AOH OBSERVER
Winter 2019

The Newsletter of the Astronomers of Humboldt

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AOH 2019 Board of Directors and Officers

On November 8, 2018, AOH members convened for the Annual General Membership Meeting. Per the AOH Bylaws, the slate of nominees for the Board of Directors was presented, approved, and elected. The 2019 Directors are Bea Asmundardottir, Becky Chambers, Bernie Christen, Greg Deja, Dan Eaton, Brent Howatt, Mark Mueller, Grace Wheeler, Mark Wilson, Ken Yanosko, and Bob Zigler.

Following the adjournment of the General Meeting, the Board of Directors met to elect the 2019 officers. Congratulations to President Brent Howatt, Vice-President Mark Wilson, Treasurer Bob Zigler, and Secretary Ken Yanosko. We are especially grateful to Brent Howatt for stepping up to be the President and are looking forward to having Brent at the helm.

Thank you to Mark Mueller for serving as President in 2018; Mark, we appreciate your service to the Club.

Retiring from the Board of Directors is Russ Owsley, who has been a board member for nineteen years, and served as President for nine years. Thank you, Russ, for your leadership and guidance through the years.

Please welcome our newest Board Members, Bea and Becky. Both of you are a great addition to the Board!

Finally, a Big Shout Out to our AOH Members! Your support of the AOH is much appreciated.

The minutes of the meeting can be found here. The election of the Board of Director and of the Officers was done following the AOH Bylaws.

The 2019 AOH Board of Directors.
Front row: Bernie, Grace, Bea, and Becky
Back row: Ken, Bob, Mark W. ,Greg, Brent, Mark M.

The 2019 AOH Officers: President Brent Howatt, Treasurer Bob Zigler, Secretary Ken Yanosko, and Vice-President Mark Wilson

Astronomers of Humboldt

www.astrohum.org

"Annual" Potluck Dinner

Saturday February 2, 2019
5:30 to 9:00 p.m.
Humboldt Area Foundation
363 Indianola Road
Bayside, CA 95524

Members and friends of the Astronomers of Humboldt and their guests are invited to participate in the "Annual" Astronomers of Humboldt Potluck. Meet and Greet at 5:30; Dinner (bring a dish to share and utensils and non-alcoholic beverages for yourself and guests) at 6:30; Talk at 7:30.

Guest Speaker: Dr. Jon Pedicino, College of the Redwoods.

Dr. Jon Pedicino has taught Astronomy and Earth Sciences at the College of the Redwoods since 2001. He earned his undergraduate degree in Physics from Dartmouth College in 1991 and his Doctorate in Planetary Science from the University of Arizona in 1996. His expertise lies in Mars Geology and Paleoclimates along with the Search for Life in the Universe. He teaches classes in Introductory Astronomy, Space Exploration, and Teaching Science with Science Fiction, among others.

"Are we alone in the Universe?"

Are we alone in the universe? That question remains definitively unanswered in 2019. We can, however, use this planet to explore how life got started here and look for those same conditions on other objects both near and far. Nearby objects include Mars and the outer solar system moons, Europa, Enceladus, and Titan. Perhaps even more intriguing is what lies beyond the edges of our solar system. Since the discovery of the first exoplanet in 1995, planetary astronomers have discovered some tantalizing clues about what these exoplanets might be like. Missions like Kepler have discovered thousands of planets, many of them could potentially support life. Current missions like TESS and the soon-to-launch Webb Space Telescope could provide us with even more significant information about where the "Search for Life" question goes next. What have we found? What do we expect to find and when?

Introducing the AOH Galileoscope Program

Grace Wheeler

In September 2018, the AOH was part of a select group of Night Sky Network clubs that were chosen to participate in a workshop entitled "**From Pinholes to Space Telescopes: Online Workshop for Informal Educators**." The workshop was taught by the staff (Brian Kruse, Anne Hurst, Dave Prosper) of the Astronomical Society of the Pacific and was funded by a grant from the Gordon and Betty Moore Foundation. The four-week workshop was a combination of webinars and hands-on activities. The course topics included: properties of light, the optical properties of lenses, how lenses organize light to form images from distant objects, and the evolution of telescopes. The last week of the course was dedicated to constructing a "Galileoscope," a simple refracting telescope, and a discussion on how to use this telescope in public outreach.

As a student in the workshop, I was impressed by the presentation of the various topics, and by the hands-on activities. Each week, we were given a set of questions to work on, and since we were "experienced" astronomers (as Brian put it), it was up to us to design the experiments that would answer the questions. My fellow workshop participants and I would communicate via an online forum, and it was wonderful to meet the members of other astronomy clubs. The workshop was challenging and enlightening (who knew pinholes could be so much fun), and I'll be incorporating what I learned as well as some of the activities into our AOH outreach program.

At the end of the workshop, the clubs received twenty-four Galileoscope kits to be used in their outreach program. The Galileoscope is a low cost refracting telescope that was developed by astronomers and science educators for the 2009 International Year of Astronomy. Because the Galileoscope requires assembly (the kit contains lenses and parts that make up the body of the telescope), this a perfect activity for showing how the different components of a refracting telescope function. The Galileoscope is easy to set up and use, and learners can start observing almost immediately.

The AOH will be using the Galileoscopes in our outreach programs with schools, youth groups, and public events. We will be using the Galileoscope to teach optics and for astronomical observations. The Galileoscope has successfully been used to view the moon, Jupiter and its Galilean Moons, Saturn, the Orion Nebula, and the Andromeda Galaxy. A number of these telescopes will be loaned out to schools and youth groups so that they can work on their observing program.

In addition to the 24 Galileoscopes that the AOH received from the Astronomical Society of the Pacific, our club also received a grant ($564) from the Gerald O. and Susan Hansen Family Fund, a fund of the Humboldt Area Foundation. The award will be used to purchase tripods and solar filters to be used with the Galileoscopes; these items will increase the effectiveness of the Galileoscope for our learners.

It is our hope is that our Galileoscope Program will make astronomy more accessible to our community, and we look forward to introducing the telescopes to the public in 2019. We are grateful to the Astronomical Society of the Pacific for selecting the AOH to be part of the Workshop and for their gift of twenty-four Galileoscopes. We thank the Gerald O. and Susan Hansen Family and the Humboldt Area Foundation for their generous funding for equipment purchase. Finally, we are indebted to our many AOH outreach volunteers who donate their time and share their knowledge and enthusiasm of astronomy with our community.

The Galileoscope Kit (Image: https://galileoscope.org)

View through the Galileoscope

Our Moon

Saturn at 25 times magnification

Image Credit: 2018.2 GalileoscopeBuild.pdf Astronomical Society of the Pacific

A Galileoscope mounted on an simple and inexpensive tripod. (Image: GDW)

Fall 2018 Outreach Events/AOH Star Parties

Albee Creek September 21. We began the fall outreach season with a star party at the Albee Creek Campground at Humboldt Redwood State Park. A small crowd assembled under cloudy skies for an evening of planet and moon watching. We almost canceled the stargazing portion of the program, but at the last minute, Jupiter made an appearance, followed by Saturn and Mars. The seeing was subpar, and we played peekaboo with Jupiter, Saturn, and Mars as the planets dodged in and out of the clouds. Nonetheless, the attendees were game to look through the telescope. The full moon finally rose above the tree line at 8 p.m. and visitors got an up-close (and somewhat blinding) view of Moon craters and mountains. After the party ended, a few people stayed behind in the meadow to enjoy the full moon on the first day of autumn. The volunteers were Grace Wheeler and Mary Kaufman (who did double duty as a HRSP Park Ranger). (Images and Report by GDW)

Mary demonstrating the gravity well.

Viewing the planets through the SCT.

Using the Astroscan to look at the moon.

