AOH OBSERVER
Summer 2017

The Newsletter of the Astronomers of Humboldt

A short one

The AOH Summer Newsletter will be a short one (less than 20 pages I promise). Despite the overcast skies and rainy weather, the AOH has managed to do eight outreach events since the beginning of the year. At the time of this writing we have another six that are on the schedule for the summer. Earlier in the month, I sent an email out to the membership asking for outreach volunteers. Currently we have a small number of members who regularly participate in outreach. It would be great to expand the number of volunteers so that we don't over burden our current participants.

Most of our requests for visits come from schools, museums, and youth groups such as the Boys and Girls Club, Girl Scouts, and the 4-H. Occasionally we are asked to participate in large community events like the upcoming "Eureka Get Out and Play". In the fall and winter months, the AOH does its version of "sidewalk" astronomy by setting up telescopes at the Eureka Arts Alive. In all of these events, telescope viewing is often the centerpiece activity since viewing the sky through a scope is exciting to most people. This last year we have expanded our repertory to include astronomy displays and demonstrations like the "scale model of the solar system" and "meteorites and meteorwrongs". A demonstration that is messy but fun is making moon craters with a pan of flour, cocoa, and marbles (kids love throwing stuff). In response to these displays, we often hear comments like "I've never thought of that before" or "you've given me something to think about". More often than not, I get questions back that I hadn't thought about. The enlightenment happens in both directions.

If you have ever been curious about doing outreach and would like to try it out, send an email to president@astrohum.org. We try to send multiple volunteers to our events so you will always be paired up with someone who is experienced.

The images on page 2-3 are from our spring outreach events at "Morris School Science Night", "Earth and Space Discovery Day at the HSU Natural History Museum", "AOH Meeting / Star Party at Kneeland School, April 29th", "Girl Scout Troop 202 Star Party", "Astronomy Program at Kneeland School",and "Star Party with the Creekside School in Willow Creek". The details of each event can be found on our "Members Only Page" http://www.astrohum.org/members_only/reports.php.

Other announcements: Our next two AOH monthly meetings / star parties will be held in Kneeland on June 24th and July 22nd. Bring your family and friends. Also don't forget to bring warm clothes and mosquito repellant. The August meeting is cancelled because several members are travelling to see the solar eclipse. If you are viewing from Eureka, it will be an 88% partial eclipse. On pages 10-12 are articles with safety tips on how to view the solar eclipse.

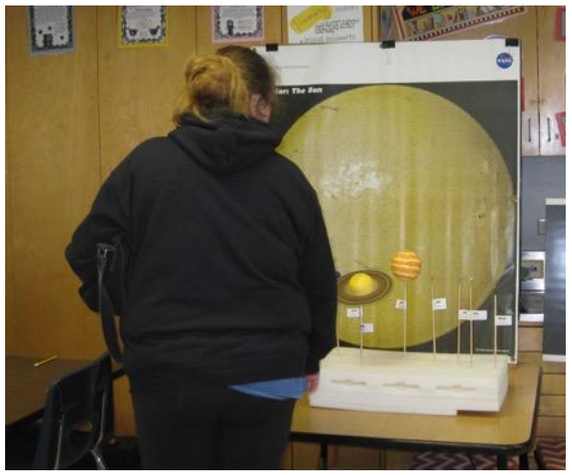
Certified eclipse shades are available to our members for free. Contact us at info@astrohum.org.

Acknowledgments: Thank you to Don Wheeler and Ken Yanosko for proofreading the newsletter.

AOH Outreach Spring 2017

Morris School Science Night (April 5)

Russ is shown demonstrating which rocks are “meteorites and meteorwrongs”,



Visitor perusing our “Scale Model of the Solar System” (the size of the planets are scaled to a one meter diameter Sun).

Mark Wilson and Greg Deja ran the telescope viewing at Morris School, and explained how telescopes work.

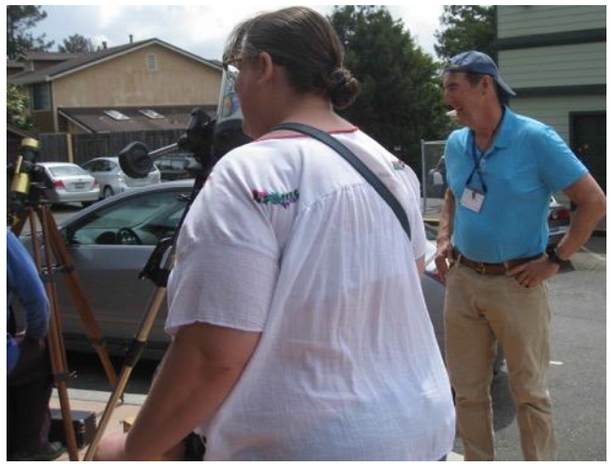
The kids and adults had fun making craters.

Earth and Space Discovery Day at HSU Natural History Museum (April 22)

Future scientists learning about asteroids and different types of meteorites.

The AOH Meteorite display had examples of different types meteorites.

Telescopes were set up to view the sun.



New member Brent Howatt helped run the solar viewing.

AOH Star Party at Kneeland School (April 29)

Astronomers setting up telescopes in the school courtyard at dusk. We also had the C14 in the Observatory up and running.

Kathy Blume and Eva Laevastu showing visitors a view of Jupiter and the Galilean moons through an 8 inch SCT.

Girl Scout Troop 202 Star Party (May 8)

Ken is shown setting up his Dob to view the Moon. (Mark Mueller brought his telescope on a bike trailer).

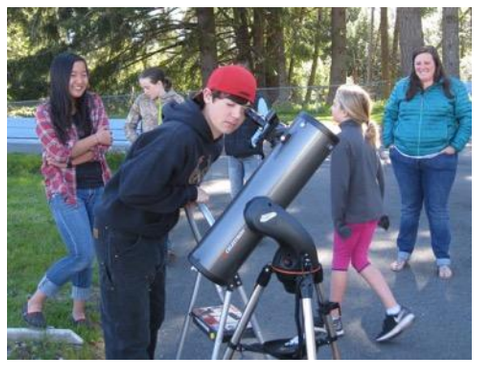
After sunset, the Scouts were able to view Jupiter and the Galilean moons.

