image quality can be gained by forcing the tuner.

In search for a better solar image, the astronomer should first find the “sweet spot” by appropriately focusing the telescope using the focusing knob. Once the PST is appropriately focused, the edge of the solar disk will appear sharp. However, if, for example, the prominences are not seen after the telescope has been focused, the tuning lever for the internal etalon may be of help. In this case the knurled ring of the adjustable tuner should be appropriately turned until the sought contrast of the Sun’s chromosphere is apparent.

Double Stacking

A second etalon for a double stack system will show increased contrast by narrowing the bandpass to $<0.5\text{\AA}$ and provides a spectacular 3D effect showing increased surface detail. The PST can be double stacked by adding the Coronado SME-40 double

stacking filter to the front of the PST. Contact your Coronado dealer or Meade Instruments directly for more information. Note the SME-40 must be used with the PST and is not a stand-alone filter.

With the SME-40 double stacking etalon attached to your PST, adjust the T-max™ tilt wheel clockwise until the gap of the T-max™ tuner is at a minimum. Rotate both internal and external RichView™ tuning rings counter-clockwise against the hard stops. This is the ideal starting point for the double stacked PST.

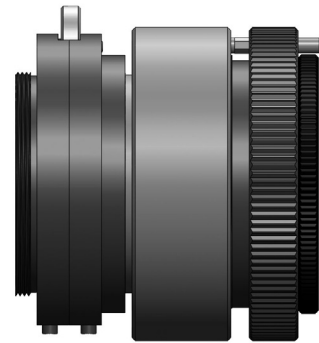
After the PST is pointed at the Sun and image has been focused, rotate the external T-max™ tuner tilt wheel in the clockwise direction. Only adjust the tilt of this tuner until any internal reflections are positioned off the image of the Sun and in the least bothersome position. With low magnification eyepieces, it may be difficult to remove the internal reflections completely from the field of view.

When adjusting the tilt on the T-max™ tuner, keep in mind the least amount of tilt used is best as image quality will begin to suffer with excessive tilt. You only need to adjust the internal reflections to the point where they do not bother your view.

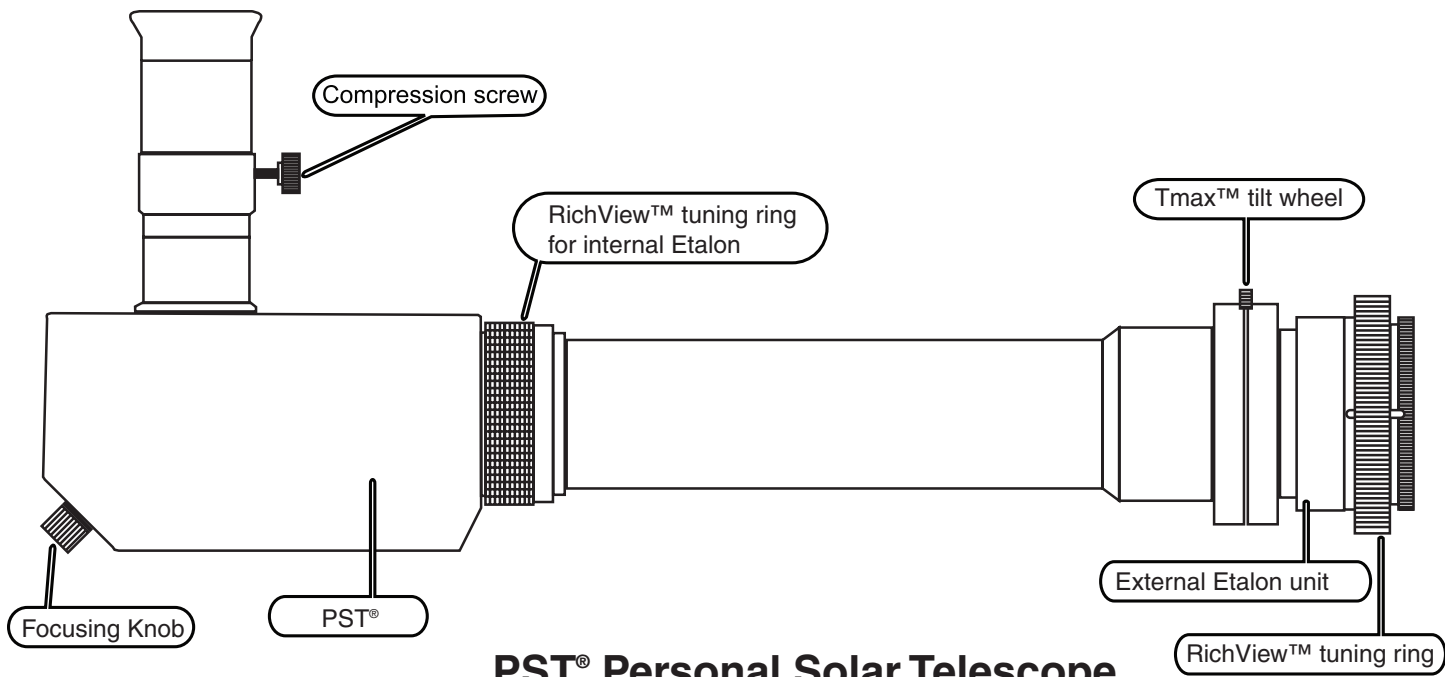
Next, slowly adjust the external RichView™ Tuner clockwise until the best contrast is achieved.

