SKYSCRAPERS INC.

the Skyscraper

vol. 44 no. 07
July 2017

AMATEUR ASTRONOMICAL SOCIETY OF RHODE ISLAND ⋆ 47 PEEPTOAD ROAD ⋆ NORTH SCITUATE, RHODE ISLAND 02857 ⋆ WWW.THESKYSCRAPERS.ORG

In This Issue:

Skyscrapers Board Meetings
Third Monday of the Month
All Members Welcome

Phases of the Moon

First Quarter Moon
July 1 00:51

Full Apollo Moon
July 9 04:07

Last Quarter Moon
July 16 19:26

New Moon
July 23 09:46

First Quarter Moon
July 30 15:36

Friday, July 7 at Seagrave Observatory

One small step for AOK, one giant leap for Kosovo.

Pranvera Hyseni is 21 years old from the Republic of Kosovo in southeastern Europe. She is the founder and director of Astronomy Outreach of Kosovo, which is the largest, non-profit astronomy outreach program in that country. She currently attends the University of Pristina School of Natural Sciences and Mathematics and majors in Geography. Astronomy Outreach of Kosovo is also a chapter of the Charlie Bates Solar Astronomy Project which is located in Atlanta, GA.

Pranvera will describe the astronomy outreach program in Kosovo. While this country has recently been through a war, she will relate how her group dealt with many difficulties and setbacks and has managed to be successful and popular just in a relatively short period of time, impacting the people and children in Kosovo.

This summer, she was a featured speaker at the Texas Star Party and will be presenting at Spacefest, Tucson Amateur Astronomy Association, and Grand Canyon Star Party. She will also speak at the Harvard-Smithsonian Center for Astrophysics in Cambridge, MA.

Margaret M. Jacoby Observatory Open House

CCRI will welcome the public to the Margaret M. Jacoby Observatory at the Knight Campus in Warwick during an open house from **10 a.m. to 2 p.m. on Saturday, July 8.** Visitors can meet astronomers and get a daytime view of the observatory, which recently underwent upgrades including new bench seating for visitors, a new control desk and work station. Control wiring also was moved underneath the floor and repairs were made to the mechanism to open the roof for viewing.

Astronomy Nights at River Bend Farm

Joshua Bell is one of the rangers at Blackstone River Valley National Historical Park and contacted us suggesting that Skyscrapers might be interested in attending the upcoming Night Sky Programs to be held at River Bend Farm.

The park has partnered with local Civil Air Patrol Squadrons to run the program. They'll be explaining basic stuff to visitors like how telescopes work and what it is that they'll be looking at. They'll have some beginner telescopes, but folks should feel free to bring their own. The following dates are scheduled: June 16 — 9:00-10:00pm • **July 14 - 9:00-10:00pm • August 11 - 8:30-9:30pm • September 15 - 7:30-8:30pm • October 20 - 6:30-7:30pm**

If we have poor weather an email will be sent out that day to let you know that the program has been postponed until the next evening (Saturday). If both days give us bad weather, we'll just have to wait until the following month.

Please don't hesitate to contact Josh with any questions at joshua_bell@nps.gov

The Skyscraper is published monthly by Skyscrapers, Inc. Meetings are held monthly, usually on the first or second Friday or Saturday of the month. Seagrave Memorial Observatory is open every Saturday night, weather permitting.

Directions
Directions to Seagrave Memorial Observatory are located on the back page of this newsletter.

Submissions
Submissions to The Skyscraper are always welcome. Please submit items for the newsletter no later than **July 15** to Jim Hendrickson, 1 Sunflower Circle, North Providence, RI 02911 or e-mail to jim@distantgalaxy.com.

E-mail subscriptions
To receive The Skyscraper by e-mail, send e-mail with your name and address to jim@distantgalaxy.com. Note that you will no longer receive the newsletter by postal mail.

Partial Solar Eclipse at Seagrave Observatory
Monday, August 21, 2017

(rain date, April 8, 2024)

Jeff Padell will be leading our local solar eclipse star party at Seagrave Observatory on Monday afternoon with white light and hydrogen-alpha-filtered solar telescopes. For more information, contact Jeff at jeffpadell@gmail.com.

Star Spangled Banner

by Francine Jackson

240 years ago, the American Continental Congress approved the design of our American flag. But, even to this day it is unknown why stars were chosen to be a part of its design, although the flag was being called the "star spangled banner" decades before the name was given to our National Anthem.

One possibility of having stars a part of our flag comes from the fact that scientists such as Benjamin Franklin and Thomas Jefferson were said to refer to the new country as "a new constellation"; others attribute the concept of a blue field with stars as a tribute to David Rittenhouse, a clockmaker and astronomer from Philadelphia. In fact, it is possible that Betsy Ross, who was a Philadelphia native, might have been suggested as the original flag maker by Rittenhouse.

It appears the resolution for the first flag came from the Continental Marine Committee of the Second Continental Congress: "Resolved. That the flag of the United States be made of thirteen stripes, alternate red and white, that the union be thirteen stars." The stars were meant to represent the original states, which had been originally British colonies, but no single star was to represent any particular state.

The second national flag to be made, in 1795, had 15 stars and stripes, to welcome the new states of Vermont and Kentucky; however, as new states began coming into the Union, the concept of a stripe for each was dropped, and only stars were added to honor the new member. As a memento of the original, though, the stripes were brought down to the original 13. It was also declared that, although the actual flag remembrance day, June 14, be designated as Flag Day, all new states would be introduced, and the new flag, with the required number of stars, would roll out on July 4th.

One of the questions that often come out is why the five-pointed stars were made to be a part of the design. Legend has it that Betsy Ross, in instructing persons in sewing the flag, realized that six-pointed stars were much harder to make quickly to keep up with the demand.

Francine Jackson is Skyscrapers Public Relations Spokesperson, writes the weekly newsletter for Ladd Observatory and serves as planetarian at the University of Rhode Island. See more at http://theskyscrapers.org/francine-jackson

Astronomical Potpourri in July

by Dave Huestis

Dateline: July 1, 2017. You don't have to be an avid weather watcher to realize that meteorological spring (March, April, May) was absolutely "drismal"! On the last day of May the Providence area ended up being the fifth wettest spring on record since records were kept beginning in 1905. We missed tying the fourth wettest record of 17.94 inches set back in 1948 by just one-tenth of an inch. NBC 10's chief meteorologist Mark Searles agrees with agent Maxwell smart: "Missed it by that much!"

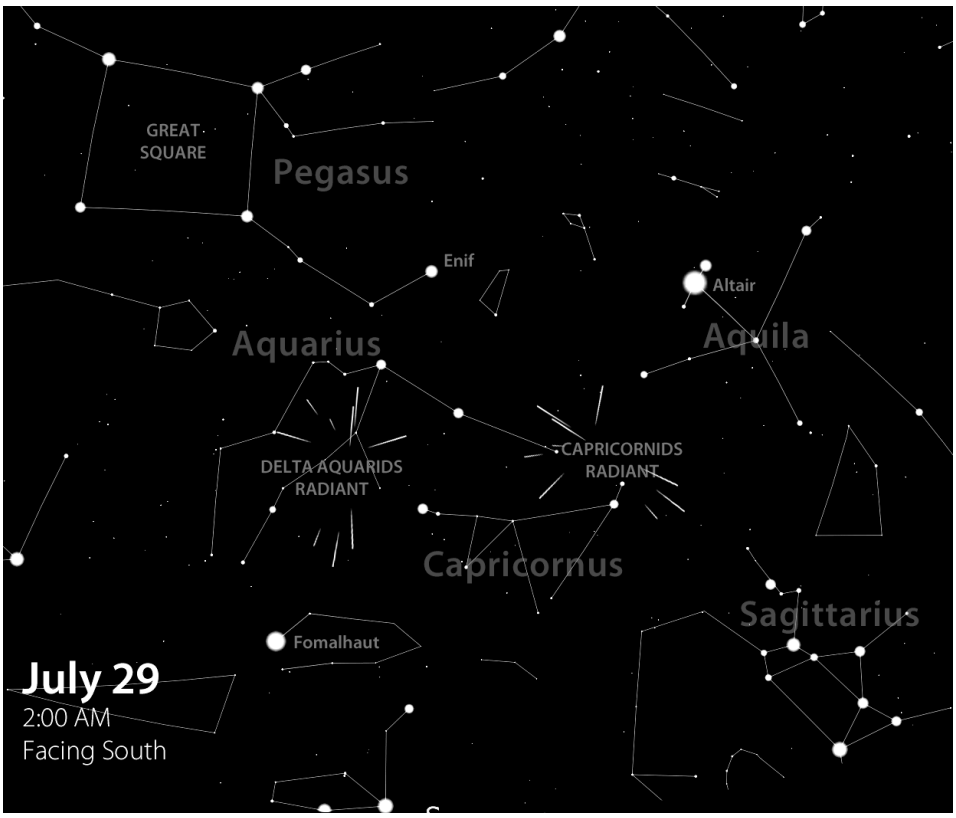
These cloudy/rainy conditions certainly put a dampener on the public open nights at the local observatories. Each year when this happens I often say it can't get any worse. Then it does!

