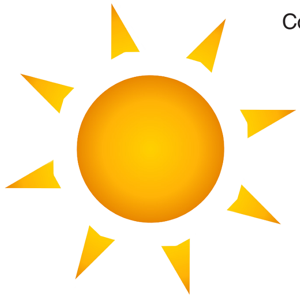
SOLAR GLOSSARY

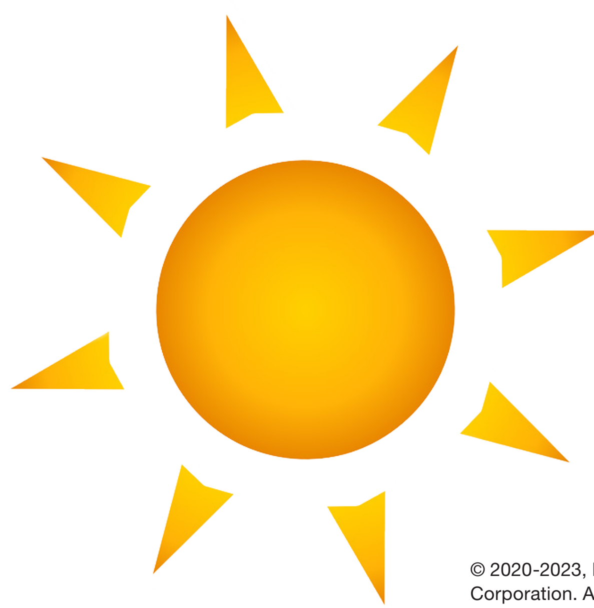
We are happy to provide this glossary of solar-observing terminology to help you as you evaluate the best products to use for viewing our Sun.

Term	Definition
Etalon	The heart of the SolarMax telescopes. An etalon is a type of ultra narrow bandpass interference filter, consisting of two parallel and partially reflective optical elements with a very specific separation distance between those glass plates. Light entering the etalon is transmitted only when at the correct incident angle and when in resonance between the optical elements. All other wavelengths are not transmitted. This is a result of a phenomenon of light known as interference, where the wavelengths of light that resonate between the etalon elements interfere with each other constructively and pass through the etalon (reinforcing the transmitted light at that wavelength), while other wavelengths will destructively interfere and won't pass through the system. In the case of the SolarMax etalon, hydrogen-alpha (H-α) light at 6562.8 angstroms (Å) is the central wavelength to pass through the system.
Blocking Filter (BF5, BF10, BF15, BF30)	The 2nd critical part of the SolarMax system (the first being the etalon). The Blocking Filter (BF) is not a single filter, but instead, multiple filters that make Coronado telescopes safe for viewing the Sun. The Coronado etalon passes the hydrogen-alpha (H-α) wavelength of light through the telescope to the Blocking Filter, but also allows its harmonics through as well. The Blocking Filter blocks all of the light transmitted by the etalon, except H-α. When combined with the etalon, only the very specific H-α wavelength centered at 6562.8 angstroms (Å) is transmitted to the eyepiece, and overall image brightness is reduced. Coronado telescopes MUST be used with both an etalon and rear Blocking Filter together in order to provide a safe and enjoyable view of the sun. There are different sizes and shapes of BF filters available, using a number designation to differentiate between models. The number designation describes the clear aperture in millimeters of the H-a cutoff filter used in the blocking filter. For example, the BF10 uses a 10mm clear aperture H-α cutoff filter, while the BF15 and BF30 use a 15mm and 30mm clear aperture filter respectively. The larger the clear aperture, the larger the unvignetted field of view provided through to the eyepiece or camera sensor. When using wide angle eyepieces, higher magnification, or a larger camera sensor, it is always recommended to use the largest BF available in your budget. The blocking filter selected also determines whether or not a full disk image of the Sun will be visible when using the etalon and BF set together on a different telescope: BF5: provides full disk image when used with telescopes having a focal length of 500mm or less. BF10: provides full disk image when used with telescopes having a focal length of 1,000mm or less. BF15: provides full disk image when used with telescopes having a focal length of 1,500mm or less. BF30: provides full disk image when used with telescopes having a focal length of 3,000mm or less. The BF5, BF10 and BF15 filters are built into the right-angle star diagonal located directly below the eyepiece. These diagonals accept 1.25" eyepieces and accessories only but also have a t-thread connection ideal for connecting imaging equipment. The BF30 uses a convertible design allowing use in a straight through or 90-degree configuration. When used in the straight through configuration, a 2" receiver with removable 2" to 1.25" zero-length adapter is used. The straight through design is advantageous when using larger format camera sensors, or when using 2" accessories. When the BF30 is used in the 90-degree diagonal configuration, the BF30 attaches to the included diagonal body which accepts 1.25" eyepieces or accessories, but also has a t-thread connection available. All Coronado Blocking Filters require use of a Coronado SolarMax etalon to make the telescope safe for solar viewing.
Bandpass	The bandpass specification of a hydrogen-alpha (H-α solar telescope refers to the range of wavelengths around the (H-α line that is transmitted through the telescope. The bandpass range is usually between 1 angstrom (Å) for the PST, down to a very narrow <0.5 Å for a double stack system. The narrower the bandpass, the higher the contrast will be for viewing surface features such as filaments, flares and surface granulation. Coronado PST's with a single etalon have a bandpass of < 1Å Coronado SolarMax telescopes with a single etalon have a bandpass of < 0.7Å. Prominences at the edge of the sun are easy to see even with a wider single etalon bandpass system (single stacked) since they stand out in profile against the black background of space and thus have higher contrast to start with. But to help pull out surface disk details even further, a narrower bandpass double stacked system is advantageous. You can further narrow the bandpass of your primary single stack etalon filter by adding an additional etalon filter to the telescope. The term "double stacking" is used to describe this process. Coronado PST's and SolarMax telescopes with two etalons (double stacked) have a bandpass of <0.5Å.