Regular Monthly Meeting, October 6. We met at Kneeland Airport. Present were members Mark M, Mark W, Ken, Russ, Dan, Greg, Bea, Becky, Joey, Grace, Margaret, Gretchen with daughters Kaliece, Miley, and Deedee and friend Joe, and guests Diana and Mike. It was totally socked in, but some tentative clearing to the west gave some hope. Russ and Joey set up scopes in the fog on the theory that it would be less effort to do so in the light than to wait until dark. A few pessimists left, but the rest of us were rewarded when the fog dissipated around 8:30. A few more scopes were hurriedly set up, and we got some views of Saturn and Mars, some nebulae: Lagoon and Owl, some open clusters: Perseus' Double and the Pleiades, at least one globular: Hercules, and a few galaxies: Andromeda and Triangulum. By 9:30 it got hazy again, and all the exposed glass got dewy. We departed, satisfied and smug in our perseverance. (Report by Ken Yanosko; Images from M.Hague and GDW)

The clearing to the west gave us hope. (image: Margaret Hague)

Deedee observing Saturn through the C-8. (image: GDW)

Gretchen setting up the “GoTo”telescope. (image: GDW)

College of the Redwoods Science, Oct. 21. It was all hands on deck for the AOH's third appearance at the Annual CR Science Night. We took over HU 115 and part of the outdoor courtyard. The demonstrations included telescope viewing (Brent, Anastasia), solar system models (Russ), meteorites (Grace, Don), and gravity well (Mary, Frank). At the kid's table (Catrina, Ken), the kids made planet masks, planispheres, and DIY solar system maps. Mark Wilson staffed the information desk. Many vintage astronomy photos and posters from the old Physical Science were given away during our event (Ken, Frank). We had about 200 people come through the room. There were a lot of smiling faces, and several visitors commented that our room was both fun and educational. Thank you to our volunteers for your hard work! (Report by GDW; Images from Catrina Howatt, Ken Yanosko, and Don Wheeler)


Catrina at the Kid's table


Russ at the Solar System Station


The Crowd in HU 115


Families enjoying "Adventures in Astronomy"


Mary at the Gravity Well


The Kid's Table was a Popular Place!


Big Kids: Ken, Mary, Frank, and Anastasia


Little Planets


Brent at the Telescope Station; Viewing through a Galileoscope

Kneeland School Fall Festival Nov 3. Grace, Russ, and Ken were on hand with telescopes (although it was too hazy to see anything), a solar system model, and a gravity well. We had fun chatting with the astronomy fans who came by to visit. We bought tickets for Chicken Poop Bingo but didn't win anything.   (Report by Ken Yanosko; Images by GDW)

Russ demonstrating the use of a planisphere.

Ken discussing gravity and motion of the planets.

Launching marbles in the gravity well.

Cub Scouts Pack 95 at Jacoby Creek School, Nov. 8. We had a large group that included the Scouts, a few siblings (13 kids in all), and several parents. The program included a discussion about night vision, finding Polaris, and identifying some of the northern constellations (Brent). We viewed Mars and Saturn, the double star Mizar and Alcor, open clusters (Pleiades, Perseus Double Cluster, Owl Cluster), globular cluster (M13), the nearby galaxy Andromeda, and the Dumbbell planetary nebula. Ken mounted his binoculars on his custom tripod and showed what can be seen in the night sky with binoculars (something the Scouts will be doing). It was an enjoyable evening with curious kids and adults. Participating were Brent and Catrina (organizers), Ken, Grace, and Kathy (who helped with the setup).   Thank you to Pack 95 leader Keith Caruso for the invitation, and to the Cub Scouts, parents, and family members for being a wonderful audience. (Report and images by GDW)

Catrina finding stars for aligning the C-6.

Brent setting up his C-8.

Lined up to look through the binoculars.

Listening to the introductory remarks.

Catrina, Ken, and Kathy looking skyward.

Keith, Brent, and Ken wrapping up at the end of the night.

This article is distributed by NASA Night Sky Network
The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.org to find local clubs, events, and more!

January's Evening Eclipse and Morning Conjunctions

By David Prosper

Observers in the Americas are treated to an evening **total lunar eclipse** this month. Early risers can spot some striking morning conjunctions between **Venus**, **Jupiter**, and the **Moon** late in January.

A **total lunar eclipse** will occur on **January 20th** and be visible from start to finish for observers located in North and South America. This eclipse might be a treat for folks with early bedtimes; western observers can even watch the whole event before midnight. Lunar eclipses take several hours to complete and are at their most impressive during total eclipse, or totality, when the Moon is completely enveloped by the umbra, the darkest part of Earth's shadow. During totality the color of the Moon can change to a bright orange or red thanks to the sunlight bending through the Earth's atmosphere - the same reason we see pink sunsets. The eclipse begins at 10:34 pm Eastern Standard Time, with totality beginning at 11:41 pm. The total eclipse lasts for slightly over an hour, ending at 12:43 am. The eclipse finishes when the Moon fully emerges from Earth's shadow by 1:51 am. Convert these times to your own time zone to plan your own eclipse watching; for example, observers under Pacific Standard Time will see the eclipse start at 7:34 pm and end by 10:51 pm.

Lunar eclipses offer observers a unique opportunity to judge how much the Moon's glare can interfere with stargazing. On eclipse night the Moon will be in **Cancer**, a constellation made up of dim stars. How many stars you can see near the full Moon before or after the eclipse? How many stars can you see during the total eclipse? The difference may surprise you. During these observations, you may spot a fuzzy cloud of stars relatively close to the Moon; this is known as the "**Beehive Cluster**," **M44**, or **Praesepe**. It's an open cluster of stars thought to be about 600 million years old and a little under 600 light years distant. Praesepe looks fantastic through binoculars.

Mars is visible in the evening and sets before midnight. It is still bright but has faded considerably since its closest approach to Earth last summer. Watch the red planet travel through the constellation Pisces throughout January.

Venus makes notable early morning appearances beside both **Jupiter** and the **Moon** later this month; make sure to get up about an hour before sunrise for the best views of these events. First, Venus and Jupiter approach each other during the third full week of January. Watch their conjunction on the 22nd, when the planets appear to pass just under 2 ½ degrees of each other. The next week, observe Venus in a close conjunction with a crescent Moon the morning of the 31st. For many observers their closest pass - just over half a degree apart, or less than a thumb's width held at arm's length - will occur after sunrise. Since Venus and the Moon are so bright you may still be able to spot them, even after sunrise. Have you ever seen Venus in the daytime?

If you have missed **Saturn** this winter, watch for the ringed planet's return by the end of the month, when it rises right before sunrise in Sagittarius. See if you can spot it after observing Venus' conjunctions!

You can catch up on all of NASA's current and future missions at nasa.gov.

*Have you ever wondered how eclipses occur? You can model the Earth-Moon system using just a couple of small balls and a measuring stick to find out! The "**yardstick eclipse**" model shown here is set up to demonstrate a lunar eclipse. The "Earth" ball (front, right) casts its shadow on the smaller "Moon" ball (rear, left). You can also simulate a solar eclipse just by flipping this model around. You can even use the Sun as your light source! Find more details on this simple eclipse model at **bit.ly/yardstickeclipse** .*

Turn Supermoon Hype into Lunar Learning

Reprinted from the Night Sky Network nightsky.jpl.nasa.org
https://nightsky.jpl.nasa.gov/news-display.cfm?News_ID=797

Illustration of the position of the Earth's moon at apogee and perigee. source image credit: NASA (Earth) Gregory R. Revera (Moon)

Supermoons get lots of publicity from the media, but is there anything to them beyond the hype? If the term "supermoon" bothers you because it's not an official astronomical term, don't throw up your hands. You can turn supermoon lemons into lunar lemonade for your star party visitors by using it to illustrate astronomy concepts and engaging them with great telescopic views of its surface!

Many astronomers find the frequent supermoon news from the media misleading, if not a bit upsetting! Unlike the outrageously wrong "Mars is as big as the moon" pieces that appear like clockwork every two years during Mars's close approach to Earth, news about a huge full moon is more of an overstatement. The fact is that while a supermoon will indeed appear somewhat bigger and brighter in the sky, it would be difficult to tell the difference between an average full moon and a supermoon with the naked eye.

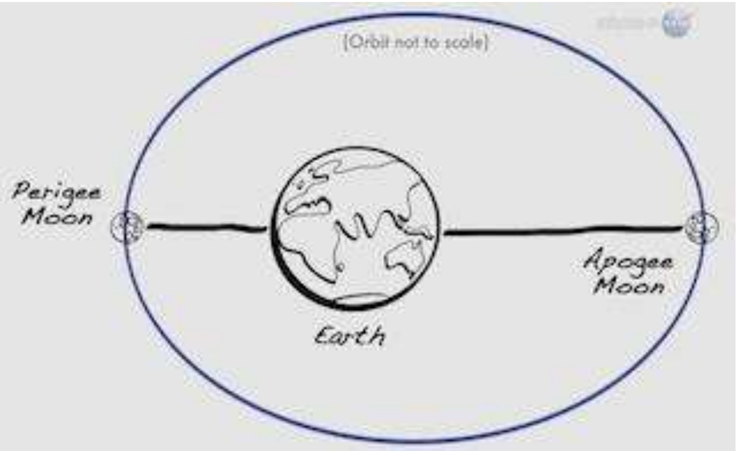


Image Credit: Science@NASA

There are great bits of science to glean from supermoon discussion that can turn supermoon questions into teachable moments. For example, supermoons are a great gateway into discussing the shape of the moon's orbit, especially the concepts of apogee and perigee. Many people may assume that the moon orbits Earth in a perfect circle, when in fact its orbit is elliptical! The moon's distance from Earth constantly varies, and so during its orbit it reaches both apogee (when it's farthest from Earth), as well as perigee (closest to Earth). A supermoon occurs when the moon is at both perigee and in its full phase. That's not very rare; a full moon at closest approach to Earth can happen multiple times a year, as you may have noticed.

