Volume 51 Number 11 November 2025

The Celestial Mechanic

The Official Newsletter of the Astronomy Associates of Lawrence

Coming Events

Monthly Meeting
November 7, 2025, 7:00PM
Baker Wetlands Discovery Center

Public Observing
November 7, 2025, 8:00PM
Baker Wetlands Discovery Center

Club Officers
President
Rick Heschmeyer email

NSN Coordinator
Howard Edin email

Faculty Advisor
Dr. Jennifer Delgado email.

Newsletter Editor
Chuck Wehner email

Inside This Issue

Report From the Officers

By Rick Heschmeyer

For our October Club Meeting, Dhwani Vani, an Undergraduate Research Assistant at the University of Kansas, presented the talk "Biosignatures in Stone and Space: Raman Spectroscopy Bridging Geology and Astronomy". The cloudy weather did not allow for public observing following the meeting.

Earlier in the month, on Friday, October 3, we held our second Autumn event at the KU Field Station, that coincided with International Observe the Moon Night. In addition to the Moon, attendees enjoyed views of Saturn. The Field Station staff estimated an attendance of over 50 people! Thanks to all who came out to help.

Halloween is a great time to break out your telescopes and offer trick-or-treaters views of the night sky. This year we have the chance to offer views of the two most spooktacular "Wow" objects for those that have never looked through a telescope. The Moon will be in a waxing gibbous phase, illuminated about 70% so it will be easy for even the little ones to see in the eyepiece. And Saturn is visible as well. While the rings are still close to edge-on, they are still visible. And depending on your location, you may be able to view Comet Lemmon (C2025 A6) in the northwest sky! As of this writing Comet Lemmon is on the edge of naked-eye visibility. For more information about the comet along with finder charts go to this link. Handing out views of the cosmos is just as fun as passing out candy, and cavity-free!

On Thursday, November 6th, AAL member Rick Heschmeyer will be presenting "The Useful Stars: The Night Sky as Calendar, Navigational Aid, and Cultural Repository". The talk will take place from 6:00 PM to 7:00 PM at the Spencer Museum of Art as part of their "Soundings: Making Culture at Sea" exhibit. Attendees will then have a chance to view the exhibit or travel across campus to join in the KU Astronomy Public Night at Slawson Hall starting at 7:30PM. More information about the KU Astronomy Public Nights can be found at this link.

As is customary, there will be no meeting at the end of November due to the Thanksgiving holiday. Our next meeting will take place on Sunday, December 7 at 7PM at the Baker Wetlands Discovery Center. Dr. Shane Larson, Professor of Physics and Director of Integrated Engineering & Applied Science Projects at Clarkson University in Potsdam, New York will be joining us via Zoom as our speaker. The meeting will be followed by public telescope observing, weather permitting.

Looking forward to seeing everyone at our upcoming events.

Clear Skies!

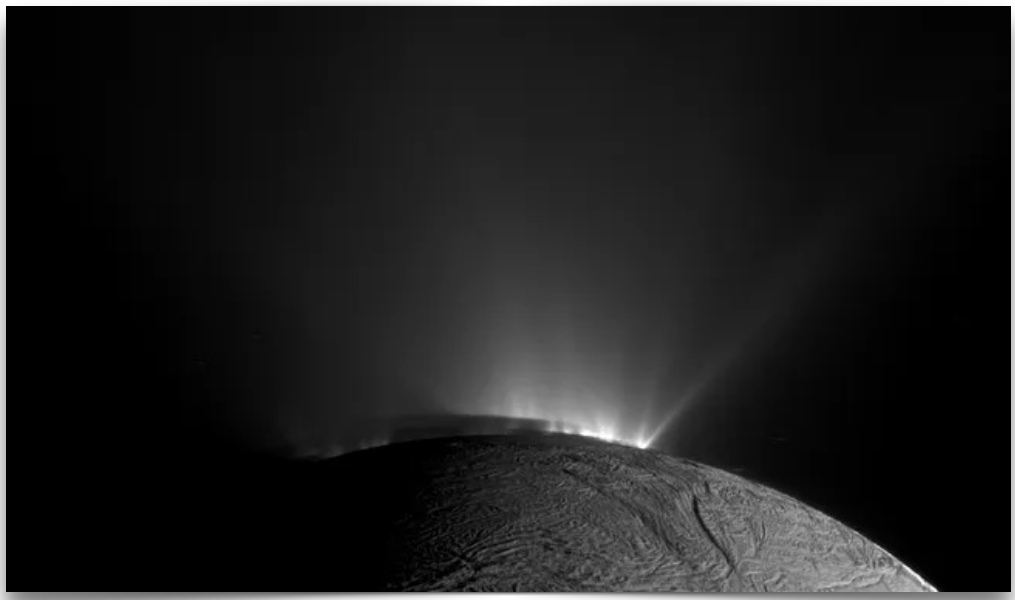
Scientists find best evidence yet that icy moon Enceladus is habitable

By Sophie Berdugo

LIVESCIENCE, OCTOBER 2, 2025

Scientists have discovered that the molecular building blocks needed for life are "readily available" on Saturn's icy moon Enceladus.

At only 314 miles (505 kilometers) wide, Enceladus could fit inside Colorado — and thanks to its liquid water, hydrothermal energy source and chemical tool kit, it has the potential to host extraterrestrial life.