Term	Definition
Angstroms (Å)	A unit of length commonly used to measure the wavelength of light. It is equal to 0.1 nanometers, or 10 billionths of a meter. The wavelength of Hydrogen-alpha light is 656.28 nanometers, or 6562.8 angstroms.
Hydrogen-alpha (H-α)	Hydrogen-alpha (H-α) light sits on the electromagnetic spectrum at 6562.8 angstroms (Å), near the middle of the red part of the visible spectrum of light. It is the first spectral line in the Hydrogen Balmer series and is emitted when an electron transitions from the third to second energy level in Hydrogen. It is also an exciting wavelength to view when solar viewing as the sun's chromosphere is a strong emitter at this wavelength. This wavelength is where many of the beautiful features of the solar disk and atmosphere radiate best. Coronado filters are designed to isolate this wavelength from the rest of the light of the sun, revealing prominences spilling off the edge of the solar disk, along with surface features such as solar flares, filaments, plages, and surface granulation.
Chromosphere	The chromosphere is a layer in the sun's atmosphere, just above the photosphere (which can be considered the visible surface of the sun). While the photosphere is around 6000°C on average, the temperature rises in the chromosphere to around 20,000°C. The temperature of this layer causes the hydrogen gas to emit strongly in the hydrogen-alpha (H-α) portion of the electromagnetic spectrum, giving it the characteristic red glow seen through an H-α solar telescope. The activity in the chromosphere changes daily and is where many of the interesting features to view through a Coronado telescope are located, including prominences, filaments, and plages
Sunspots	Small dark spots or blotches that appear on the disk of the sun. They appear dark because they have a cooler temperature compared with the surrounding area (though still very hot at around 4000-4500° Celsius!). They form where the magnetic fields are especially strong, and can be fun to watch slowly migrate across the surface of the sun over the course of a few weeks as the sun rotates. The number of sunspots visible at any given time is known to be variable with an approximate 11-year cycle known as the solar cycle. Solar cycle 25 began in late 2019, and is expected to reach peak (known as solar maximum) sometime around 2024 or 2025.
Active Region	A small area on the solar surface that has a strong and complex magnetic field. Sunspots are a good indicator of an active region, though not all active regions include sunspots. Active regions also can be the source of solar flares. Similar to sunspots, the number of active regions present on the sun at any given time is dependent on the solar cycle, an approximate 11-year cycle of activity, most obvious in the number of sunspots visible at any particular time.
Prominence	A solar prominence is a large and bright structure of plasma rising up from the solar surface into the outer atmosphere of the sun. They are visible around the edge of the sun, in profile against the black background of space when viewed through a solar telescope. These same structures when seen directly on the solar disk are called filaments. Prominences are the most easily visible structure seen through a hydrogen-alpha (H-α) telescope, and can be seen with all Coronado telescopes, even with wider bandpass filtering, such as the single stack <0.7 angstrom (Å) SolarMax telescopes and the <1 Å PST telescope. Prominences are composed mostly of ionized hydrogen and helium, and rise up from the surface following twisted magnetic field lines. They can form shapes including hedgerows, loops, and in more powerful cases such as an erupting prominence, a loop that breaks away, sending plasma outward away from the sun. A prominence can form and disappear over the timescale of a single day, so while you don't see "live" motion in real time, if you study the prominence over an hour or two, you can often notice changes to its shape.
Filament	The same structure as a solar prominence, but seen directly on the surface of the sun instead of hanging off the edge of the solar disk. The plasma that a filament is composed of is relatively cool compared with the surface that it rises from, making filaments appear darker than the surrounding surface. Since the contrast is lower when viewing a filament on the solar disk compared with a prominence protruding away from the edge of the disk over the black background of space, it helps to view filaments with a narrower bandpass solar telescope. While filaments can be visible with all Coronado telescopes, the narrower <0.7 angstrom (Å), or even better a double stacked system at <0.5 Å will really make these features of the solar disk stand out.
Flare	Solar flares are powerful bursts of radiation, localized in a small active region of the sun in and around sunspots. The magnetic field lines around sunspots can get twisted and tangled, and suddenly untangle or reorganize, causing a massive release of electromagnetic radiation. This will heat the surrounding plasma to a much higher temperature, causing a brightening of the area in hydrogen-alpha (H-α) light, which will be visible in the Coronado telescope as a bright patch in the area of the sunspot undergoing a solar flare. Flares are a relatively rare occurrence, compared with the daily visibility of sunspots, prominence and filaments, so keep watching to hopefully catch one of these events!
Granulation	The solar "surface" that we see through a hydrogen-alpha (H-α) telescope is the sun's photosphere. Within the photosphere are convection cells of plasma that rise and fall to and from the surface, called granules. The tops of these granules are what we see as granulation on the disk of the sun. Granulation is a fairly low contrast feature of the sun, and thus a double stacked narrower bandpass filter system is recommended. A <0.5 angstrom (Å) Coronado telescope is best for bringing out the contrast of the granulation. It can also be seen in <0.7 Å single stack systems, but imaging the solar disk and increasing the contrast in post processing of the photograph will provide the best "pop" for this feature when using wider bandpass filtering.

