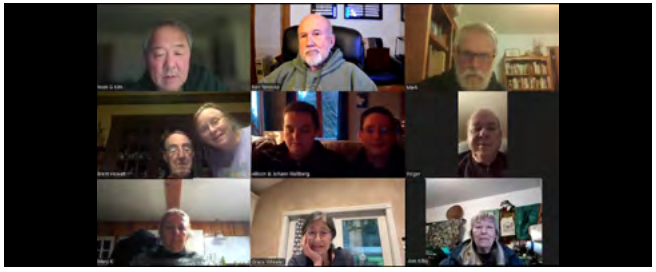
AOH Newsletter

Spring 2025

News and Notes

Recent Activities

AOH held its monthly Zoom meetings in January, February, and March. In attendance were Allison, Ann, Brent, Catrina, Grace, Greg, Jeff, Johann, Ken, Mark, Mary, Rick, Roger, and Yoon.



The major AOH event of the season was the Annual Anniversary Potluck Dinner and Lecture on February 22. The Eureka Woman's Club was filled to capacity for fine dining and an interesting and informative lecture by Dr. Susan Terebey of Cal State LA (and of AOH) who spoke on "Origins: From Stars to Planets." We also awarded NSN outreach pins and certificates (see page 11) and members scored some nice loot in our customary (free) raffle. There are more pictures on page 3.

We went 0 for 2 on scheduled Kneeland observing events because of clouds and rain, but got a head start on our outreach program when Mark went to speak to the Miranda 4H Club and when Mark and Bernie encountered a bunch of random viewers at Kneeland on an impromptu non-cloudy visit there.

And several members and friends continued to observe and photograph on their own; some of their results are shared beginning on page 4.

The Potluck and Lecture. Photo by Ken Yanosko.

Upcoming Activities

The Messier Marathon is scheduled for either the weekend on March 21-22 (primary) or March 28-29 (secondary). We'll keep our fingers crossed for clear weather.

The next Kneeland meetings after the Marathon are scheduled for April 26 and May 24. Zoom meetings are scheduled for April 12, May 10, and June 14. Astronomy Day (sponsored by the Astronomical League and a number of other amateur astronomy associations) will be celebrated on May 3. Stay up-to-date on all AOH activities by regularly checking our website at https://www.astrohum.org/upcoming.html.

A deep partial solar eclipse will be visible from New England, eastern Canada, and Greenland on March 29—there will be a livestream at https://www.timeanddate.com/live/eclipse-solar-2025-march-29 beginning at 1:30 am.

The Lyrid meteor shower will occur on April 22. Meanwhile we're still waiting for Nova T Coronae Borealis, which was predicted to occur sometime during or after last fall.

And apparently it's still aurora season—people are still seeing faint glows in the north from time to time. See Grace's report beginning on page 8.

The Astronomical League's annual convention will be held in Bryce Canyon June 25-28. Info is at https://astrocon2025.org/. AOH will pay the $100 registration fee for one member who volunteers to represent us there. Contact Brent at president@astrohum.org if you are interested.

Later on we will again be doing star parties at Albee Creek this summer; see the poster opposite. Check your mailbox for calls for volunteers.

Thanks

As usual, thanks very much to all who helped put together the Newsletter, especially to Allison, Don, Grace, Jack, Johnny, Mark, Mary, Susan, and Susie.

—Ken

Poster by Mary Kaufman.

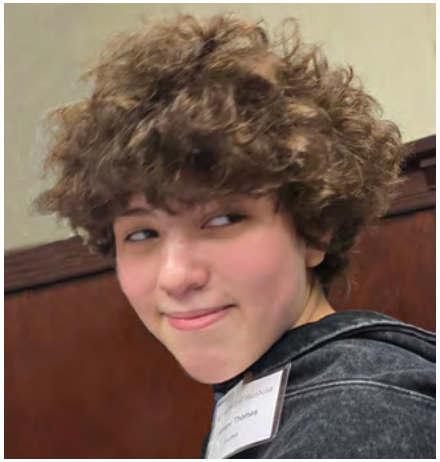
Photos

From the Potluck

Vice President Mark Wilson, Guest of Honor Susan Terebey, President Brent Howatt, and Secretary Ken Yanosko. —Don Wheeler

Grace Wheeler presenting "swag" to Susan Terebey. —Don Wheeler

Longtime Club Members Clare and Bernie Christen. —Johnny Thomas



Left: Rachel Wagenfuhr & new member Ripley; Right: Longtime but young member Stormy Thomas. —Johnny Thomas

Everybody chowing down at dinner. —Ken Yanosko

From Jack Hopkins

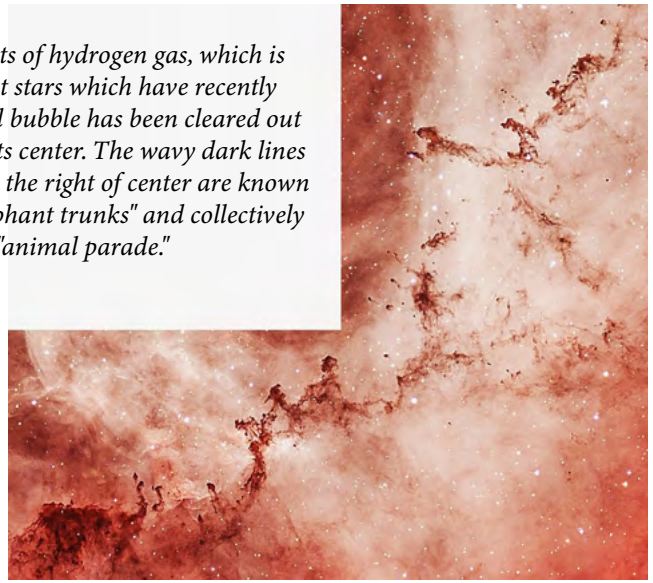
Molecular Cloud in Orion. Stack of 305 frames of 180 seconds each.

A zoomed-in piece of the above photo showiing the familiar dark dust cloud known as the Horsehead Nebula (Barnard 33).

The Rosette Nebula (NGC 2237) in Monoceros. Stack of 121 frames of 180 seconds each.

The nebula consists of hydrogen gas, which is ionized by the hot stars which have recently formed. The central bubble has been cleared out by the two stars at its center. The wavy dark lines of dust below and to the right of center are known individually as "elephant trunks" and collectively as the "animal parade."

Can you see a donkey, cat, cheetah, giraffe, poodle, ostrich?



From Mark Wilson and Seestar

Clockwise from left:

The galaxies M81 and M82 in Ursa Major. This is a collage of 8 minute and 1 minute exposures.

The open cluster M37 in Auriga. 2 minute exposure.

Two-thirds of the Leo Triplet: M65 and M66. 10 minute exposure.

M101, the Pinwheel Galaxy, in Ursa Major, 15 minute exposure.

From Grace Wheeler

Much has been written about the recent seven-planet lineup (February 28, 2025), when Mars, Jupiter, Uranus, Venus, Neptune, Mercury, and Saturn arced across the sky and were visible after sunset. There was a misconception that all seven planets could be easily seen

as visible points of light in the sky. However, of the seven planets, only Mars, Jupiter, Venus, and perhaps Mercury were bright enough to be seen with the unaided eye. The two outermost planets in our solar system, Uranus and Neptune, are usually too dim and often require binoculars or a small telescope. Additionally, the three planets near the western horizon—Neptune, Mercury, and Saturn—would have been difficult to see, as they were likely lost in the glow of sunset.

On February 26, I observed and imaged the planets visible from my backyard in Eureka. I used an 8-inch Schmidt-Cassegrain telescope and a planetary camera. I took inspiration from an illustration I saw in USA Today (https://www.usatoday.com/story/graphics/2025/02/25/planet-alignment-february-28-how-when-view/79994155007/) and incorporated my images into a Stellarium graphic (February 26, 2025, at 6:30 pm). I thought this was a clever way to show the planets' relative positions to each other and their locations in the sky.

In late February, Mars was high overhead in the constellation Gemini. Mars was about six weeks past opposition and showed a gibbous phase, i.e., 83% illumination. The image of Mars captured the north polar ice cap and the light and dark surface albedo features.

