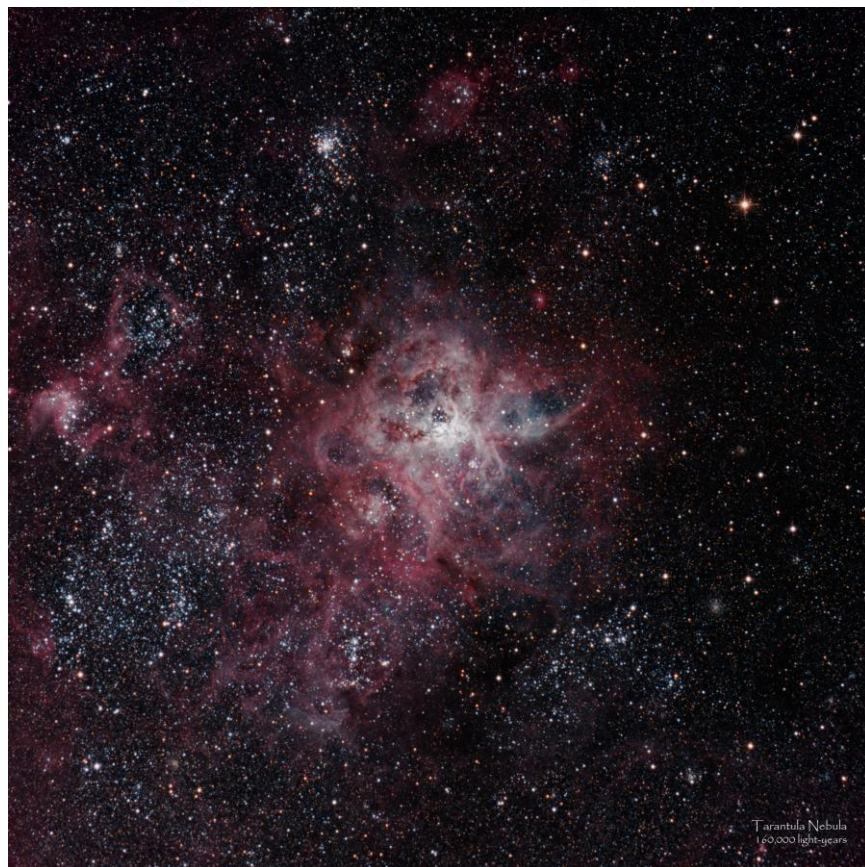


# Sky WAA tch



## ***The Tarantula Nebula***

Courtesy of Scott Nammacher is this image of the Tarantula Nebula (aka 30 Doradus), one of the showcases of the southern sky. A denizen of the Large Magellanic Cloud, the nebula is somewhat similar to the northern sky's Orion Nebula. Amateur observers see primarily ionized hydrogen illuminated by hot, newly formed stars. But compared to its northern counterpart, the Tarantula nebula is enormous. If placed at the same 1500 light year distance as the Orion nebula, the Tarantula would occupy 30-degrees of the night-sky.

Scott used an FLI PLO9000 CCD attached to a Planewave 20" CDK astrograph (f/ratio 4.4). The focal length was 2259 with focal reducer (75 min Lum; 50 min RGB). The imaging was done January 3, 5 and 7, 2014 at the Siding Springs, Australia iTelescope Observatory (Telescope T-31)--iTelescope is a telescope-for-rent company with locations in New Mexico, Spain and Australia.

## ***In This Issue . . .***

- pg. 2    Events For September
- pg. 3    Almanac
- pg. 4    Looking Ahead to 2015
- pg. 5    The Moon and Sun
- pg. 6    A Home-made 90mm Hydrogen Alpha Telescope
- pg. 10   Observing the Summer Triangle
- pg. 16   Astrophotos

## Events for September 2014

### WAA September Lecture

#### "Member Presentations Night"

Friday September 12<sup>th</sup>, 7:30pm

Lienhard Lecture Hall, Pace University  
Pleasantville, NY

WAA members will showcase their photos, equipment and astronomy insights. So if you've done something interesting astronomically this summer, gotten a new piece of equipment, or made some images and would like to talk to fellow club members about it, contact Pat Mahon, WAA Vice President for Programs, at [waa-programs@westchesterastronomers.org](mailto:waa-programs@westchesterastronomers.org). Free and open to the public. [Directions](#) and [Map](#).

### Upcoming Lectures

Lienhard Lecture Hall,  
Pace University Pleasantville, NY

Our next lecture is on October 10<sup>th</sup> when Victor Miller will be speaking on the Galileo Jupiter Probe Mission. During the remainder of the Fall, Dr. Caleb Scharf will present on his new book and Dr. Michael Tuts will discuss gravity.

### Starway to Heaven

Saturday September 20<sup>th</sup>, 7:00 pm.

Meadow Picnic Area,  
Ward Pound Ridge Reservation,  
Cross River, NY

This is our scheduled Starway to Heaven observing date for September, weather permitting. Free and open to the public. The rain/cloud date is September 27<sup>th</sup>. **Note:** By attending our star parties you are subject to our rules and expectations as described [here](#). [Directions](#).

### New Members. . .

Cathleen Walker - Greenwich  
Comtec Systems - Carmel  
Margaret Brewer-LaPorta - Goshen  
Mary and Ryan DeWitt - Rye  
Valerie Dugan - Sleepy Hollow

### Renewing Members. . .

Michael & Ann Cefola - Scarsdale  
Mark Girvin - Larchmont  
Doug Baum - Pound Ridge  
Joe Geller - Hartsdale  
Anthony Monaco - Bronx  
Eric and Katherine Baumgartner - Redding  
Deidre Raver - Wappingers Falls

The Cerbone Family - Tarrytown  
Ihor Szkolar - White Plains  
Leandro Bento - Yonkers  
Thomas Boustead - White Plains  
Harry Vanderslice - Mamaroneck  
Andrea Anthony - Yorktown Heights  
Patricia Mahon - Yonkers

### Kopernik AstroFest 2014

This event will be held at the Kopernik Observatory & Science Education Center – Vestal, NY on October 24<sup>th</sup> and 25<sup>th</sup>, 2014. Presented by the The Kopernik Astronomical Society, the Astrofest will feature astronomy workshops, solar viewing, observatory tours and speakers from the amateur and professional communities as well as observing at night. To register and for more information go to the [Astrofest website](#).

(Note this event is not affiliated with the WAA).

**Call: 1-877-456-5778 (toll free)** for announcements, weather cancellations, or questions. Also, don't forget to periodically visit the [WAA website](#).



Here is an iPhone image of a double rainbow taken after a torrential rainstorm at the Rockland Astronomy Club Summer Star Party in Plainfield, Massachusetts (Tom Boustead).