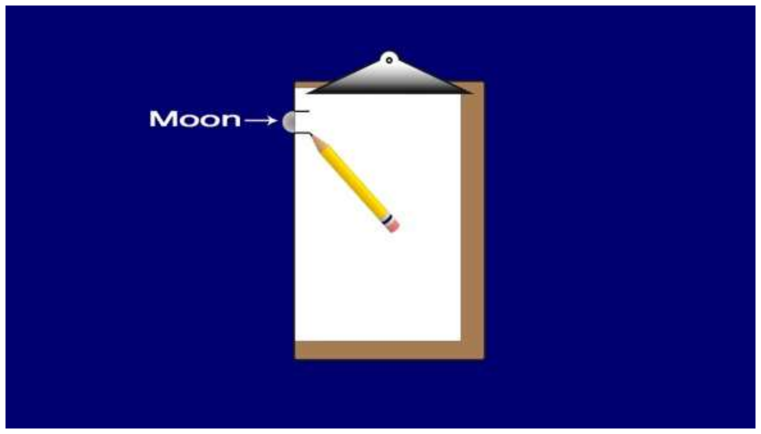
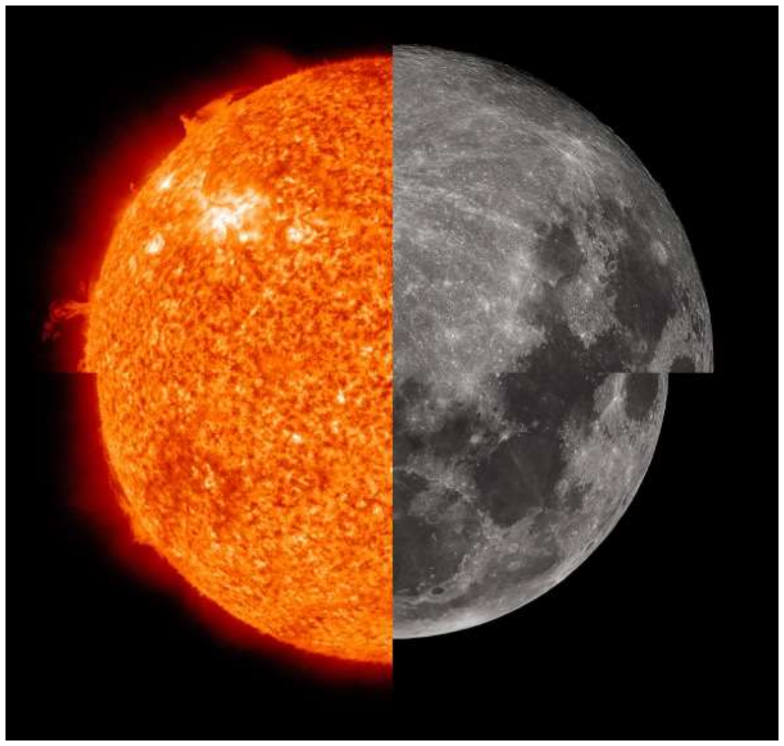


Image of the supermoon measurement activity. (credit: NASA/JPL)

While a human observer won't be able to tell the difference between the size of a supermoon and a regular full moon, comparison photos taken with a telephoto lens can reveal the size difference between full moons. NASA has a classroom activity where students can measure the size of the full moon month to month and compare their results: "Measuring the Supermoon."

Apparent size difference between a "supermoon" (left, full moon at perigee) and "minimoon" (right, full moon at apogee). This is an example of the comparisons curious individuals can make with a DSLR camera following this activity. Photo credit: NASA

Students can use digital cameras (or smartphones) to measure the moon, or they can simply measure the moon using nothing more than a pencil and paper! Both methods work and can be used depending on the style of teaching and available resources. Find out more here: https://www.jpl.nasa.gov/edu/teach/activity/measuring-the-supermoon.



Apparent sizes of the Sun and moon depicted to scale at apogee (top right) and perigee (bottom).

There *is* actually is a way for naked eye observers to observe the different apparent sizes of the moon in our sky, but oddly enough it's not when the moon is full and brilliant, but the opposite: when the moon is new and dark, during eclipses! For eclipse chasers, the apparent size of the moon matters very much to what they will see. For example, a total eclipse can happen in conjunction with a supermoon as many in the USA saw on August 17, 2017. The apparent size of the moon was large enough to completely block the disc of the sun in our skies along a narrow path for a couple of minutes. If the moon was further away from the Earth, especially if it was at apogee - its furthest point - then a total eclipse would not occur. Instead, an annular eclipse would be seen instead, where a "ring of fire" would seem to circle the black disc of the new moon.

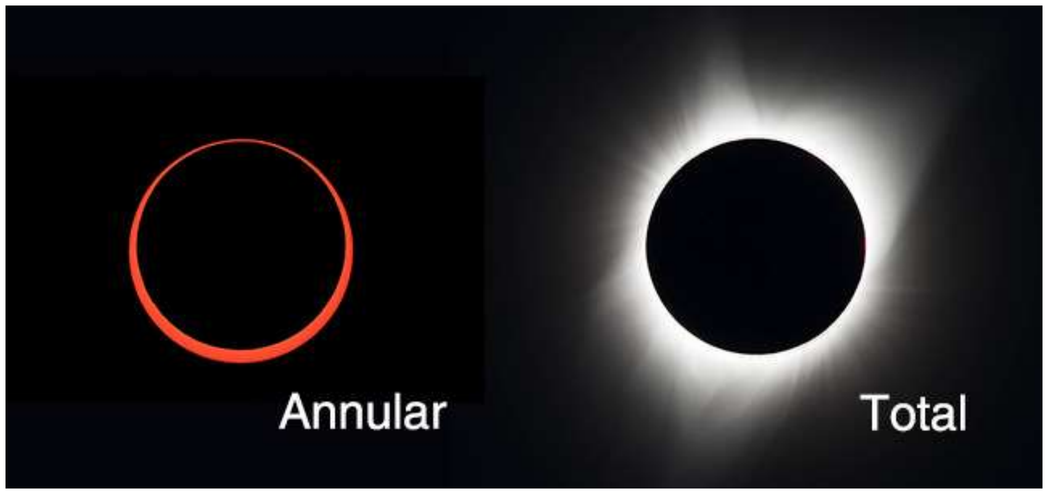


Image Credits: Dale Cruikshank (Annular Eclipse)/ NASA/ Aubrey Gemignani (Total Eclipse)

This discussion of the different phases of the moon and can also make for a fun, simple, long-term project for a classroom. Students can observe the phases of the moon every day (when weather permits) over a thirty day period and write down their observations of the moon's phases and what times of day and night they can actually see the moon during this period. This can also be paired at some point with the crafty "Make a Moon Phases Calculator and Calendar" activity. You can find out more about the "Observing the Moon" classroom activity at: https://www.jpl.nasa.gov/edu/teach/activity/observing-the-moon.

A related moon phases activity, which is short and perfect for small interactive groups, can be found at: https://www.jpl.nasa.gov/edu/teach/activity/moon-phases/.

You can find a more detailed discussion of the science of supermoons on NASA's "What is a Supermoon and Just How Super Is It?" page from their "Teachable Moments" blog. You can find links to the above activities there, along with more lunar science that can be used to make the hype about Supermoons teachable moments for your star party visitors.

The next supermoon arrives the night of January 20, 2019 and will be paired with a total lunar eclipse - a perfect time to ring in the new year with some solid lunar science!

Winter Constellations and Deep Sky Objects

Grace Wheeler

The Winter Hexagon is an asterism of the winter night sky that contains the brightest stars of the constellations Auriga, Taurus, Orion, Canis Major, Canis Minor, and Gemini (Fig. 1). Within the Winter Hexagon, a faint ribbon of stars and dust known as the Orion-half of the winter time Milky Way can be seen coursing through these constellations. The winter Milky Way is less apparent than its summer counterpart as we are looking outward into space towards the less star-populated spiral arm know as the Orion Spur (in the summer we are looking towards the bright center of the galaxy). While the summer Milky Way is rich in globular clusters (ancient star clusters), the winter Milky Way contains an abundance of open star clusters (young stars recently formed out the same cloud of gas). Thus, the constellations of the Winter Hexagon are dominated by open star clusters.