The Scouts saw the Great Hercules Cluster. Despite the brightness of the moon and streetlights, we managed to find several deep sky objects.

Kneeland School Astronomy Program (May 19)

Mark W. with the Kneeland School K-8 students.

Ken giving the introduction to how telescopes work.



A student viewing Venus through a Newtonian reflector.

Kneeland students viewing the sun and sunspots through Mark's refractor telescope.

Creekside School (Willow Creek, May 23)

The AOH volunteers were impatient for the skies to get dark. In the photo above, they were scanning for Jupiter just after sunset.

Ken speaking to a gathering of students (K-8), parents and teachers about telescopes and the night sky.

A Creekside student seeing Jupiter for the first time through a telescope

Club Calendar

To get the latest information on the events listed go to http://www.astrohum.org/upcoming.html

Wednesday June 21. **Night Sky Network Webinar**. "Exploring the Earliest Habitable Environments of Mars". Bethany Ehlmann (Professor of Planetary Science, Caltech). AOH members can register at http://www.astrohum.org/members_only/webinars.php.

Saturday June 24. **Regular Monthly Meeting**. Location TBA.

Saturday July 22. **Regular Monthly Meeting**. Location TBA.

Tuesday July 25. **Night Sky Network Webinar**. "Monitoring Conditions During the Solar Eclipse with the Globe Explorer". Kristen Weaver and Holli Riebeek (NASA Goddard Space Flight Center). AOH members can register at http://www.astrohum.org/members_only/webinars.php.

Saturday July 29. **Eureka Get Out & Play Day**. 12-5 p.m. at Sequoia Park.

Saturday August 12. **Perseid Meteor Shower**. Check the AOH Facebook for any updates on where members might be gathering to watch the shower. https://www.facebook.com/groups/51366671055/. Note: This year, the gibbous moon rises at midnight.

Monday Aug. 21. **Total Solar Eclipse**. The path of totality passes across Oregon. The degree of the partial solar eclipse in Eureka can be found here: https://www.timeanddate.com/eclipse/in/usa/eureka.

THE PERSEIDS: WHY IS THERE A METEOR SHOWER?

By VirtualAstro
Reprinted from Universe Today
https://www.universetoday.com/88094/the-perseids-why-is-there-a-meteor-shower/

Every year from late July to mid-August, the Earth encounters a trail of debris left behind from the tail of a comet named Swift-Tuttle. This isn't the only trail of debris the Earth encounters throughout the year, but it might be one of the most notorious as it is responsible for the annual Perseid meteor shower, one of the best and well-known yearly meteor showers.

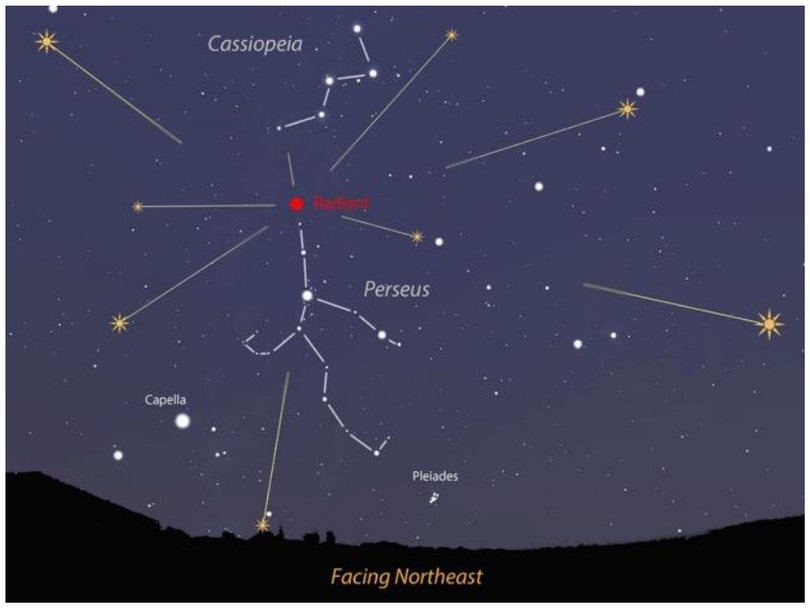
Comet Swift-Tuttle is a very long way away from us right now, but when it last visited this part of the Solar system, it left behind a stream of debris made up of particles of dust and rock from the comet's tail. Earth encounters this debris field for a few weeks each year, reaching the densest part on the 11th to 13th August. The tiny specs of dust and rock collide with the Earth's atmosphere, entering at speeds ranging from 11 km/sec (25,000 mph), to 72 km/sec (160,000 mph). They are instantly vaporized, emitting bright streaks of light. These tiny particles are referred to as meteors or for the more romantic, shooting stars.

The reason the meteor shower is called the Perseids, is because the point of the sky or radiant where the meteors appear to originate from is in the constellation of Perseus, hence Perseid.

When the Perseid meteor shower reaches its peak, up to 100 meteors an hour can be seen under ideal dark sky conditions. *Editor Note: On August 12, 2107, the peak of the Perseid shower coincides with the rise of the gibbous moon at midnight*. Many of the fainter meteors (shooting stars) will be lost to the glare of the Moon, but do not despair as some Perseids are bright fireballs made from larger pieces of debris, that can be golf ball size or larger.

These amazingly bright meteors can last for a few seconds and can be the brightest thing in the sky. They are very dramatic and beautiful, and seeing one can be the highlight of your Perseid observing experience.

(Editor's note: The original article written in 2011 was edited to reflect the conditions for the 2017 Perseid meteor shower.)



The Perseids appear to radiate from spot below the W of Cassiopeia in the constellation Perseus, hence the shower's name. This map shows the sky facing northeast around 12:30 a.m. local time August 13. Source: Stellarium.

Figure and caption reprinted from https://www.universetoday.com/121599/kick-back-look-up-were-in-for-a-great-perseid-meteor-shower/.