Finally adjust the RichView™ tuning ring for the internal etalon until the best detail and contrast is achieved.

After these adjustments, you may find it beneficial to go back and re-adjust the RichView™ tuners again to make sure you are seeing the best detail possible. Surface details will generally require one setting, while prominences will require a different setting for maximum detail.



SME-40 Double Stacking Etalon with RichView™ Tuning



PST® Personal Solar Telescope Double Stacked

Blocking Filters

The Coronado PST comes with an integrated 5mm blocking filter. This is built into the PST 1.25" eyepiece holder. You MUST use this 1.25" eyepiece holder that contains the blocking filter. You cannot safely substitute another eyepiece holder for use with the Coronado PST. This would create an unfiltered system and deliver light from the Sun that will cause damage to the eye.

Imaging

Due to its compact design, the PST back focus is limited. This can make imaging the Sun challenging when using DSLRs or other equipment requiring long back focus. Dedicated astronomy cameras, such as Meade LPI-G Advanced will have no issue reaching focus and imaging the full solar disk. These cameras are placed directly into the eyepiece holder similar to a normal eyepiece and have high frame rates ideal for solar imaging.

Eyepieces

The best eyepieces for solar viewing are Coronado's CEMAX™ contrast enhanced series eyepieces. Conventional eyepieces can also be used. An eyepiece with high-quality anti-reflection coatings and/or with fewer lens elements can help reduce unwanted

internal reflections.

Dark Cloth

One easy way to reduce incidental light from entering your eye is to use a dark cloth to completely cover your head and the eyepiece. The inside should be black but a reflective surface on the outside is recommended to avoid heat buildup.

Location

One of the benefits of owning a Coronado solar observing set up is the portability of the system. For optimal seeing avoid setting up on heat reflective surfaces such as concrete or tarmac. Grass, water, or low trees are your best surroundings for viewing.

PST	
Aperture	40mm
Focal Length	400mm
Focal Ratio	f/10
Bandwidth (Single Stacked)	<1 Å
Bandwidth (Double Stacked)	<0.5 Å
Thermal Stability	0.005 Å/°C
Blocking	Full blocking >10 ⁻⁵ EUV to far IR
Etalon Clear-Aperture	30mm

Cleaning

Should your filter get a build up of loose dirt particles on any surface use a static free lens brush to gently “sweep” it clean. Fingerprints and other residue can be cleaned using a high grade optical solution applied to an optical tissue. Using a circular motion work from the outside edge in towards the center. As these are hard coatings you can be firm but do not rub. Finish with an anti-static lens cloth. All of these cleaning items can be purchased through a camera/telescope dealer. Never use the following items on any section of your filter.

1. Compressed Air
2. Acetone
3. Anything with acidic properties
4. Any fabric not intended to clean optical coatings
5. Household cleaners

If you have questions please contact our customer support.

Care

The telescopes and filters, if used properly, will not degrade with exposure to the Sun’s rays. You may leave your system set up in the Sun, even tracking the Sun, all day without risk. When your system is not being used it should be stored in a cool, dry location in the foam-lined case it was shipped in and with the included protective caps securely in place. In locations with excessive humidity placing a silica packet in the box is advised. Provided you do not drop or subject the telescope or filter to rough handling, it will work as well years from now as it does today. We use hard coatings throughout the system to ensure uniform performance for years to come. It is safe to carry your filters on airplanes and to pass them through X-Ray machines.

Additional Support and Accessories

Additional support and accessories are available at <http://www.meade.com/solar/solar-scopes.html>. There you can browse different accessories, or download a replacement instruction manual.

CEMAX Eyepieces - The best eyepieces for H- α observing. These are the only eyepieces built specifically to have their peak transmittance at H- α . Using optimized coatings to enhance contrast and minimize glare, we have set the standard for the market. Available in 25mm, 18mm, 12mm, and a 2x Barlow, 20mm eye relief, 52 degree FOV. You will see the difference! Call or see our website for package deals.

Definition of Terms

Prominences — H- α emissions projecting beyond the limb of the sun, consisting of complex clouds or streamers of ionized hydrogen above or in the Chromosphere.

