Volume 49 Number 1 January 2023

# The Celestial Mechanic

The Official Newsletter of the Astronomy Associates of Lawrence

## Coming Events

**Monthly Meeting**
**January 29, 2023, 7:00PM**
**Baker Wetlands Discovery Center**

**Public Observing**
**January 29, 2023, 8:00PM**
**Baker Wetlands Discovery Center**

**Club Officers**
**President**
Rick Heschmeyer email

**AICOR**
William Winkler 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

Here's hoping everyone is having a wonderful holiday season. The arrival of the Winter Solstice coincided with an arctic blast announcing winter's definitive arrival. Brrr!

Our Spring 2023 Meeting and Observing schedule is listed below. All meetings will start at 7 PM, followed by telescope observing (weather permitting).

Sunday, January 29

Sunday, February 26

Sunday, March 26

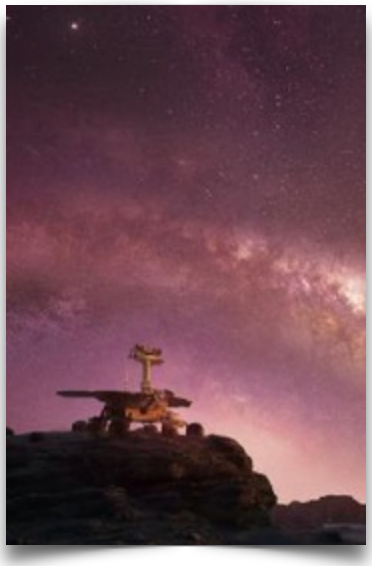
Sunday, April 30

In January, we will be viewing the 2022 Critic's Choice Award-Winning documentary film "Good Night Oppy". The film tells the story of Opportunity, a rover that was sent to Mars for a 90-day mission but ended up surviving for 15 years, and the remarkable bond forged between Oppy and her humans millions of miles away.

For our March meeting, AAL club member David Kolb will be talking about his astrophotograhy efforts in a presentation titled "Twenty Years of Lucky Imaging". If only we were all that lucky!

The talks for February and April are still being finalized. Stay tuned.

Our "PlanetPalooza" event with the Lawrence Public Library, which was cancelled due to weather in November, has been rescheduled for 2023. The new date will be Monday, April 3rd. Same location on the roof of the LPL Parking Garage. Mark your calendars. Details to follow.