Night Sky Report: Planets, Comet Johnson, and Summer Constellations

G.D. Wheeler

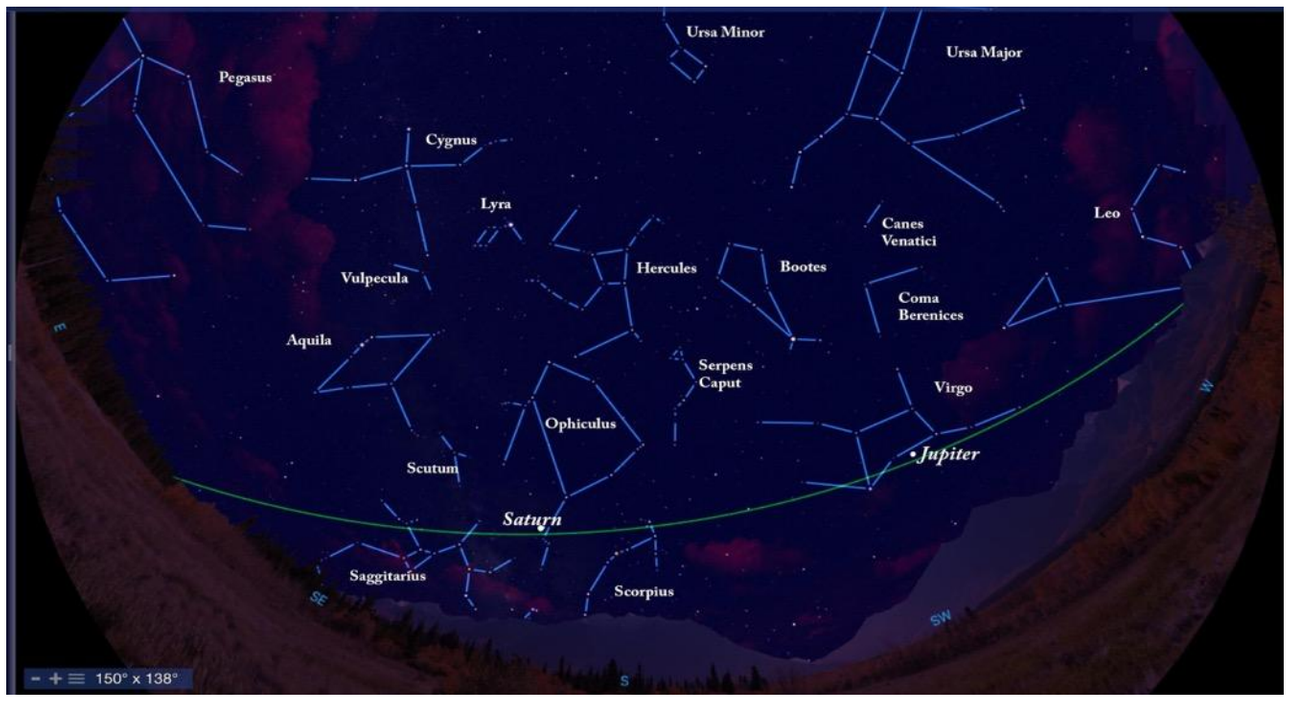


Figure 1. The night sky on July 15 at 11 p.m. PDT. The star chart was created with Starry Night Pro.

Planets

Jupiter is visible shortly after sunset throughout the summer, but will set progressively earlier with each day. The rise and set time for Jupiter (and major solar system bodies) can be found at http://aa.usno.navy.mil/data/docs/mrst.php.

Jovian features include the Great Red Spot and the four large Galilean moons (Fig. 2). The transit of the Great Red Spot for specific dates can be found at http://www.skyandtelescope.com/observing/celestial-objects-to-watch/transit-times-of-jupiters-great-red-spot/.

The positions of the Galilean Moons can be determined by using the Jupiter Moon App at http://www.skyandtelescope.com/wp-content/observing-tools/jupiter_moons/jupiter.html.

Figure 2: Jupiter and the Galilean moons imaged through an 8 inch SCT. (400 ASA, 1/10 s). Photo credit: G. Wheeler.

Saturn is at opposition on June 15th and rises at about 8:30 p.m. PDT. For the remainder of June, July, and early August, Saturn will be visible throughout the night and predawn hours. Tips for viewing Saturn can be found at http://www.skyandtelescope.com/observing/celestial-objects-to-watch/viewing-saturn-the-planet-rings-and-moons/.

Saturn's Moons (Figure 3): Titan, the largest moon in our solar system can be seen even through a small telescope. Larger telescopes will detect the smaller Saturnian moons. The positions of these orbiting moons can be found using the Saturn Moon App http://www.skyandtelescope.com/observing/celestial-objects-to-watch/saturns-moons-javascript-utility/.