But once in a while we do get a good clear night. The night of May 16 was perfect. After so many weeks of less than ideal sky conditions forcing closures, Ladd Observatory in Providence opened its dome for public viewing. We were deluged (pun intended) with visitors. They were all treated to fantastic views of Jupiter and his four Galilean moons (until Ganymede disappeared behind the disk of the planet). Ladd Observatory Manager Bob Horton and I estimated 150 folks enjoyed the gorgeous view provided by the 12-inch Brashear refractor telescope that night.

Jupiter will continue to be favorably placed for observation during July. On the first it will form a nice triangle with Virgo's bright star Spica and a waxing gibbous Moon. By month's end Jupiter will set just before 11:00 p.m., so come out to any of the local observatories to take a look at this beautiful planet before it gets too low in the sky to be easily observed.

However, as July begins everyone will be treated to views of the magnificent ringed-planet Saturn. I'm sure Saturn will soon replace Jupiter as the main focus of our open nights. As long as the skies are cloud-free we will be observing Saturn and his absolutely beautiful rings throughout the summer and into mid fall. If the local observatories should encounter cloudy skies for several consecutive weeks, once they reopen be sure to arrive early. For when Saturn is in view crowds descend upon the public open nights.

Currently Saturn's rings are tilted almost to their maximum angle possible—about 27 degrees— providing a remarkable three-dimensional view of them and the disk of the planet. In astronomer Garrett P. Serviss' 1901 book, Other Worlds, he wrote, "Many telescopic views in the heavens disappoint the beginner, but that of Saturn does not. Even though the planet may not look as large as he expects to see it from what he has been told of the magnifying power employed, the untrained observer is sure to be greatly impressed by the wonderful rings, suspended around it … No previous inspection of pictures of these rings can rob them of their effect upon the eye and the mind. They are overwhelming in their inimitable singularity, and leave every spectator truly amazed." I couldn't agree more.



Should clear skies prevail and you are an early riser, brilliant Venus will be that beacon in the pre-dawn eastern sky. All month Venus will be amongst the stars of Taurus. Before the sky brightens too much you can view the Pleiades star cluster, also known as Subaru, as well as the V-shaped Hyades star cluster which contains Taurus' brightest star Aldebaran. This sky scene should be very picturesque. Try to snap a few images.

Contrary to popular belief, the Earth is not at its closest distance to the Sun in July. Our planet is actually at aphelion (farthest from the Sun) on July 3 at about 94,505,901 miles at 4:11 p.m. EDT. It just so happens that the tilt of the Earth's polar axis has the northern hemisphere tipped toward the Sun at that time, providing more direct sunlight for us. At perihelion (Earth closest to the Sun) back on January 4, the Earth-Sun distance was 91,404,322 miles. The difference, just over three million miles (or 7 percent), has little effect on our planet. However, northern hemisphere summer is warmer than its southern hemisphere counterpart because of the fact that there is much more land mass north of the Earth's equator to absorb the solar radiation.

Our solar system's innermost planet Mercury can also be glimpsed this month, providing you have an unobstructed view of the western horizon after sunset. Mercury will be less than ten degrees above that horizon at its highest. Increase your chances of seeing it by looking on July 25 soon after sunset. Mercury will be about seven degrees to the lower right of a waxing crescent Moon, and just one degree (equivalent to two full moon diameters) to the lower left of Regulus, Leo's brightest star.

And finally, the Moon will not affect observation of two late month meteor showers. These overlapping shooting star displays are best observed from the southern

hemisphere, but approximately 15-20 Delta Aquarids and Alpha Capricornids can be seen between midnight and dawn from July 28-30 locally. Face south and scan from the horizon to zenith and left to right. Both showers display fairly bright yellow meteors, while the Alpha Capricornids are noted for producing brilliant fireballs. However, you might see more fireflies than meteors, depending upon sky conditions. That scenario can make it all worthwhile.

Though it doesn't get sufficiently dark to observe the heavens until after 9:15 p.m. or so during July, all of the local observatories will remain open during the summer months. Seagrave Memorial Observatory (http://www.theskyscrapers.org) in North Scituate is open every clear Saturday night. Ladd Observatory (http://www.brown.edu/Departments/Physics/Ladd/) in Providence is open every clear Tuesday night. The Margaret M. Jacoby Observatory at the CCRI Knight Campus in Warwick (http://www.ccri.edu/physics/observatory.htm) is open every clear Wednesday night. Frosty Drew Observatory (http://www.frostydrew.org/) in Charlestown is open every clear Friday night. Check the respective websites for open times.

As always, keep your eyes to the skies.

Great American Total Solar Eclipse on August 21, 2017. Countdown: 51 days as of July 1, 2017.

Dave Huestis is Skyscrapers Historian and has been contributing monthly columns to local newspapers for nearly 40 years. See more at http://theskyscrapers.org/dave-huestis

Globular Cluster in Ophiuchus

M14 (NGC 6402)

by Glenn Chaple for LVAS

Mag. 7.6; Size 11′

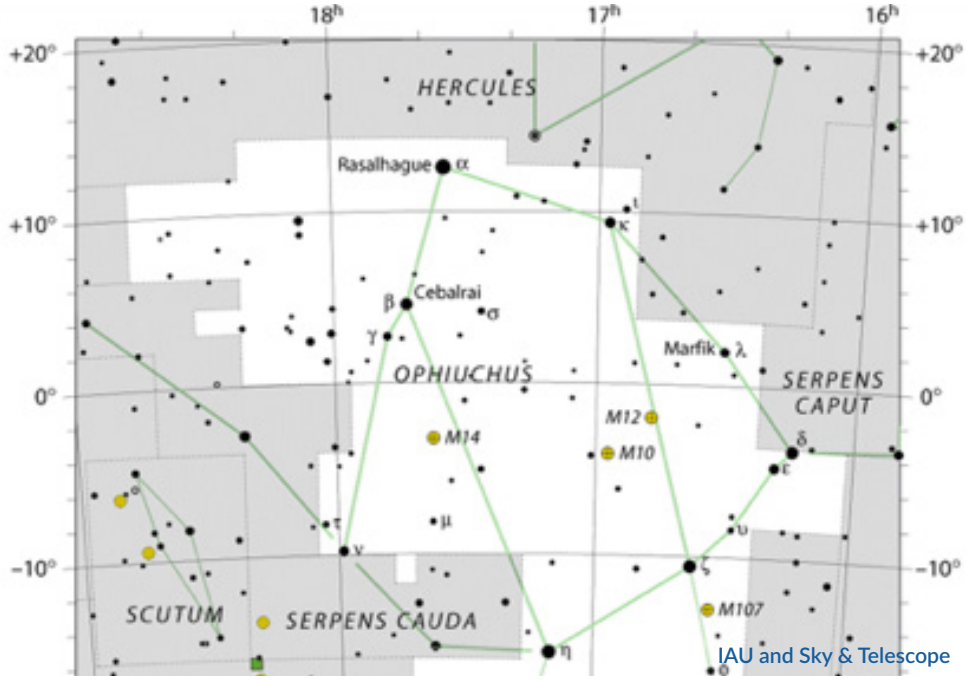
Ophiuchus is home to seven Messier globulars. One of them, M14, is this month's LVAS Observer's Challenge. It was discovered by Charles Messier on June 1, 1764 and first resolved into individual stars by William Herschel 19 years later. At magnitude 7.6, it's relatively faint, but still bright enough to be viewed with binoculars and small-aperture scopes.