## Almanac

### For September 2014 by Bob Kelly



Sep 2



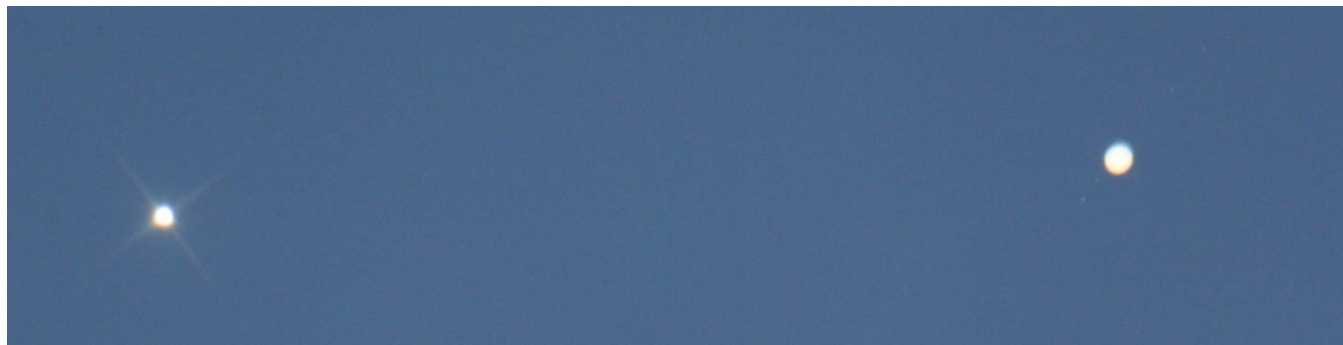
Sep 8



Sep 15



Sep 24



Venus (near) and Jupiter and its moons (far). Canon XS Rebel at prime focus of 200mm dobsonian telescope. Camera settings: ISO eq 800, 1/20 sec. exposure. For Jupiter, a longer exposure shows the moons better and with a shorter exposure you can't see the moons, but you can see the two main darker cloud bands. At this exposure, you can either see both the moons and the bands or neither.

Last month we explored the concepts of 'near' and 'far'. Let's review:

Since Venus' brightness has saturated the camera, it's hard to tell that Venus is six times brighter than Jupiter and Jupiter appears in a telescope to be three times larger.

This month, we compare objects that look near each other in the sky and explore ways they are alike and different. For those going back to school, you might say the brighter planets are working in the margins of our paper this month. Venus will be brilliant, but low in the east as sunrise moves past 7am. Mars and Saturn will make lovely changing patterns, along with Antares and Spica, low in the southwest after sunset. Mercury will be hard to see, even when 26 degrees east of the Sun in the evening sky on the 21<sup>st</sup>.

When Mars moves near Antares in the sky early in September, does Antares live up to its name 'rival of Mars' (Anti – Ares)? They are about the same brightness now, so the comparison is on a level basis. Does one look brighter than the other? Does this perception change when viewing with optical aid? Mars is 6 arc-seconds wide this month, appearing only twice as wide as Uranus, so details are hard to see even in a telescope. Mars matches the Sun's apparent motion in the sky and will keep out of the glare of the Sun until next April.

In October, comet Siding Spring swoops past Mars. But it may be hard to see from Earth since the comet will be faint and Mars' glare will make it harder to see. If we can see the comet, it will be an example of two very different objects appearing near each other in

our sky that actually are near each other in space. Scientists are planning to protect spacecraft orbiting Mars from the fast-moving comet dust and still sneak a peek at the comet.

Saturn will be sliding into the twilight, but its rings continue to reward persistent followers. Saturn will have an additional neighbor in early September, a +7.8 magnitude star. One of Saturn's moons, Rhea (perhaps out of jealousy?), will block out the 7<sup>th</sup> magnitude star on the evening of the 12<sup>th</sup> as seen from parts of the northeast US and eastern Canada. At the time of the occultation, about 8:38pm ET, the Sun will be about 14 degrees below the horizon and Saturn will be only 11 degrees above the southwestern horizon at that time. Rhea will be hard to find in a telescope at magnitude +10, so train your optics on the 7<sup>th</sup> magnitude star, east of Saturn, since it will be noticeably brighter than Saturn's moons. It would be rewarding to see the star appear to dim if Rhea passes in front of it for your location.

After last month's close pass of Jupiter, Venus will do a lesser, but still notable grouping within a degree of the magnitude -0.6 star Regulus around the 5<sup>th</sup>. You may need binoculars to find Regulus with Venus so low in the morning twilight.

Jupiter will be soaring into the pre-dawn sky, suitable for pointing out to fellow commuters on the way to work. If you're up early, a few minutes spent observing Jupiter, its dancing moons and changing cloud belts, will brighten your day.

The next few months will provide a good chance to find Neptune is up in the sky after sunset, with Uranus following afterwards.

The Astro Bob blogger from Duluth, MN reports two comets are available for viewing in small telescopes or large binoculars. See the [Sky and Telescope website](#) for the good news.

This is a great month for observing the last quarter moon high in the morning sky. The Moon is at its highest point on the ecliptic during last quarter, which occurs around the 16<sup>th</sup>.

It's a good time to look for Hadley Plain where Apollo 15 landed, a tiny notch in the large, curving Apennine Mountain range that marks the rim of the Mare Imbrium impact. This month's full moon, on the evening of the 8<sup>th</sup>, is 22 hours after perigee. Watch out for higher-than normal tides around that date.

The International Space Station arcs across our area in the morning twilight from September 11<sup>th</sup> through the rest of the month.

The length of daylight decreases at its fastest rate around the equinox, which occurs at 10:29pm ET on the 22<sup>nd</sup>.

## Looking Ahead to 2015

### By Bob Kelly

Mars will hang out low in the southwest for the rest of 2014 until mid-April 2015. Mars moves into the morning sky in August, beginning its move to opposition with the Earth in May 2016. We never get close to Mars in 2015.

Venus returns to the evening twilight sky in late December 2014 until August 2015, when it swings into the morning twilight sky for the rest of the year. The safest daytime viewing is around its greatest eastern elongation, following the Sun, in early June

Jupiter soars high into the morning sky the rest of 2014. It's largest near opposition in early February 2015. After spending August behind the Sun, Jupiter comes back into the morning sky in September through the rest of the year.

Venus and Jupiter line up even closer than their outstanding August 2014 paring in the evening sky around July 1<sup>st</sup> 2015. On February 22<sup>nd</sup>, Venus will be ½-degree from Mars, low in the southwest after sunset. Venus, Jupiter and Mars will make a nice grouping in the morning sky on October 28<sup>th</sup>.

Mercury is visible low in the twilight sky at various times in 2015. Look In the mornings in February and March, June to mid-July, and October. Check the evenings in January, mid-April to mid-May and August through September. The best appearances for our latitude for 2015 are in the evening around the 1<sup>st</sup> of May and in the morning in mid-October.

Saturn's brightest months in 2015 are May and June, well placed in the Primetime Summer sky, with rings wide open.

Uranus is occulted by the Moon 12 times in 2015. Only one is visible from the northeast United States, on February 21<sup>st</sup> during evening twilight. Closest at opposition in October, Uranus is preceded into the evening sky by Neptune in September.

Besides being fun to observe, the Moon is the subject of many highlights in 2015. If you want the 2015 'Supermoon', September 27<sup>th</sup>/28<sup>th</sup> is the night, with perigee within two hours of full moon. The Moon occults Aldebaran on September 4<sup>th</sup>/5<sup>th</sup> just around midnight, right about moonrise. The reappearance will be visible on the dark limb of the Moon. On November 26<sup>th</sup>, the Moon also occults Aldebaran, but in morning twilight. On December 7<sup>th</sup>, the Moon occults Venus in daylight, 42 degrees ahead of (and to the lower right of) the Sun.