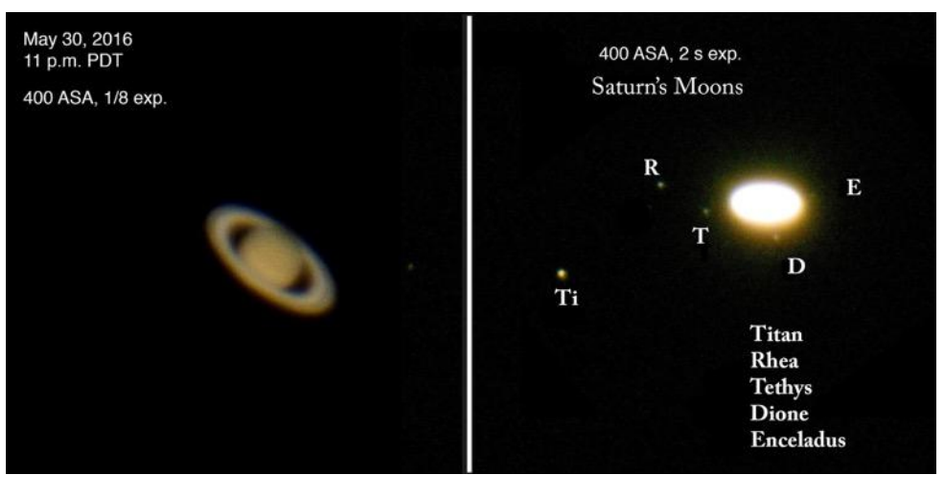
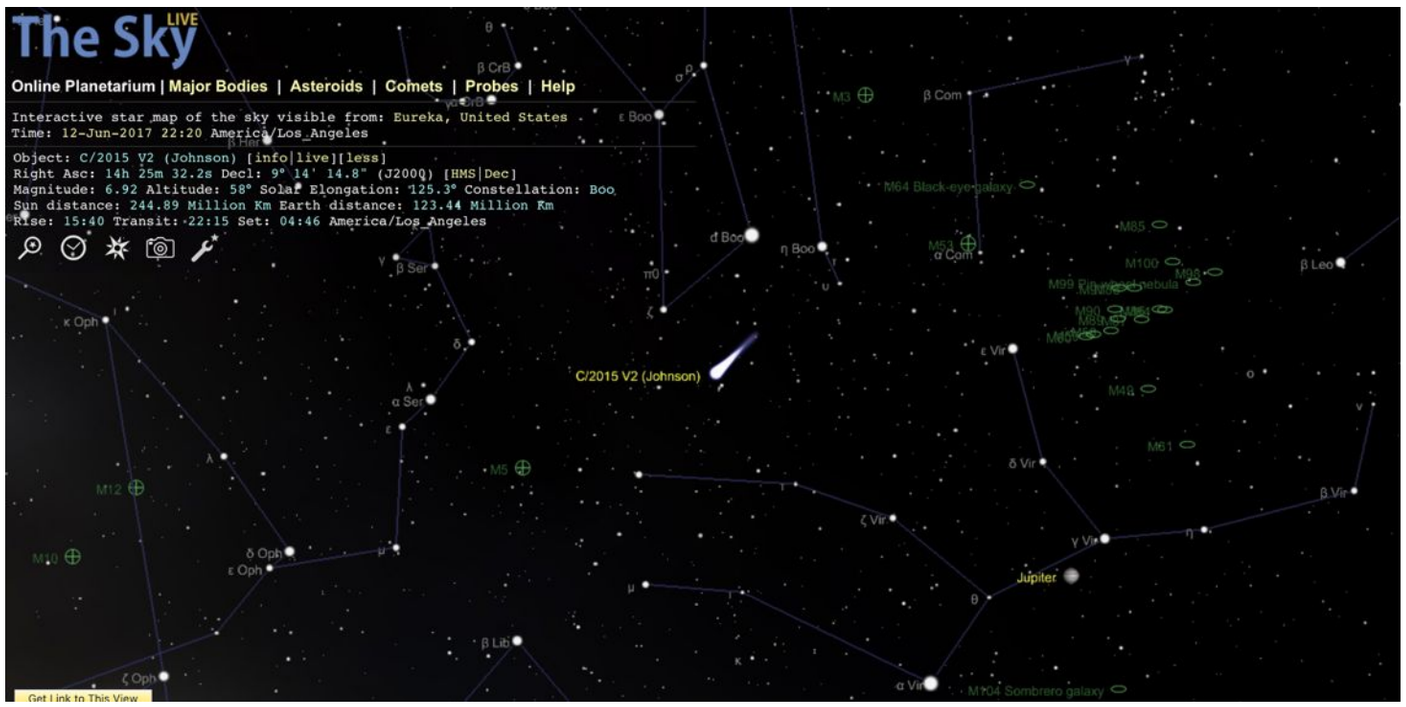


Figure 3. Image of Saturn through an 8 inch SCT. By taking a long photographic exposure of Saturn, it is possible to record the positions of the moons.

Comet/2015 V2 (Johnson)

Comet Johnson entered the constellation Bootes on May 13th when it could be found near the triple star Mu Bootis (Figs. 4 and 5). Throughout May to the early part of June, Comet Johnson will be traversing the constellation Bootes. By mid-June, the comet will enter Virgo and continue on its southern path. Currently the comet is at magnitude 7.1 and has a small dust tail. The comet is expected to brighten as it moves closer to the sun. Additional information and photos can be found at http://www.skyandtelescope.com/observing/comet-johnson-makes-a-splendid-sprint-through-bootes/ and https://www.universetoday.com/135578/comet-v2-johnson-takes-center-stage/.

The comet will reach perihelion on June 12 at which time it will be between Bootes and Virgo. The location of Comet Johnson at perihelion is shown below.



The link below gives the location of Comet Johnson on the interactive planetarium program for The Sky Live. Click on the "Visible From" link to reset it to your location. The "Time" defaults to "Current". It can be changed to give the time at which you plan to observe.

https://theskylive.com/planetarium?obj=c2015v2

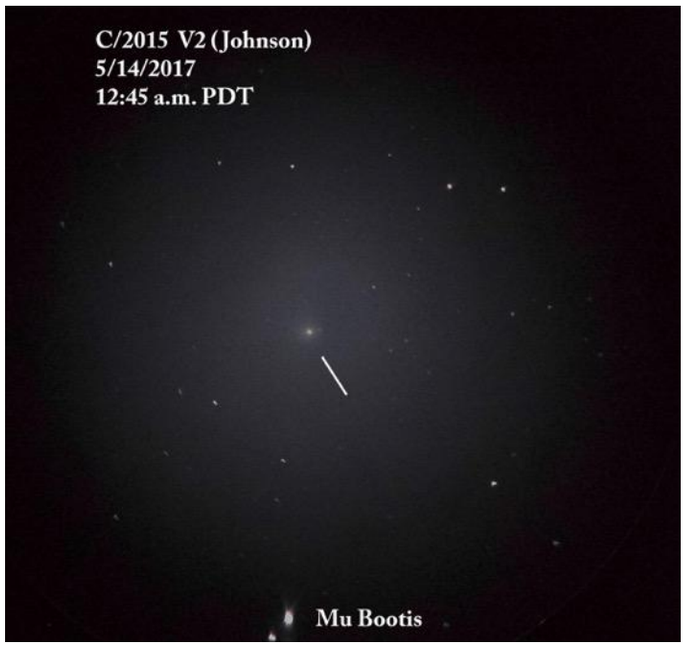


Figure 4. A view of Comet Johnson through a 6 inch SCT. Comet was imaged using a single 30 second exposure (ASA 800). Photo credit: G. Wheeler.