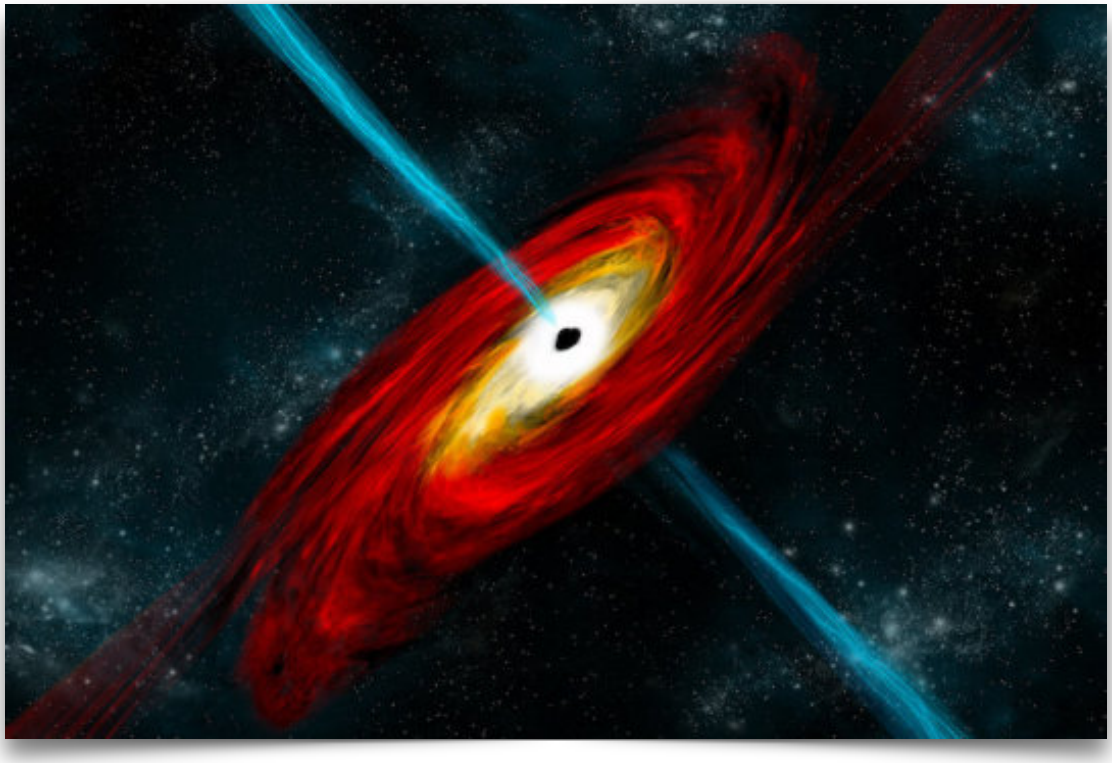


There will not be a Telescope Night at KU in January, but the plans are to have these restart in February. The tentative date is February 9. Once the flyer is released, we will forward to everyone and post on our Facebook page.

Enjoy the winter night sky and look forward to seeing everyone in the new year.

# Mysteriously bright flash is a black hole jet pointing straight toward Earth, astronomers say

Sciencenews, November 30, 2022



Astronomers have determined the source of an incredibly bright X-ray, optical and radio signal appearing from halfway across the Universe.

The signal, named AT 2022cmc, was discovered earlier this year by the Zwicky Transient Facility in California. Findings published today in *Nature Astronomy,* suggest that it is likely from a jet of matter, streaking out from a supermassive black hole at close to the speed of light.

The team, including researchers from MIT and the University of Birmingham, believe the jet is the product of a black hole that suddenly began devouring a nearby star, releasing a huge amount of energy in the process. Their findings could shed new light on how supermassive black holes feed and grow.

Astronomers have observed other such "tidal disruption events," or TDEs, in which a passing star is torn apart by a black hole's tidal forces. However AT 2022cmc is brighter than any TDE discovered to date, and is also the farthest TDE ever detected, at some 8.5 billion light years away.

The team measured the distance to the AT 2022cmc using the European Southern Observatory's Very Large Telescope, in Chile.

Dr Matt Nicholl, associate professor at the University of Birmingham, said: "Our spectrum told us that the source was hot: around 30,000 degrees, which is typical for a TDE. But we also saw some absorption of light by the galaxy where this event occurred. These absorption lines were highly shifted towards redder wavelengths, telling us that this galaxy was much further away than we expected!"

How could such a distant event appear so bright in our sky? The team says the black hole's jet may be pointing directly toward Earth, making the signal appear brighter than if the jet were pointing in any other direction. The effect is "Doppler boosting," and is similar to the amped-up sound of a passing siren.

AT 2022cmc is the fourth Doppler-boosted TDE ever detected and the first such event that has been observed since 2011. It is also the first boosted TDE discovered using an optical sky survey. As more powerful telescopes start up in the coming years, they will reveal more TDEs, which can shed light on how supermassive black holes grow and shape the galaxies around them.

Following AT 2022cmc's initial discovery, the team focused in on the signal using the Neutron star Interior Composition ExploreR (NICER), an X-ray telescope that operates aboard the International Space Station.

"Things looked pretty normal the first three days," recalls Dheeraj "DJ" Pasham, who was first author on the study. "Then we looked at it with an X-ray

telescope, and what we found was, the source was 100 times more powerful than the most powerful gamma-ray burst afterglow."

Typically, such bright flashes in the sky are gamma-ray bursts -- extreme jets of X-ray emissions that spew from the collapse of massive stars.