Jupiter was located west of Mars in the constellation Taurus, near the star Aldebaran. Jupiter was about 12 weeks past its opposition (December 7, 2024) and noticeably smaller than early December. Although the image of Jupiter still showed distinctive zones and bands, there was less detail than when it was at its maximum size during opposition.

Uranus was located in the constellation Aries, near the Pleiades. Unlike Mars and Jupiter, which were bright and visible, I could not see Uranus with the unaided eye. This was my second time imaging Uranus with a planetary camera. I was pleased that I captured the planet's blue-green color.

Venus could be seen after sunset in the western sky, in the constellation Pisces. In late February, Venus was in a crescent phase and was 17% illuminated. The crescent phase of Venus will continue to shrink as the planet moves between the Sun and Earth (inferior conjunction) on March 23.

Because I did not have a clear view of the western horizon, I did not observe Neptune, Mercury, and Saturn as part of the evening planetary lineup. To observe Mercury, I turned to daytime observation when the planet was overhead. Mercury (like Venus) is bright enough to be seen during the day. Although it was challenging to locate Mercury due to its small size, I still managed to find it and take an image. Mercury was in a gibbous phase (85% illumination). Almost a week later, on March 7, Mercury reached its greatest eastern elongation, marking its furthest distance from the Sun. On that date, Mercury, now in quarter phase (50% illumination) was at a higher altitude. I was able to view Mercury in the evening along with Mars, Jupiter, Uranus, and Venus.

Additional photos, clockwise from above:
• Jupiter on November 27, 2024. The planet was 10 days from opposition. Note that the bands and zones of Jupiter show more detail when the planet is near opposition. The moon Europa is near the eastern limb.
• Mars on January 27, 2025 when Mars was eleven days post-opposition. Mars was 99% illuminated. The Syrtis Major Planum and North Polar Ice Cap are features seen in the image.
• Mercury at greatest eastern elongation on March 7, 2025. The planet was in quarter phase and was 51% illuminated.

Aurora Report: Winter 2025

by Grace Wheeler

A New Year's Aurora

Since the beginning of 2025, solar activity has been low to moderate, with auroral sightings mostly occurring at high latitudes. The exception was from December 31 to January 1, when a severe G4 geomagnetic storm arrived, with a Kp index of 8–9. Unfortunately, much of the U.S., including Humboldt County, had overcast skies. As a result, I had to watch the spectacular auroral display via webcams from the New England Outdoor Center in Maine (https://www.neoc.com/webcam3/) and the aurora camera at Martens Observatory in North Dakota (https://www.youtube.com/@northdakotadualauroracamer7115).

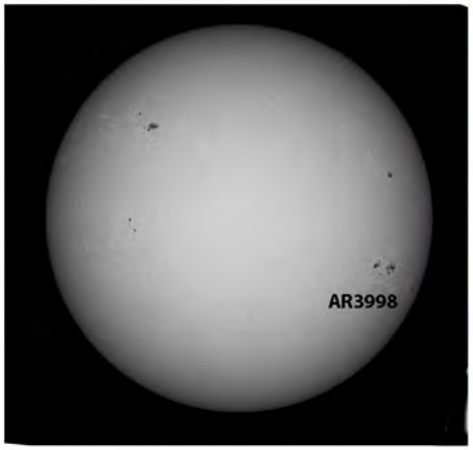
Given that the aurora oval is centered around the polar regions, I expected to see intense auroral lights at these high-latitude locations. I was also curious whether the G4 storm would push the aurora's visibility line southward, making it possible to see the aurora at lower to mid-latitude locations. Based on a handful of *Northern Lights Alert* Facebook posts, the aurora did indeed extend southward and was visible in Central California (Fig. 1), Arizona, and Mexico. I'm sure that had it been clear in Humboldt County, we would have seen the aurora here as well.

Coronal Holes and Auroras

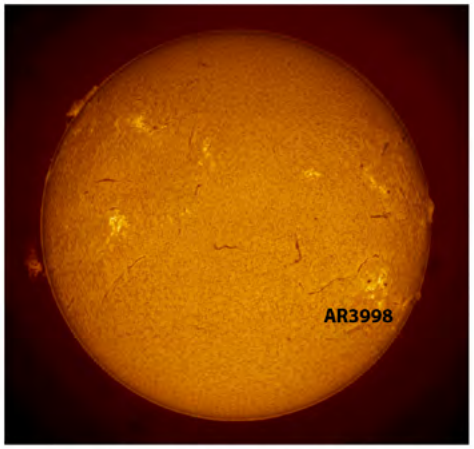
Except for the G4 storm on New Year's Eve, most geomagnetic storms over the last three months have been G1-G2 (weak to moderate). This reflects the sun's low to moderate solar activity: the X- and M-class solar flares during this time produced either weak CMEs or ones directed away from Earth. Many of the G1-G2 storms resulted from solar winds originating from coronal holes. Coronal holes are areas in the corona where the magnetic field is absent. Because the solar winds in these holes are not connected to the sun's magnetic field, these can stream freely into space, often at high speeds. If the winds are directed toward Earth, these can cause G1-G2 geomagnetic storms. While aurora chasers in the northern latitudes experienced many nights of auroral displays due to these G1-G2 storms, chasers in the lower latitudes could only admire the aurora photos posted on social media.

During the week of February 25, there was some anticipation in

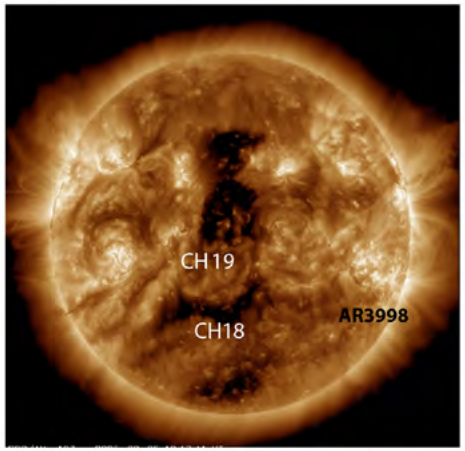
Figure 1. Aurora seen from Coarsegold, Ca. Autumn Ensign on Northern Lights Alert *wrote: "Aurora Borealis made it as far south as the Central Sierra Nevada Mountain Range on January 1rst, 2025. Made this panoramic of lights Wednesday morning at 5:30 a.m." Image credit: Autumn Ensign.*



A. Sunspots on the photoshere as seen in visible light. The sun was imaged with an 80 mm refractor telescope and Herschel Wedge.



B. The chromosphere of the sun in H-alpha. The sun was imaged with a Lunt 80mm solar telescope.



C. The corona of the sun in extreme UV (19.3 nm). The imageis from the AIA 193 channel of the Solar Dynamics Observatory (NASA).

Figure 2. The Sun imaged in three spectra: (A) visible, (B) hydrogen-alpha, and (C) extreme UV. In all three images, AR 3998 is labeled for orientation. (A) shows sunspots on the photosphere. (B) displays the chromosphere, featuring bright active regions with plage, filaments on the disk, and prominences on the limb. (C) shows the Sun and the corona as imaged in extreme UV light. Coronal holes appear as cool, dark structures, while active regions are seen as bright, hot areas.

Image credit: (A) and (B) imaged by GDW; (C) from the AIA 193 channel of the Solar Dynamics Observatory.

the aurora community as two massive coronal holes rotated into a geo-effective position. While images of the sun in visible light and H-alpha showed a few small sunspots (Fig. 2A) and some bright active regions (Fig. 2B), the extreme UV image from SDO (AIA 193) revealed two large, dark coronal holes, CH18 and CH19 (Fig. 2C) that were pointed directly at Earth.

While this was promising news to aurora watchers, plasma streams from coronal holes generally produce weak (G1) to moderate (G2) storms, and the visibility is limited to northern latitudes. However given the large size of the coronal holes, there was hope that the density and speed of the solar winds would be enough for the aurora to be seen at mid-to-low latitudes.

When the solar winds from Coronal Holes 18 and 19 reached the Earth at 6 a.m. EST on February 27th, the resulting storm was measured to be a G2 with a Kp 4. The exciting news was that the storm was strong enough to push the aurora view line southward. An observer

Figure 3. Northern Lights Alert. Jennifer Alvey wrote: "February 27, 2025 Eagle, Colorado USA. I got an alert at 4:23 a.m. I ran outside and there she was! I was outside sky gazing for 40 minutes and this is as bright as it got. It is not as spectacular as seeing the Aurora in/near the Arctic Circle. It's amazing we can see this at our latitude." Image credit: Jennifer Alvey.

in Colorado received an aurora alert at 4:30 a.m. MST and posted this photo (Fig. 3) on the *Northern Lights Alert* Facebook Group.