Figure 5. Comet Johnson, May 15, 2017, 02:00 UT. 28×180 sec @ ISO 3200, Canon T3, Televue TV-85 at F/5.6. Star-Freeze version. *(Editor's note: Mu Bootis is shown in the upper left of the image.)* Credit: Republished with kind permission from Mike Broussard. https://blog.cajunastro.com/2017/05/15/comet-johnson-may-15-2017-0200-ut/#comment-907

Constellations in the Summer Night Sky

Summer Constellations Part 1: Gobs of Globs And the Summer Triangle

The summer constellations include Lyra, Altair, Cygnus, Vulpecula, Scutum, Hercules, Ophiuchus, Serpens Caput, Scorpius and Sagittarius. For part of the night, the spring constellations, Canes Venatici, Coma Berenices, and Virgo are located in the western part of the summer sky (Fig. 1). A comprehensive review of each constellation, and the stars and deep sky objects that reside within these constellatoins can be found at http://www.constellation-guide.com/constellation-list/ For this report, I have focused mostly on the Messier objects. There are also NGC, Caldwell, IC, and Abell objects that can be found in these constellations. Happy hunting!

Hercules: Hercules is the fifth largest constellation in the northern sky. Ras Algethi represents the head and the keystone asterism represents his torso. Messier Objects associated with Hercules are the globular clusters M13 and M92 (Figs. 7 and 8). M13 is located between the two western stars that form part of the keystone (about a third of the way from Eta to Zeta Herculis). M92 is less bright than M13, and is located northeast of the keystone.

Serpens Caput and Ophiuchus. Serpens Caput, the serpent's head forms the western half of the constellation Serpens (Serpens Cauda is the eastern half). The constellation Serpens is often associated with Ophiuchus, the serpent bearer. Serpens Caput contains the bright globular cluster M5 (Fig. 9). Ophiuchus contains seven Messier globular clusters: M10, M12, M62, M19, M9, M14, M107. In Ophiuchus it is possible to view the different density classes of globular clusters http://messier.seds.org/xtra/supp/gc-cltab.html. Shown at the right is M12 in Ophiuchus which is a low star density globular cluster (Fig. 10).

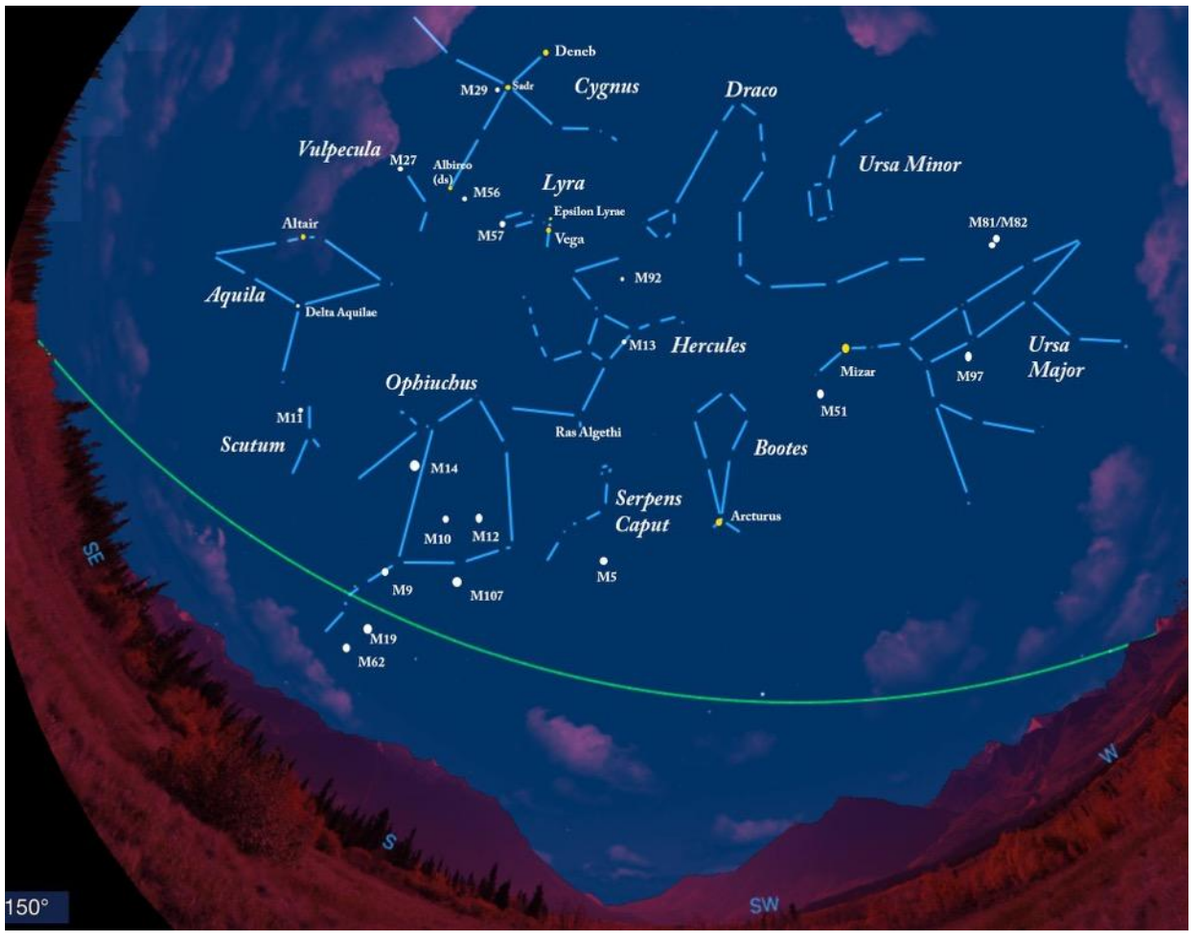


Figure 6: Star map of selected constellations, Messier Objects, and stars for July 22, 2017 at 9:30 p.m. PDT. Star guide was generated on Starry Night Pro.