Dr Benjamin Gompertz, assistant professor at the University of Birmingham, led the gamma-ray burst comparison analysis. "Gamma-ray bursts are the usual suspects for events like this." he said. "However, as bright as they are, there is only so much light a collapsing star can produce. Because AT 2022cmc was so bright and lasted so long, we knew that something truly gargantuan must be powering it -- a supermassive black hole."

The extreme X-ray activity is believed to be powered by an "extreme accretion episode" when the shredded star creates a whirlpool of debris as it falls into the black hole. Indeed, the team found that AT 2022cmc's X-ray luminosity was comparable to, though brighter than, three previously detected TDEs.

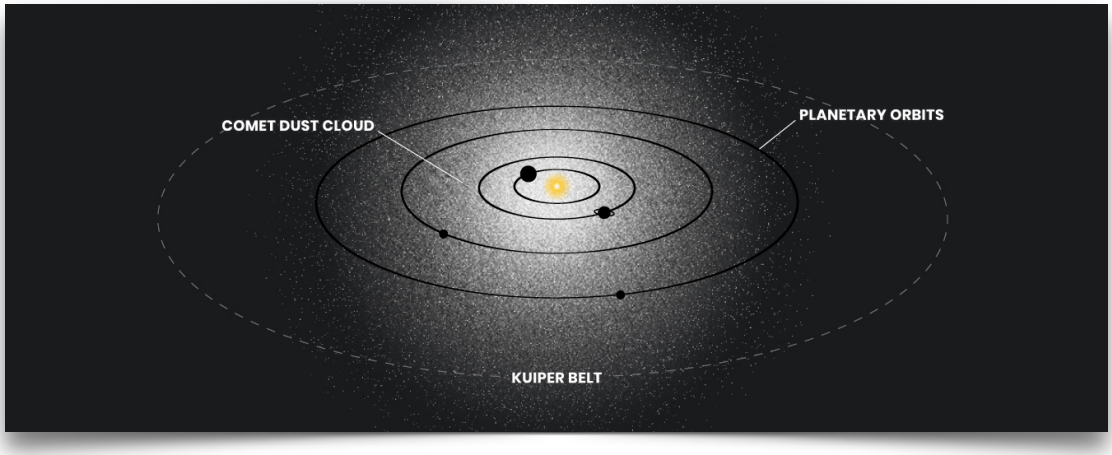
"It's probably swallowing the star at the rate of half the mass of the sun per year," Pasham estimates. "A lot of this tidal disruption happens early on, and we were able to catch this event right at the beginning, within one week of the black hole starting to feed on the star."

"We expect many more of these TDEs in the future," co-author Matteo Lucchini adds. "Then we might be able to say, finally, how exactly black holes launch these extremely powerful jets."

Other Birmingham scientists who contributed to this paper were Dr Graham Smith, Dr Samantha Oates, and PhD researchers Aysha Aamer, Evan Ridley and Xinyue Sheng. ☀

# HUBBLE DETECTS GHOSTLY GLOW SURROUNDING OUR SOLAR SYSTEM

Hubblesite, Dec 8, 2022




EXHAUST FROM INFALLING COMETS MAKES SPACE A DUSTY PLACE

Imagine walking into a room at night, turning out all the lights and closing the shades. Yet an eerie glow comes from the walls, ceiling, and floor. The faint light is barely enough to see your hands before your face, but it persists.

Sounds like a scene out of "Ghost Hunters?" No, for astronomers this is the real deal. But looking for something that's close to nothing is not easy. Astronomers searched through 200,000 archival images from Hubble Space Telescope and made tens of thousands of measurements on these images to look for any residual background glow in the sky. Like turning out the lights in a room, they subtracted the light from stars, galaxies, planets and the zodiacal light. Surprisingly, a ghostly, feeble glow was left over. It's equivalent to the steady light of ten fireflies spread across the entire sky.