In January, an observing tour of the Winter Hexagon can be done between 8 p.m. and midnight. A dark clear night is needed to be able to see the streak of the Milky Way. In addition to the many open clusters in the Hexagon, notable deep sky objects include the star-forming regions in Orion (M41, M42), a supernova remnant (M1), and an unusual globular cluster in the constellation Lepus.

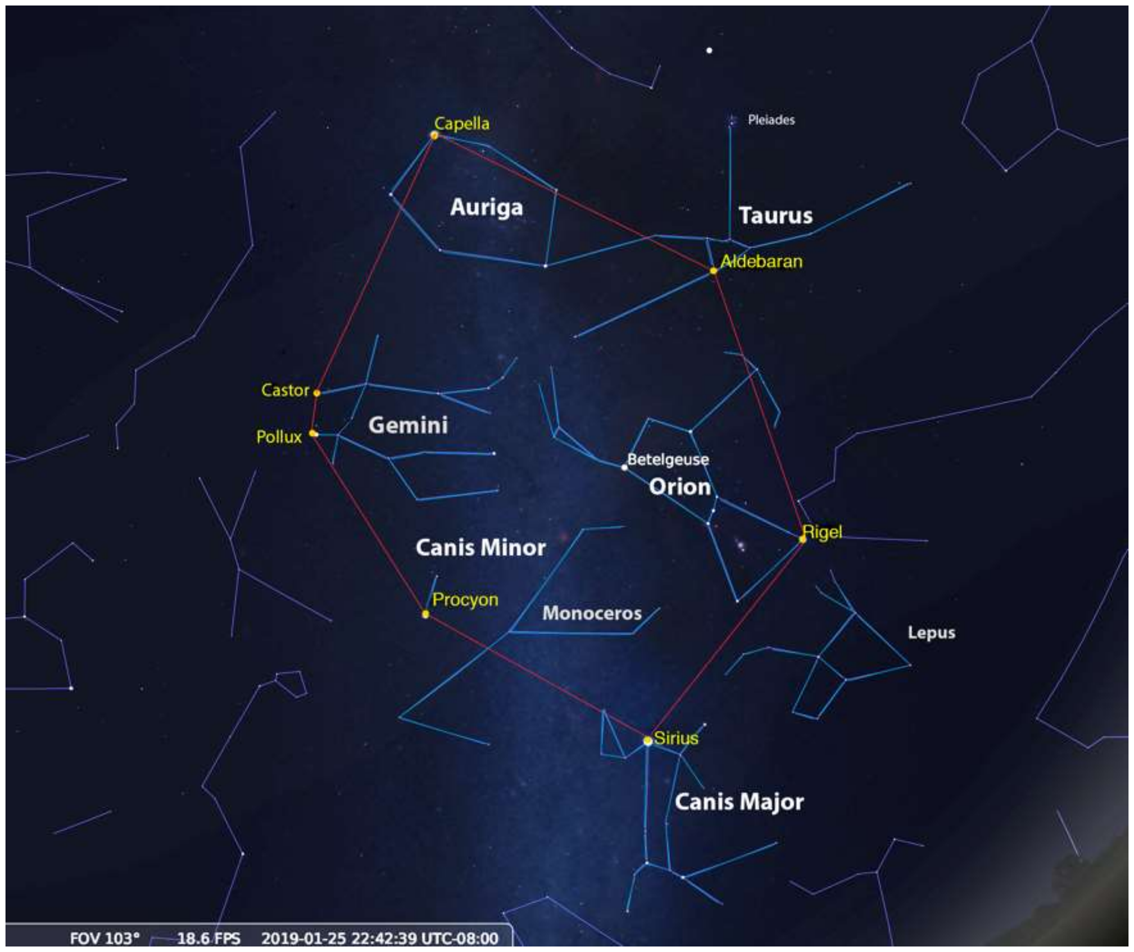


Figure 1. The star chart generated by Stellarium for the evening of January 25, 2019. The outline of the Winter Hexagon is in red and contain the brightest stars (in yellow) of the constituent constellation at the vertices: Pollux, Castor, Capella, Aldebaran, Rigel, Sirius, and Procyon. The background shows the streak of the wintertime Milky Way.

Auriga (The Charioteer) is a pentagonal shaped constellation that lies north of the celestial equator. The shape of Auriga resembles a helmet of the charioteer. Capella is the brightest star in Auriga. Notable deep sky objects are the open clusters M36, M37, and M38. M37 brightest and largest open cluster (Fig. 2). M37 is the brightest open cluster Auriga, and has a visual magnitude of 6.2, and contains over 500 stars (Fig. 3).

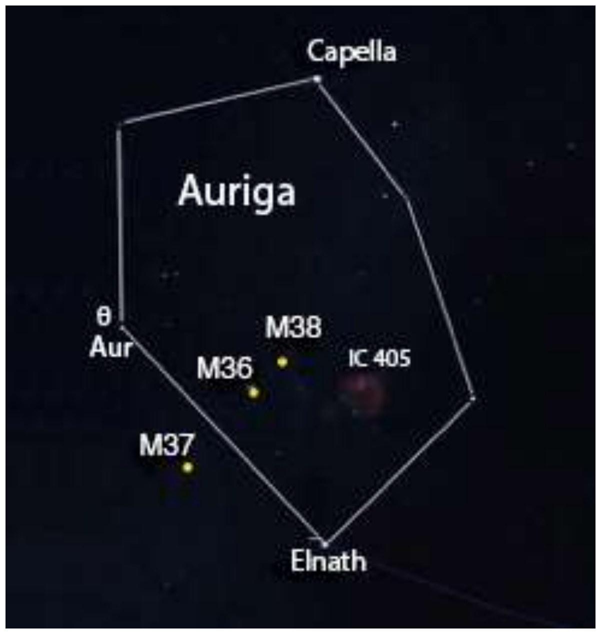


Figure 2. The location of M37, M36, and M38 in Auriga. (Image was generated in Stellarium with modifications)

Figure 3. Messier 37 is the brightest open cluster in Auriga. (Image: Slooh Canary One Half Meter Telescope).

Taurus (The Bull). The brightest star of Taurus (Fig. 4) is the orange star Aldebaran, also known as the "fiery eye of the bull". Taurus is known for the two open clusters Pleiades (mag 1.6) and the Hyades Cluster (mag. 0.5). Both clusters are naked eye objects but best viewed with binoculars or small telescopes. The Pleiades (M45) is composed of hot type B stars and the nebulosity can still be seen (Fig. 5). The Hyades Cluster (Caldwell 41) is thought to be older than the Pleiades and contain red giants and white dwarfs which are considerably cooler than stars of the Pleiades. The Hyades, in association with Aldebaran form the "V" shaped face of Taurus and is the closest star cluster to Earth (because of this, the stars of this cluster appears more spread out). Taurus also contains the supernova remnant Crab Nebula (M1) (Fig. 6). It is thought that M1 corresponds to the supernova observed by Chinese astronomers in 1054.

Figure 4. The constellation Taurus showing the location of M1, Hyades, and Pleiades. (Image was generated in Stellarium with modifications).

Figure 5. The Pleiades (M45) is an open cluster in Taurus is also known as the "Seven Sisters". (Image: Slooh Canary Three Telescope).

Figure 6. The Crab Nebula (M1) is a supernova remnant in Taurus. (Image: GDW, C-6, Atik Infinity camera).

Gemini (The Twins). The constellation is found in the northern hemisphere and is known for its two brightest stars Castor and Pollux (Fig. 7). Pollux, an orange giant star, is the brighter of the two. The whitish star Castor is actually made up of 3 sets of double stars known as Castor A, Castor B, and Castor C. Open clusters in Gemini include the M35 open cluster (mag. 5.3) which is located near the three "foot stars" of Gemini (Fig. 7, 8). M35 is a naked eye object (easily seen with binoculars) which is composed of several hundred stars spread over the area the size of the full moon. To the southwest of M35 is the distant open cluster NGC 2158. NGC 2158 is two billion years old and is unrelated to M35. Also found in Gemini is the the bluish double-shelled planetary nebula known as the Eskimo Nebula (NGC 2392). The Eskimo Nebula is located southeast of the star Wasat (Fig. 7, 9).