The only comet predicted to reach naked-eye brightness in 2015 is C/2013 US10 (Catalina Observatory). The [comet website \(Seiichi Yoshida's Home Page\)](#) projects the comet to appear as bright as fourth magnitude in December 2015 in the morning sky, becoming circumpolar in January 2016. Comet 67P/Churyumov-Gerasimenko, currently being visited by the Rosetta spacecraft, will max out at magnitude +11 in September 2015.

To find out when bright planets, asteroids and star clusters will be visible near the Sun in the Solar and Heliospheric Observatory's (SOHO) C3 camera, see

the [Sungrazer Project website](#). (Sources: USNO Astronomical Phenomena for the year 2015, Cartes du Ciel software).

### Eclipses in 2015

There are four eclipses in 2015, two of the Sun and two when the Earth's shadow will be seen on the Moon. In Westchester, we can see part of a lunar eclipse in April and all of a lunar eclipse in prime time in September.

The Solar Eclipse of March 20<sup>th</sup> will not be visible in any form from the northeastern United States. To see the total eclipse, you'll need a boat south of Greenland and Iceland. Truly crazy people could travel to just south of the North Pole and try to watch the partial eclipse while the Sun and Moon sail along at the horizon, including a brief total eclipse.

The next total solar eclipses in the United States are in 2017 and 2024.

The April 4<sup>th</sup> eclipse of the Moon will be ending for our area before the Moon is totally eclipsed. At the time of sunrise, you'll be on the edge of the Earth's shadow as projected on the Moon. But your individual shadow will be too small to be seen on the Moon itself. Left as an exercise for the reader: What's the minimum size object that could be resolved?

The September 13<sup>th</sup> Solar Eclipse is not total anywhere on Earth, but partial in Antarctica and Southern Africa.

The September 28<sup>th</sup> eclipse of the Moon will be seen in its entirety in the Eastern United States, beginning after 9pm EDT and ending before 11:30pm, making this a Prime Time event!

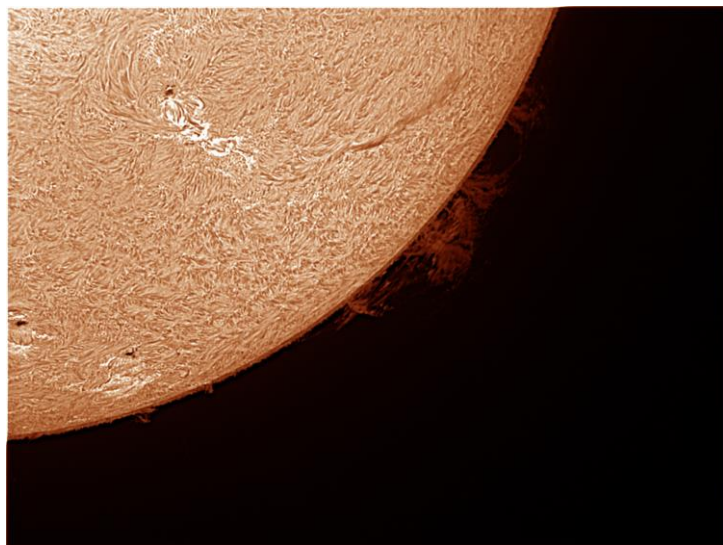
## The Moon and Sun



### ← Luna

Bob Kelly took this photo of the last-quarter Moon, showing crater Copernicus near the center. At the 12 o'clock position relative to Copernicus is crater Kepler (above Kepler is the Ocean of Storms) while craters Reinhold and Landsberg are at the 10 o'clock position. The Mares Imbrium, Insularum, Cognitum, Humor and Nubrium can also be seen.

Notes Bob: After the initial sharpening and lighting level adjustment, I brightened and increased the contrast on the photo and compressed so it might show up better in the newsletter. Original was Canon XS at prime focus: a 1/400 second exposure (ISO-800) through my Orion Dobsonian 200mm F6 telescope, one frame using a small amplifier lens.



### ← Sol

John Paladini captured this image of the Sun--replete with solar prominences, sunspots and photosphere granules--through his homemade solar scope. For more on John's solar scope, see his article "A Home-made 90 mm Hydrogen Alpha Telescope" on page 6

## A Home-made 90mm Hydrogen Alpha Telescope

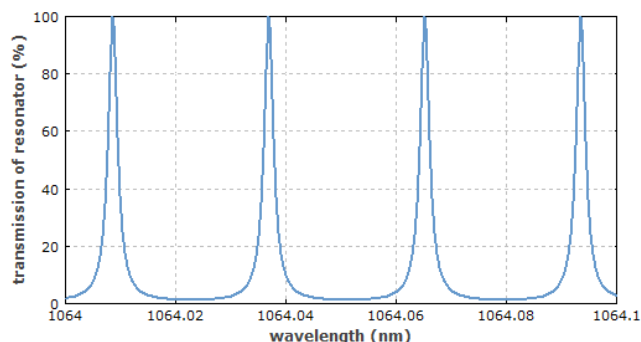
John Paladini (edited by Larry Faltz)



The author with his scope

Many amateur astronomers observe the sun through telescopes that pass the hydrogen-alpha ( $H\alpha$ ) line at 656.28 nanometers, allowing views of activity on the solar surface (actually the chromosphere just above the surface) and limb prominences that are not visible with “white light” scopes that use a dense filter or a Herschel Wedge. Affordable  $H\alpha$  filters were developed in the 1990’s by the late David Lunt, who founded Coronado (later bought by Meade). His son, Andy, started Lunt Solar Systems a few years ago and the company’s numerous improvements in  $H\alpha$  design and construction fueled even more interest in solar observing and imaging. The heart of an  $H\alpha$  telescope system is the Fabry-Pérot etalon, basically a pair of partially reflective glass optical flats spaced a short (and exact) distance apart, with the reflective surfaces facing each other. The etalon (“precise measure” in French) acts like a “visual radio”. The light bouncing from each internal surface creates constructive and destructive interference at wavelengths specific to the gap. A

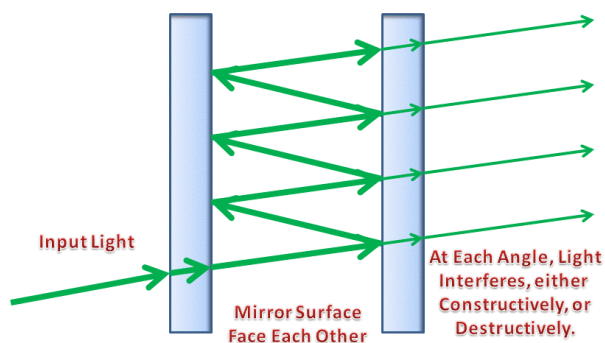
“comb” of frequencies is passed which can later be filtered to pass one specific wavelength.



An example of a series of constructive interference wavelengths passed by an etalon.

The wavelength that is passed can be “tuned” a fraction above and below the original value by slightly tilting the surfaces with a mechanical linkage of various types. This is very helpful since the Doppler effect can shift the  $H\alpha$  line slightly. The  $H\alpha$  of a filament coming directly at you from the center of the sun will have a slightly different wavelength than a prominence coming off the solar edge, at right angles to your view.