**Where's that coming from?**

One possible explanation is that a shell of dust envelops our solar system all the way out to Pluto, and is reflecting sunlight. Seeing airborne dust caught in sunbeams is no surprise when cleaning the house. But this must have a more exotic origin. Because the glow is so smoothy distributed, the likely source is innumerable comets – free-flying dusty snowballs of

ice. They fall in toward the Sun from all different directions, spewing out an exhaust of dust as the ices sublimate due to heat from the Sun. If real, this would be a newly discovered architectural element of the solar system. It has remained invisible until very imaginative and curious astronomers, and the power of Hubble, came along.

Aside from a tapestry of glittering stars, and the glow of the waxing and waning Moon, the nighttime sky looks inky black to the casual observer. But how dark is dark?

To find out, astronomers decided to sort through 200,000 images from NASA's Hubble Space Telescope and made tens of thousands of measurements on these images to look for any residual background glow in the sky, in an ambitious project called SKYSURF. This would be any leftover light after subtracting the glow from planets, stars, galaxies, and from dust in the plane of our solar system (called zodiacal light).

When researchers completed this inventory, they found an exceedingly tiny excess of light, equivalent to the steady glow of 10 fireflies spread across the entire sky. That's like turning out all the lights in a shuttered room and still finding an eerie glow coming from the walls, ceiling, and floor.

The researchers say that one possible explanation for this residual glow is that our inner solar system contains a tenuous sphere of dust from comets that are falling into the solar system from all directions, and that the glow is sunlight reflecting off this dust. If real, this dust shell could be a new addition to the known architecture of the solar system.

This idea is bolstered by the fact that in 2021 another team of astronomers used data from NASA's New Horizons spacecraft to also measure the sky background. New Horizons flew by Pluto in 2015, and a small Kuiper belt object in 2018, and is now heading into interstellar space. The New Horizons measurements were done at a distance of 4 billion to 5 billion miles from the Sun. This is well outside the realm of the planets and asteroids where there is no contamination from interplanetary dust.

New Horizons detected something a bit fainter that is apparently from a more distant source than Hubble detected. The source of the background light seen by New Horizons also remains unexplained. There are numerous theories ranging from the decay of dark matter to a huge unseen population of remote galaxies.

"If our analysis is correct there's another dust component between us and the distance where New Horizons made measurements. That means this is some kind of extra light coming from inside our solar system," said Tim Carleton, of Arizona State University (ASU).

"Because our measurement of residual light is higher than New Horizons we think it is a local phenomenon that is not from far outside the solar system. It may be a new element to the contents of the solar system that has been hypothesized but not quantitatively measured until now," said Carleton.

Hubble veteran astronomer Rogier Windhorst, also of ASU, first got the idea to assemble Hubble data to go looking for any "ghost light." "More than 95% of the photons in the images from Hubble's archive come from distances less than 3 billion miles from Earth. Since Hubble's very early days, most Hubble users have discarded these sky-photons, as they are interested in the faint discrete objects in Hubble's images such as stars and galaxies," said Windhorst. "But these sky-photons contain important information which can be extracted thanks to Hubble's unique ability to measure faint brightness levels to high precision over its three decades of lifetime." ☀

# Astronomers report most distant known galaxies, detected and confirmed

Sciencedaily, Dec 9, 2022

An international team of astronomers has discovered the earliest and most distant galaxies confirmed to date using data from the James Webb Space Telescope (JWST). The telescope captured light emitted by these galaxies more than 13.4 billion years ago, which means the galaxies date back to less than 400 million years after the Big Bang, when the universe was only 2% of its current age.

Initial observations from JWST yielded several candidate galaxies at extreme distances, as had earlier observations with the Hubble Space Telescope. Now, four of these targets have been confirmed by obtaining long spectroscopic observations, which not only provide secure measurements of their distances, but also allow astronomers to characterize the physical properties of the galaxies.

"We've discovered galaxies at fantastically early times in the distant universe," said Brant Robertson, professor of astronomy and astrophysics at UC Santa Cruz. "With JWST, for the first time we can now find such distant galaxies and then confirm spectroscopically that they really are that far away."