The Cassini spacecraft took this image while looking across the south pole of Saturn's icy moon Enceladus on Nov. 30, 2010. Jets of water from the moon's underground ocean are visible bursting through cracks in the ice.

Twenty years ago, NASA's Cassini spacecraft discovered evidence that a vast salty ocean hidden beneath Enceladus' surface was spitting out minuscule "ice grains" through cracks near the moon's south pole. Subsequent studies have spotted five of the six essential elements for life — carbon, hydrogen, nitrogen, oxygen and phosphorus (only missing sulfur) — within these grains.

However, the majority of these past studies looked at the relatively old ice grains that settled in Saturn's E ring — a diffuse ring outside the planet's bright main rings — after being ejected decades or centuries prior. This meant scientists couldn't be sure that the compounds truly came from Enceladus rather than from space weathering in the ring.

Now, astronomers have identified organic molecules, perhaps including nitrogen and oxygen, in fresh ice grains sprayed from Saturn's icy moon. The new research was published Wednesday (Oct. 1) in the journal Nature Astronomy.

Secrets of the ice moon

In 2008, as Cassini shot through a geyser of freshly spewed-up ice grains from Enceladus, it collected data on the splatter that covered the spacecraft's Cosmic Dust Analyzer. These grains hit the spacecraft at 11 miles per second (18 kilometers per second), which was so fast that the water molecules didn't cluster. This meant the team could see "previously hidden signals," study co-author Nozair Khawaja, a planetary scientist at the Free University of Berlin, said in a statement.

The researchers used mass spectrometry to analyze the chemical fingerprint of the molecules in the fresh ice grains. They found chemical compounds that, on Earth, are involved in reactions that lead to the formation of complex molecules required for life, including structures potentially containing nitrogen and oxygen.

"These molecules we found in the freshly ejected material prove that the complex organic molecules Cassini detected in Saturn's E ring are not just a product of long exposure to space, but are readily available in Enceladus's ocean," study co-author Frank Postberg, a professor of planetary science at the Free University of Berlin, said in the statement.

Nozair said there are various ways these molecules could become biologically relevant, "which enhances the likelihood that the moon is habitable." Even so, he said it would still be a huge discovery to not find any life on Enceladus because it would raise "serious questions about why life is not present in such an environment when the right conditions are there."

ESA is planning a future mission to land a spacecraft on the southern pole of Enceladus to collect more samples. The agency is targeting the early 2040s as the earliest possible launch date. ☀

Night Sky Notes: Let's Go, LIGO!

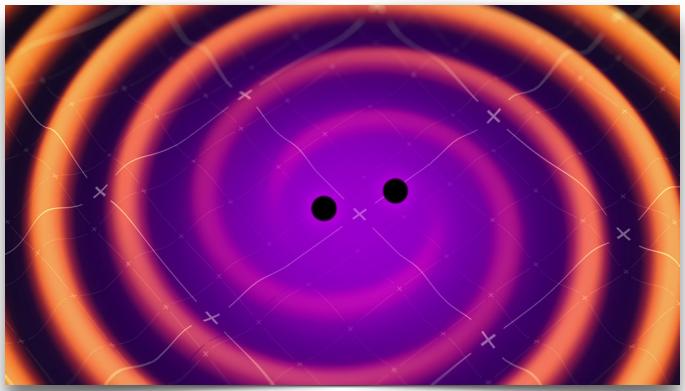
By Kat Troche

Nightskynetwork, October 2025

September 2025 marks ten years since the first direct detection of gravitational waves as predicted by Albert Einstein's 1916 theory of General Relativity. These invisible ripples in space were first directly detected by the Laser Interferometer Gravitational-Wave Observatory (LIGO). Traveling at the speed of light (~186,000 miles per second), these waves stretch and squeeze the fabric of space itself, changing the distance between objects as they pass.

Waves In Space

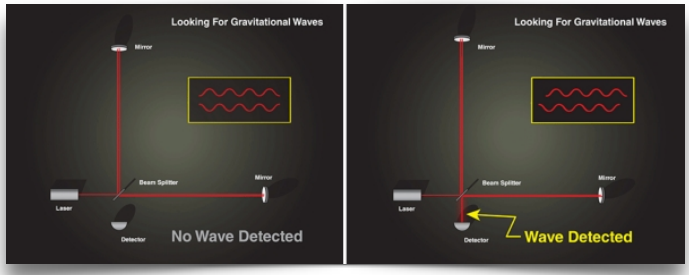
Gravitational waves are created when massive objects accelerate in space, especially in violent events. LIGO detected the first gravitational waves when two black holes, orbiting one another, finally merged, creating ripples in space-time. But these waves are not exclusive to black holes. If a star were to go supernova, it could produce the same effect. Neutron stars can also create these waves for various reasons. While these waves are invisible to the human eye, this animation from NASA's Science Visualization Studio shows the merger of two black holes and the waves they create in the process.



Two black holes orbit around each other and generate space-time ripples called gravitational waves in this image.