I first saw M14 in the summer of 1977 with a 3-inch f/10 reflector and magnifying power of 30X. More recently, I picked it up with a 4.5-inch reflector at 76X. In neither case was there any hint of resolution.

Finding M14 is somewhat of a challenge, as it lies in a rather star-poor region of Ophiuchus. The accompanying finder chart shows its location about 5 degrees north of the magnitude 4.6 star mu (μ) Ophiuchi.

What is the smallest scope that can resolve this cluster? Is it uniformly bright or condensed towards the center? What is its overall shape – round or oval? Find out for yourself and forward your impressions (image, sketch, and/or notes) to the LVAS via the email addresses listed below.

M14 lies some 30,000 light years away. It contains an estimated 150,000 stars and spans a distance of about 100 light years.



Mario Motta, MD

The purpose of the LVAS Observer's Challenge is to encourage the pursuit of visual observing. It is open to everyone that is interested, and if you are able to contribute notes, drawings, or photographs, the LVAS will be happy to include them in our monthly summary. If you would like to contribute material, submit your observing notes, sketches, and/or images to either Roger Ivester (rogerivester@me.com) or Fred Rayworth (queex@embarqmail.com). To find out more about the LVAS Observer's Challenge or access past reports, log on to lvastronomy.com/observing-challenge.

A Guide to the Total Solar Eclipse of August 21, 2017

Part I: Eclipse Primer and Local Partial Eclipse Circumstances

by Dave Huestis

On August 21, anyone living in the continental United States will have the opportunity to observe an eclipse of the Sun. Depending upon where you live will determine how much of the Sun will be covered by the Moon. Most folks will see a partial eclipse. However, if you happen to reside in a 71 mile-wide path that stretches diagonally 2,500 miles across the United States from Oregon to South Carolina, then you will witness one of Mother Nature's most spectacular and beautiful events. I'm talking about the Great American Total Solar Eclipse of 2017.

Unfortunately totality will not be visible from southern New England. Here in Rhode Island about 65% of the solar disk will be covered by the Moon. However, a 16-18 hour drive could deliver you to a site within totality's path. The following guide will detail all you'll need to know to experience the eclipse from wherever you decide to observe it.

Why Does a Solar Eclipse Occur?

I think most everyone knows that the Moon orbits the Earth. And during a lunar month (29.5 days), the lunar disk exhibits varying degrees of illumination as the Earth/Moon/Sun angle changes continuously. We say that the Moon is going through phases. The main phases are New, First Quarter, Full, and Last Quarter, each phase lasting 7.375 days. For a solar eclipse to occur the Moon must pass between the Earth and the Sun. This scenario happens once a month only at New Moon. But why doesn't a solar eclipse occur each month? Other factors determine whether an eclipse happens or not.

The Moon's orbit is tilted five degrees from the plane of the ecliptic, the Sun's apparent path across the sky. For most months the New Moon passes above or below the solar disk as viewed from the Earth. However, when the Moon crosses the ecliptic (a position in space called a node) coincident with the Sun, a solar eclipse can occur.

But wait! There's more. I've often compared the celestial mechanics of a solar eclipse to a celestial ballet. The Earth, Moon and Sun must be in perfect alignment where a straight line could be drawn through their centers.

In addition, one incredible coincidence accounts for this spectacular event to happen at all. The Sun and Moon appear to be the same size. They cover an area in our sky of ½ of a degree. How can that be? Well, the Moon is 400 times smaller than the Sun but 400 times nearer to the Earth.

Different Types of Solar Eclipses

There are four different types of eclipses. When the proper alignment occurs, the Moon's shadows can be projected onto the Earth's surface. Yes, I did say shadows, for the Moon has two shadow cones. One is the dark shadow called the umbra. The lighter shadow is called the penumbra. For August's eclipse the Moon will completely cover the Sun, resulting in a total eclipse. The umbral shadow will sweep across about 8,000 miles of the Earth's surface in a path not more than 71 miles wide. If one could observe the progress of this eclipse from a vantage point out beyond the Moon's orbit, this animation shows what would be seen: https://youtu.be/yKFPL9xBe_U. Observers within the path will see totality, which will last a maximum of two minutes and 40.3 seconds in the vicinity of Carbondale, Illinois and Hopkinsville, Kentucky. Observers outside the path will see a partial eclipse as they will be within the penumbral shadow. How much of the solar disk is covered will depend upon how far away from the path of totality one is.

A second type of eclipse called an annular eclipse can occur. During an annular eclipse the Earth, Moon and Sun are in alignment, but the Moon's elliptical orbit has caused it to be a little farther from the Earth so that it doesn't completely obscure the Sun. We then see a ring (annulus) of sunlight surrounding the Moon. Annular eclipses have very narrow paths where the "ring of fire" (the Sun's photosphere and chromosphere) can be seen surrounding the Moon. They are dangerous to observe for this very reason. As with a total eclipse, observers outside the path will only see a partial eclipse.

There is also a rare solar eclipse type called a hybrid. Along the eclipse path the type can transition from annular to total or total to annular. This scenario occurs because during the event the Moon has moved closer to the Earth (blocking the Sun completely) or moved farther from the Earth (not blocking the solar disk).

And finally, there is a fourth type of solar eclipse. The Moon is close to a node, but it doesn't quite line up with the Sun and Earth. Only a partial eclipse will be seen. No totality or annularity.

Where and When does the August 21 Solar Eclipse Occur?

There is a wealth of information available on the internet about the August 21, 2017 total solar eclipse. One extremely useful interactive eclipse map can help with planning your eclipse experience: https://eclipse2017.nasa.gov/sites/default/files/interactive_map/index.html.

Zooming in and clicking on any location on the map will display details about the eclipse at these locations, including start time, time of mid-eclipse, end time, and how much of the solar disk will be covered by the Moon. Clicking within totality's path will also show the start and end time of totality, also noting the duration of totality. The times are provided in UT (Universal Time – a worldwide time standard.) Be sure to convert the provided times to the desired time zone.

How to Safely Observe this Eclipse

Whether you observe the eclipse locally or travel to position yourself within the path of totality, one common safety protocol must be observed. While totality can be viewed without any special protective filters, if even a small portion of the Sun's bright photosphere is visible, that unfiltered portion of the Sun can cause irreparable damage to one's eyes. When observing the Sun, observe caution as well. Please heed the following guidelines.

Amateur astronomers will be using a wide variety of telescopes to observe this wonderful event. For the partial phases they will be using special full-aperture solar filters that fit over the front end of the telescope tube. These filters of various designs block 100% of the harmful infrared and

ultraviolet radiation. They also significantly block 99.9999% of the Sun's brightness. This effectively prevents heat energy from entering the telescope, keeping the optics cool. Be very careful if you are new to using these filters. They are simple and safe to use if you prepare in advance.

A rather archaic method involves using a telescope to project the solar image onto a white sheet/screen (https://asedinburghjournal.files.wordpress.com/2015/05/img_1871.jpg). The advantage of using this observing method is that it allows many people to observe the image simultaneously. However, extreme caution must be observed. Do not leave this set-up unattended. You don't want anyone accidentally stepping up to an unguarded eyepiece to take a look. And regarding eyepieces—do not use cemented eyepieces. Use air-spaced ones. Eyepieces have been ruined when the cement has melted due to the heat produced by the concentrated sunlight collected by a telescope. And furthermore, remember to cap off your finder scope. I have seen solar observers singe their hair or clothes by failing to do so!!

Don't risk your eyesight or anyone else's due to an oversight or an outright mistake. And if you have one of those department store refractors that often come with small glass or plastic solar filters, throw them away. Do not be tempted to use them because they have been known to shatter when exposed to the Sun's concentrated image.