Filaments - Prominences seen against the face of the sun, appearing as long narrow dark streamers or diffuse dark areas.

Active Region - Active regions are the result of enhanced magnetic fields and appear darker than the surrounding areas with a roughly circular shape. Active regions show plage, sunspots, and flares.

Plage - Patchy H- α brightening on the solar disk, usually found in or near active regions, which can last for several days. These are found in areas of nearly vertical emerging or reconnecting magnetic lines.

Sunspots - Spots of varying size usually consisting of a dark central region (umbra) and a lighter halo consisting of many short fine fibrils (penumbra).

Flares - A sudden eruption of energy in the solar atmosphere lasting minutes to hours, from which radiation and particles are emitted.

Chromosphere - An incandescent, transparent layer of gas, primarily hydrogen, several thousand miles in depth, lying above and surrounding the Photosphere of the Sun and beneath the transition region of the Corona.

FOV - Field of View. This describes, in degrees, the area of sky one can see when looking through the eyepiece.

OTA - Optical Tube Assembly. This is the main body of a telescope.

H- α - A wavelength of light at 656.3nm or 6562.8 Angstroms (1nm = 1 billionth of a meter)

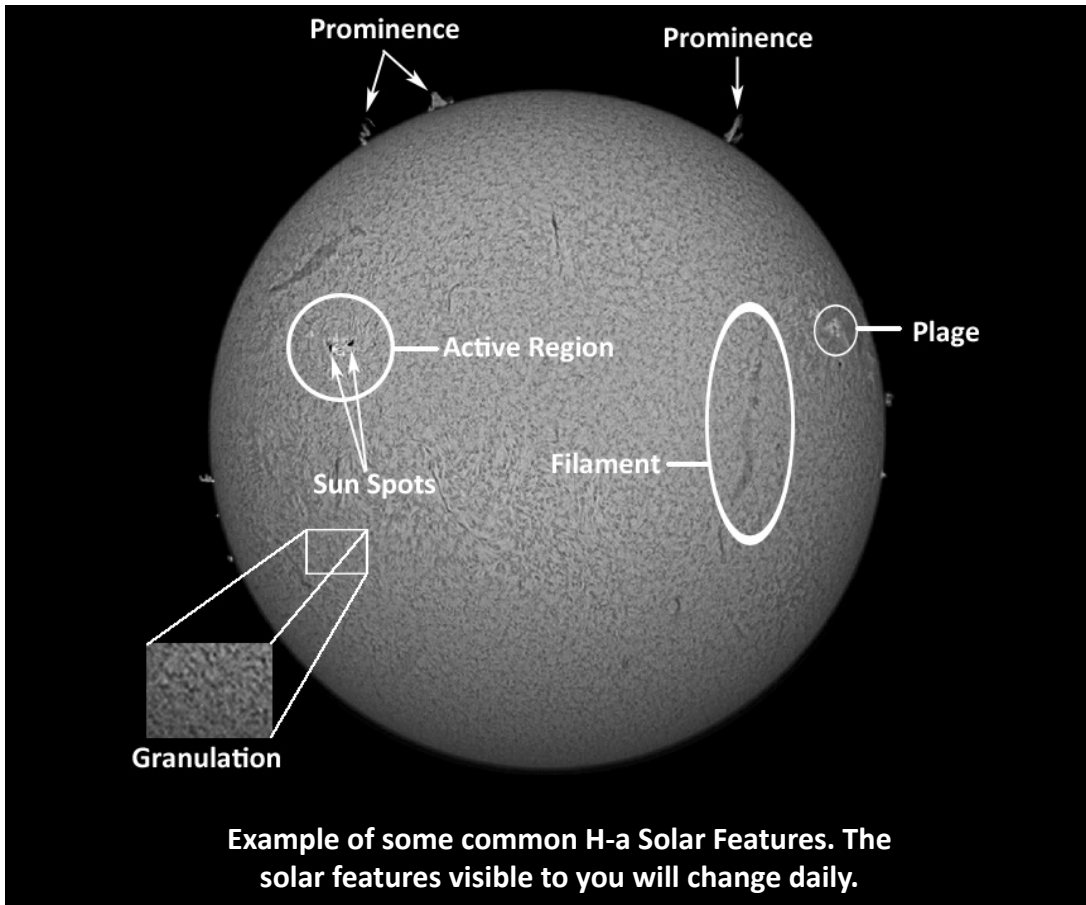
Angstrom - A unit of measurement for the wavelength of light. (1Å = 0.1nm)

Bandpass - A filter's bandpass tells how wide a region of the light spectrum is transmitted around the primary wavelength. The narrower the bandpass, the more surface detail becomes visible on the Sun. You can further narrow the bandpass of your primary single stack filter by adding an additional filter of the same size to the objective. The term "double stacking" is used to describe this process.