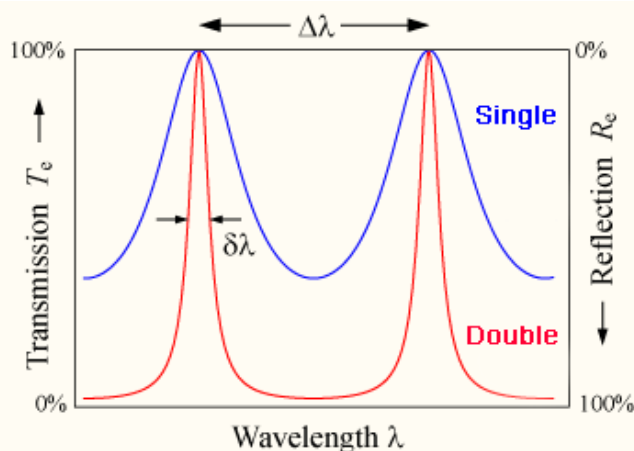
The etalon’s surfaces must be very precise (Lunt states theirs are  $1/100^{\text{th}}$  wave) and the gap must be exact (Lunt uses layers of mica as spacers). Although etalons are somewhat expensive to produce, they are far less expensive than previous  $H\alpha$  technologies.



What happens inside an etalon

Lunt sells etalon units in several apertures, to be mounted in front of a refractor’s objective lens or “double-stacked” on the front of an existing Lunt scope. “Double stacking” narrows the width of the

passed wavelengths, ultimately increasing contrast and detail.



Wavelengths passed by single etalon ("single") and a double-stacked system ("double"). The narrower bandwidth provides more contrast and detail.

I have a 50mm Lunt etalon and blocking filter and was looking for a way to build a larger aperture solar scope to improve the image scale and resolution.



The Lunt etalon

I happened to have a 90 mm f/10 objective on hand that seemed ideal. Simply making a refractor and putting the etalon in front would defeat the fundamental goal because the aperture would be reduced to 50 mm, compromising the image scale as well as making it impossible for me to reach the tuning knob; my arms would have to be more than 3½ feet long! If I could place the etalon inside the scope relatively near the observing position, where the light cone was reduced by the objective lens to a diameter less than 50mm, I could maintain the full image size and resolution of the objective while getting optimal performance from the etalon.

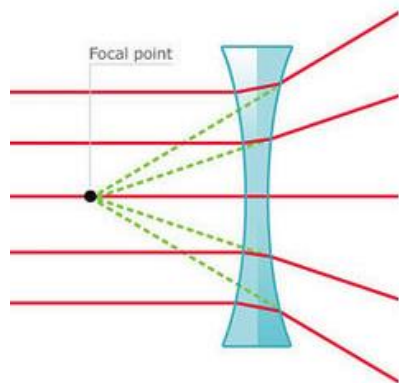
I got the idea for this project from reading about a design for a hand-held H $\alpha$  scope posted on the Internet by David Groski, a Delaware amateur astronomer. He made his 60-mm instrument from a riflescope and two narrow-band H $\alpha$  filters in a tiltable housing to permit tuning. I thought I could scale this up and utilize the etalon I already had, which should give a narrower bandpass and therefore better image contrast than using two filters. An important consideration was that I could use the Lunt etalon without having to modify it.



A partially assembled 50mm Lunt etalon at the Lunt factory in Tucson (photo by L. Faltz)

Etalons work best when light comes in at a very high focal ratio, better than f/25, and they work optimally when the wavefront is completely parallel, that is, f/ $\infty$ . The light waves from a point source such as a star can be considered as being parallel. The sun is half a degree in diameter, so the wavefront of the light reaching the front of an objective is the equivalent of about f/107. The first commercially available etalon H $\alpha$  scopes made by Coronado had the etalon at the front, which was reasonable considering the f/107 figure. One practical problem with this setup was that it was hard to reach the small wheel that tuned the filter, especially with larger objectives with their longer focal lengths, and many subsequent designs placed the primary etalon behind the objective with the tuning control closer to the focuser and eyepiece. Double stacked scopes usually use a second etalon on the front, but Lunt is now making double-stacked scopes with both etalons inside the tube. The problem with an internal etalon is that because the objective focuses the beam, the wavefront is changed to whatever the objective's f ratio is, in our case f/10. To maximize image quality, that wavefront must be made as close to parallel as possible when it enters the internal etalon. This can be

done in one of two ways: with a negative lens (such as a simple biconcave lens or a doublet, such as a Barlow) or a “relay” system. The negative lens system, used in most commercial scopes, is more compact, but it requires a short focal length objective lens (which is more expensive) and is extremely sensitive to any tilt of the optics, making construction much harder. I opted for the relay system.



How a negative (biconcave) lens makes converging light rays (coming from the right) parallel

Relay lenses are commonly found on endoscopes and periscopes, where they function to extend the length of the light path and invert the image. There are two kinds; I chose the one that uses two convex lenses (I used achromatic doublets that achieve the same result). The first lens makes the converging wavefront parallel, and then the second lens refocuses the wavefront for presentation to the eyepiece. By putting the etalon between the two lenses, it can operate on a completely parallel wavefront. The relay lens system gives a very uniform field and maintains the resolution of the objective lens, which for a 90mm lens is about 1.3 arc minutes.

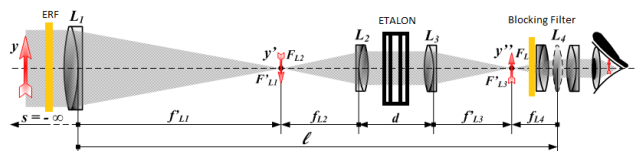


Diagram of the relay lens system as used in this telescope

Another advantage of the relay system is that the image size depends on exact position of the relay lenses, which means you can enlarge or reduce the image size to some extent. When both focal lengths just touch each other the image size is unity (the same that the scope's objective lens naturally provides). The disadvantage is that the scope becomes fairly long (over 5 feet) and a bit unwieldy. On the other hand, one could say that a scope of that length is “impressive.”

The formula for placing the optics is fairly simple. The length of front part of scope is the focal length of the objective (900 mm) plus the focal length of the first relay lens (400 mm). The back part of the scope, which contains the etalon, is the physical length of the first lens plus the length of the etalon plus the physical length of the second lens plus the focal length of the second relay lens (400 mm) minus the length of the focuser (to get the image plane in the right place for the eyepiece).

A critical item is an Energy Rejection Filter (ERF) on the front of the scope, which reduces the intensity of the sunlight entering the scope as well as filtering out UV and IR wavelengths that can damage the optical coatings. It goes in front of the objective. An unmounted Lunt 100 mm ERF is \$325, but it's a necessary item for an H $\alpha$  scope. At the back end of an H $\alpha$  scope is a Blocking Filter, which goes in front of the eyepiece and gets rid of all of the frequencies except the 656.28 nm H $\alpha$  line. The Lunt filter is combined with a diagonal, so the only other optical component needed is an eyepiece. I've got plenty of those.