I had to wait another 18 hours to find out whether the G2 storm had persisted into the evening and if an aurora was visible at my latitude in Humboldt County. I turned to the Kneeland Airport Cam, which I had used twice before for aurora viewing. (The last time was on November 10, 2024, when I detected an aurora from a G2 storm.) There was no sign of an aurora during the early evening, so I reminded myself to be patient and wait for our location to rotate into the "midnight portion" of the auroral oval—where the oval extends farthest southward. Like clockwork, at 11 p.m., I saw a faint reddish glow on the northern horizon (Fig. 4). The aurora was brief, lasting only 30 minutes. I continued to monitor the webcam and observed three substorms: 11-11:30 p.m., 2:15-3:30 a.m., and 4:15-4:30 a.m. (I confess to using the webcam's playback for part of the later observations.)

While this wasn't a particularly exciting aurora in terms of intensity, it was still interesting and gave me a lot to think about. For the last few years, during the solar maximum, it has been easy to link X- and M-class solar flares and their CMEs with the creation of auroras. However, the aurora I witnessed on February 27-28 was driven by solar winds from a coronal hole. I had also written off looking for auroras at my latitude during G2 storms, but now I have seen two such auroras.

Figure 4. An aurora seen on the Kneeland Airport Cam (north camera) on February 27, 2025 at 11 p.m. The three hour timelapse can be seen here: https://www.youtube.com/watch?v=1Fqnqx3BTgs

*Acknowledgment: Many thanks to Autumn Ensign and Jennifer Alvey (*Northern Lights Alert *Facebook Group) for allowing me use their images and words for this article. Social media at its best!*

Additional readings:

- *Coronal Holes. Space Weather Prediction Center.* https://www.swpc.noaa.gov/phenomena/coronal-holes
- *Wavelengths of Light. The Sun Today.* https://www.thesuntoday.org/sun/wavelengths/
- *Is it Possible to See Powerful Auroras During Solar Minimum? Thanks to Coronal Holes the Answer is a Resounding Yes! Lights over Lapland.* https://lightsoverlapland.com/is-it-possible-to-see-powerful-auroras-during-solar-minimum-thanks-to-coronal-holes-the-answer-is-a-resounding-yes/

"Out of nowhere, they appear, falling like silvery rain in the night sky, swirling and dancing across the northern horizon in complete silence—graceful, delicate, silent, and peaceful. They're a beautiful surprise. When you experience them, you realize how lucky you are to get to witness such incredible beauty. They shine and glow for a while, and then they're gone. The memory is all you have left, but it stays with you—amazing, special, and unique."

Leo Solstrom, *Northern Lights*

More Reports

Outreach Awards

The Night Sky Network awards certificates and pins every year to club members who participate in their club's outreach events. In 2024 AOH set a new record (for us) in the number of participants. Awards were granted to Allison Waltberg, Barry Evans, Ben Shaeffer, Bernie Christen, Bob Zigler, Brent Howatt, Catrina Howatt, Connor Johnston, Dan Eaton, Dave Van Buren, Diane Minton, Frank Simpson, Grace Wheeler, Jack Hopkins, Jeff Schmitt, Joe Eiers, Johann Waltberg, Johnny Thomas, Joy Ehlert, Ken Yanosko, Lisa Schmitt, Mark Mueller, Mark Wilson, Mary Kaufman, Rick Gustafson, Rob Wohleb, Roger Coy, Russ Owsley, Sussan Coy, Susan Frances, Susan Terebey, Susie Christian, anf Yoon Kim.

Travel Suggestion?

From the NY Times
Text by Kat Hill

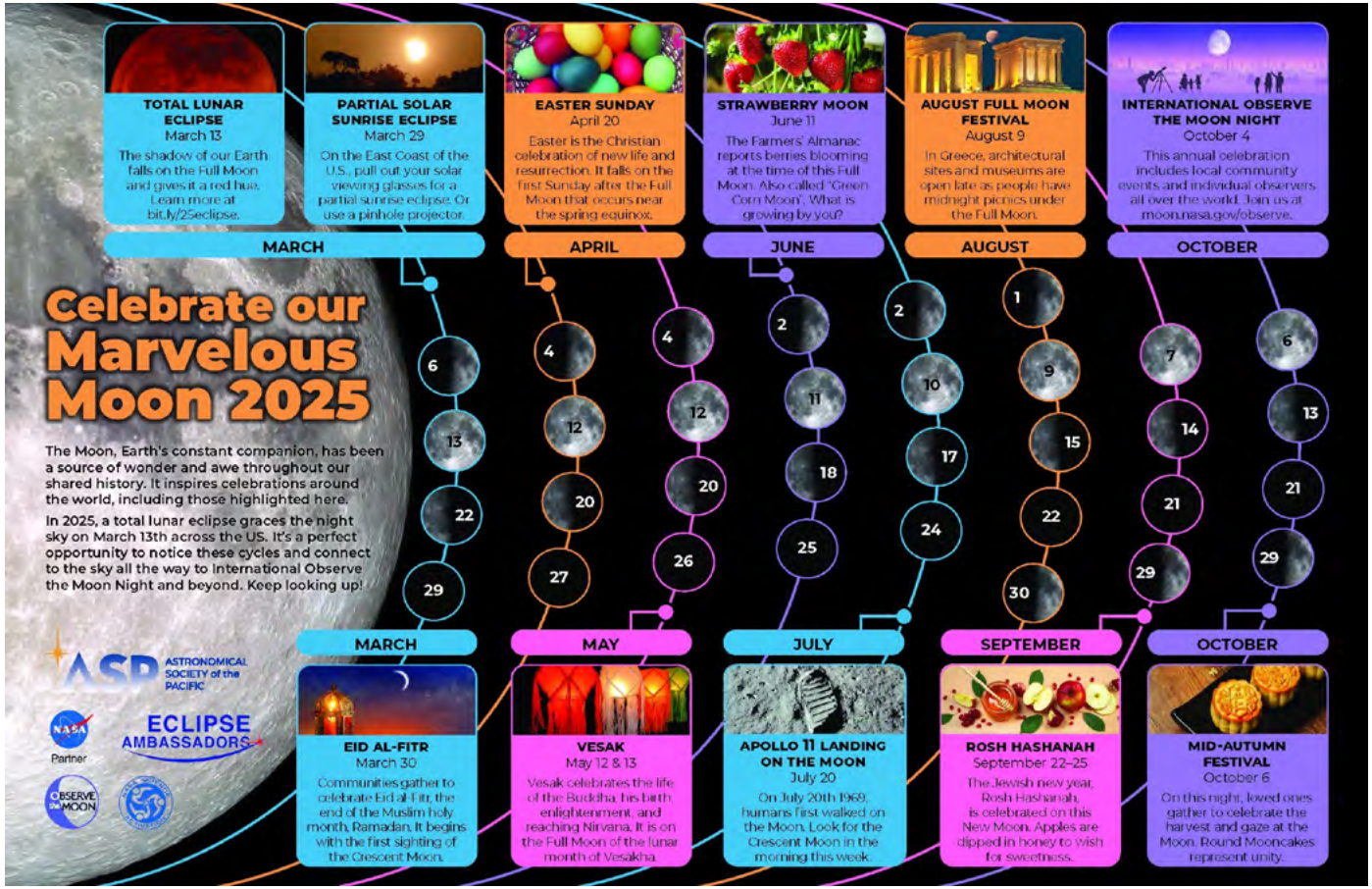
"Rum, a diamond-shaped island off the western coast of Scotland, is home to 40 people. Most of the island — 40 square miles of mountains, peatland and heath — is a national nature reserve, with residents mainly nestled around Kinloch Bay to the east. What the Isle of Rum lacks is artificial illumination. There are no streetlights, light-flooded sports fields, neon signs, industrial sites or anything else casting a glow against the night sky. On a cold January day, the sun sets early and rises late, yielding to a blackness that envelopes the island, a blackness so deep that the light of stars manifests suddenly at dusk and the glow of the moon is bright enough to navigate by.