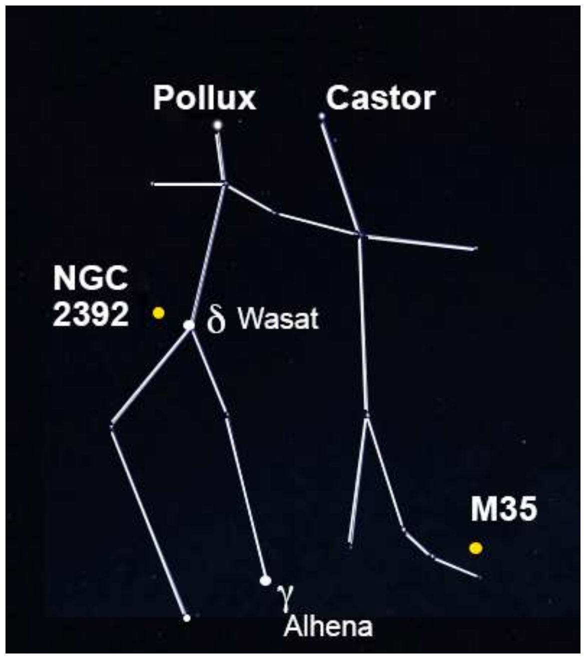


Figure 7. The constellation Gemini showing the locations of M35 and NGC 2392. (Image was generated in Stellarium)

Figure 8. M35 is a large open cluster in Gemini. The more distant open cluster is NGC 2158 is seen in the southwest corner of M35. (Image: Slooh Canary Three Telescope)

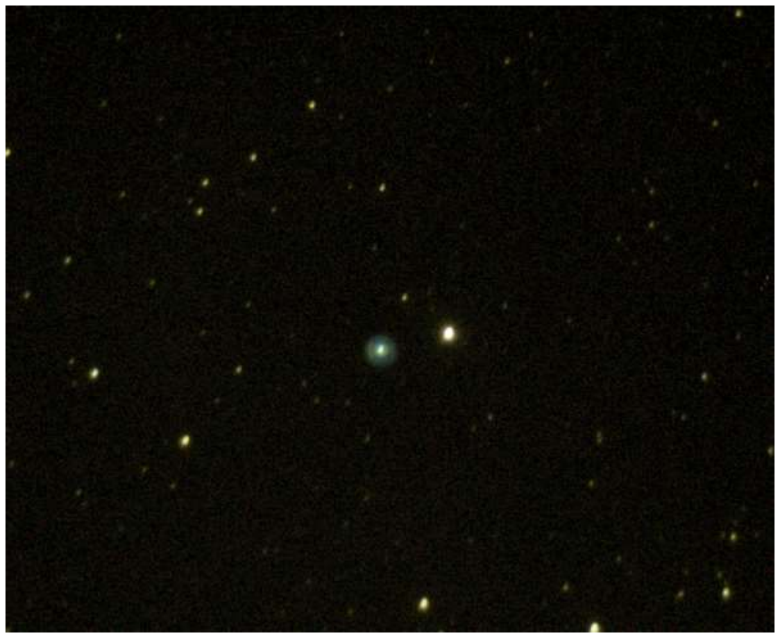


Figure 9. NGC 2392, the Eskimo Nebula is a blue double-shelled planetary nebula. (Image: C-8, Atik Infinity camera)

Orion (the Hunter). Orion lies on the celestial equator and dominates the winter night sky (Fig. 10). In Greek mythology, the stars of Orion are thought to represent the "Hunter" and he is flanked by his hunting dogs Canis Major and Canis Minor. The two brightest stars of Orion are Rigel (blue supergiant) and Betelgeuse (red supergiant). The asterism Orion's Sword lies beneath the belt stars Mintaka, Alnilam, Alnitak. Orion's Sword (Fig. 10) can be seen with the unaided eye and contains the star-forming region Orion Nebula (M42) and DeMairan's Nebula (M43) (Fig. 11). At the heart of M42 lie the 4 brightest stars of the Trapezium Cluster (Fig.12). M43 lies north of M42, and the two are separated by a dark dust lane. M43 a smaller comma shape nebula with the star Nu Orionis as the bright center. A dark dust lane separates the two. M78 (Fig. 13) is another star-forming region of Orion and is located about 2 degrees northeast of the belt star Alnitak (Fig. 10). Embedded in the nebula are young blue stars. It is fainter than Orion's Nebula, and a telescope is needed to see the nebulosity.

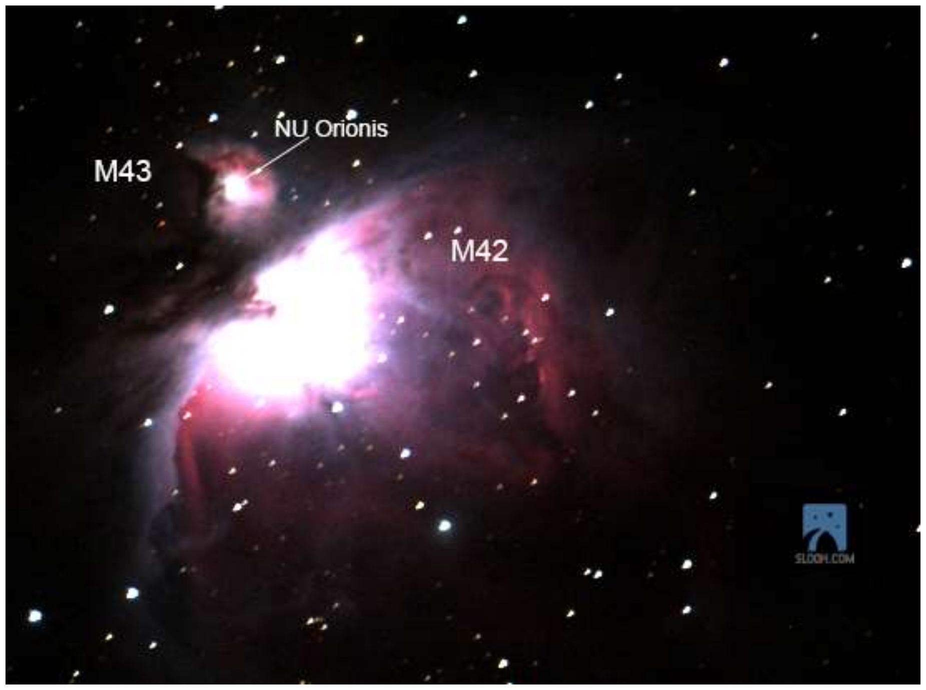


Figure 11. Orion Nebula: M42 and M43 are star nurseries separated by dust lanes. The bright area of M42 is the Trapezium Cluster. The bright center of M43 is the star NU Orionis (image: Slooh Canary Three Telescope).

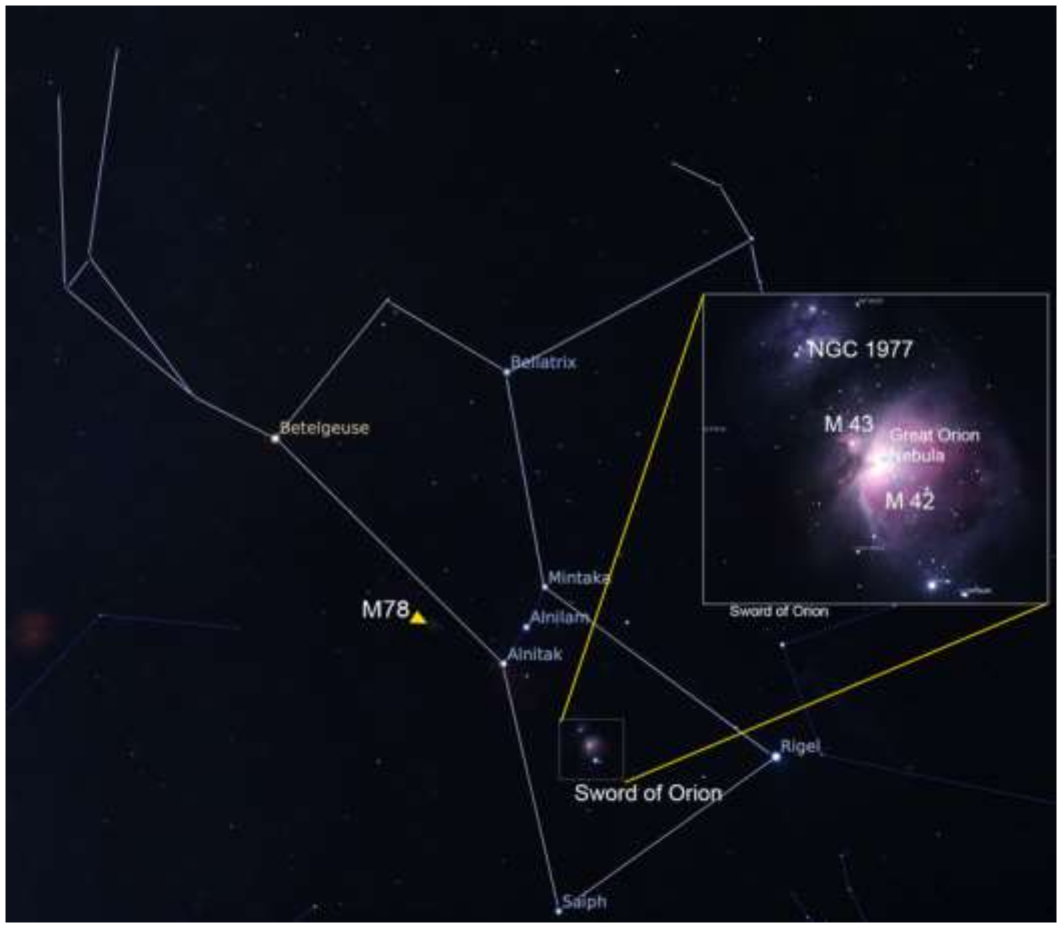


Figure 10: The Constellation Orion. The location of various deep sky objects are shown. Orion's Sword has been enlarged and is shown in the inset. (Image: Stellarium with modifications).