How It Works

A gravitational wave observatory, like LIGO, is built with two tunnels, each approximately 2.5 miles long, arranged in an "L" shape. At the end of each tunnel, a highly polished 40 kg mirror (about 16 inches across) is mounted; this will reflect the laser beam that is sent from the observatory. A laser beam is sent from the observatory room and split into two, with equal parts traveling down each tunnel, bouncing off the mirrors at the end. When the beams return, they are recombined. If the arm lengths are perfectly equal, the light waves cancel out in just the right way, producing darkness at the detector. But if a gravitational wave passes, it slightly stretches one arm while squeezing the other, so the returning beams no longer cancel perfectly, creating a flicker of light that reveals the wave's presence.



Still images of how LIGO (Laser Interferometer Gravitational-Wave Observatory) detects gravitational waves using a laser, mirrors, and a detector. You can find the animated version here.

Get Involved

With the help of two additional gravitational-wave observatories, VIRGO and KAGRA, there have been 300 black hole mergers detected in the past decade; some of which are confirmed, while others await further study.

While the average person may not have a laser interferometer lying around in the backyard, you can help with two projects geared toward detecting gravitational waves and the black holes that contribute to them:

- **Black Hole Hunters:** Using data from the TESS satellite, you would study graphs of how the brightness of stars changes over time, looking for an effect called gravitational microlensing. This lensing effect can indicate that a massive object has passed in front of a star, such as a black hole.
- **Gravity Spy:** You can help LIGO scientists with their gravitational wave research by looking for glitches that may mimic gravitational waves. By sorting out the mimics,

we can train algorithms on how to detect the real thing.

You can also use gelatin, magnetic marbles, and a small mirror for a more hands-on demonstration on how gravitational waves move through space-time with JPL's Dropping In With Gravitational Waves activity! ☀

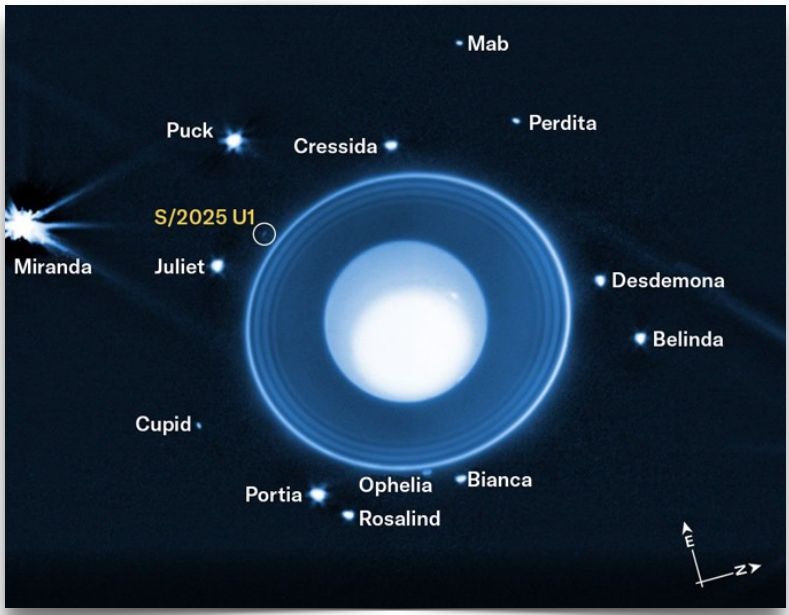
⁜ Since 2018, the NASA Night Sky Network has provided articles featuring the latest stargazing and NASA news to share with your organization's readership. As of October 1, 2025, Night Sky Notes will be suspended until further notice, as cuts and restructuring are part of NASA's Fiscal Year 2026 budget. ☀

NASA's Webb telescope spotted a new moon orbiting Uranus

This is the planet's 29th identified moon

By McKenzie Prillaman
SCIENCENEWS, AUGUST 22, 2025

Uranus hosts yet another moon, which looks like a tiny, faint smudge in images captured by the James Webb Space Telescope, researchers report in an Aug. 19 NASA release. The newfound object makes the 29th observed lunar companion for the sideways-tilted ice giant.



The new moon, currently called S/2025 U1, will be named after a character from the works of William Shakespeare or Alexander Pope, like the rest of Uranus's 28 known moons. Some of the planet's moons are shown and labeled with their names in this processed image from the James Webb Space Telescope.

"Uranus is a very strange planet," says planetary scientist Maryame El Moutamid of the Southwest Research Institute in Boulder, Colo. Most of its rings are narrow, just a few kilometers wide, hinting that moons orbiting their edges might constrain the rings' sizes.

El Moutamid leads a project studying the odd planet's rings and moons, so in February, she had JWST snap a series of 10 long-exposure images of Uranus over the course of nearly seven hours.

All the images contained an unknown blurry blotch traveling around Uranus, just beyond the planet's set of narrow inner rings. The repeated appearances, along with the object's speed, suggested the faint spot was a newly discovered moon. El Moutamid and colleagues confirmed the lunar companion's presence by ruling out any other kind of object or an error in the data.

"At first I couldn't believe it," El Moutamid says. "It's the first time I ever discovered a moon — I was really excited."

The newfound moon, currently called S/2025 U1, is located about 56,000 kilometers away from Uranus's center, orbiting in a circular path. El Moutamid and colleagues estimate that the moon is roughly 10 kilometers wide, based on comparisons to the planet's known moons, although the researchers are seeking additional data for a more accurate measurement. S/2025 U1 is smaller and fainter than the 28 other lunar companions, which is probably why past telescopes and the Voyager 2 flyby — equipped with cameras less sensitive than JWST's — missed the mini moon.