Think about what a small magnifying glass can do, and then imagine the amount of energy even a small telescope lens or mirror can focus. It's not worth damaging your eyesight. Many years ago, when I first started out in astronomy, I had one of those unreliable dark green plastic solar filters shatter during a partial solar eclipse. Luckily I wasn't looking through the eyepiece at the time.

The only time in which the Sun can be directly looked at will be if you are fortunate to be within the path of totality. No filters will be required then. However, before and after totality you will need eye protection. And I'm not talking about sunglasses either! Sunglasses will not provide adequate protection. Number 14 welder's glass is safe to use. DO NOT use exposed film (if you still have some around) of any kind. This method is not safe.

If you purchased some solar eclipse glasses for the transit of Venus back in 2012, here's your opportunity to put them to good use (considering clouds prevented many of us from observing that event). These inexpensive and safe eclipse glasses are available from a variety of manufacturers, including Rainbow Symphony (https://www.rainbowsymphony.com/eclipse-glasses/).

If you do not have access to any of the above safe solar observing techniques, you could engage your family in an interesting project by constructing a viewing device called the Shoebox Pinhole Projection System (SPPS). Use the following link to access directions on how to build and use this simple viewer: http://www.theskyscrapers.org/build-a-shoebox-eclipse-viewer.

Remember, severe eye damage or even blindness can result from looking directly at the partial phases of the eclipse. Don't lose your sight to an oversight.

Partial Eclipse Visible in Rhode Island

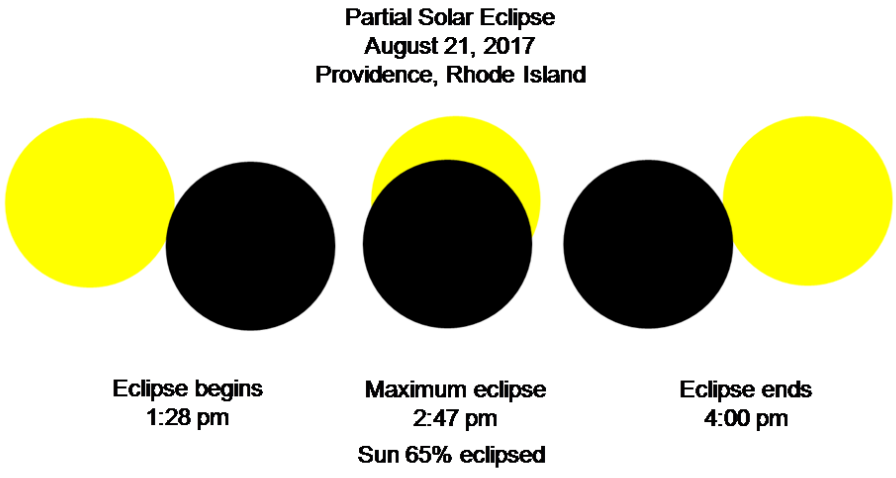
As I mentioned in the introduction, the Rhode Island area will experience a partial eclipse. The accompanying graphic shows the time schedule for this event.

As the graphic shows, the eclipse begins (called 1st contact) at 1:28 p.m. EDT when the Moon begins to slide from right to left in front of the Sun. Without optical aid this beginning phase will not readily be visible to the naked-eye. However, any increased magnification will help to catch sight of the Moon's disk sooner as it begins to "take a bite" out of the Sun. The Moon will continue to move across the face of the Sun, until it reaches its maximum obscuration of only 65% at 2:47 p.m. That would be a good time to look under nearby trees to see images of the partial phase. These images are created in much the same way the shoebox eclipse viewer works. Spaces between the leaves act as a pinhole camera, resulting in a myriad of eclipse images projected upon the ground or onto any surface.

After that point the Moon will continue to move to the left, and will move off the solar disk (4th contact) at 4:00 p.m. (Since totality is not experienced locally, there is no 2nd or 3rd contact.) Your 2 hour and 32 minute eclipse experience will then be complete, and the celestial ballet performed by the Earth, Moon and Sun will continue until the next great local partial eclipse performance on June 10, 2021.

Furthermore, if you have an opportunity to travel to observe totality, make every effort to do so. To prepare yourself for that incredible experience please go to this Skyscrapers link for Part II of this primer: http://www.theskyscrapers.org/2017-solar-eclipse-guide-part-2. There I have outlined all the phenomena an observer should look for.

I hope everybody will have a chance to observe some aspect of the Great American Total Solar Eclipse. This guide should provide enough information to allow you to safely observe this spectacular event. School will not be in session, so I encourage parents to properly warn their children on the dangers of solar observing. Please don't make them stay indoors though. Observe caution and everyone should safely experience one of Mother Nature's most beautiful phenomenon.



Shoebox Pinhole Projection System Eclipse Viewer Construction and Use

by Dave Huestis

The pinhole projection system can easily be constructed using a shoebox (reference figures 1 and 2). Choose the largest shoebox you can find.

1. Tape the top onto the box.

2. In one end of the box cut 2 to 3 inches off the top.

3. Inside the box on this end tape a piece of white paper. The white paper will be the viewing area where the projected image of the Sun will be visible for safe observation. White paper is used to increase the contrast of the image.

4. The most important step of this system is to cut a small hole in the opposite end of the shoebox.

5. Over this hole tape a piece of aluminum foil. Make a pinhole in the foil directly over the hole that was cut out of the shoebox. The foil is used because a pinhole in it will produce a nice round hole (a pinhole in the cardboard box would be rough and irregular).

Your pinhole projection viewing device is now complete. When it comes time to observe the eclipse, stand with your back to the Sun, place the shoebox on your shoulder with the pinhole end (E) facing the Sun, and watch the viewing area on the white paper inside the shoebox (C). Reference figure 3. There you will see a bright projected image of the Sun. The image will be small, about 1/4 inch in diameter, but it will be easy to see.

If you desire a larger image, a long-stem rose box could be substituted instead, but the image will only be slightly larger. For example, to produce a 1 inch in diameter image you would need a box about 9 feet long (a little difficult to hold on your shoulder). Regardless of the size of the image, this method is safe because it forces the observer to look in a direction away from the Sun. There is less temptation to continually glance upward at the Sun directly, as other methods tend to do. Viewing the eclipse this way is like watching a movie screen or a slide show.

Remember, severe eye damage or even blindness can result from looking directly at the Sun. Don't lose your sight to an oversight. Save your eyesight for many of the other spectacular astronomical events that will be visible from time to time.

Keep your eyes to the skies, but keep them protected for this wonderful event!