Figure 7. M13, the Great Hercules Cluster was imaged through an 8 inch SCT. Single 30s exp. (ASA 800). Photo credit: G. Wheeler.

Figure 8. M92 globular cluster in Hercules was imaged through an 8 inch SCT. Single 30s exp. (ASA 800). Photo credit: G. Wheeler.

Figure 9. M5 globular cluster in Serpens Caput. Imaged with a 6 inch SCT. 30s exposure (800 ASA). Photo credit: G. Wheeler.

Figure 10. M12 in Ophiuchus. Imaged with a 6 inch SCT. 30s exposure (800 ASA). Photo credit: G. Wheeler.

Lyra (Harp), Cygnus (Swan), Aquila (Eagle) and the Summer Triangle. The three bright stars that mark the vertices of the summer triangle are Vega (Lyra), Deneb (Cygnus), and Altair (Aquila). Constellations near the summer triangle include Vulpecula (The Fox) and Scutum (The Shield).

Lyra contains the M56 globular cluster (Fig. 11) and M57, the Ring Nebula (Fig. 12). The Ring Nebula is a gas remnant of a collapsed giant red star. A popular destination for telescope viewers is the double star Epsilon Lyrae, also known as the "Double Double". Epsilon Lyrae is located near Vega, and with a telescope it is possible to resolve the component stars ε^1 and ε^2 into double stars. http://earthsky.org/brightest-stars/epsilon-lyrae-the-famous-double-double-star

Figure 11. M56 globular cluster in Lyra. Imaged with a 6 inch SCT. 30s exposure (800 ASA). Photo credit: G. Wheeler.

Figure 12. M57 Ring Nebula is a planetary nebula in Lyra. Imaged with a 6 inch SCT. 30s exposure (800 ASA). Photo credit: G. Wheeler.

Cygnus contains two Messier open clusters, M39 and M29 (Fig. 13). The star Albireo (β-Cygni) marks to the head (beak) of the swan. To the unaided eye, Albireo appears to be a single star, but with a low-powered telescope, it is possible to resolve the two stars (Fig. 14). β-Cygni A is amber-colored whereas β-Cygni B is blue-green.

Figure 13. M29 open cluster in Cygnus. Imaged with a 6 inch SCT. 30s exposure (800 ASA). Photo credit: G. Wheeler.

Figure 14. Albireo double star in Cygnus. Photo credit: Hewholooks. https://en.wikipedia.org/wiki/Albireo#/media/File:NewAlbireo.jpg

The constellation **Vulpecula** is located between Cygnus and Aquila; this area of the sky contains M27, a planetary nebula commonly known as the Dumbbell Nebula (Fig. 15).

Aquila contains no Messier objects, but the stars Altair and Delta Aquilae are often used to starhop to the open cluster M11 in the constellation **Scutum.** M11 is also known as the Wild Duck Cluster for its abundance of stars that resembles a flock of birds in flight (Fig. 16).

Figure 15. M27, the Dumbbell Nebula in Vulpecula. Imaged with a 6 inch SCT. 30s exposure (800 ASA). Photo credit: G. Wheeler.

Figure 16. M11, the Wild Duck Cluster in Scutum. Photo credit: NASA. https://www.nasa.gov/multimedia/imagegallery/image_feature_003.html

Summer Constellations Part 2: Scorpius and Sagittarius. (Figure 17)

Scorpius and Sagittarius are constellations of the southern hemisphere. At our latitude (40.8 degrees North), both Scorpius and Sagittarius are low in the southern horizon throughout the summer, The prime viewing time for these two constellations is in July, August, and early September. The two constellations are in a region of the sky that is rich in globular clusters, open clusters, and nebulae. One could spend an entire evening or two just exploring Scorpius and Sagittarius.

Scorpius is a "J" shaped constellation, and its most noticeable feature is the bright red star Antares, which is the heart of the scorpion. At the lower end of the "J" are the stars that form the stinger of the scorpion. Scorpius contains four Messier objects: M4 globular cluster (Fig. 20), M6 open cluster (Butterfly Cluster; Fig. 21), M7 open cluster (Ptolemy Cluster), and M80 globular cluster.

Sagittarius (the Centaur), the largest constellation of the southern hemisphere, is best recognized in the night sky as the "teapot" asterism. Sagittarius is at the center of the Milky Way, and contains many globular clusters that lie towards the galactic center https://ned.ipac.caltech.edu/level5/ESSAYS/Cudworth/cudworth.html Shown in the above star guide are Messier objects M8 (Lagoon Nebula), M17 (Swan Nebula), M18 (open cluster), M20 (Trifid Nebula), M22 (Sagittarius Cluster), M24 (Sagittarius Star Cloud), M54 (globular cluster), M69 (globular cluster), and M70 (globular cluster). For a complete listing and description of the 15 Messier objects of Sagitarrius (as well as stars and other deep sky objects) go to http://www.constellation-guide.com/constellation-list/sagittarius-constellation/.

Shown at right is M20 (Fig. 20) which contains an open cluster of stars, and has three types of nebulosity: emission, reflection, and dark. (Although it was originally named the "Trifid Nebula" because in small telescopes it appears to be divided into three lobes, modern photographs reveal this second justification for its name.) Also shown is the dense star field M24 (Fig. 21), which makes up part of the Sagittarius-Carina arm of the Milky Way.