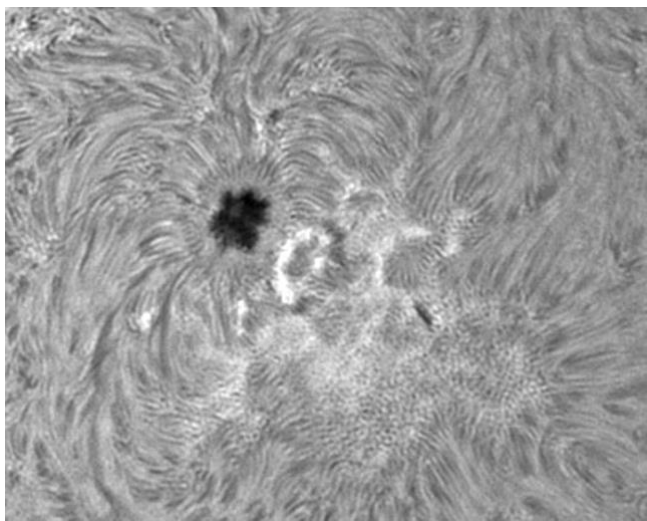
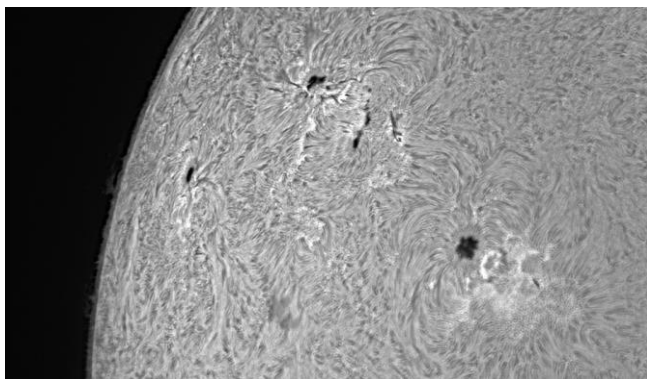
The key to constructing the scope was the fortuitous finding that the Lunt 50 mm unit and the 90mm objective lens set fit almost perfectly in a 4 inch PVC pipe, requiring only minor modifications and shimming. PVC is easy to cut and drill. I preferred not to make permanent bonds with PVC solvent and so the segments were secured with small screws. Each PVC pipe size is accompanied by a variety of concentric fittings that allow you to mate shorter pieces, which helped when I was installing the various components. In addition, there are reducing fittings that allowed me to easily mount a commercial 2" focuser on the back end. PVC is strong and lightweight.

I needed about 60" of 4" PVC piping plus some additional fittings, all easily obtained at stores like Home Depot or Lowe's. Screws, tape, some rubber foam and paper were used. I simply slip-fit the etalon into one section of the tube and shimmed it with rubber tape. I cut a small window cut in the tube to provide access to the tuner wheel. The relay lenses were relatively inexpensive 80 mm f/5 (400 mm focal length) convex lenses obtained from Surplus Shed. They also fit nicely into the tube, secured with some rubber rings that I made. They're located about 1 inch on either side of the etalon. I also flocked the inside of the tube with black felt to absorb any stray light. I felt that was easier and more effective than making baffles. I secured a

dovetail bar to the scope with hose clamps so it could be mounted on a tripod.

The final result was very gratifying. The scope provides an image that's more detailed than Lunt's more costly 60 mm scopes. The view is remarkably close to the image in Mike Virsinger's 100mm Lunt (although he's got a second, internal, etalon for double-stacking). In fact, I was so happy with the result for the 90 that I built a 104 mm scope with a fine Dutch objective I obtained in 2002 that was looking for something to do. This 1/8<sup>th</sup> wave Zeiss-variant glass has a 1200 mm focal length. I just swap out the etalon/relay segment of the 90 mm scope into the body of the 104 mm scope. The only drawback is that the 104's tube is much longer, and that makes it much more unwieldy.

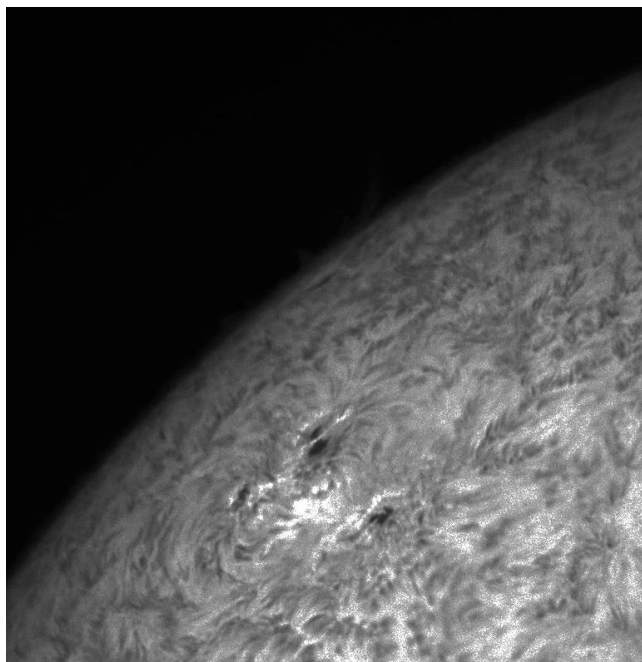
Chromatic aberration in the optics is not a consideration when only one discrete wavelength of light is passed through the system, so a super-fine ED objective isn't necessary to get a really smashing image.



Two images of the sun on July 10th



Here I am with the scope at the 2014 WAA picnic



One of my first images, April 2014

## Observing the Summer Triangle

By Larry Faltz



The stars and dust of the Milky Way runs through the Summer Triangle, accompanied by a meteor. Photo by the author taken on July 23, 2014 near Avon, Colorado. SQM was 20.16, transparency 4/10. Canon T3i with 14mm f/2.8 lens mounted on iOptron SkyTracker. 90 seconds at ISO 1600. The bright star above center is Vega. Can you find Deneb and Altair?

This is the time of year to view the Summer Triangle and survey its astronomical riches. The asterism flies overhead, sitting right across the Milky Way and moves into the western sky on cooler, less humid September and October nights.

The Triangle is made up of the three 1<sup>st</sup> magnitude stars Vega ( $\alpha$  Lyrae, mag 0.03, distance 25.04 LY, type A0), Altair ( $\alpha$  Aquilae, mag 0.77, distance 16.73 LY, type A7) and Deneb ( $\alpha$  Cygni, mag 1.25, distance 1418 LY, type A2). As an asterism, it was popularized in the early 20<sup>th</sup> century, but it was clearly recognized by the ancients. Vega and Altair form the basis of a charming Chinese folk tale, *The Weaver and the Cowherd*, which dates back at least as far as the 6<sup>th</sup> century BC (probably much farther). It was known to Confucius. The weaver girl Zhinu is represented by Vega and the cowherd Niulang by Altair. For one of the

usual trivial god-affronting reasons common to folktales, their happy love was forbidden and they were banished to opposite sides of the Silver River (the Milky Way). However, Chinese tales often have an element of forgiveness, and so once a year, a flock of magpies forms a bridge that would permit the lovers to unite. The popular legend was referred to more than once by the great Chinese poet Du Fu (8<sup>th</sup> century AD), who frequently used images of the night sky in his works. Robert Burnham, in his famous *Burnham's Celestial Handbook*, quotes the following lines:

*Silver candles, autumn night, a cool screen,  
Soft silks, a tiny fan to catch the fireflies...  
On the stone stairs the night breathes cool as water.  
I sit and watch the Herd-Boy and the Weaving-Girl...*

Because the lovers are allowed to meet only on the 7<sup>th</sup> day of the 7<sup>th</sup> month of the year, this day is celebrated

as the Qixi Festival (七夕節), which generally falls in August. During the festival, people go out at night to observe Vega and Altair, and so they'll get a good look at the whole area of the Summer Triangle. If they have a telescope (and they should...the vast majority of consumer scopes are made in China these days) they can see a variety of interesting objects.