The next step, El Moutamid says, is to submit an official name for the moon to the International Astronomical Union, the organization in charge of naming astronomical objects and their features. S/2025 U1 will be named after a character from the writings of William Shakespeare or Alexander Pope, just like the rest of its lunar siblings. And more might join them soon, El Moutamid says, especially with a NASA Uranus orbiter mission predicted to launch in the 2030s.

"Probably, there are a lot of moons out there," she says. "They're just waiting to be discovered." ☀

NASA's Hubble Sees White Dwarf Eating Piece of Pluto-Like Object

HUBBLESITE, SEPTEMBER 18, 2025

In our nearby stellar neighborhood, a burned-out star is snacking on a fragment of a Pluto-like object. With its unique ultraviolet capability, only NASA's Hubble Space Telescope could identify that this meal is taking place.

The stellar remnant is a white dwarf about half the mass of our Sun, but that is densely packed into a body about the size of Earth. Scientists think the dwarf's immense gravity pulled in and tore apart an icy Pluto analog from the system's own version of the Kuiper Belt, an icy ring of debris that encircles our solar system. The findings were reported on September 18 in the Monthly Notices of the Royal Astronomical Society.

The researchers were able to determine this carnage by analyzing the chemical composition of the doomed object as its pieces fell onto the white dwarf. In particular, they detected "volatiles" — substances with low boiling points — including carbon, sulphur, nitrogen, and a high oxygen content that suggests the strong presence of water.

"We were surprised," said Snehalata Sahu of the University of Warwick in the United Kingdom. Sahu led the data analysis of a Hubble survey of white dwarfs. "We did not expect to find water or other icy content. This is because the comets and Kuiper Belt-like objects are thrown out of their planetary systems early, as their stars evolve into white dwarfs. But here, we are detecting this very volatile-rich material. This is surprising for astronomers studying white dwarfs as well as exoplanets, planets outside our solar system."

Only with Hubble

Using Hubble's Cosmic Origins Spectrograph, the team found that the fragments were composed of 64 percent water ice. The fact that they detected so much ice meant that the pieces were part of a very massive object that formed far out in the star system's icy Kuiper Belt analog. Using Hubble data, scientists calculated that the object was bigger than typical comets and may be a fragment of an exo-Pluto.

They also detected a large fraction of nitrogen – the highest ever detected in white dwarf debris systems. "We know that Pluto's surface is covered with nitrogen ices," said Sahu. "We think that the white dwarf accreted fragments of the crust and mantle of a dwarf planet."

Accretion of these volatile-rich objects by white dwarfs is very difficult to detect in visible light. These volatile elements can only be detected with Hubble's unique ultraviolet light sensitivity. In optical light, the white dwarf would appear ordinary.

About 260 light-years away, the white dwarf is a relatively close cosmic neighbor. In the past, when it was a Sun-like star, it would have been expected to host planets and an analog to our Kuiper Belt.

Like seeing our Sun in future

Billions of years from now, when our Sun burns out and collapses to a white dwarf, Kuiper Belt objects will be pulled in by the stellar remnant's immense gravity. "These planetesimals will then be disrupted and accreted," said Sahu. "If an alien observer looks into our solar system in the far future, they might see the

same kind of remains we see today around this white dwarf."

The team hopes to use NASA's James Webb Space Telescope to detect molecular features of volatiles such as water vapor and carbonates by observing this white dwarf in infrared light. By further studying white dwarfs, scientists can better understand the frequency and composition of these volatile-rich accretion events.

Sahu is also following the recent discovery of the interstellar comet 3I/ATLAS. She is eager to learn its chemical composition, especially its fraction of water. "These types of studies will help us learn more about planet formation. They can also help us understand how water is delivered to rocky planets," said Sahu.

Boris Gänsicke, of the University of Warwick and a visitor at Spain's Instituto de Astrofisica de Canarias, was the principal investigator of the Hubble program that led to this discovery. "We observed over 500 white dwarfs with Hubble. We've already learned so much about the building blocks and fragments of planets, but I've been absolutely thrilled that we now identified a system that resembles the objects in the frigid outer edges of our solar system," said Gänsicke. "Measuring the composition of an exo-Pluto is an important contribution toward our understanding of the formation and evolution of these bodies." ☀

World's largest camera just snapped the Universe in 3,200 megapixels

Sciencedaily, June 27, 2025

The Vera C. Rubin Observatory just snapped the universe's biggest portrait with its 3200-megapixel LSST camera, kicking off a decade-long sky survey that could revolutionize our understanding of the cosmos. Credit: Greg Stewart/SLAC National Accelerator Laboratory.

The NSF-DOE Vera C. Rubin Observatory in Chile has unveiled the very first "mega" images of the cosmos obtained thanks to the extraordinary features and wide-field view of its LSST camera -- the largest in the world. The camera took nearly two decades to build and involved hundreds of scientists across the globe, including a number of CNRS teams. The world-wide First Look unveiling event is held on June 23 at the National Academy of Sciences in Washington, D.C.