Term	Definition
Plage	Bright regions of the solar disk, usually found surrounding sunspots. They can appear as small patches or tendrils of a lighter shade compared with the background surface. Also known as bright flocculi.
RichView Tuning	Coronado's patented RichView tuning mechanism uses a proprietary method of adjusting the primary etalon directly to achieve optimal hydrogen-alpha (H-α) performance. To see the ever-changing solar features with the highest contrast, etalons need to be fine-tuned in real-time to bring it "on-band" for H-alpha. This is done by either tilting the etalon slightly, or changing the gap size within the etalon cavity. Coronado can do both! With RichView tuning, the air-spaced etalon gap size can be mechanically adjusted quickly to see surface details such as filaments and granulation, or again to see prominence details on the solar limb. This optimizes the exact wavelength of light that passes through the etalon and provides the largest range of adjustment, all while maintaining precise optical alignment. Solar features often move quickly which requires further adjustments to the etalon due to Doppler shifting. Even the sun's rotation itself can affect the wavelength you observe as one side of the sun moves toward the observer and other side moves away. RichView tuning allows for adjusting the etalon to compensate for this Doppler shift. Barometric pressure at your observing site also changes the etalon's performance which can move the H-alpha line too far for normal tip-tilt tuning. With Coronado's patented RichView tuning, the additional tuning range it provides makes using solar scopes at high altitudes still possible.
T-Max Tuning	T-Max tuning is a method of slightly tilting the etalon in order to move the etalon transmission "on-band" with hydrogen-alpha (H-α), providing the highest contrast and brightest image possible. It is also used to minimize any ghost reflections caused by internal light bouncing off various solar filters within the telescope.
Single Stack	A solar telescope with only one etalon filter is commonly referred to as being "single stacked.". The Coronado Solarmax III single stacked telescopes have a bandpass of <0.7 Angstroms and the PST has <1 Angstrom. These single etalon telescopes have a wider bandpass than their double stacked counterparts and are ideal for observing solar features on the limb of the sun. Edge features such as solar prominences stand out extremely well in single stacked telescopes as they are viewed against the black background of space. These telescopes can also view surface features such as granulation and filaments, although with a lower contrast than what is observed with a double stacked system.
Double Stack	Stacking two etalons in line with each other creates a double stack system, and narrows the bandpass of the entire system in order to boost contrast on surface features such as filaments, granulation, and plages. This greatly increases contrast by narrowing the bandpass to <0.5 angstroms (Å) and gives a spectacular 3D effect showing increased surface detail. The SolarMax III filters can be double stacked by adding an additional SolarMax III Etalon with T-Max of the same aperture. Contact your Coronado dealer or Meade Instruments directly for pricing.
Double Stack	Stacking two etalons in line with each other creates a double stack system, and narrows the bandpass of the entire system in order to boost contrast on surface features such as filaments, granulation, and plages. This greatly increases contrast by narrowing the bandpass to <0.5 angstroms (Å) and gives a spectacular 3D effect showing increased surface detail. The SolarMax III filters can be double stacked by adding an additional SolarMax III Etalon with T-Max of the same aperture. Contact your Coronado dealer or Meade Instruments directly for pricing.
Cemax	Coronado's line of eyepieces and Barlow designed specifically for use with hydrogen-alpha (H-α) telescopes. The CEMAX contrast enhanced series have premium coatings optimized for solar viewing and to minimize unwanted internal reflections.



MEADE®