On a moderately dark night (the best we get around here), there are quite a few objects awaiting your perusal in a small telescope. For nebulas, a good light pollution filter, like an IDAS P2 or Orion SkyGlow, helps quite a bit; some people like the more aggressive Orion Ultrablock or Lumicon UHC. These filters suppress skyglow from light pollution by filtering out wavelengths of earthly but not celestial origin. They increase the contrast of extended objects. A very narrow-band Oxygen III filter provides the most contrast but also shows the most dimming. The skill of averted vision often helps.

### Constellations

In addition to Lyra (the Lyre), Cygnus (the Swan) and Aquila (the Eagle), which contain the three stars of the Summer Triangle, there are two more constellations that are partially inside it. Vulpecula (the Little Fox)

has no stars brighter than magnitude 4.4, but it's notable for containing M27, the Dumbbell Nebula, and Collinder 399, Brocchi's Cluster, better known as the Coathanger. Tiny Sagitta (the Arrow), whose brightest star is also about magnitude 4.4, contains the globular cluster M71.

To save space, I won't give coordinates for each object. Use a star atlas, planetarium program or your go-to controller to find the objects. For double stars I'll give the SAO number of one of the components in case that's the best way to program the star's identity into your go-to controller. I find that an easier way to locate non-named stars with my iOptron Minitower.

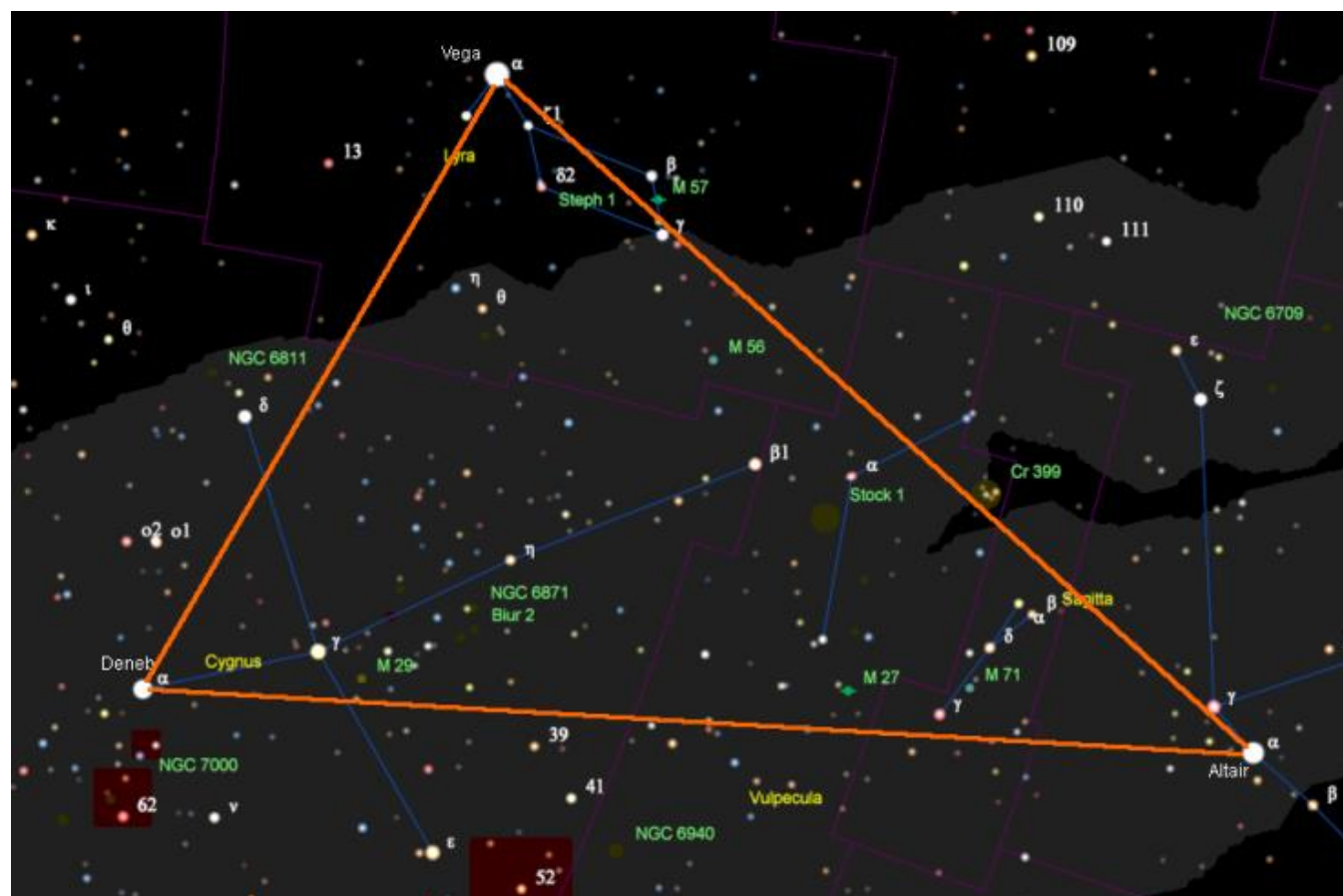
### Double stars

#### **Beta Cygni (SAO 87301, mag 3/5.1, sep 35")**

The famous Albireo is a telescopic wonder, easily found, split in any instrument (even binoculars) and glowing in gold and blue. It's often a first stop in a summer evening's outreach program, justly so.

#### **Epsilon Lyrae (SAO 67309, mag/sep 3.5'/2.35")**

The famous "Double Double" is not far from Vega. The two main components are widely split, some 208" (3.5', about a tenth the width of the full moon). The

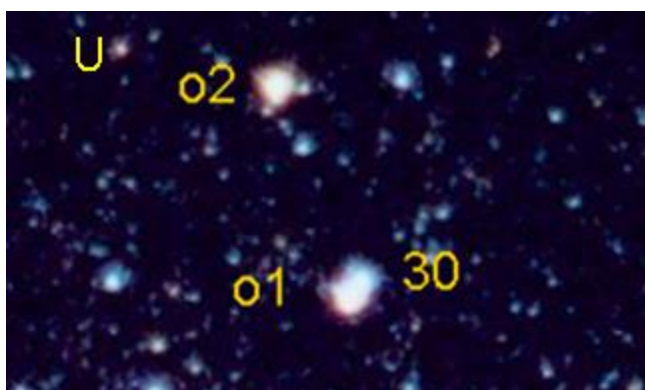


two stars of  $\epsilon^1$  are mag 4.7 and 6.2, separated by 2.35" and the stars of  $\epsilon^2$  are mag 5.1 and 5.5, separated by about the same amount. Make sure your Newtonian or SCT scope is well collimated to cleanly split each member of the primary pair.

### Delta Lyrae (SAO 67537, mag 4.3/5.6, sep 10')

The two stars of  $\delta$  Lyrae are not truly in orbit around each other. They form a "visual" binary.  $\delta^2$  (mag 4.3) is a red giant star, 900 light years distant, the brightest member of the vague Stephenson 1 open cluster.  $\delta^1$  (mag 5.6) is a blue white star 1,100 light years away, but turns out to be a spectroscopic binary.