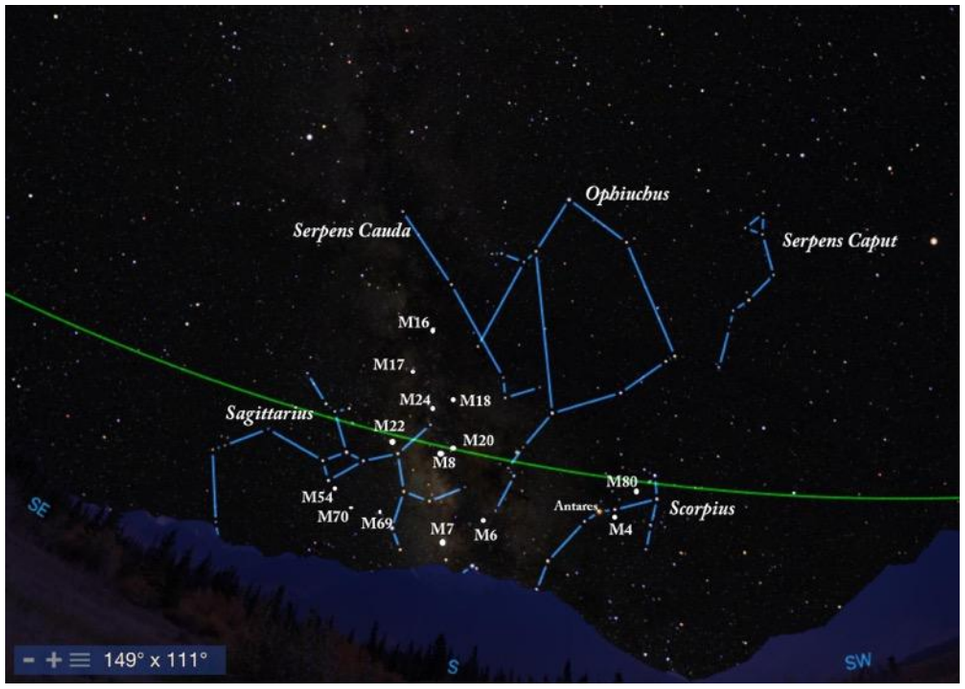


Figure 17. Star guide for Scorpius and Sagittarius on July 22 at 11:30 PDT. Note: M16 (Eagle Nebula) is the Messier object of Serpens Cauda.

Figure 18. M4 Globular cluster through an amateur telescope. Photo credit: Hewholooks. https://en.wikipedia.org/wiki/Messier_4#/media/File:M4HunterWilsonNew.jpg.

Figure 19. M6 open cluster in Scorpius. Photo Credit: Ole Nielson. https://en.wikipedia.org/wiki/Butterfly_Cluster#/media/File:M6a.jpg.

Figure 20. M20, the Trifid Nebula. Photo Credit: Hewholooks. https://en.wikipedia.org/wiki/Trifid_Nebula#/media/File:TrifidHunterWilson.jpg.

Figure 21. M24, the Sagittarius Star Cloud. Photo credit: Caustaiche. https://en.wikipedia.org/wiki/Sagittarius_Star_Cloud#/media/File:Caustiche.jpg.

How to View a Solar Eclipse Safely

Reprinted with permission from the American Astronomical Society https://eclipse.aas.org/eye-safety/safe-viewing.

Looking directly at the Sun is unsafe except during the brief total phase of a solar eclipse ("totality"), when the Moon entirely blocks the Sun's bright face, which will happen only within the narrow path of totality. To find out whether your home or any other specific location is within the path on August 21, 2017, see *Xavier Jubier's Google Map* *http://xjubier.free.fr/en/site_pages/solar_eclipses/TSE_2017_GoogleMapFull.html* which supports zooming in to street level.

The only safe way to look directly at the uneclipsed or partially eclipsed Sun is through special-purpose solar filters, such as "eclipse glasses" (example shown at left) or handheld solar viewers. Homemade filters or ordinary sunglasses, even very dark ones, are not safe for looking at the Sun. To date four manufacturers have certified that their eclipse glasses and handheld solar viewers meet the ISO 12312-2 international standard for such products: Rainbow Symphony, American Paper Optics, Thousand Oaks Optical, and TSE 17.

Instructions for safe use of solar filters/viewers:

- Always inspect your solar filter before use; if scratched or damaged, discard it. Read and follow any instructions printed on or packaged with the filter. Always supervise children using solar filters.

- Stand still and cover your eyes with your eclipse glasses or solar viewer before looking up at the bright Sun. After glancing at the Sun, turn away and remove your filter — do not remove it while looking at the Sun.

- Do not look at the uneclipsed or partially eclipsed Sun through an unfiltered camera, telescope, binoculars, or other optical device. Similarly, do not look at the Sun through a camera, a telescope, binoculars, or any other optical device while using your eclipse glasses or handheld solar viewer — the concentrated solar rays will damage the filter and enter your eye(s), causing serious injury. Seek expert advice from an astronomer before using a solar filter with a camera, a telescope, binoculars, or any other optical device.

- If you are within the *path of totality* remove your solar filter only when the Moon completely covers the Sun's bright face and it suddenly gets quite dark. Experience totality. Then, as soon as the bright Sun begins to reappear, replace your solar viewer to glance at the remaining partial phases.

An alternative method for safe viewing of the partially eclipsed Sun is pinhole projection. For example, cross the outstretched, slightly open fingers of one hand over the outstretched, slightly open fingers of the other. With your back to the Sun, look at your hands' shadow on the ground. The little spaces between your fingers will project a grid of small images on the ground, showing the Sun as a crescent during the partial phases of the eclipse.

A solar eclipse is one of nature's grandest spectacles. By following these simple rules, you can safely enjoy the view and be rewarded with memories to last a lifetime. More information: https://eclipse.aas.org and https://eclipse2017.nasa.gov.