"For this reason, Rum was recently named Europe's newest dark-sky sanctuary, a status that DarkSky International, a nonprofit organization focused on reducing light pollution, has granted to only 22 other places in the world. With the ever-increasing use of artificial lighting at night, places where people can gaze at the deep, ancient light of the universe are increasingly rare. Rum's designation is the result of a long, meticulous bid by the Isle of Rum Community Trust. The effort was led by Alex Mumford, the island's former tourism manager, and Lesley Watt, Rum's reserve officer, with the support of Steven Gray and James Green, two astronomers who started Cosmos Planetarium, a mobile theater offering immersive virtual tours of the night sky. Rum 'stands for something greater,' Mr. Mumford said, and aspires to be 'a haven for others to experience the darkness and the Milky Way.' **...**

"Plans are in motion to renovate an abandoned lodge nearby into a place where tourists could stay in their quest for celestial splendor. 'What you are seeing is not just a 2-D map, but the four dimensions of space and time,' Dr. Green said. 'You are looking back into the past.'"

Lunar Calendars

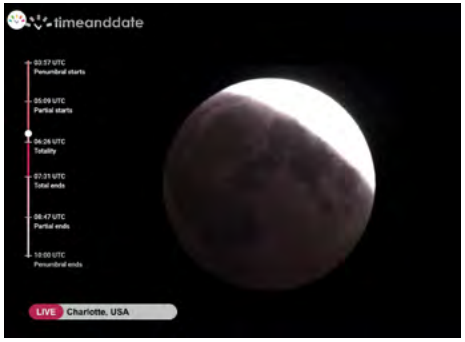
We have a limited number of “Celebrate our Marvelous Moon 2015” posters printed on 17" by 11" glossy paper that the Night Sky Network sent us. See Ken or Brent if you want one. Or you can download your own from https://nightsky.jpl.nasa.gov/documents/1960/MoonCelebrations2025.pdf.



Lunar Eclipse

There was a total lunar eclipse on March 13-14. Here in Humboldt County, we got a double eclipse—not only was the Moon obscured by passing through the Earth's shadow, but most of the event was obscured by our local clouds. Most of us went in to watch on the internet. Instant replay is available at https://www.timeanddate.com/live/eclipse-lunar-2025-march-14.

From left to right below: The early partial phase was barely visible through a cloud layer from Berry Summit; photograph by Mark Wilson. The late partial phase from Charlotte, an "upside down" view from Santiago, and totality from Charlotte were live-streamed; screenshots from timeanddate.com.



Spring Constellations

by Allison Waltberg

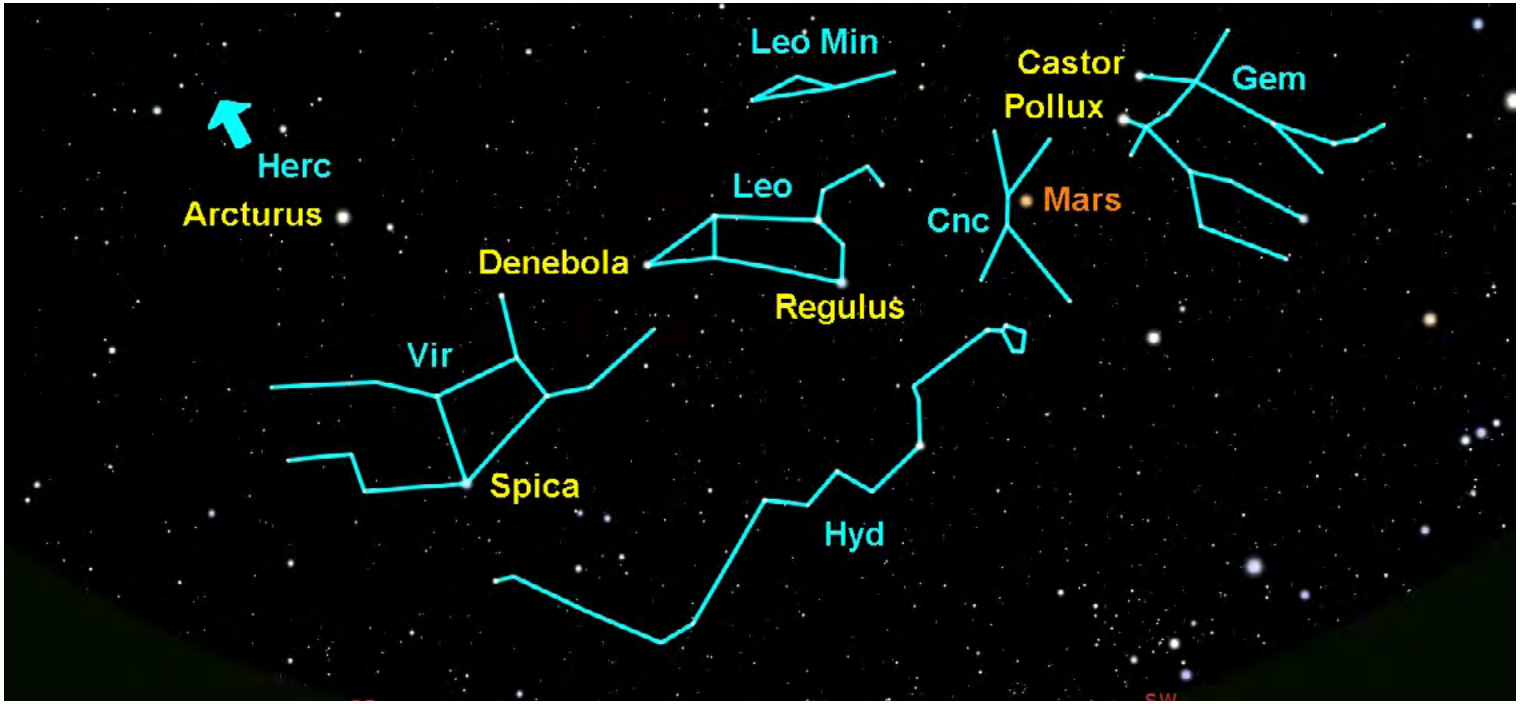
Mars will be bright and easy to spot this spring, moving along the zodiac following a path from the bright Gemini twins Castor and Pollux, through Cancer the crab, and on toward Regulus at the heart of Leo the lion. On May 4, it will actually pass right across the Beehive open Cluster (M44). Also known as Praesepe (from the Latin for "crib"), the Beehive is visible to the naked eye as a small area of nebulosity in the center of Cancer. It's one of a small number of nebulae known since ancient times, and one of the first objects Galileo observed with his telescope in 1609.

Farther to the east is Virgo the virgin, associated with Demeter, the Greek goddess of agriculture and fertility. Its bright star Spica, from a Latin word meaning "an ear of grain," represents a piece of wheat that the goddess holds in her hand. Many backyard astronomers recall Spica as the final stop along the curved path of the Big Dipper's handle, from the mnemonic "Arc to Arcturus, then speed on to Spica." It is also part of the Spring Triangle asterism, which connects Spica with Arcturus as well as Regulus (or Denebola, for a more equilateral triangle).

In between Cancer and Virgo, look high to the south to find Leo the lion reclining regally. Leo's brightest star, Regulus, is at the bottom of the asterism called "The Sickle," which is more recognizably a backwards question mark. Imagine this curved shape as Leo's majestic mane, with the lion reclining like a sphinx facing westward (to the right). Regulus comes from the diminutive form of the Latin rex, meaning "king," and represents the lion's kingly heart. From there his front paw extends forward, and in the opposite direction is a triangle forming his rear end and tail. The star marking his tail is called Denebola, from a shortening of an Arabic phrase meaning "tail of the lion"; you might recognize the "Deneb" part as Cygnus's tail star, with the same etymology.

Leo's smaller companion, the extremely questionable constellation Leo Minor, supposedly sits just above Leo's head between his majestic mane and Ursa Major's back legs…but its stars are unremarkable and hard to pick out from the others, and even the ancient astronomer Ptolemy couldn't find any patterns here; he called this area *amorphotoi* ("unformed" or "shapeless").