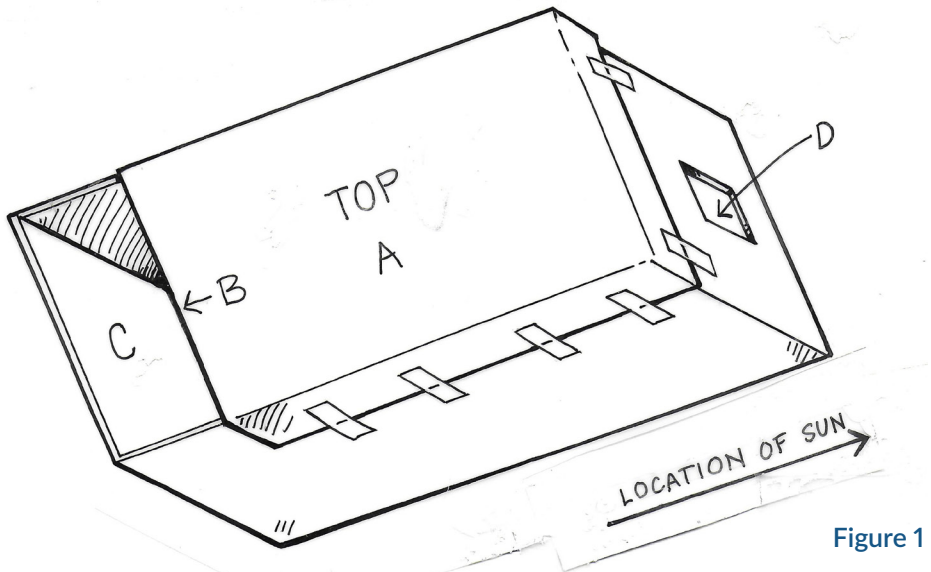


Figure 1

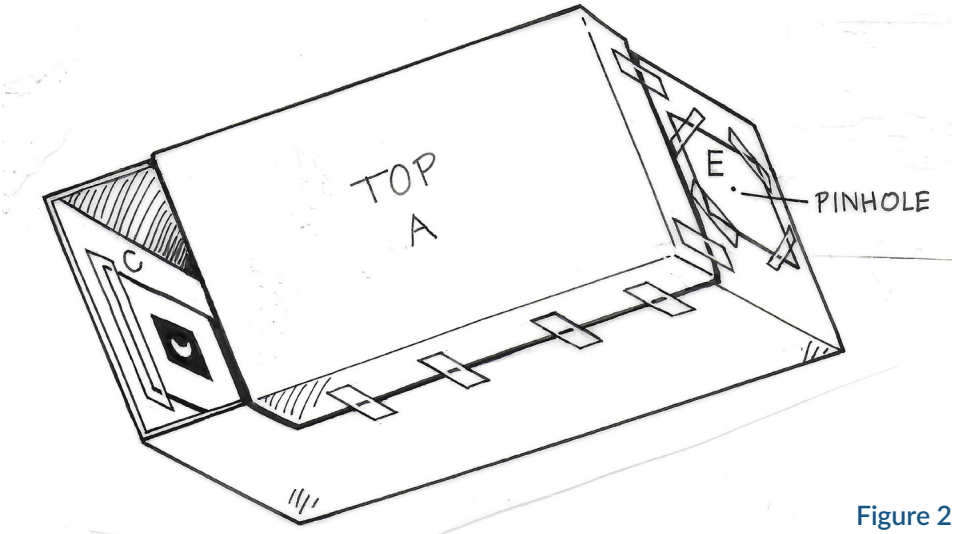


Figure 2

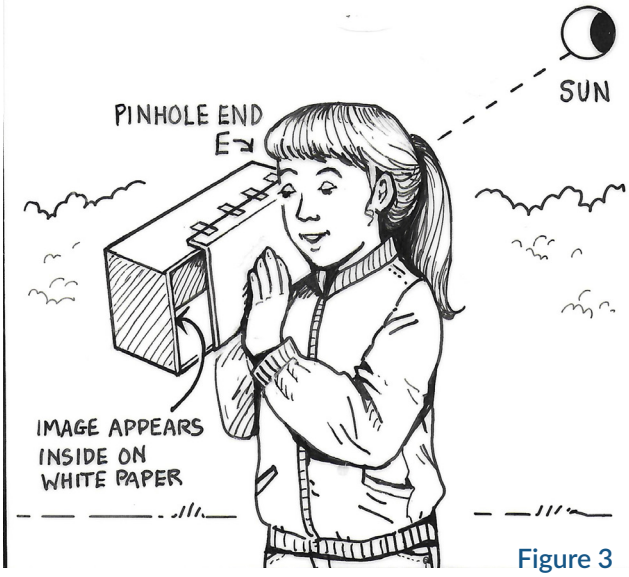


Figure 3

Illustrations by Ruth Flanagan-Gucfa.

A Guide to the Total Solar Eclipse of August 21, 2017

Part II: Within the Path of Totality

by Dave Huestis

You've decided on an expedition to position yourself within the path of totality. Please read Part I of my eclipse primer (http://www.theskyscrapers.org/2017-solar-eclipse-guide) you haven't already done so. It will provide some important background information about solar eclipses in general and how to safely view the partial phases.

In choosing your observing location you should reference this interactive eclipse map: https://eclipse2017.nasa.gov/sites/default/files/interactive_map/index.html. See further details in Part I. The closer to the centerline as possible will provide the maximum duration of totality for that area.

As the eclipse begins (called 1st contact) the Moon will begin to cover the solar disk from right to left. As for any partial phase, you will require eye protection until just before totality. As more and more of the Sun is eclipsed look under nearby trees to see images of the partial phase. These images are created in much the same way the shoebox eclipse viewer works. Spaces between the leaves act as a pinhole camera, resulting in a myriad of eclipse images projected upon the ground or onto any surface.

The Moon continues to cover the Sun. As totality nears, everything seems to progress much faster. This is merely an illusion. Look for the approaching lunar shadow out of the west-northwest. It will soon be upon you. About two minutes before the Sun is completely obscured, look around to see if you can spot shadow bands. The shadow band phenomena are the result of cells of atmospheric turbulence above the observer in the tropopause that are accentuated due to the decreasing solar crescent as totality draws near. They are best observed in contrast against white or bland backgrounds, like sandy ground or the sides of buildings. They also move at varying speeds and in many directions, dependent on the upper air currents. Check out this video: https://youtu.be/2tiI6VWXqj4. They have been described as A) undulating B) wavy C) shimmering D) fluctuating E) scintillating F) indistinct G) almost imperceptible shadings H) fluctuating I) diffuse smoky bands J) all of the above. They are fairly elusive to capture with a camera due to their low contrast and irregular motion.

While waiting for 2nd contact (totality begins) in Tanzania in 1980, shadow bands became quite pronounced. Unlike many of the descriptions you have just read, these bands couldn't be missed. It seemed like we were immersed in them, not just on the ground but surrounding us as well. All of a sudden they were there, 85 seconds before 2nd contact, moving in the opposite direction as the moon's shadow cone. They were two and one half to three inches wide, approximately 14 - 18 inches apart, and very fast. It was like watching an old-time movie where you can see the frames flashing by. During totality they disappeared. After 3rd contact (totality ends) they reappeared and had the same characteristics as those before 2nd contact. They also moved in the opposite direction as the shadow cone. I was quite impressed with this phenomenon, especially since they were so prominent. My description: rapidly moving striations of light and dark shadows.

Don't get too absorbed by the shadow bands, as they occur just up to the beginning of the grand event – totality (2nd contact). Seconds before the Moon completely covers the Sun a phenomenon known as Bailey's Beads occurs. Along the Moon's limb (edge) sunlight is rapidly disappearing behind the lunar disk. However, since the Moon's limb is irregular, while some light is being block by lunar mountain ranges, valleys still allow some light to reach us. We see these glimpses of sunlight as beads. Then just a second or two before totality we experience the Diamond Ring Effect, the last of the Bailey's Beads.

At Diamond Ring time you will most likely begin to see the Sun's pearly white and very hot atmosphere called the corona, as well as the red glow of hydrogen in the Sun's chromospheres. Solar prominences may also extend beyond the disk of the Moon. Catching prominences will depend on whether an active solar region is close to the solar limb. Solar activity is currently on the downside toward solar minimum, projected for 2019-2020. Therefore, prominences may not be prominent.

Once totality begins you will see the corona completely encircle the Moon. With solar activity so low, an observer should see white coronal streamers outline the Sun's magnetic fields. One should note the Sun's north and south magnetic poles, as the magnetic field lines, and therefore the corona, will curve up and away from the poles, like iron filings oriented to a magnet. The corona is quite bright, about the same brightness as a Full Moon.

If you don't already have enough activity to absorb, take some time to look at your surrounding horizon. You should see the rosy red glow of sunset colors all around you. Also, look immediately around your observing site. It may not be as dark as you expected. Depending upon how extensive and bright the corona is will determine that. However, your surroundings should be about as bright as if a full moon was present.

But wait!! There's still more to see. The sky will be dark enough to see a couple of planets and a bright star or two with your naked-eye. Brilliant Venus will be west of the Sun, while bright Jupiter will be towards the east. The bright star Sirius will be low in the southwestern sky. Depending upon local sky conditions you might be able to detect Mercury to the southeast of the Sun and Mars to the northwest. See this sky map for the details: https://dyer.vanderbilt.edu/wp-content/uploads/sites/63/Eclipse-Sky.png.