E.R.F. - Energy Rejection Filter. Prevents UV and IR light from entering the telescope.

Etalon - The heart of a Coronado filter. Composed of optics with tolerances 4 times tighter than those used in the Hubble telescope.

Granulation - Small scale convective cell structures visible in white light ("rice grains"), best seen in apertures over three inches, and in green light. Each cell consists of a brighter polygonal area of hot rising gas typically about 1100 km across, and a cooler edge or "channel" of descending gas about 230 km wide.



Example of some common H-a Solar Features. The solar features visible to you will change daily.

Solar Facts

The Sun is on average 93 million miles (150 million km) away from Earth and 900,000 miles (1.4 million km) across.

The Earth is about 8,000 miles (13,000 km) across.

Think of the Sun as a basketball and Earth as pin head and you have the proper proportions.

It takes a little over 8 minutes for light from the Sun to reach Earth.

Approximately 1 million Earths would fit inside the Sun.

Solar radius = 695,990 km = 432,470 mi = 109 Earth radii

Solar mass = 1.989×10^{30} kg = 4.376×10^{30} lb = 333,000 Earth masses

Solar luminosity (energy output of the Sun) = 3.846×10^{33} erg/s

Surface temperature = 5770 K = 10,400 °F

Surface density = 2.07×10^{-7} g/cm³ = 1.6×10^{-4} Air density

Surface composition = 70% H, 28% He, 2% (C, N, O, ...) by mass

Central temperature = 15,600,000 K = 28,000,000 °F

Central density = 150 g/cm³ = 8x Gold density

Central composition = 35% H, 63% He, 2% (C, N, O, ...) by mass

Troubleshooting

Solar observing is a unique aspect of the telescope hobby and there are a few things to keep in mind and tricks that may assist in the early outings, even for those who may have owned one or more traditional night time telescopes:

Locating the Sun: Sometimes the single hardest thing for new owners to master is the simple act of locating the brightest

object in the sky. One pro tip is to simply look at and minimize the shadow of the telescope on the ground. Flat level ground like a sidewalk will make this easier.

Be sure to use the lowest power/widest field eyepiece available also just to make finding the Sun easier- you can then switch to higher magnification. The Meade PST has a built in Sun finder while Coronado III models come with the Sol Ranger™ finder, also available separately for those purchasing a Coronado filter set only.

GOTO and Tracking: Meade AutoStar or AudioStar equipped mounts and telescopes can be “mock aligned” in the daytime by simply doing a standard Meade one star alignment. Although the stars themselves will obviously not be visible in broad daylight, this pseudo-alignment will allow motorized tracking of the Sun, while selecting Mercury from the database after the mock alignment should take the scope to the near vicinity of the Sun itself. You can then center the Sun using the keypad arrow keys.

The image isn't focused: The first thing to look for is a sharp disk which is easiest to determine by examining the edges of the Sun. Step Two is to use the T-Max™ tuner to minimize or remove any ghost image. Step Three is to use the H- α tuning on the scope to enhance the visible detail on the disk, prominences, and any specific features of interest. If, however, the disk is very sharp but without any discernable detail whatsoever it is possible that the image in the eyepiece is actually a ghost image of the Sun and the Sun itself is in fact completely outside the field of view of the eyepiece. Double check to be sure the Sun is actually in the very center of the Sun finder and if needed move the telescope slightly in a search pattern to find the actual Sun. The difference between a ghost and the actual Sun will be immediately obvious once seen the first time.

Detail: Many observers report that with time and experience their own perception of detail becomes more acute. H- α light is very far into the red end of the spectrum and our eyes are not, initially, very sensitive to this. The more you view the more you may find you perceive additional detail more easily. Blocking stray light with a hat or even complete head covering (observing cloth) blocking all ambient light can actually make a great difference and we definitely recommend giving it a try. As with any telescope observing conditions will vary greatly from day to day, changing the level of detail you can see. Additionally of course the Sun itself is an ever changing object unlike the vast majority of celestial targets with changes in the surface features and prominences taking place over the course of mere hours or even minutes. Be sure to observe often and we hope you greatly enjoy the experience of taking in the wonder of the unique and highly dynamic center of our Solar System.

Meade Instruments Warranty for Coronado® Products

The Meade Instruments Statement of Limited Warranty is published at:

www.meade.com/supports/warranty/

A printed copy of the Meade Statement of Limited Warranty will be made available by Meade upon written request.

See below for Meade contact information.

Warranty Claim
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SUBJECT: Warranty Claim



Register Your Coronado® Product

Register your Coronado® solar telescope with Meade Instruments to receive updates and other important information related to your product.

Visit the URL below to register your product: www.meade.com/product-registration

Or scan the QR code to access the product registration page:





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