The impressive, car-sized *Legacy Survey of Space and Time* camera is like nothing seen before: thanks to its 3200-megapixel resolution and the wide field of view of the telescope at the Vera C. Rubin Observatory1, the LSST camera can photograph 45 times the area of the full moon in the sky with each exposure. The high-definition images, which use six different colour filters, capture the entire southern night-sky in just three nights of shooting. One year after its journey from the United States to the Vera C. Rubin Observatory in Chile, the first "mega" images will be unveiled on June 23 at a press conference held at the National Academy of Sciences in Washington, D.C. This worldwide premiere is the culmination of 25 years of research and construction by international teams, including several research teams from CNRS 2.

This image combines 678 separate images taken by Vera C. Rubin Observatory in just over seven hours of observing time. Combining many images in this way clearly reveals otherwise faint or invisible details, such as the clouds of gas and dust that comprise the Trifid Nebula (top) and the Lagoon Nebula, which are several thousand light-years away from Earth. Credit: NSF–DOE Vera C. Rubin Observatory

The exceptional quality of these initial images show that the telescope is ready to start its mission: to scan the entire southern hemisphere sky by taking 1,000 high-definition photographs using six colour filters, every three nights for the next ten years. Studied end-to-end, these scans will provide a high-definition, four-dimensional film of the evolving processes of the Universe. The ten-year project will also generate unprecedentedly rich and profound views of the southern sky and reveal the faintest and furthest-away objects of the cosmos. For the first time on a large scale, this vast survey will reveal the slightest changes

in the Universe, from nearby celestial phenomena, such as asteroids and comets, to very distant ones, like supernovae. The project paves the way for major advances in cosmology in dark matter and dark energy, as well as our understanding of our solar system.

CNRS: a key component of this international project.The project is funded by the U.S. Department of Energy and the U.S. National Science Foundation (NSF). The SLAC National Accelerator Laboratory built the Legacy Survey of Space and Time (LSST) camera. As historic partners, SLAC called on CNRS scientists to help build the focal plane of the camera and help design and build its robotic filter exchange system, which will automatically change the camera's colour filters -- each weighing 24-38 kgs -- 5-15 times per night. By measuring the quantity of light emitted by night-sky objects, and by converging the images taken through the different filters, it will make it possible to precisely determine their position and distance in relation to the Earth. Other CNRS scientists helped develop the computing infrastructure for the quantitative and qualitative data analysis of the gigantic trove of images that will be collected from the 17 billion observable stars and 20 billion observable galaxies. The goal of this painstaking effort is to create the most comprehensive catalogue of data on the universe.

Twenty terabytes of collected data will be stored every night. In France, the France Data Facility (IN2P3) (CNRS) in Lyon will store and process 40% of the collected raw image data. This data will be released to scientists around the world at regular intervals to foster groundbreaking discoveries and breakthroughs over the coming decades.

Why develop a ground-based telescope? Even with 25 space telescopes currently in use, ground-based observation remains essential in documenting the Universe in its entirety. Larger and more sensitive, ground-based instruments produce higher-precision exposures as a result. These instruments also record larger volumes of data than space-based ones, as the remote downloading of data from the latter remains a complex process. Last but not least, ground-based telescopes can also be repaired and improved with increasingly efficient tools. With this state-of-the-art camera, the Vera C. Rubin Observatory is the latest addition to the fifty or so structures operating equipment and infrastructure to observe the universe from Earth and space. ☀

William R. Winkler our ALCor representative passed away peacefully on September 25, 2025 in Lawrence, KS at the age of 83 after a short illness. He was born in Hillside NJ, the son of Burton and L. Angela Winkler and spent his childhood in Stratford, CT. He graduated from Stratford High School, University of Bridgeport and New York University, and received his master's degree in meteorology from the University of Chicago. He was passionate about the weather and astronomy and meteorology and was a longtime neighborhood weather observer for the National Weather Service. He had a long and distinguished career at NOAA, (National Oceanographic and Atmospheric Association), as a technical writer and analyst. Later, Bill became a certified special education teacher and taught in Dallas, TX. He retired to Lawrence, Kansas because of the exciting, changeable weather and the cultural environment provided by the University of Kansas and taught many Lawrence children as a substitute teacher. He was a long-time member of the Lawrence Kiwanis Club and Toastmasters Club, as well as Astronomical League Coordinator for the Astronomy Associates of Lawrence, He shared his love of astronomy with the residents of Lawrence through nighttime telescopic viewings at the Baker Wetlands. He was predeceased by brothers Burton, Michael and John Winkler, and is survived by sister Lorrie Winkler Ksiazek (Mike), special niece Kristen Cole (Ray), nephews Michael (Chrissy) and Tom (Melinda) Ksiazek, many nieces, nephews, cousins, and ex-wife Jane Winkler of New Mexico. He travelled the world with his best friend Chuck Vlcek of Oregon, viewing solar eclipses and national parks. Jim Wagner and Steve Flood were special meteorology friends. He also was a storm chaser! In his earlier years, he owned a horse and learned dressage and played the French horn. His gentle nature, brilliant mind, and loving heart were known to all who met him. Bill lived a life of faith. A devout Christian, he was an active member of St. John the Evangelist Church in Lawrence, serving as lector. "The wonders of Heaven that Bill loved to observe, he can now view from Heaven." ☀

The Backyard Observer, November 2025

By Rick Heschmeyer

AQUARIUS

This month's destination, Aquarius the Water Bearer, is the tenth largest constellation and lies along the ecliptic making it a zodiacal constellation as well. It is one of the fainter zodiacal constellations, though, with no stars brighter than 3rd magnitude. It is located is a part of the sky sometimes called The Sea, because of the all the water=based constellations nearby (Delphinus the Dolphin, Cetus the Whale, Pisces the Fishes, Piscus Austrinus the Southern Fish, and Eridanus the River. While it is officially known as the Water Bearer, it could just as easily be called the "Lucky One" if its Arabic star names had any say in the matter as we shall see.