Leo senior, however, has an awesome reputation: it represents



A view to the south at 9:30 pm on May 1. From Stellarium.

the Nemean lion, a fearsome beast from Greek mythology. And another monster lurks below Leo: Hydra, visualized as a long snaking path of stars, roughly parallel to the southwestern horizon and spanning a full quarter of the sky. These two creatures star in pretty epic stories that are not for the faint of heart.

We open in the city of Nemea, terrorized by a lion whose fur was invulnerable to weapons and whose claws could slice through even the strongest armor. Every warrior brave enough to face it was devoured as their swords and spears bounced harmlessly off its impermeable coat.

Enter the greatest of Greek heroes, Hercules. He was actually Heracles in the original Greek, but is better known today by his Roman name, so we'll stick with that. (Hercules does have a constellation of his own, shaped like a "keystone" and off near Vega, rising in the northeast; it'll be higher in the sky in the summer.)

Some backstory is in order here: Hercules was conceived from Zeus's infidelity with yet another mortal woman (interestingly, she was a descendant of the hero Perseus, making Hercules both a great-grandson and half-brother of Perseus). This made him rather unpopular with Zeus's actual divine wife Hera, who regularly sought opportunities to curse Hercules throughout his life. After a failed attempt to prevent his birth, and again failing to kill him as an infant with giant snakes (which baby Hercules simply strangled barehanded), she eventually cursed him with temporary insanity, during which he killed his wife and children. As penance for this crime, a Hera-influenced oracle directed him to serve a Hera-favored king for ten years and do whatever he was asked. The king then assigned Hercules the biggest, baddest bounty hunts the ancient world had ever seen. Those tasks became known as the "Labors of Hercules"; there were originally supposed to be 10, but it later grew to 12 due to a technicality. And the first Labor the king assigned him was to save the city of Nemea by slaying the unkillable lion and returning with its coat.

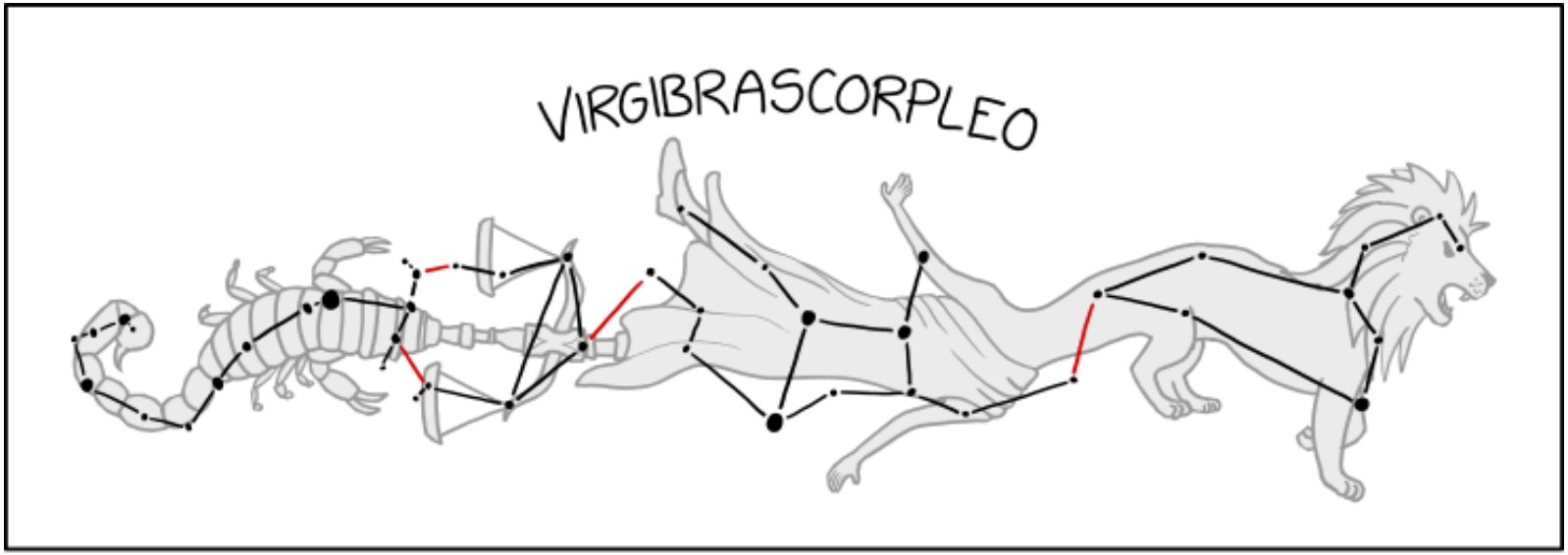
Since no weapons or armor would be useful in the battle with the lion, Hercules naturally decided that he should wrestle it naked and kill it with his bare hands. He trapped it in its cave with a boulder and then got down to business. Surprisingly, Hera somehow missed her opportunity to intervene, and Hercules won the wrestling match. After strangling the lion, Hercules found it impossible to skin with any knife, but with a nudge from Athena—the goddess of wisdom, and patron of heroes—he eventually skinned it with its own legendarily-sharp claws, and wore the lion's coat as armor for all his Labors thereafter.

Upon returning to the astonished king, who had been fully prepared to never see him again, Hercules was assigned his second Labor: to kill Hydra, the nine-headed lake monster, which guarded the gate to the underworld deep in a "bottomless" lake near Lerna. The virulent poison in its blood and toxic fumes in its breath would have been bad enough, but it was also immortal and regenerating; each head that was cut off would sprout two more. Thanks to another dose of Athena's divine inspiration, rather than hacking till he was overrun with heads, Hercules had his nephew cauterize the neck stumps each time he cut off a head before it could regenerate. Finally, after reducing the beast to its one final immortal head, he buried it under a huge rock and dipped his arrows in the beast's poisonous blood for use in his future Labors.

Ironically, that Hydra poison would, many years and adventures later, become the weapon that caused his death. We could go into that, but this is supposed to be an astronomy newsletter, and there aren't dedicated constellations for the other stories. His many, many other adventures are worth reading elsewhere, but I can't resist closing out with a Hercules highlight reel.

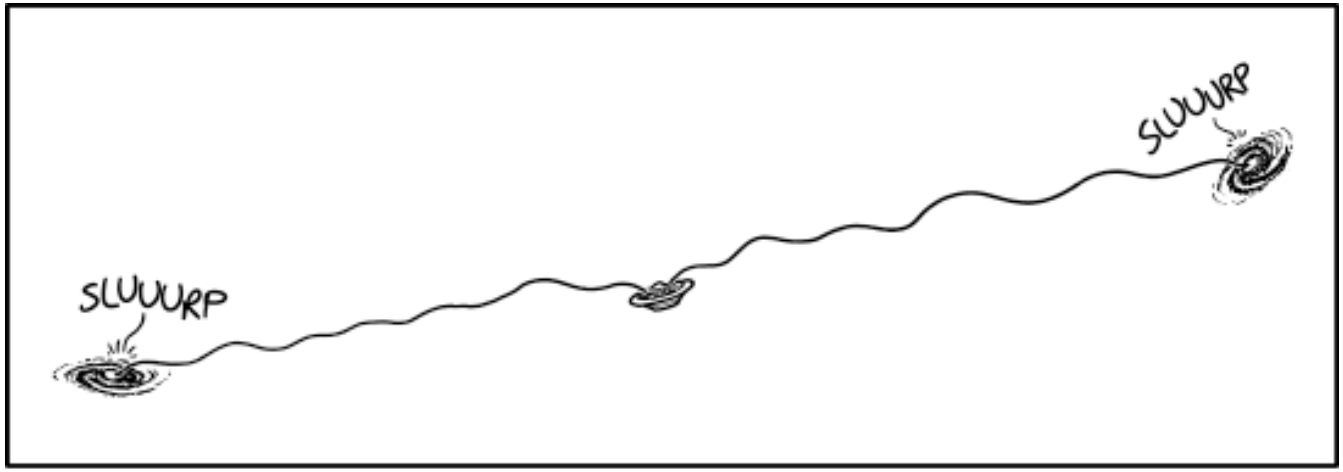
After he completes his 12 Labors, he continues to adventure about, regularly wrestling bad guys, leading battles, and saving cities. There's another round of accidental murder by Hera-induced temporary insanity, and the subsequent atonement by servitude—this time to a queen who makes him dress like a woman, then later frees and marries him. He literally tackles Death at a party to save the life of his friend's wife. He challenges Dionysus the god of wine to a drinking contest. He beats a river god in a wrestling match for the hand of a princess, who later gets tricked into inadvertently giving her husband Hydra poison. Not one to go out quietly, he builds his own funeral pyre, ascends to godhood, reconciles with Hera, and marries one of her divine daughters.