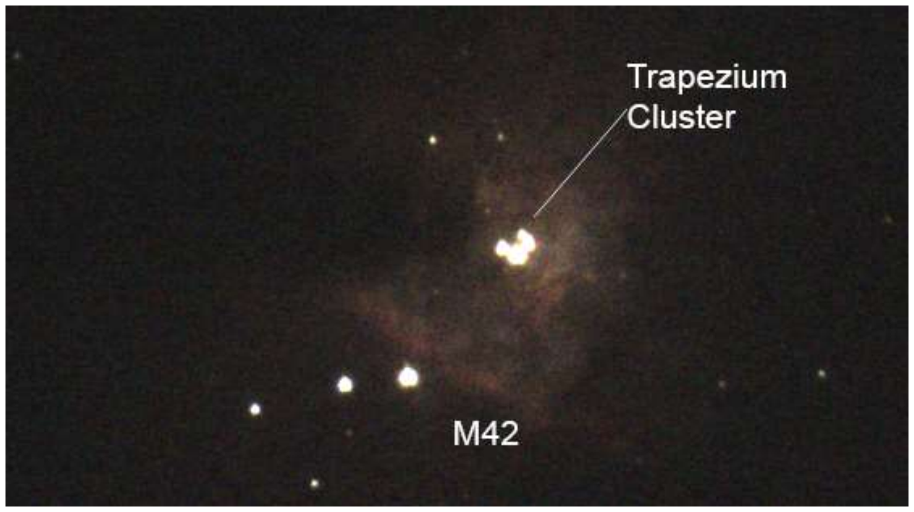


Figure 12. The four brightest stars of the Trapezium Cluster in M42. (Image: GDW, 6 SCT, Atik Infinity camera).

Figure 13. M78 is a bright diffuse reflection nebula. The two bright stars in the center of the cloud illuminate the dust clouds of the nebula. (image: GDW, 6 SCT, Atik Infinity camera).

The **Orion Family of Constellations** (Fig. 14) is made up of Orion, Canis Major, Canis Minor, Lepus, and Monoceros. These constellations draw from the Greek myth of the hunter (Orion) and his two dogs (Canis Major and Canis Minor) chasing the hare (Lepus). Donald Menzel (Harvard Observatory, 1975) added the Monoceros (the Unicorn) to the Orion Family for completeness. Included in this section is the unrelated constellation Puppis which is found near Sirius and Monoceros.

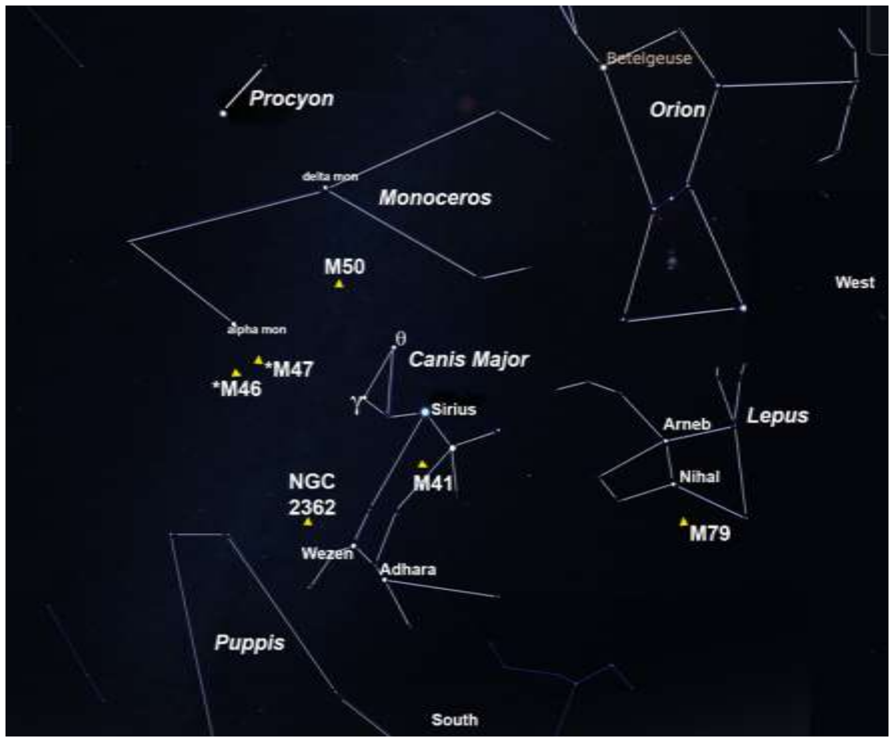


Figure 14. Star Chart showing the Orion Family of Constellations with the locations of selected deep sky objects. Included is the nearby constellation Puppis and its deep sky objects, M46 and M47. (Image: Stellarium with modifications).

Canis Major (Greater Dog) is a constellation of the southern hemisphere (Fig. 14). The "Dog Star" Sirius is the brightest star in the night sky (magnitude -1.42). Sirius is a binary star made up the brilliant Sirius A and the white dwarf Sirius B. Canis Major contains M41, an open cluster of about 100 stars (Fig. 15). M41 is bright and large, and can be found about four degrees directly south of Sirius (Fig. 14). Another notable open cluster is NGC 2362 (Fig. 16) which is located 2.75 degrees northeast of the star Wezen (the third brightest star in Canis Major). The cluster is made up of 60 stars, and its center is the brilliant O-type supergiant Tau Canis Major.

Figure 15. Messier 41 Open Cluster. (Image: Slooh Canary Two Telescope).

Figure 16. NGC 2362 Open Cluster. (Image: GDW, 6 inch SCT with Atik Infinity Camera).

Canis Minor (Lesser Dog) is a constellation of the northern skies. The constellation is recognized by its two brightest stars: Procyon (mag. 0.34) and Gomeisa (mag. 2.9). Canis Minor contains several faint deep sky objects; these are considered to be too difficult to see telescopically.

Monoceros (the Unicorn) is a faint constellation that lies within the Winter Hexagon (Fig.1). Monoceros contains the open cluster M50 (Fig. 14). M50 (Fig. 17), also called the Heart-Shaped Cluster, is a dense cluster of about 80 stars and has a visual magnitude of 5.9. It is best seen with a small telescope. Because Monoceros does not have any bright stars to use as "pointers," the more brilliant stars from nearby Canis Major are used to star hop to M50. M50 lies about ten degrees northeast of Sirius with the star θ-Canis Major in between (Fig. 14).

Figure 17. M50 Open Cluster. (Image: Slooh Canary Three Telescope).

Lepus (the Hare) is a constellation of the northern skies that lies immediately south of Orion (Fig. 14). Lepus contains the globular cluster M79 (Fig. 18). M79 lies about 42,000 light years from Earth, and one of the few globular clusters found away from the Milky Way's galactic center. It is thought to have been stolen from another nearby galaxy in a not too distant past; the nearby Canis Dwarf Galaxy is one such candidate. To find M79, use Arneb and Nihal, the brightest stars of Lepus, as a guide.

Figure 18. M79 Globular Cluster. (Image: 6 SCT, Atik Infinity Camera).

Puppis (The Stern) is located in the southern hemisphere (Fig. 14). Although this constellation is not part of the Orion Family, two of its open clusters, M46 and M47, lie near Monoceros and Canis Major. The stars Sirius and Gamma Canis Major can be used to find M47 and M46. M47 is a bright cluster of about 50 stars (Fig. 19), many of which are blue-white. M46 is a relatively bright and large cluster made up of 500 stars (Fig. 20); the starfield is about the size of the full moon. The planetary nebula NGC 2438 lies northeast of the center of the cluster. NGC 2438 lies in front of M46, and the two are unrelated.