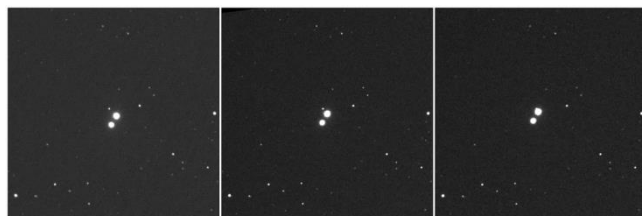
### Omicron Cygni & 30 Cygni (SAO 49643 [ $\alpha^1$ ], mag 3.8/3.9/4.8, sep 1.0°/5.5')



The orange omicron pair is widely separated by more than a degree, which makes you wonder why they have the same name, but blue-white 30 Cyg is only 5' from omicron<sup>1</sup>, making a nice visual double even if these stars are not physically related. 43' east of o1 is U Cygni, a red carbon star, mag 8.25.

### 61 Cygni (SAO 70919, mag 5.2/6, sep 28")

Sometimes called Bessel's Star or Piazz's Flying Star because of its large proper motion, which was first noted in 1804, this was the first star (albeit a double) to have its parallax measured. Friedrich Wilhelm Bessel obtained a distance of 10.3 LY from his measurements, close to the current value of 11.4 LY.



Proper motion of 61 Cygni between 2006 (L), 2008 (C) and 2010 (R). Note its movement relative to a fainter background star. (Wolfgang Vollmann)

### Open clusters

Open clusters are associations of stars that formed in the same molecular cloud, and so are all about the same age. They are sometimes referred to as "galactic clusters" to distinguish them from globular clusters, which are really extra-galactic, surrounding the Milky Way rather than in it. Open clusters are often more distinct in the eyepiece than in astrophotographs. Clusters smack dab in the Milky Way can be hard to pick out from the rich starry background. Open clusters are particularly beautiful when reasonably wide fields are used.

### Collinder 399 (Vulpecula, mag 3.6)



Perhaps the most famous open cluster in the Summer Triangle is Brocchi's cluster, known as the Coathanger. It's easily found almost on a direct line between Vega and Altair. It was first noticed by the Persian astronomer al-Sufi in the 10<sup>th</sup> century, and was described in his *Book of the Fixed Stars* (964), a manuscript copy of which was in the recent Treasures from the Bodleian Library (Oxford) exhibition at the Morgan Library in Manhattan.

### M39 (Cygnus, mag 5.5)



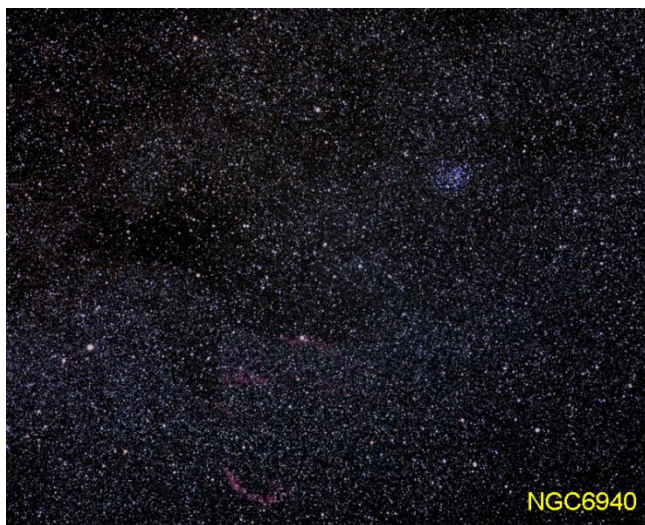
M39 is as wide as the full moon. This group of about 30 stars lies 800 light years from us. The cluster is about 300 million years old. They can be distinctly picked out from the rich background of the Milky Way.

#### M29 (Cygnus, mag 7.0)



Located not far from  $\gamma$  Cygni, the heart of the Swan, this 10-million year-old cluster lies at an uncertain distance; values from 4,000 to 7,000 light years have been cited. On long-exposure deep-sky astrophotographs, there is nebulosity surrounding the cluster, known as the “Cooling Tower”. M29 is approaching us at 28 km/s.

#### NGC6940 (Vulpecula, mag 6.3)



Also about half-moon-sized, this compact open cluster sits against a slightly less intense background than M39. It's near the Veil Nebula, as seen in the wide-angle photograph above. It lies 2,500 light years from Earth. Its 100 or so stars are about 890 million years old.

#### NGC6871 (Cygnus, mag 5.2)



This young (9 million years old) cluster has about 50 members, mostly blue-white stars, in an area 20 arc-minutes in diameter. It lies at a distance of 5,135 light years.

#### NGC6709 (Aquila, mag 6.7)



About 60 stars covering an area about half the diameter of the full moon lie at a distance of 3,900 light years. The age of the cluster is about 315 million years.

#### Globular Clusters

Although we are looking into a dense part of the Milky Way, there are a few globular clusters in the region. We manage to see them through a substantial bulk of the nearer Milky Way, but in a direction away from the galactic center.

Globular clusters form a spherical halo surrounding the center of the galaxy. There are at least 150 globulars encircling the Milky Way, and presumably more remain to be discovered because they must be hiding behind dust and intervening stars along our line of

sight. The Andromeda nebula may have as many as 500 globulars. M87, the giant elliptical galaxy in Virgo that is near the center of the Virgo galaxy cluster, has over 13,000 globulars surrounding it, some as far as 130,000 light years from the galaxy's center.

#### M71 (Sagitta, mag 6.1)



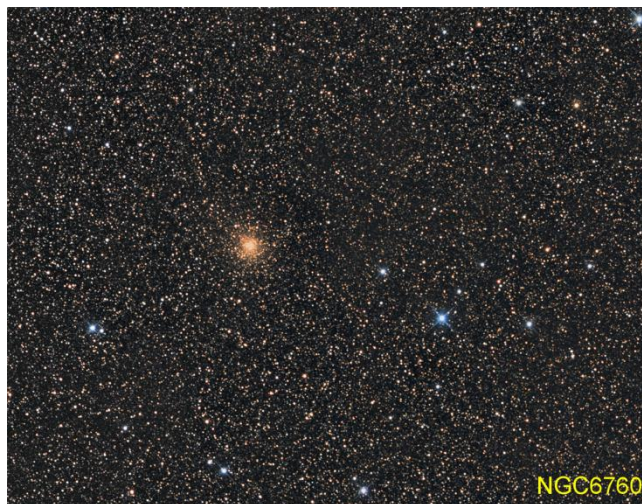
The distance to this globular cluster is 13,000 light years. For a long time it was thought to be a dense, somewhat metal-rich open cluster until modern photometry disclosed that it is indeed a globular cluster.

#### M56 (Lyra, mag 8.3)



This cluster is on the far side of the Milky Way, some 32,000 light years away. Like all globular clusters, it's very ancient, at least 13 billion years old.

#### NGC6760 (Aquila, mag 9.1)



This globular cluster is about 12° southwest of Altair but still within the boundary of Aquila and smack dab in the middle of the Milky Way. It is 24,000 light years distant.