Duration of totality will depend where you are along the eclipse path. Once the Moon begins to uncover the Sun (3rd contact) you will see the Diamond Ring Effect again, followed by Bailey's Beads. It will be time to protect your eyes once again as more and more of the solar disk is uncovered. Then it's time to catch your breath, because it may be possible you didn't breathe during totality! Regardless of the duration of totality from your location, it will be the fastest minutes of your life. Some astronomers view and image the eclipse right up until the Moon "moves off" the solar disk (4th contact) and the Sun returns to normal. I do have to say though, after totality anything else is extremely anticlimactic!!

I wish everyone the best of luck with experiencing this fantastic event. Let's hope Mother Nature cooperates and provides everyone clear skies on eclipse day for the Great American Total Solar Eclipse of August 21, 2017.

June Reports

Minutes of the board of directors meeting, May 15 2017

Present were: Steve and Kathy Siok (ruling Diarchy), Linda Bergemann, Jim Crawford, Jim Hendrickson, Tom Thibeault, Lloyd Merrill, Francine Jackson, Jeff Padell, Ian Dell'Antonio

We start late:

Mr. and Mrs. Siok were late to the meeting, but I immediately forgave them when they gave me an autographed book.

Mr. Siok then proceeded to expound upon the subject of Bordeaux futures and then Jim Crawford handed around some sort of mystery sandwiches that he made.

7:11pm.

We finally start,

Upcoming meetings:

Ian reported that we have Pranvera Hyseni founder and director of "Astronomy Outreach of Kosovo" for July 7.

Dr. Rainer Weiss, Professor Emeritus at MIT and one of the founders of LIGO will speak to us on August 4.

The September meeting is still being worked on and could possibly be an eclipse roundup.

August Eclipse program at Seagrave:

There was much discussion about this? Should we? Where? Who? It was decided that Jeff Padell would the point person on this. We have plenty of eclipse glasses available and it was suggested that we could live stream the eclipse in the meeting hall. More discussion and preparation to be done.

Trustees:

The trustees as represented by Matt Ouellette informed us that there was a repair made to the support system that carries the dome for the Clark telescope.

The red lights near the inner wall coming in from the parking lot were repaired.

Jim Crawford and Bob Janus have been coming to the observatory weekly to check the porta potty and to cut the grass. We now have 2 riding mowers available.

The same group of amateur radio enthusiasts who had used our clubhouse last year are returning this coming weekend. They will provide verification of insurance coverage to us.

We discussed the row of trees lining area between the parking lot and lawn in front of the observatory. We got a quote of $800 to remove them. This was discussed and the trustees will be moving forward on this.

The stumps along the driveway where the row of trees that died were have been ground down. It was proposed that a fence be put in along the same area. Cost to be about $240 for material. Trustees will proceed with this.

We received 2 LX200 controllers donated by Brown University. One appears to be brand new.

Jeff Padell donated a Losmandy dovetail for the 16" telescope. Thank you Jeff!

Jim Crawford presented the inventory of all Society property. This is in spread sheet form and comes with pictures of each item clickable from the spreadsheet.

AstroAssembly:

We have as speakers so far: Francis O'Reilly who will talk about telescope making in South Arica where he recently went, Stella Kafka, current director of the AAVSO and Mario Motta. Still working on securing more speakers. We have someone who is willing to head up and handle daytime refreshments.

Library Telescopes:

Linda Bergemann reported that 3 telescopes have been modified so far and ready to go to their new homes at libraries in the state. She is just waiting for a new set of instructions to come from Cornerstone of Science. Linda has spent about $1059 to make the needed modifications.

It was suggested that we really need an outreach committee to oversee the library telescopes as well as our outreach events.

Outreach:

Francine Jackson reported that The Jesse Smith Memorial Library asked for a star party sometime in August. Date and details to be set.

A Cub Scout pack with 25 to 30 kids has asked for us to do a star party at St. Pious Church near Providence College in late October or early November.

Rain drops and trustees:

It started to rain a minor amount. For some inexplicable reason, the trustees went around the meeting hall closing all of the windows sealing us in. Fortunately the meeting broke up soon after before we started dying of heat stroke.

Membership:

There was a discussion about whether we should look into an better system to keep track of the members. Lloyd reported that there are some websites that specialize in handling memberships. We are going to look into this more.

The meeting ended at 8:31pm

Respectfully submitted, your Humble Society Secretary

Michael O'Shea from Boston PopScope gave a presentation after our annual summer potluck dinner on Saturday, June 3.

The Shape of the Solar System

By Marcus Woo

When Stamatios (Tom) Krimigis was selected for the Voyager mission in 1971, he became the team's youngest principal investigator of an instrument, responsible for the Low Energy Charged Particles (LECP) instrument. It would measure the ions coursing around and between the planets, as well as those beyond. Little did he know, though, that more than 40 years later, both Voyager 1 and 2 still would be speeding through space, continuing to literally reshape our view of the solar system.

The solar system is enclosed in a vast bubble, carved out by the solar wind blowing against the gas of the interstellar medium. For more than half a century, scientists thought that as the sun moved through the galaxy, the interstellar medium would push back on the heliosphere, elongating the bubble and giving it a pointy, comet-like tail similar to the magnetospheres—bubbles formed by magnetic fields—surrounding Earth and most of the other planets

"We in the heliophysics community have lived with this picture for 55 years," said Krimigis, of The Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland. "And we did that because we didn't have any data. It was all theory."

But now, he and his colleagues have the data. New measurements from Voyager and the Cassini spacecraft suggest that the bubble isn't pointy after all. It's spherical.

Their analysis relies on measuring high-speed particles from the heliosphere boundary. There, the heated ions from the solar wind can strike neutral atoms coming from the interstellar medium and snatch away an electron. Those ions become neutral atoms, and ricochet back toward the sun and the planets, uninhibited by the interplanetary magnetic field.

Voyager is now at the edge of the heliosphere, where its LECP instrument can detect those solar-wind ions. The researchers found that the number of measured ions rise and fall with increased and decreased solar activity, matching the 11-year solar cycle, showing that the particles are indeed originating from the sun.

Meanwhile, Cassini, which launched 20 years after Voyager in 1997, has been measuring those neutral atoms bouncing back, using another instrument led by Krimigis, the Magnetosphere Imaging Instrument (MIMI). Between 2003 and 2014, the number of measured atoms soared and dropped in the same way as the ions, revealing that the latter begat the former. The neutral atoms must therefore come from the edge of the heliosphere.

If the heliosphere were comet-shaped, atoms from the tail would take longer to arrive at MIMI than those from the head. But the measurements from MIMI, which can detect incoming atoms from all directions, were the same everywhere. This suggests the distance to the heliosphere is the same every which way. The heliosphere, then, must be round, upending most scientists' prior assumptions.

It's a discovery more than four decades in the making. As Cassini ends its mission this year, the Voyager spacecraft will continue blazing through interstellar space, their remarkable longevity having been essential for revealing the heliosphere's shape.

"Without them," Krimigis says, "we wouldn't be able to do any of this."