What a guy. He definitely deserves a bigger constellation.



I GOT KICKED OUT OF THE INTERNATIONAL ASTRONOMICAL UNION FOR ADDING EXTRA LINES BETWEEN THE CONSTELLATIONS TO CREATE A MONSTROSITY.

Randall Munroe, xkcd, CC.



ASTRONOMERS HAVE DETERMINED THAT THE MILKY WAY AND ANDROMEDA ARE CURRENTLY SLURPING UP THE SAME STRAND OF COSMIC SPAGHETTI, SUGGESTING THAT IN 5 BILLION YEARS THEY WILL LIKELY KISS.

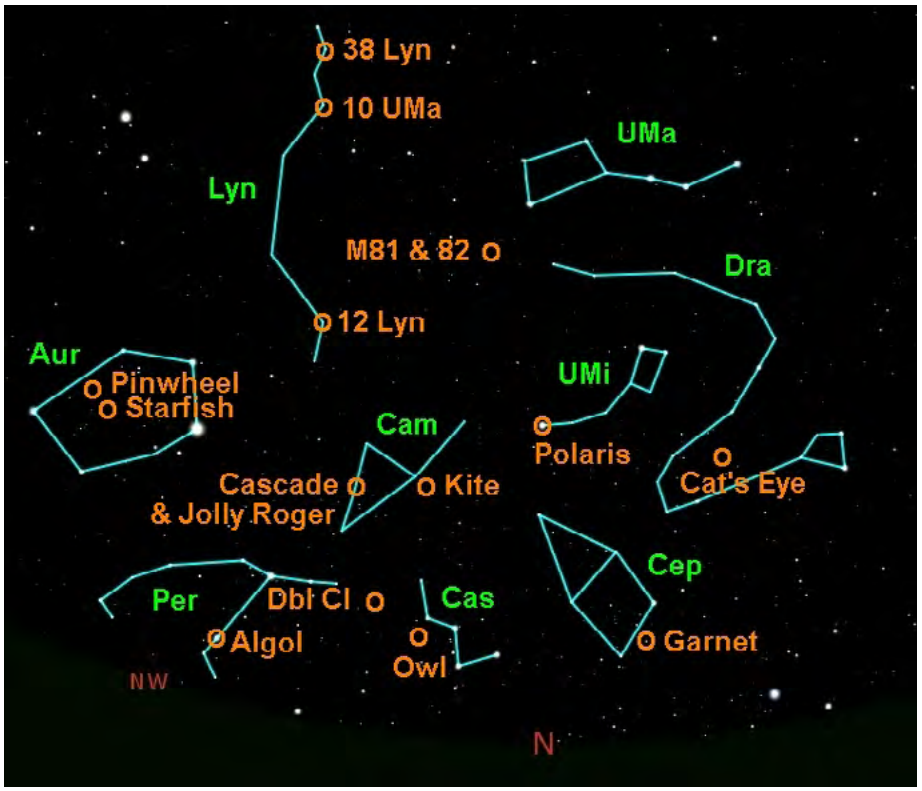
Randall Munroe, xkcd, CC.

This article is distributed by the NASA Night Sky Network, a coalition of hundreds of astronomy clubs across the US dedicated to astronomy outreach.

Constant Companions: Circumpolar Constellations

by Kat Troche

What does "circumpolar" mean when referring to constellations? This word refers to constellations that surround the north and south celestial poles without ever falling below the horizon. Depending on your latitude, you will be able to see up to nine circumpolar constellations in the northern hemisphere. In this article we'll focus on Ursa Major, Draco, Ursa Minor, Cepheus, Cassiopeia, Camelopardalis, Perseus, Auriga, and Lynx, and some of the gems that they contain. These objects can all be spotted with a pair of binoculars or a small to medium-sized telescope under dark skies.



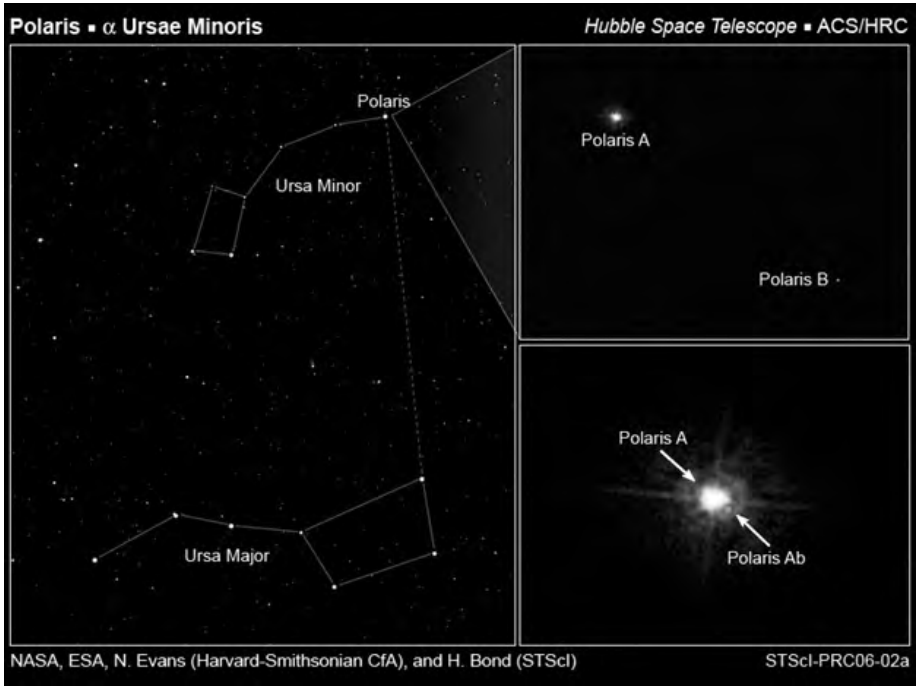
A view to the north on May 1 at 10 pm. From Stellarium.

The Cigar Galaxy. Credit: NASA, ESA, CXC, and JPL-Caltech.

- Bode's Galaxy and the Cigar Galaxy: Look diagonally across the bowl of the Big Dipper from the star Dubhe in Ursa Major. There you will find Bode's Galaxy (Messier 81) and the Cigar Galaxy (Messier 82). Sometimes referred to as Bode's Nebula, these two galaxies can be spotted with a small to medium-sized telescope. Bode's Galaxy is a classic spiral shape, similar to our own Milky Way galaxy and our neighbor, Andromeda. The Cigar Galaxy, however, is known as a starburst galaxy type, known to have a high star formation rate and incredible shape.

- The Cat's Eye Nebula: Labeled a planetary nebula, there are no planets to be found at the center of this object. Observations taken with NASA's Chandra X-ray Observatory and Hubble Space Telescopes give astronomers a better understanding of this complex, potential binary star, and how its core ejected enough mass to produce the rings of dust. When searching for this object, look towards the 'belly' of Draco with a medium-sized telescope.

This composite of data from NASA's Chandra X-ray Observatory and Hubble Space Telescope gives astronomers a new look for NGC 6543, better known as the Cat's Eye nebula. This planetary nebula represents a phase of stellar evolution that our sun may well experience several billion years from now. Credit: X-ray: NASA/CXC/SAO; Optical: NASA/STScI.
When searching for this object, look towards the 'belly' of Draco with a medium-sized telescope.