#### Nebulas

#### M57 (Lyra, mag 8.8, planetary nebula)



The Ring Nebula is one of our true showpieces. It's easy to find halfway between  $\beta$  and  $\gamma$  Lyrae. Because of its reasonably high surface brightness, it's a fairly easy object in spite of its low visual magnitude. Even a small scope will show a ghostly smoke ring, often best seen with averted vision. It helps to use high power to narrow the field of view and with it the amount of skyglow (since the object occupies more of the field). The central star is 15<sup>th</sup> magnitude, but I can see it on the screen with my Mallincam under usual Ward Pound conditions. M57 appears more circular in

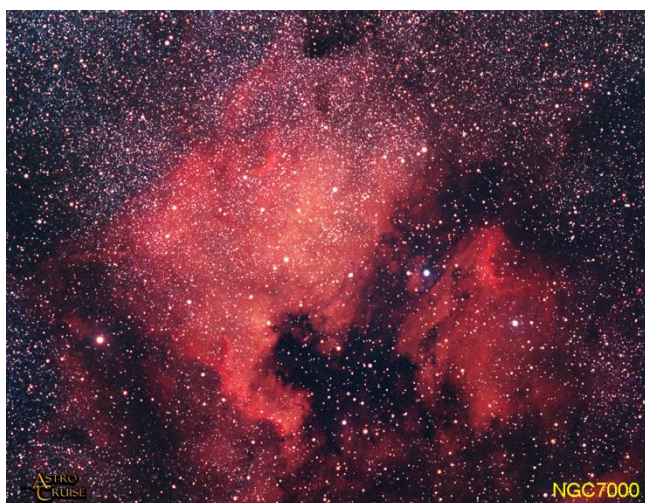
an eyepiece than in photographic images, primarily because we don't visually perceive the faint hydrogen at its upper and lower margins in our small telescopes. The Ring is 3.8 arc-minutes in diameter, about 12% as large as the full moon. Its distance is 2,300 light years, with significant (perhaps 40%) uncertainty. It's a crowd-pleaser for sure, a definite stop in any summer/fall viewing session.

#### **M27 (Vulpecula, mag 7.5, planetary nebula)**



The Dumbbell Nebula was the first planetary to be discovered, by Messier himself in 1764. It's a good bit larger than the Ring, about 8 x 6 arc-minutes. At a distance of 1,360 light years, it's closer than the Ring. It's less dramatic in the eyepiece but responds well to LPR filters. I've had a good view of it with a 105 mm refractor and LPR filter from Ward Pound. It's spectacular with the MallinCam and a crowd favorite, more impressive on screen because of its larger size and distinct coloration.

#### **NGC7000 (Cygnus, mag 4, emission nebula)**



From our light-polluted location, the North America Nebula is difficult. It's a naked-eye object in very dark, clear skies, and it's not hard to photograph. It's quite easily seen near Deneb in the photo at the head of this article. Even though it's listed as magnitude 4, it's so spread out ( $2^\circ \times 1.6^\circ$ ) that it's a real challenge when there's significant light pollution. At our star parties, it's potentially visible in the larger Dobs at low power with filtration. It's particularly dramatic with the BiPH image intensifier system when used with a hydrogen alpha filter and a telephoto lens.

#### **NGC6888 (Cygnus, mag 7.4, emission nebula)**



The final object in our survey is the Crescent Nebula, a very challenging object because of its low surface brightness. It's quite a bit larger than the Dumbbell, some 18x12 arc-minutes. It definitely needs an OIII or ultra-high contrast LPR filter and the more aperture the better.

Most of these objects are well within reach of WAA members' telescopes. Some patience, dark adaptation and filtration (for the nebulae) will help. Go-to scope control always makes finding objects easy, but planning a route from bright stars via star-hopping isn't too difficult for most of these targets. For me, looking at double stars means using an apochromatic or ED refractor rather than my SCT, but a decent Newtonian or even a well-cooled Maksutov will give a good double-star image.

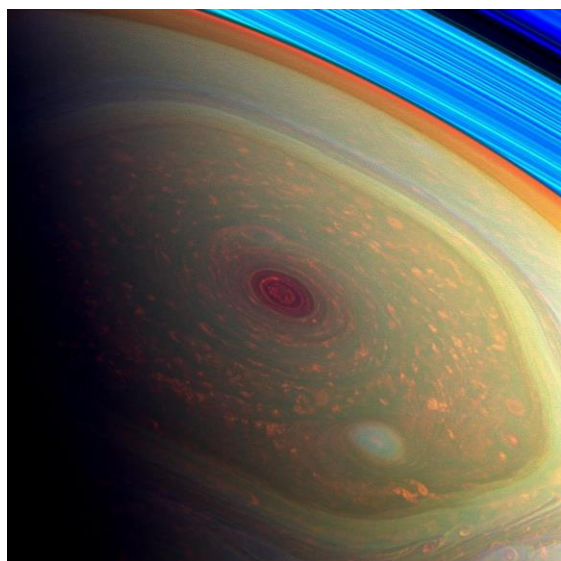
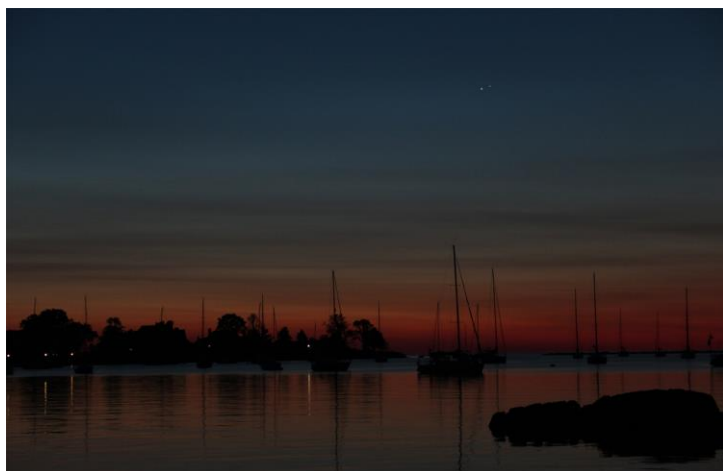
Of course, there are many fine objects elsewhere in the summer/fall sky outside of the Triangle, such the nebulae M8, M16, M17 and M20 setting in the southwest, the Double Cluster in Perseus and M31 in Andromeda, rising in the east as the evening progresses, and several dozen globular clusters brighter than 10<sup>th</sup> magnitude. Plan to look beyond M57 this fall!

## Astrophotos



### ◀ Venus-Jupiter Conjunction

Larry Faltz took these two images of the Venus-Jupiter conjunction on August 18<sup>th</sup> at Manor Park in Larchmont. Notes Larry: The high-power shot (at 5:18 am) is 0.25" ISO 800 with Stellarvue SVR-105 (FL 735 mm, f/7) and Canon T3i. Venus was mag -3.9, Jupiter mag -1.8, so Venus was by necessity overexposed if the moons of Jupiter were to be imaged. The wide angle (at 5:24 am) is with a Canon 18-135 zoom at 53 mm, f/5 1/8 sec ISO 800.



### ◀ North Pole

This is an [APOD](#) image of Saturn's north pole. Acquiring its first sunlit views of far northern Saturn in late 2012, the Cassini spacecraft's wide-angle camera recorded this false color of the ringed planet's north pole. The composite of near-infrared image data results in red hues for low clouds and green for high ones, giving the planet's cloudscape a vivid appearance. Saturn's north polar hurricane-like storm is deep, red, and about 2,000 kilometers wide. Clouds at its outer edge travel at over 500 kilometers per hour.

Image Credit: [Cassini Imaging Team](#), [SSI](#), [JPL](#), [ESA](#), [NASA](#)