There is a prominent asterism within Aquarius known as the Water Jar. The Water Jar is formed by five relatively bright stars in the constellation: Alpha, Gamma, Pi, Eta, and Zeta Aquarii. Also known as the Urn, the Y-shaped asterism represents the water jar from which the celestial Water Bearer pours water towards Fomalhaut, the mouth of Piscis Austrinus, the Southern Fish. Fomalhaut is one of the brightest stars in the sky.

Let's circle back to my "Lucky One" comment above and examine the stars names associated with the brightest stars in Aquarius. Alpha Aquarii is named Sadalmelik, meaning "lucky star of the king". Beta is Sadalsuud, or "luckiest of the lucky stars". Gamma is Sadachbia, the "lucky star of hidden things". Delta is Skat meaning "lucky wish". Zeta is Al Bali "good fortune of the swallower". I think you get the idea!

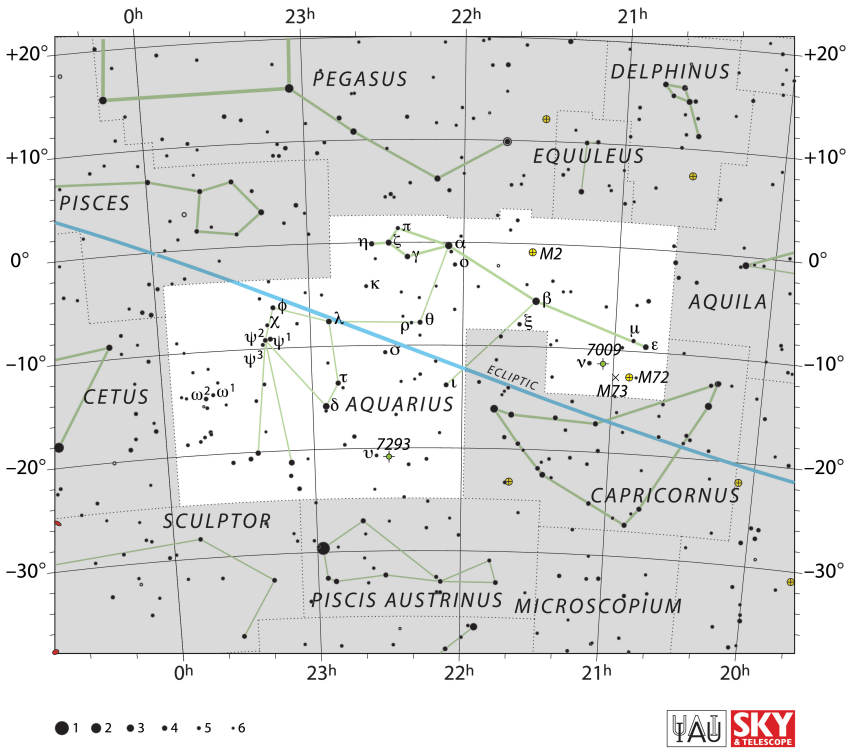
There are a few Messier objects in Aquarius, the brightest, and best, of which is Messier 2. M2 is a rich globular cluster discovered in 1746 by the French-Italian astronomer Miraldi, who is most famous for discovering that the ice caps on Mars are not perfectly aligned with the Martian poles. M2 is more compact than many globulars, packing around 150,000 stars into a diameter of 175 light years. In one of my favorite descriptions of a globular cluster, John Herschel, son of William Herschel, said "It is like a heap of fine sand!"

Messier 72 is another globular cluster in the constellation. Smaller and dimmer than its constellation mate, this one is difficult to resolve without a telescope. M72 holds particular significance: it was the first image ever featured in ESA/ Hubble's Picture of the Week series, published on April 22, 2010. Since then, the series has released a new Hubble image every Monday, contributing nearly 800 awe-inspiring photos to the growing archive over the past 15 years.

Now we come to one of the mysterious objects in Messier's catalogue, Messier 73. Notice it is marked by an "x" in the accompanying star map. It has been called the "star cluster that wasn't". Originally entered into the Messier catalogue as a star cluster, no star cluster can be found at that location. Only four, unrelated stars. So not a cluster! Never was, never will be. One can only assume that Messier's telescope made the stars appear hazy, giving them the appearance of a cluster of stars. So, the next time you do a "Messier Marathon", stop by M73, smile a bit, and check it off your list. Nothing to see here!

There are a couple of well-known planetary nebula within Aquarius as well. The first is NGC 7009, the Saturn Nebula. The name was given by Lord Rosse because of its elongated shape, reminiscent of Saturn's rings. Small, bright, and oval-shaped, the nebula is elongated in a NE-SW direction.