To teach kids about the Voyager mission, visit the NASA Space Place: https://spaceplace.nasa.gov/voyager-to-planets

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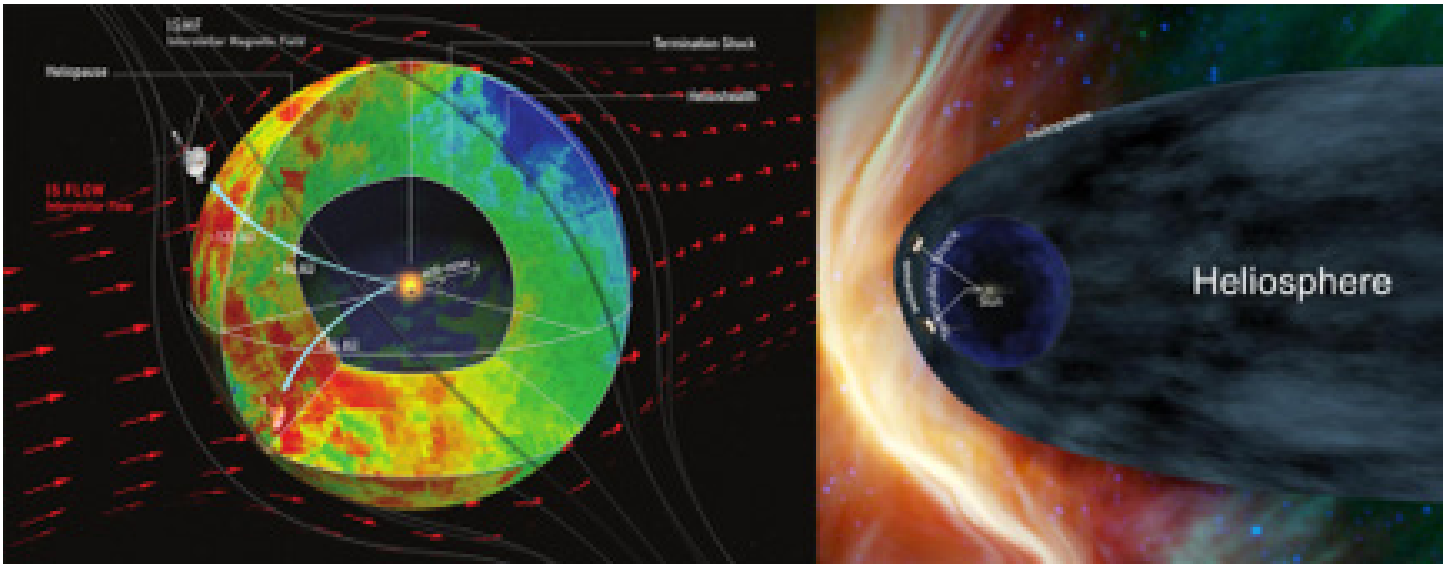
This article is provided by NASA Space Place. With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit spaceplace.nasa.gov to explore space and Earth science!



Caption: New data from NASA's Cassini and Voyager show that the heliosphere — the bubble of the sun's magnetic influence that surrounds the solar system — may be much more compact and rounded than previously thought. The image on the left shows a compact model of the heliosphere, supported by this latest data, while the image on the right shows an alternate model with an extended tail. The main difference is the new model's lack of a trailing, comet-like tail on one side of the heliosphere. This tail is shown in the old model in light blue. Image credits: Dialynas, et al. (left); NASA (right)

The Sun, Moon & Planets in July

This table contains the ephemeris of the objects in the Solar System for each Saturday night in July 2017. All times are in Eastern Daylight (UTC-4). Ephemeris times are for Seagrave Observatory (41.845N, 71.590W).

Object	Date	RA	Dec	Const	Mag	Size	Elong	Phase(%)	Dist(S)	Dist(E)	Rise	Transit	Set
Sun	**1**	6 40.8	23 06.1	Gem	-26.8	1887.8	-	-	-	1.02	05:14	12:50	20:25
	8	7 09.6	22 28.2	Gem	-26.8	1887.8	-	-	-	1.02	05:19	12:51	20:23
	15	7 38.1	21 31.2	Gem	-26.8	1888.2	-	-	-	1.02	05:24	12:52	20:19
	22	8 06.2	20 16.3	Cnc	-26.8	1889.0	-	-	-	1.02	05:30	12:52	20:14
	29	8 33.8	18 44.8	Cnc	-26.8	1890.3	-	-	-	1.02	05:37	12:52	20:07
Moon	**1**	12 37.6	-0 54.1	Vir	-11.8	1849.9	90° E	50	-	-	13:31	19:29	01:21
	8	18 15.6	-20 01.9	Sgr	-12.5	1777.8	166° E	99	-	-	19:55	00:51	05:48
	15	0 06.9	-3 21.6	Psc	-12.2	1853.5	113° W	69	-	-	23:34	05:37	11:49
	22	6 39.2	18 37.4	Gem	-9.0	1979.0	20° W	3	-	-	04:37	12:08	19:36
	29	13 08.7	-3 34.2	Vir	-11.4	1847.7	71° E	34	-	-	12:19	18:09	23:52
Mercury	**1**	7 29.2	23 44.2	Gem	-1.2	5.3	11° E	91	0.34	1.28	06:04	13:42	21:18
	8	8 25.4	21 03.1	Cnc	-0.6	5.6	18° E	80	0.38	1.20	06:45	14:09	21:32
	15	9 12.1	17 22.7	Cnc	-0.2	6.1	23° E	69	0.42	1.10	07:19	14:27	21:34
	22	9 49.9	13 19.0	Leo	0.1	6.8	26° E	59	0.45	0.99	07:45	14:37	21:27
	29	10 19.1	9 20.6	Leo	0.4	7.6	27° E	48	0.46	0.89	08:01	14:37	21:12
Venus	**1**	3 35.8	16 34.0	Tau	-4.1	18.4	44° W	63	0.73	0.92	02:39	09:45	16:51
	8	4 07.1	18 19.5	Tau	-4.0	17.4	43° W	66	0.73	0.97	02:36	09:49	17:02
	15	4 39.4	19 48.2	Tau	-4.0	16.5	42° W	68	0.73	1.03	02:34	09:54	17:13
	22	5 12.8	20 56.4	Tau	-4.0	15.7	40° W	71	0.73	1.08	02:35	09:59	17:24
	29	5 47.0	21 40.6	Tau	-3.9	15	39° W	73	0.72	1.13	02:39	10:06	17:34
Mars	**1**	7 15.7	23 19.1	Gem	1.6	3.6	8° E	100	1.62	2.62	05:50	13:24	20:57
	8	7 35.3	22 41.0	Gem	1.6	3.6	6° E	100	1.63	2.63	05:45	13:16	20:46
	15	7 54.7	21 54.5	Gem	1.6	3.5	4° E	100	1.63	2.64	05:40	13:08	20:35
	22	8 13.7	21 00.0	Cnc	1.7	3.5	2° E	100	1.64	2.65	05:36	12:59	20:22
	29	8 32.5	19 58.2	Cnc	1.7	3.5	1° W	100	1.64	2.66	05:31	12:50	20:08
1 Ceres	**1**	5 43.0	23 27.2	Tau	8.7	0.3	13° W	100	2.69	3.67	04:16	11:50	19:25
	8	5 55.8	23 43.4	Tau	8.8	0.3	17° W	100	2.68	3.64	04:00	11:36	19:12
	15	6 08.6	23 55.9	Gem	8.8	0.3	21° W	100	2.68	3.60	03:44	11:21	18:58
	22	6 21.4	24 04.8	Gem	8.9	0.3	25° W	99	2.67	3.56	03:29	11:06	18:44
	29	6 34.2	24 10.3	Gem	8.9	0.4	28° W	99	2.67	3.52	03:14	10:51	18:29
Jupiter	**1**	12 53.2	-4 16.4	Vir	-1.9	37.3	95° E	99	5.45	5.28	13:12	18:59	00:45
	8	12 55.0	-4 29.6	Vir	-1.9	36.5	88° E	99	5.45	5.39	12:47	18:33	00:19
	15	12 57.2	-4 45.6	Vir	-1.8	35.8	82° E	99	5.45	5.49	12:23	18:08	23:53
	22	12 59.9	-5 04.2	Vir	-1.8	35.1	76° E	99	5.45	5.60	11:59	17:43	23:27
	29	13 03.0	-5 25.2	Vir	-1.7	34.5	71° E	99	5.45	5.70	11:36	17:18	23:01
Saturn	**1**	17 31.4	-21 56.6	Oph	0.1	18.2	164° E	100	10.06	9.08	18:57	23:35	04:14
	8	17 29.4	-21 56.0	Oph	0.1	18.2	157° E	100	10.06	9.12	18:28	23:06	03:44
	15	17 27.6	-21 55.6	Oph	0.1	18.1	150° E	100	10.06	9.17	17:58	22:37	03:15
	22	17 25.9	-21 55.3	Oph	0.2	17.9	143° E	100	10.06	9.23	17:29	22:08	02:46
	29	17 24.5	-21 55.3	Oph	0.2	17.8	136° E	100	10.06	9.31	17:00	21:39	02:17
Uranus	**1**	1 45.2	10 15.3	Psc	5.8	3.5	71° W	100	19.92	20.23	01:13	07:52	14:32
	8	1 45.8	10 18.7	Psc	5.8	3.5	78° W	100	19.92	20.11	00:46	07:25	14:05
	15	1 46.3	10 21.3	Psc	5.8	3.5	84° W	100	19.92	20.00	00:19	06:58	13:38
	22	1 46.6	10 23.1	Psc	5.8	3.5	91° W	100	19.92	19.88	23:51	06:31	13:11
	29	1 46.8	10 24.0	Psc	5.8	3.6	98° W	100	19.92	19.76	23:24	06:04	12:44
Neptune	**1**	23 03.2	-7 03.2	Aqr	7.9	2.3	115° W	100	29.95	29.50	23:34	05:11	10:47
	8	23 03.0	-7 05.0	Aqr	7.8	2.3	122° W	100	29.95	29.40	23:06	04:43	10:19
	15	23 02.7	-7 07.3	Aqr	7.8	2.3	129° W	100	29.95	29.30	22:39	04:15	09:51
	22	23 02.2	-7 10.1	Aqr	7.8	2.3	135° W	100	29.95	29.22	22:11	03:47	09:23
	29	23 01.8	-7 13.4	Aqr	7.8	2.3	142° W	100	29.95	29.14	21:43	03:19	08:55
Pluto	**1**	19 19.0	-21 24.2	Sgr	14.2	0.3	171° W	100	33.36	32.35	20:47	01:27	06:07
	8	19 18.3	-21 26.3	Sgr	14.2	0.3	178° W	100	33.36	32.35	20:19	00:59	05:39
	15	19 17.6	-21 28.3	Sgr	14.2	0.3	175° E	100	33.37	32.35	19:46	00:27	05:07
	22	19 16.9	-21 30.4	Sgr	14.2	0.3	168° E	100	33.37	32.38	19:18	23:58	04:38
	29	19 16.2	-21 32.4	Sgr	14.2	0.3	162° E	100	33.38	32.41	18:50	23:30	04:10