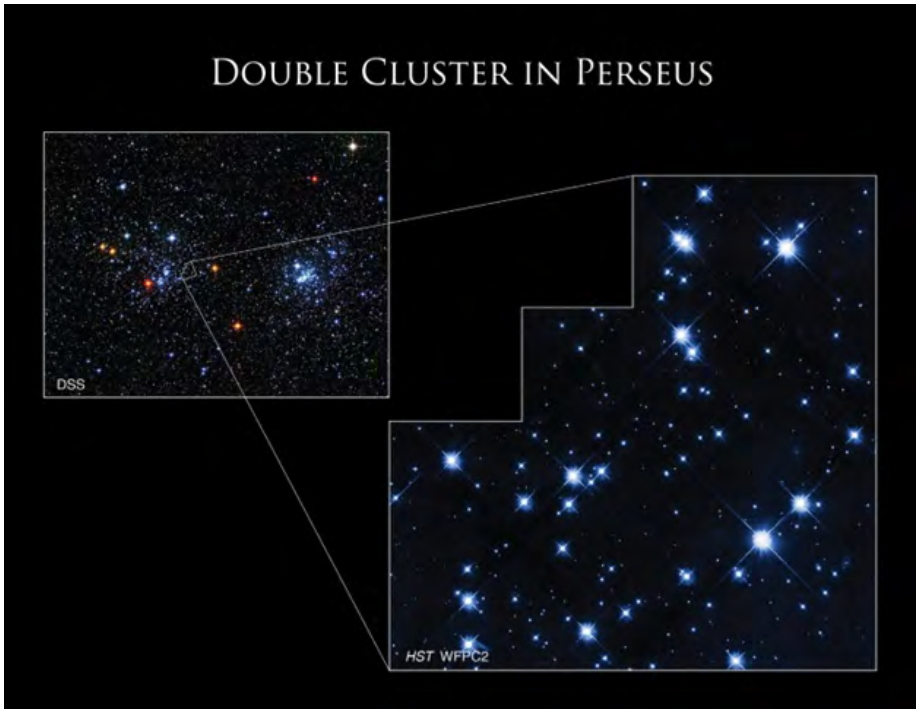


A black and white image from the Hubble Telescope of the Polaris star system, showing three stars: Polaris A, Ab, and Polaris B. Credit: NASA, ESA, N. Evans (Harvard-Smithsonian CfA), and H. Bond (STScI).

- Polaris: Did you know that Polaris is a triple star system? Look for the North Star on the edge of Ursa Minor, and with a medium-sized telescope, you should be able to separate two of the three stars. This star is also known as a Cepheid variable star, meaning that it varies in brightness, temperature and diameter. It's the closest one of its kind to Earth, making it a great target for study and conceptual art.
- Herschel's Garnet Star: Mu Cephei is a deep-red hypergiant known as The Garnet Star, or Erakis. While the star is not part of the constellation pattern, it sits within the constellation boundary of Cepheus, and is more than 1,000 times the size of our Sun. Like its neighbor Delta Cephei, this star is variable, but is not a reliable Cepheid variable. Rather, its brightness can vary anywhere between 3.4 to 5.1 in visible magnitude, over the course of 2-12 years.

- The Owl Cluster: Located in the 'W' or 'M' shaped constellation Cassiopeia is the open star cluster known as the Owl Cluster. Sometimes referred to as the E.T. Cluster or Dragonfly Cluster, this group of stars never sets below the horizon and can be spotted with binoculars or a small telescope.

- Kemble's Cascade: This asterism located in Camelopardalis has over 20 stars, ranging in visible magnitude (brightness) and temperature. The stars give the appearance of flowing in a straight line leading to the Jolly Roger Cluster (NGC 1502). On the opposite side of this constellation, you find the asterism Kemble's Kite. All three objects can be spotted with a pair of binoculars or a telescope and require moderate dark skies.



A ground-based image from the Digitized Sky Survey (DSS) in the upper left shows Caldwell 14, the Double Cluster in Perseus, with an outline of the region imaged by Hubble's Wide Field and Planetary Camera 2 (WFPC2). Ground-based image: Digitized Sky Survey (DSS); Hubble image: NASA, ESA, and S. Casertano (Space Telescope Science Institute); Processing: Gladys Kober (NASA/Catholic University of America).

- Double Cluster: The constellation Perseus contains the beautiful Double Cluster, two open star clusters (NGC 869 and 884) approximately 7,500 light-years from Earth. This object can be spotted with a small telescope or binoculars and is photographed by amateur and professional photographers alike. It can even be seen with the naked eye in very dark skies. Also in Perseus lies Algol, the Demon Star. Algol, is a triple-star system that contains an eclipsing binary, meaning two of its three stars constantly orbit each other. Because of this orbit, you can watch the brightness dim every two days, 20 hours, 49 minutes – for 10-hour periods at a time.

- The Pinwheel Cluster: Located near the edge of Auriga, this open star cluster is easy to spot with a pair of binoculars or small telescope. At just 25 million years old, it contains no red giant stars and looks similar to the Pleiades. To find this, draw a line between the stars Elnath in Taurus and Menkalinan in Auriga. You will also find the Starfish Cluster nearby.

- Double Stars: The area that comprises the constellation Lynx is famous for its multiple star systems, all of which can be separated with a telescope under dark skies. Some of the notable stars in Lynx are the following:
  * 12 Lyncis – a triple star that can be resolved with a medium-sized telescope.
  * 10 Ursae Majoris – a double star that was once a part of Ursa Major.
  * 38 Lyncis – a double star that is described as blue-white and lilac.

Katherine "Kat" Troche is Project Coordinator and Night Sky Network Administrator at the Astronomical Society of the Pacific.
This article was first published by NSN in three parts in February, March, and June of 2024.

From dead galaxies to mysterious red dots, here's what the James Webb telescope has found in just 3 years

by Themiya Nanayakkara, Ivo Labbe, and Karl Glazebrook

On [December 24] three years ago, we witnessed the nail-biting launch of the James Webb Space Telescope (JWST), the largest and most powerful telescope humans have ever sent into space.

It took 30 years to build, but in three short years of operation, JWST has already revolutionised our view of the cosmos. It's explored our own Solar System, studied the atmospheres of distant planets in search of signs of life and probed the farthest depths to find the very first stars and galaxies formed in the universe.

Here's what JWST has taught us about the early universe since its launch – and the new mysteries it has uncovered.

Eerie blue monsters

JWST has pushed the boundary of how far we can look into the universe to find the first stars and galaxies. With Earth's atmosphere out of the way, its location in space makes for perfect conditions to peer into the depths of the cosmos with infrared light.

The current record for the most distant galaxy confirmed by JWST dates back to a time when the universe was only about 300 million years old. Surprisingly, within this short time window, this galaxy managed to form about 400 million times the mass of our Sun. This indicates star formation in the early universe was extremely efficient. And this galaxy is not the only one.

Dust in the heart of galaxy NGC628.
NASA / ESA / CSA / Judy Schmidt, CC BY.

When galaxies grow, their stars explode, creating dust. The bigger the galaxy, the more dust it has. This dust makes galaxies appear red because it absorbs the blue light. But here's the catch: JWST has shown these first galaxies to be shockingly bright, massive and very blue, with no sign of any dust. That's a real puzzle.

There are many theories to explain the weird nature of these first galaxies. Do they have huge stars that just collapse due to gravity without undergoing massive supernova explosions? Or do they have such large explosions that all dust is pushed away far from the galaxy, exposing a blue, dust-free core? Perhaps the dust is destroyed due to the intense radiation from these early exotic stars – we just don't know yet.

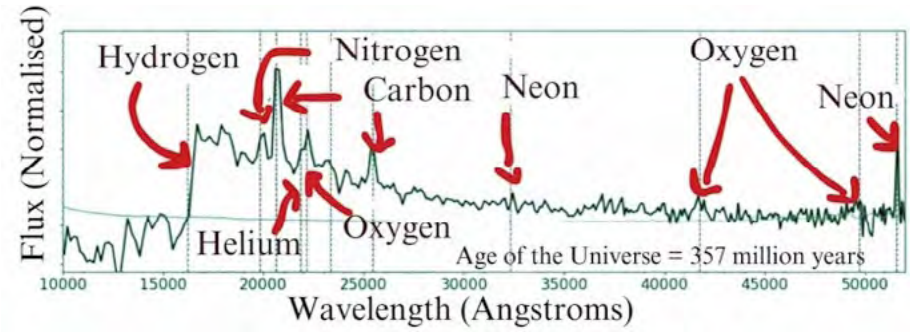
Unusual chemistry in early galaxies

The early stars were the key building blocks of what eventually became life. The universe began with only hydrogen, helium and a small amount of lithium. All other elements, from the calcium in our bones to

the oxygen in the air we breathe, were forged in the cores of these stars.