NGC 7293, the Helix Nebula, is another planetary nebula in Aquarius. Unlike NGC 7009, the Helix is not compact, spanning a diameter about half that of the Moon. That is due to the fact that it is one of the nearest planetary nebulae to us, at a distance of about 500 light years. And while its listed magnitude would lead one to believe it is brighter than NGC 7009, the large angular size comes a very low surface brightness. If you know what you are looking for observers can spot the Helix using telescopes from a dark-sky location. The addition of an O-III filter will help. Fans of the popular US comedy The Big Bang Theory may think that the Helix Nebula looks familiar. A Hubble poster of the nebula can be seen in the background of Sheldon and Leonard's apartment throughout the series.

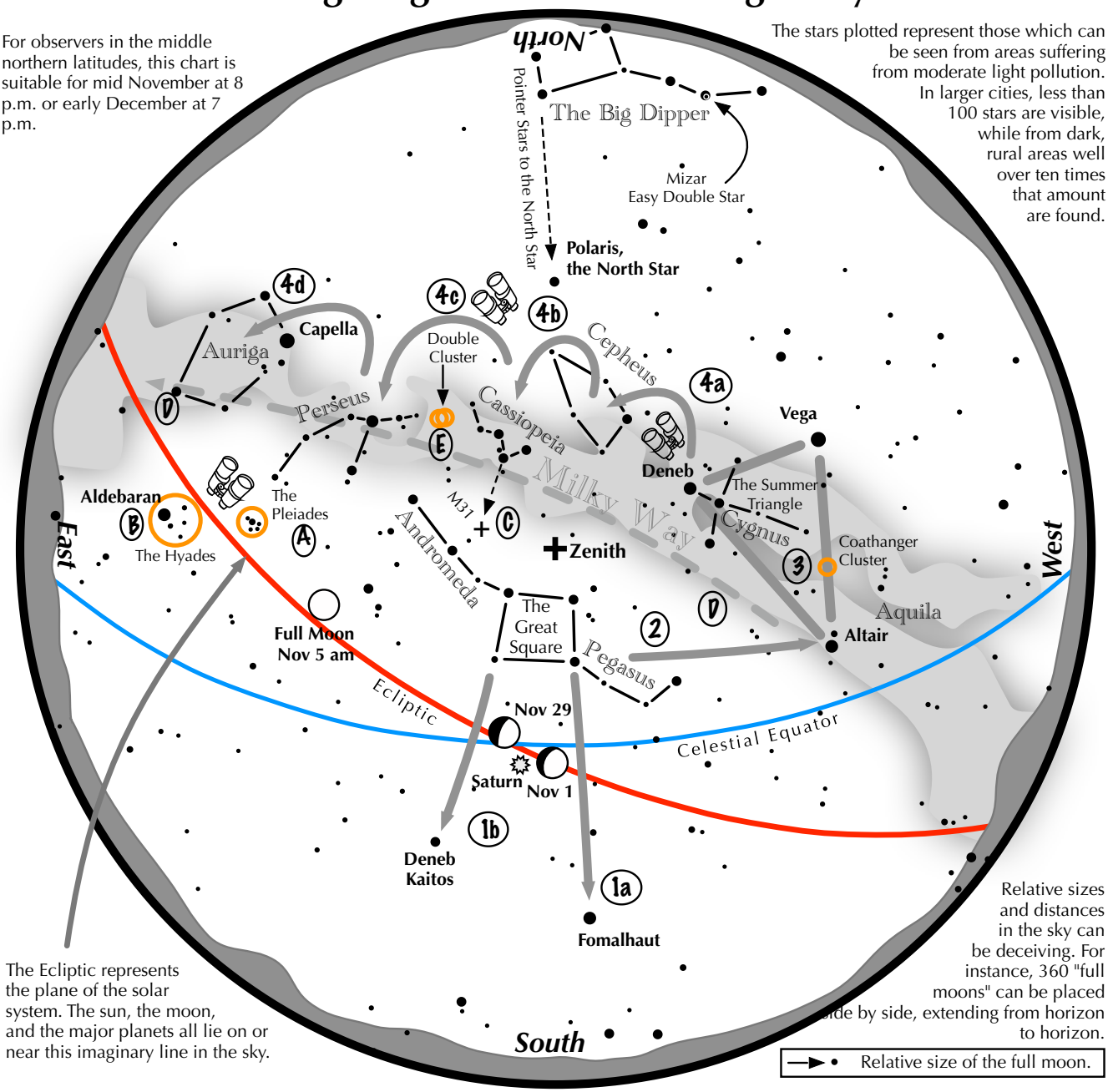


So if you are feeling lucky, get out and observe the wonders that the Water Bearer has to offer.

Navigating the November Night Sky

For observers in the middle northern latitudes, this chart is suitable for mid November at 8 p.m. or early December at 7 p.m.

The stars plotted represent those which can be seen from areas suffering from moderate light pollution. In larger cities, less than 100 stars are visible, while from dark, rural areas well over ten times that amount are found.



The Ecliptic represents the plane of the solar system. The sun, the moon, and the major planets all lie on or near this imaginary line in the sky.