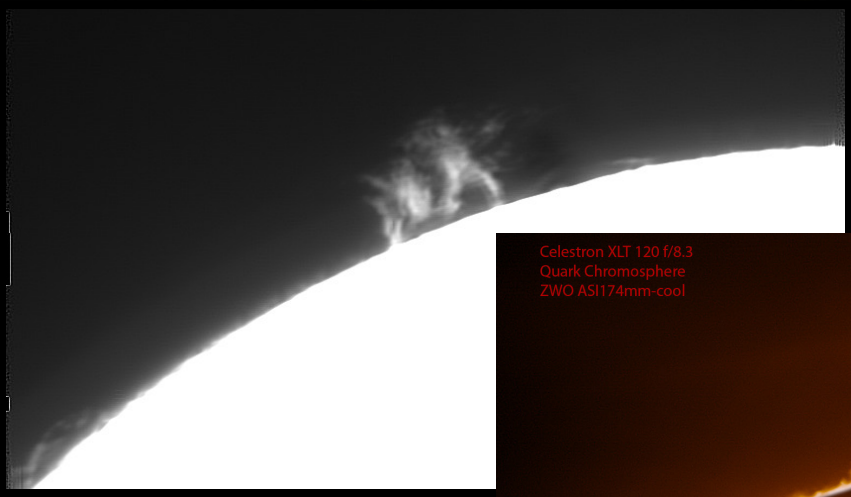
Steve Hubbard took this photo of the Milky Way from Kodachrome Basin State Park in Utah, using a 28mm lens and 30 second exposure.

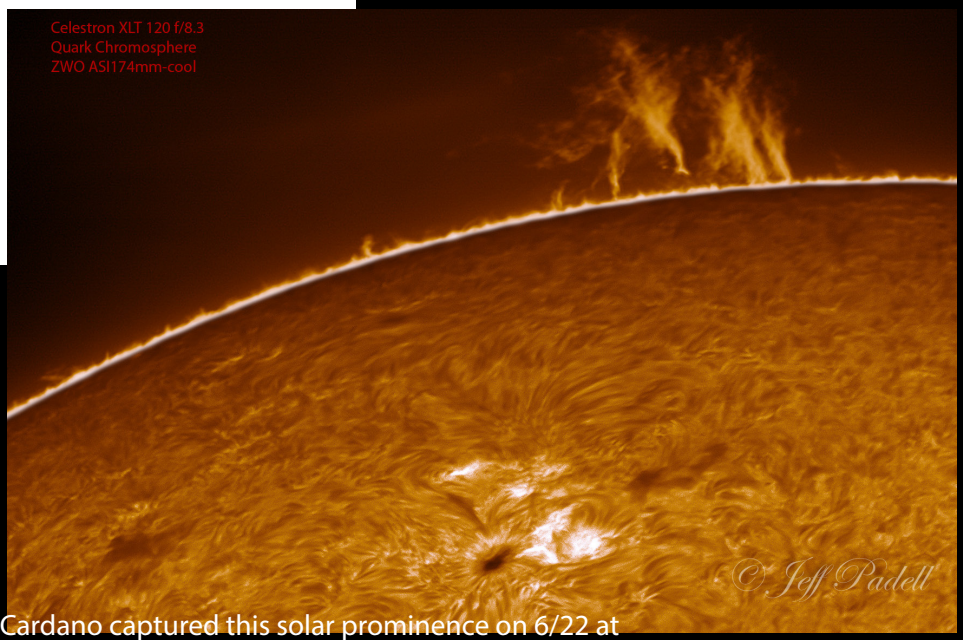
Bob Horton captured a single frame of M27 with no image processing using a Nikon Df on a C14 @ f11. ISO 12,800. Exposure 43 seconds.

Seagrave Observatory - The New Look

On Monday, June 26, the Trustees contracted a local tree service to remove the line of tall trees between the parking lot and front yard, allowing for a considerable increase in exposed sky area.

The new opening in the sky permits viewing objects further south and earlier than in the past. The center of the Milky Way can now be seen from the front yard as seen in this photo from Jim Hendrickson.





Solar prominence on 6/22. Left: Conrad Cardano captured this solar prominence on 6/22 at 1pm. This was taken with a Lunt Ha 60mm scope and ZWO 174mm camera. Right, Jeff Padell captured this image using a Quark Chromosphere with a Celestron XLT 120 f/6.3.

Directions to Seagrave Memorial Observatory

www.theSkyscrapers.org

From the Providence area:
Take Rt. 6 West to Interstate 295 in Johnston and proceed west on Rt. 6 to Scituate. In Scituate bear right off Rt. 6 onto Rt. 101. Turn right onto Rt. 116 North. Peeptoad Road is the first left off Rt. 116.

From Coventry/West Warwick area:
Take Rt. 116 North. Peeptoad Road is the first left after crossing Rt. 101.

From Southern Rhode Island:
Take Interstate 95 North. Exit onto Interstate 295 North in Warwick (left exit.) Exit to Rt. 6 West in Johnston. Bear right off Rt. 6 onto Rt. 101. Turn right on Rt. 116. Peeptoad Road is the first left off Rt. 116.

From Northern Rhode Island:
Take Rt. 116 South. Follow Rt. 116 thru Greenville. Turn left at Knight's Farm intersection (Rt. 116 turns left) and follow Rt. 116. Watch for Peeptoad Road on the right.

From Connecticut:
• Take Rt. 44 East to Greenville and turn right on Rt. 116 South. Turn left at Knight's Farm intersection (Rt. 116 turn left) and follow Rt. 116. Watch for Peeptoad Road on the right.
• or • Take Rt. 6 East toward Rhode Island; bear left on Rt. 101 East and continue to intersection with Rt. 116. Turn left; Peeptoad Road is the first left off Rt. 116.

From Massachusetts:
Take Interstate 295 South (off Interstate 95 in Attleboro). Exit onto Rt. 6 West in Johnston. Bear right off Rt. 6 onto Rt. 101. Turn right on Rt. 116. Peeptoad Road is the first left off Rt. 116.

SKYSCRAPERS INC.

47 Peeptoad Road
North Scituate, Rhode Island 02857