Figure 19. Messier 47 Open Cluster. (Image: GDW, SCT, Atik Infinity Camera).

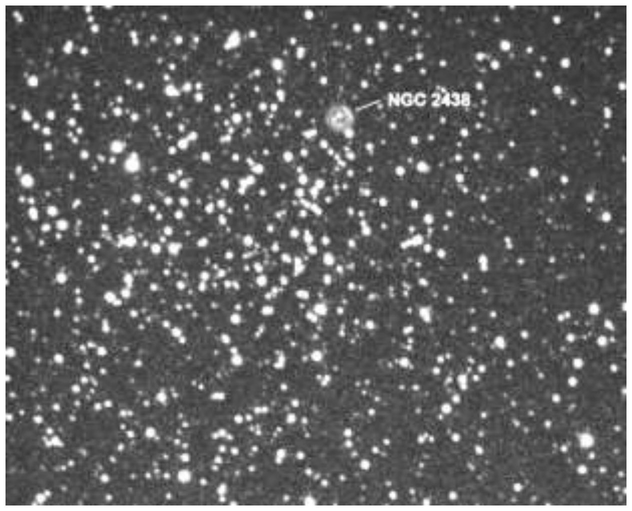


Figure 20. Messier 46 Open Cluster. (Image: GDW, SCT, Atik Infinity Camera).

Winter Stargazing Tips: Stay Warm and Cozy!

reprinted from the Night Sky Network
https://nightsky.jpl.nasa.gov/news-display.cfm?News_ID=671

1. Layers are your friend!
You may already know this, but remember to wear multiple layers of clothes! A super warm coat won't help that much if all you are wearing underneath is a t-shirt. At the same time, moving around during your setup and observing may actually heat you up to an uncomfortable degree, so being able to peel off a sweater or overcoat would be very welcome.

2. Warm, wool socks
Thick cozy socks are a must, especially as the night wears on. Your feet will thank you, especially if you are wearing good boots! Which brings us [to] ...

3. Waterproof boots
You will want warm boots, and if there is snow, make sure your boots are also waterproof. Any water soaking through … your boots [to your feet] is a sure way to make your toes icy and prematurely end your observing.

4. Clear out your observing area
Is there snow on the ground where you usually set up? Bring a shovel and clear it out, even if there is just an inch or two of the white stuff. Your equipment and toes will thank you.

5. Blankets
Did you bring a blanket? Good. Even if you think you won't need one...you very well may want one after the first hour or so, especially if you are seated very still.

6. Gloves
Pack your gloves! Some astronomers prefer fingerless gloves that allow them to work on their instruments while outside, while others prefer combo mitten-gloves that allow you to flip the ends of the mittens off for fingerless glove access. Remember, you will be handling lots of cold metal as you set up your equipment in the cold so if you don't want your fingers going numb within minutes, gloves are a must!

7. Heat pads
Chemical heating pads are your friend. Stick these little beauties into your gloves and boots to stay warm. Some heating pads now offer rechargeable electrical heating-just make sure they are charged before you leave the house!

8. A big goofy hat and earmuffs
A hat with ear flaps? Big fuzzy earmuffs? You will definitely want these! While they may look a bit silly, you will be toasty inside, with nice warm ears rather than frigid lobes in danger of frostbite. Besides, you will be in the dark: who cares what you look like?

8. A warm thermos
A thermos full of your favorites warm liquid - hot chocolate, soup, coffee, tea - is your best friend during these long winter nights.

One final thing to remember: however cold you think you are, there is probably someone somewhere else who is in an even colder location...like, say, an amateur astronomer in **Antactica**.

I've Always Wondered: Why are the volcanoes on Earth active, but the ones on Mars are not?

Helen Maynard-Casely Instrument Scientist, Australian Nuclear Science and Technology Organisation

This is an article from I've Always Wondered, a series where readers send in questions they'd like an expert to answer. Send your question to alwayswondered@theconversation.edu.au

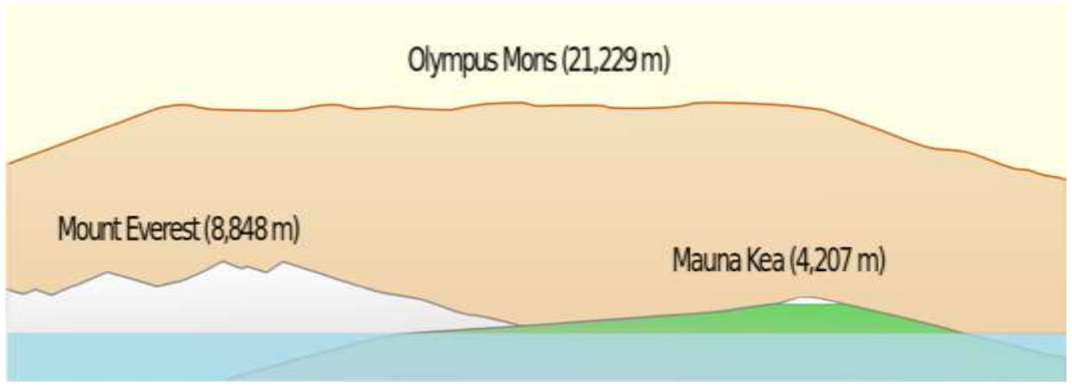
I've always wondered why we still have active volcanoes on Earth but those of Mars stopped millions of years ago. What's the difference between the planets that explains this? – Nial, Sydney

Volcanoes have been an important part of the history of both Earth and Mars. So why do we not see any activity on Mars today? The quick answer is because Mars is smaller than our planet.

Twice as high as Everest

Olympus Mons is one of the largest mountains in the solar system – it dwarfs all of the mountains on Earth. It sits on the surface of Mars and dominates the landscape.

As long ago as the 19th century observer like Schiaparelli had noted that the top of Olympus Mons could sit above the red planet's frequent dust storms.

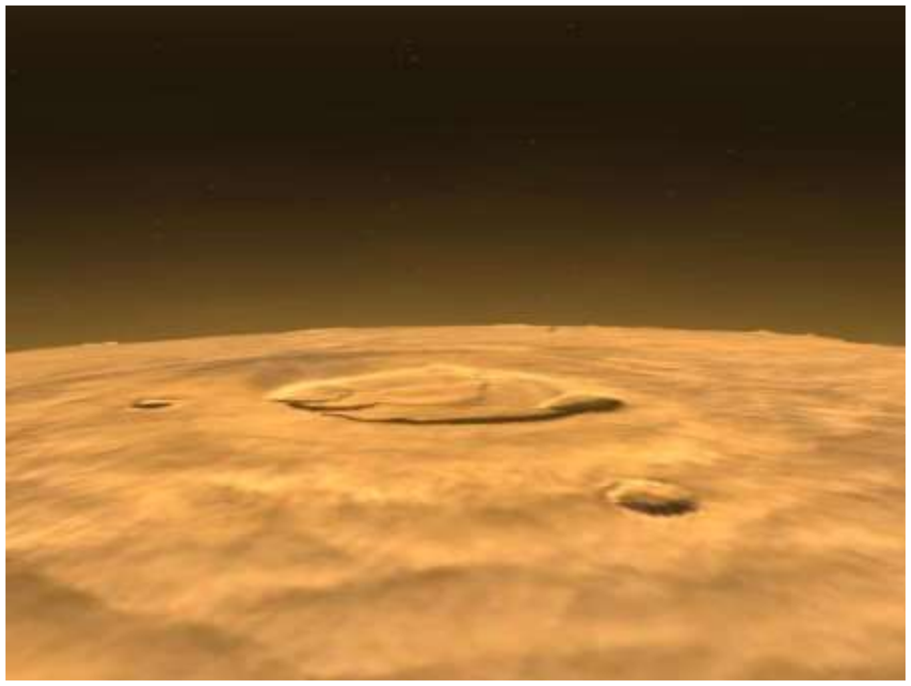


Olympus Mons is way higher and wider than even Mt Everest and the Himalayas. Wikimedia Commons, CC BY

Olympus Mons is just one of thousands of volcanoes observed on the surface of Mars, and we know that volcanic activity has shaped the majority of the planet's surface.

But this is a process that has long since stopped on that planet: the youngest volcanoes on Mars are about 500 million years old. That's before dinosaurs roamed the Earth.

The lack of currently active volcanoes on Mars is quite puzzling, given we see evidence that volcanoes were active there up from 3.7 billion years ago to 500 million years ago.



Olympus Mons is an extinct volcano on Mars. A visualisation by Tom Bridgman/NASA

It's about gravity

Both Earth and Mars are terrestrial planets, mostly made up of rock and metal.