Relative sizes and distances in the sky can be deceiving. For instance, 360 "full moons" can be placed side by side, extending from horizon to horizon.

Relative size of the full moon.

Navigating the November night sky: Simply start with what you know or with what you can easily find.

1. Face south. Almost overhead lies the "Great Square" with four stars about the same brightness as those of the Big Dipper. Extend a line southward following the Square's two westernmost stars. The line strikes Fomalhaut, the brightest star in the south. A line extending southward from the two easternmost stars, passes Deneb Kaitos, the second brighest star in the south.
2. Draw a line westward following the southern edge of the Square until it strikes Altair, part of the "Summer Triangle."
3. Locate Vega and Deneb, the other two stars of the Summer Triangle. Vega is its brightest member, while Deneb sits in the middle of the Milky Way.
4. Jump along the Milky Way from Deneb to Cepheus, which resembles the outline of a house. Continue jumping to the "W" of Cassiopeia, then to Perseus, and finally to Auriga with its bright star Capella.

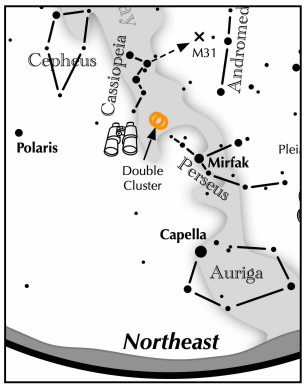
Binocular Highlights

A and B: Examine the stars of the Pleiades and Hyades, two naked eye star clusters. **C:** The three westernmost stars of Cassiopeia's "W" point south to M31, the Andromeda Galaxy, a "fuzzy" oval. **D:** Sweep along the Milky Way from Altair, past Deneb, through Cepheus, Cassiopeia and Perseus, then to Auriga for many intriguing star clusters and nebulous areas. **E.** The Double Cluster.

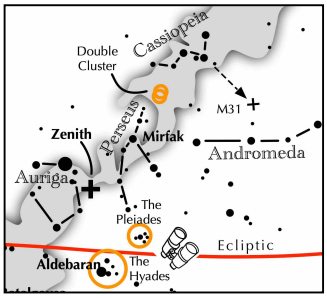
Can you easily find this open cluster showpiece?

Every Curious Skywatcher should know how to find the Double Cluster

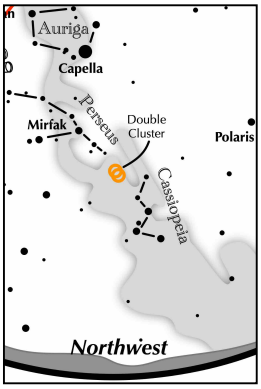
Visible in the early evening sky from late October through late March.



November in the northeast



January facing south looking past the zenith

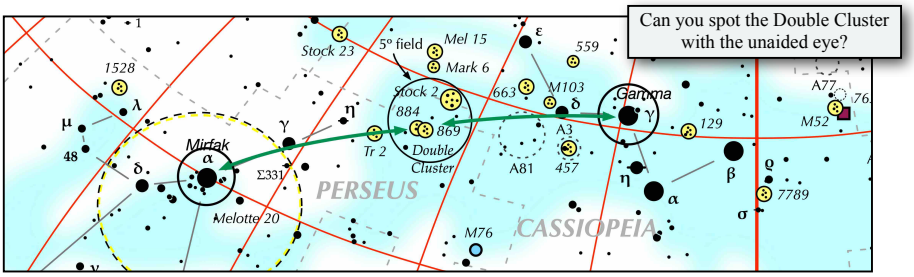


March in the northwest

The **Double Cluster** can be spotted with unaided eye from a dark sky as a dim glow in the Milky Way between Perseus and Cassiopeia. Through 10x50 binoculars, it is an obvious sight, revealing its brighter glittering lights. The neighboring cluster, **Stock 2,** can be seen as a much dimmer and more spread out grainy glow.

How to find the Double Cluster (aka NGC 869 & 884, and Caldwell 14):

1. Find the "w" shaped constellation Cassiopeia and the neighboring constellation to its southeast, Perseus. Identify Perseus' brightest star, 1.8 magnitude Mirfak.
2. Mid way between the center star of Cassopeia's "w" (Gamma Cas) and Mirfak lies a soft glow.
3. Binoculars aimed at the glow reveal the famous Double Cluster, also called NGC 869 and 884, Caldwell 14, and h Persei and Chi Persei.
4. Place the Double Cluster near the southern edge of the field. Near its center lies Stock 2, the Muscleman Cluster, which appears as a large, dim grainy glow.



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About Astronomy Associates

The club is open to all people interested in sharing their love for astronomy. Monthly meetings are typically on the last Sunday of each month and often feature guest speakers, presentations by club members, and a chance to exchange amateur astronomy tips. These meetings and the public observing sessions that follow are scheduled at the Baker Wetlands Discovery Center, south of Lawrence. All events and meetings are free and open to the public. Periodic star parties are scheduled as well.

Because of the flexibility of the schedule due to holidays and alternate events, it is always best to check the Web site for the exact Sundays when events are scheduled.

Copies of the Celestial Mechanic can also be found on the web at newsletter.
Annual Dues for the club are: $12 for regular members; $6 for students Membership forms can be accessed at the club website form.