JWST has discovered that early galaxies also have unusual chemical features. They contain a significant amount of nitrogen, far more than what we observe in our Sun, while most other metals are present in lower quantities. This suggests there were processes at play in the early universe we don't yet fully understand.

JWST has shown our models of how stars drive the chemical evolution of galaxies are still incomplete, meaning we still don't fully understand the conditions that led to our existence.



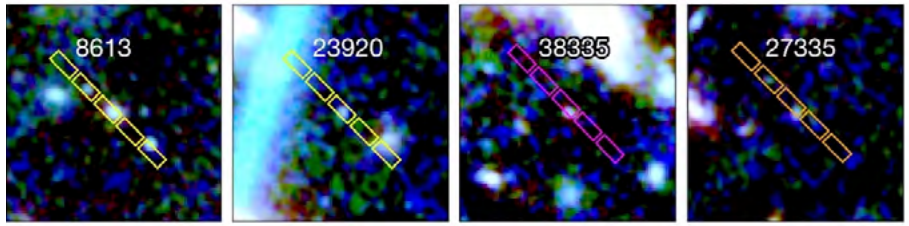
Different chemical elements observed in one of the first galaxies in the universe uncovered by JWST.
Adapted from Castellano et al., 2024, The Astrophysical Journal; JWST-GLASS and UNCOVER Teams.

Small things that ended the cosmic dark ages

Using massive clusters of galaxies as gigantic magnifying glasses, JWST's sensitive cameras can also peer deep into the cosmos to find the faintest galaxies.

We pushed further to find the point at which galaxies become so faint, they stop forming stars altogether. This helps us understand the conditions under which galaxy formation comes to an end. JWST is yet to find this limit. However, it has uncovered many faint galaxies, far more than anticipated, emitting over four times the energetic photons (light particles) we expected.

The discovery suggests these small galaxies may have played a crucial role in ending the cosmic "dark ages" not long after the Big Bang.



The faintest galaxies uncovered by JWST in the early cosmos. Rectangles highlight the apertures of JWST's near infrared spectrograph array, through which light was captured and analysed to unravel the mysteries of the galaxies' chemical compositions. Atek et al., 2024, Nature.

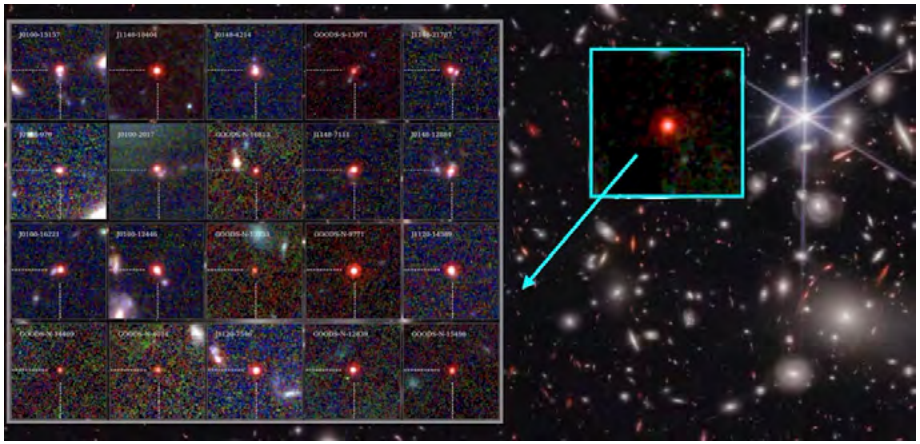
The mysterious case of the little red dots

The very first images of JWST resulted in another dramatic, unexpected discovery. The early universe is inhabited by an abundance of "little red dots": extremely compact red colour sources of unknown origin. Initially, they were thought to be massive super-dense galaxies that shouldn't be possible, but detailed observations in the past year have revealed a combination of deeply puzzling and contradictory properties.

Bright hydrogen gas is emitting light at enormous speeds, thousands of kilometres per second, characteristic of gas swirling around a supermassive black hole. This phenomenon, called an active galactic nucleus, usually indicates a feeding frenzy where a supermassive black hole is gobbling up all the gas around it, growing rapidly.

But these are not your garden variety active galactic nuclei. For starters: they don't emit any detectable X-rays, as is normally expected. Even more intriguingly, they seem to have the features of star populations.

Could these galaxies be both stars and active galactic nuclei at the same time? Or some evolutionary stage in between? Whatever they are, the little red dots are probably going to teach us something about the birth of both supermassive black holes and stars in galaxies.



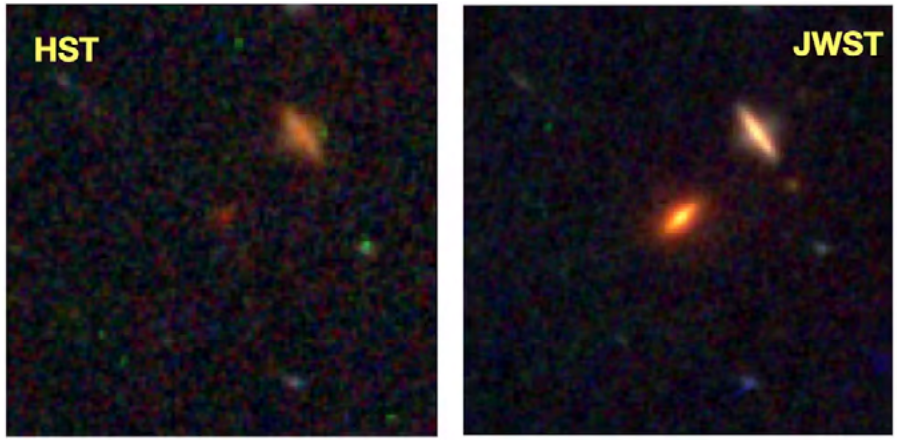
An image of galaxies with several red ones highlighted in a series of boxes. In the background, the JWST image of the Pandora Cluster (Abell 2744) is displayed, with a little red dot highlighted in a blue inset. The foreground inset on the left showcases a montage of several little red dots discovered by JWST.
Adapted from Furtak et al., and Matthee et al., The Astrophysical Journal, 2023-2024; JWST-GLASS and UNCOVER Teams.

The impossibly early galaxies

As well as extremely lively early galaxies, JWST has also found extremely dead corpses: galaxies in the early universe that are relics of intense star formation at cosmic dawn. These corpses had been found by Hubble and ground-based telescopes, but only JWST had the power to dissect their light to reveal how long they've been dead.

It has uncovered some extremely massive galaxies (as massive as our Milky Way today and more) that formed in the first 700 million years of cosmic history. Our current galaxy formation models can't explain these objects – they are too big and formed too early. Cosmologists are still debating whether the models can be bent to fit (for example, maybe early star formation was extremely efficient) or whether we have to reconsider the nature of dark matter and how it gives rise to early collapsing objects.

JWST will turn up many more of these objects in the next year and study the existing ones in greater detail. Either way, we will know soon.



A dead galaxy, observed 2 billion years after the Big Bang. A small red source in the Hubble Space Telescope image proves to be a monstrous galaxy as seen by JWST.
Glazebrook et al., Nature, 2024

What's next for JWST?

Just within its first steps, the telescope has revealed many shortcomings of our current models of the universe. While we are refining our models to account for the updates JWST has brought us, we are most excited about the unknown unknowns.

The mysterious red dots were hiding from our view. What else is lingering in the depths of cosmos? JWST will soon tell us.

Read more at [https://theconversation.com/from-dead-galaxies-to-mysterious-red-dots-heres-what-the-james-webb-telescope-has-found-in-just-3-years-243592.](https://theconversation.com/from-dead-galaxies-to-mysterious-red-dots-heres-what-the-james-webb-telescope-has-found-in-just-3-years-243592)

Themiya Nanayakkara is a Scientist at the James Webb Australian Data Centre, Swinburne University of Technology.

Ivo Labbe is an ARC Future Fellow / Associate Professor, Swinburne University of Technology.

Karl Glazebrook is an ARC Laureate Fellow & Distinguished Professor, Centre for Astrophysics & Supercomputing, Swinburne University of Technology.

Heavenly Bodies by Susie Christian

Cow-a-Palooza at the AOH Star Party or.....

What happens when someone forgets to close the gate.