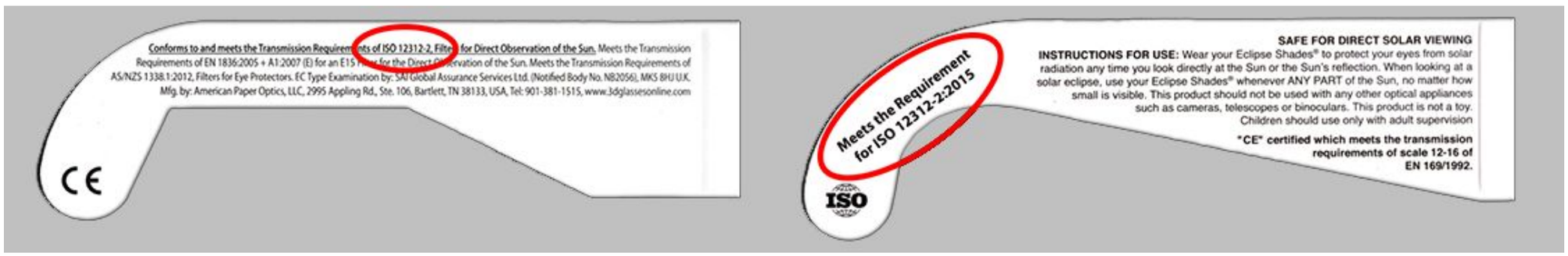
This safety information has been endorsed by the American Astronomical Society, the American Academy of Ophthalmology, the National Aeronautics and Space Administration, the American Academy of Optometry, the American Optometric Association, and the National Science Foundation. Note: This document does not constitute medical advice. Readers with medical questions should contact a qualified eye-care professional.

How to Tell If Your Eclipse Glasses or Handheld Solar Viewers Are Safe

Reprinted with permission from the American Astronomical Society https://eclipse.aas.org/eye-safety/iso-certification.

Short Answer

Look for evidence that they're certified to meet the ISO 12312-2 international standard for safe direct viewing of the Sun.



Long Answer

The #1 rule for observing a solar eclipse, or for looking directly at the Sun at any other time, is ***safety first.***
As noted elsewhere on this site, with one exception, it is ***never*** safe to look directly at the Sun without a special-purpose safe solar filter. That exception is during totality, when the Moon completely blocks the dazzlingly bright face of the Sun. On August 21, 2017, this will happen ***only*** within the roughly 70-mile-wide path of the Moon's dark inner shadow from Oregon to South Carolina — and ***only*** for a minute or two. Before and after totality, and at ***all*** times outside the path of totality, you ***must*** use a special-purpose safe solar filter when looking directly at the Sun.

"Special purpose" means designed exclusively for looking directly at the everyday Sun. Filters for direct viewing of the Sun are typically sold in the form of wearable “eclipse glasses” or "eclipse shades" or as solar-viewing cards that you hold in your hand. What makes them special is that they reduce sunlight to safe levels so that you don't injure your eyes. Our daytime star shines about a half million times brighter than the full Moon in visible light and emits potentially harmful ultraviolet (UV) and infrared (IR) radiation too. Looking directly at the Sun through anything that isn't specially made to deal with all that light and invisible radiation is a recipe for serious eye injury, perhaps even blindness.

What to Look For

How do you know if your eclipse glasses or handheld solar viewers are truly safe? First and foremost, make sure they're marked as meeting the ISO 12312-2 (sometimes written as ISO 12312-2:2015) international standard. Filters that are ISO 12312-2 certified not only reduce visible sunlight to safe and comfortable levels but also block solar UV and IR radiation.
To date four manufacturers have certified that their eclipse glasses and handheld solar viewers meet the ISO 12312-2 international standard for such products:

- Rainbow Symphony, https://www.rainbowsymphonystore.com/collections/eclipse-glasses-safe-solar-viewers.
- American Paper Optics https://www.eclipseglasses.com.
- Thousand Oakes Optical http://www.thousandoaksoptical.com/ecplise.html.
- TSE 17 http://tse17.com.

Rainbow Symphony's Eclipse Shades and American Paper Optics' Eclipser glasses are made with black polymer or silver-black polymer manufactured by Thousand Oaks Optical (which uses the same material in its Solar Viewers). TSE 17 manufactures its own filter material and calls it SUNsafe SOLARfoil.

The companies listed above produce eclipse glasses and handheld viewers in an astonishing variety of designs. They also provide custom-printed filters to vast networks of retailers and other organizations, some of whom re-brand the filters. Prominent examples include some of the leading U.S. manufacturers of telescopes for backyard astronomers:

•Meade Instruments' EclipseView filters are produced by Rainbow Symphony.
•Celestron's EclipSmart filters are produced by American Paper Optics.
•Lunt Solar Systems' SUNsafe SUNglasses filters are produced by TSE 17.

You'll find "ISO 12312-2" or "ISO 12312-2:2015" printed on all these filters. In addition to making sure your eclipse shades or handheld viewers meet the ISO safety standard, make sure they're in good condition:

•If the filters are torn, scratched, or punctured, discard them.
•If the filters are coming loose from their cardboard or plastic frames, discard them.

What to Avoid

Baader Planetarium's AstroSolar Safety Film, manufactured in Germany and meant for use with telescopes, binoculars, and camera lenses, is not designed to work as an eclipse shade or handheld solar filter, is not certified to meet the ISO 12312-2 international safety standard, and is not suitable for direct viewing of the Sun.

Dark sunglasses, neutral density or polarizing filters (such as those made for camera lenses), smoked glass, exposed film, "space blankets," potato-chip bags, DVDs, and any other materials you may have heard about for solar viewing are *not* safe. In some cases these homemade filters may seem like they dim the Sun to a comfortable level, but that doesn't mean they do so across the whole electromagnetic spectrum. While you're enjoying a "comfortable" view of the "dim" Sun, solar infrared radiation could be cooking your retinas. And you wouldn't know till later, because your retinas don't have pain receptors. Only after the eclipse, when you notice blind spots or other vision problems, would you realize you'd made a catastrophic mistake.

Note that on this page we're talking *only* about filters made for direct viewing of the uneclipsed or partially eclipsed Sun with your eyes. Eclipse glasses and handheld viewers should *never* be used when looking through telescopes, binoculars, camera lenses, or other optical devices. For tips on using solar filters with optics, see. https://eclipse.aas.org/eye-safety/optics-filters.

Heavenly Bodies By Susie Christian

EVER WONDER WHY
THE EARTH IS 70% WATER?