But Mars only has a tenth of the mass of Earth. This has a profound effect on gravity: if you weigh 100 kg on Earth you'll only weigh 38 Kg on Mars.

Low gravity has a dramatic effect on how volcanic eruptions can take place on Mars, as these are driven by buoyancy of the fluid rock, known as magma.

Magma is a really complicated mixture of liquid, solid and gas components, and changes frequently as it moves about a planet's subsurface. Buoyancy is the contrast in density between the surrounding crust rock and the magma ascending for eruption. A high buoyancy means that the magma comes to the surface quite easily.

https://commons.wikimedia.org/wiki/File:Pahoehoe_toe.jpg

On Mars, the buoyancy of magma is relatively low, and the gravity is also relatively low. Also, the magma chambers that feed the eruptions are deeper than their counterparts on Earth. All up, this means more "oomph" is required to overcome the lower magma buoyancy and bring it to the surface of the planet. We think this leads to bigger but less frequent eruptions on Mars.

These bigger eruptions might explain how Olympus Mons got so big. Bigger eruptions mean more magma delivered to the surface, which is more material to build a monster mountain.

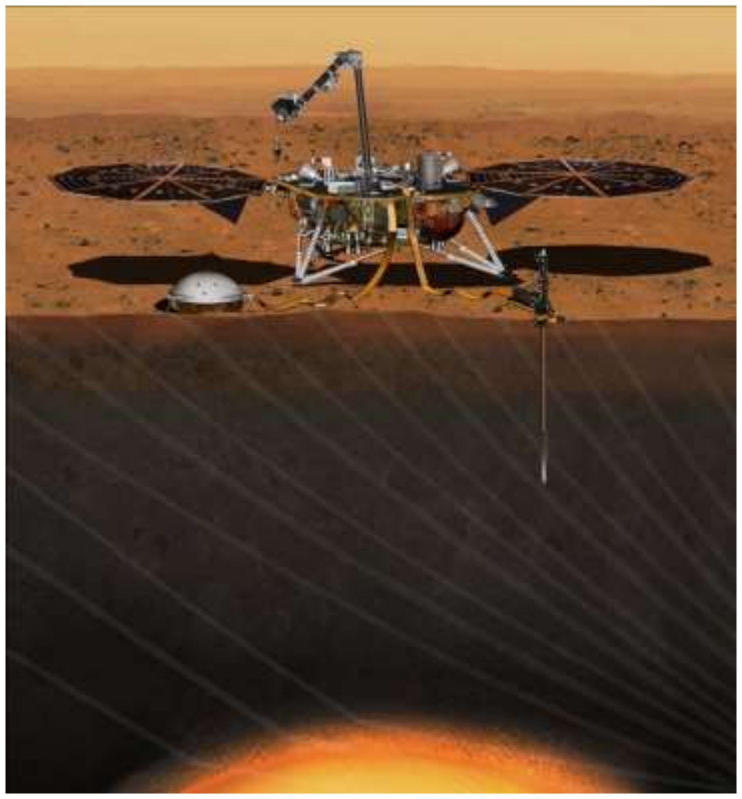
Heat energy also matters

While Mars' gravity probably leads to bigger and less frequent eruptions, this doesn't necessarily explain why we don't see anything active today. Many believe this could be because this smaller planet has simply lost most of its heat energy.
A terrestrial planet has two main ways of generating heat: radioactive decay and primordial heating.

The radioactive decay comes from elements like potassium and uranium, which although present in small amounts, can release a lot of energy throughout the planet. Primordial heating is from the first formation of a planet – in the case of Mars as a mixture of metal and rock, where energy has come from the denser metal sinking towards the core.

While on Earth these two heat sources are going strong, this may not be the case for Mars. As a smaller planet it would have had less radiogenic and primordial heat sources to start with, so the planet may have already cooled down too much to drive volcanic activity.

However, we now know of other much smaller bodies – such as Jupiter's moon Io and Saturn's moon Enceladus – that are volcanically active. This (at least in Io's case) is driven by tidal forces generated by their close orbit to a gas giant.



NASA's InSight mission will measure seismic activity on Mars – which could come from magma moving under the surface.NASA/JPL-Caltech, CC BY

Evidence incoming

But new sources of evidence do arise.

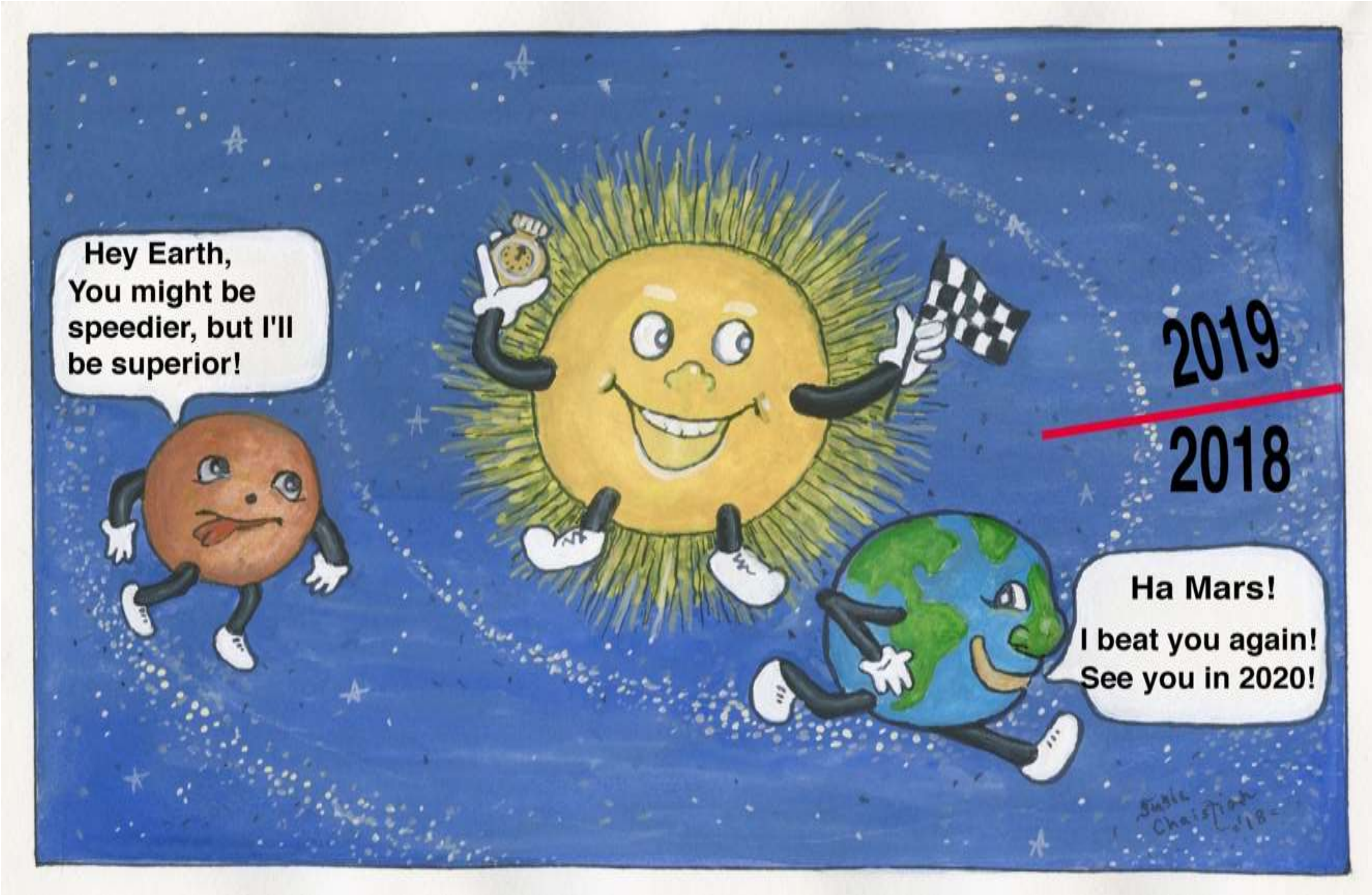
The European Space Agency's Mars Express mission has spotted what was interpreted to be a more recent lava flow (only a mere two million years old) on Mars.

And with NASA's InSight mission, currently on its way to the red planet, we could potentially catch volcanic activity in the act.

Read more: Launching in May, the InSight mission will measure marsquakes to explore the interior of Mars

If all goes well, the InSight probe will sit on the Martian surface and listen for seismic activity (sound waves travelling through the rock). Seismic activity on Mars could be due to meteorite impacts or marsquakes, but it could also result from magma moving through the crust.

Happy Journey Around the Sun!



Heavenly Bodies
By Susie Christian