Astronomers measure the distance to a galaxy by determining its redshift. Due to the expansion of the universe, distant objects appear to be receding from us and their light is stretched to longer, redder wavelengths by the Doppler effect. Photometric techniques based on images captured through different filters can provide redshift estimates, but definitive measurements require spectroscopy, which separates the light from an object into its component wavelengths.

The new findings focus on four galaxies with redshifts higher than 10. Two galaxies initially observed by Hubble now have confirmed redshifts of 10.38 and 11.58. The two most distant galaxies, both detected in JWST images, have redshifts of 13.20 and 12.63, making them the most distant galaxies confirmed by spectroscopy to date. A redshift of 13.2 corresponds to about 13.5 billion years ago.

"These are well beyond what we could have imagined finding before JWST," Robertson said. "At redshift 13, the universe is only about 325 million years old."

Robertson and Emma Curtis-Lake from the University of Hertfordshire (U.K.) will be presenting the new findings on December 12 at a Space Telescope Science Institute (STScI) conference in Baltimore on "First Science Results from JWST." They are the lead authors of two papers on the results that have not yet been through the peer-review process.

The observations result from a collaboration of scientists who led the development of two of the instruments onboard Webb, the Near-Infrared Camera (NIRCam) and the Near-Infrared Spectrograph (NIRSpec). The investigation of the faintest and earliest galaxies was the leading motivation in the concepts for these instruments. In 2015, the instrument teams joined together to propose the JWST Advanced Deep Extragalactic Survey (JADES), an ambitious program that has been allocated just over one month of the telescope's time and is designed to provide a view of the early universe unprecedented in both depth and detail. JADES is an international collaboration of more than eighty astronomers from ten countries.

"These results are the culmination of why the NIRCam and NIRSpec teams joined together to execute this observing program," said Marcia Rieke, NIRCam principal investigator at the University of Arizona.

The JADES program began with NIRCam, using over 10 days of mission time to observe a small patch of sky in and around the Hubble Ultra Deep Field. Astronomers have been studying this region for over 20 years with nearly all large telescopes. The JADES team observed the field in nine different infrared wavelength ranges, capturing exquisite images that reveal nearly 100,000 distant galaxies, each billions of light years away.

The team then used the NIRSpec spectrograph for a single three-day observation period to collect the light from 250 faint galaxies. This yielded precise redshift measurements and revealed the properties of the gas and stars in these galaxies.

"With these measurements, we can know the intrinsic brightness of the galaxies and figure out how many stars they have," Robertson said. "Now we can start to really pick apart how galaxies are put together over time."

Coauthor Sandro Tacchella from the University of Cambridge in the United Kingdom added, "It is hard to understand galaxies without understanding the initial periods of their development. Much as with humans, so much of what happens later depends on the impact of these early generations of stars. So many questions about galaxies have been waiting for the transformative opportunity of Webb, and we're thrilled to be able to play a part in revealing this story."

According to Robertson, star formation in these early galaxies would have begun about 100 million years earlier than the age at which they were observed, pushing the formation of the earliest stars back to around 225 million years after the Big Bang.

"We are seeing evidence of star formation about as early as we could expect based on our models of galaxy formation," he said.

Other teams have identified candidate galaxies at even higher redshifts based on photometric analyses of JWST images, but these have yet to be confirmed by spectroscopy. JADES will continue in 2023 with a detailed study of another field, this one centered on the iconic Hubble

Deep Field, and then a return to the Ultra Deep Field for another round of deep imaging and spectroscopy. Many more candidates in the field await spectroscopic investigation, with hundreds of hours of additional time already approved. ☀

# These Stargazing Domes in Washington's Cascade Mountains Have 15-foot-wide Skylights and Heated Decks With Private Saunas and Hot Tubs

By Evie Carrick

TRAVEL+LEISURE, DECEMBER 12, 2022

Combine dark nights and bright stars with 15-foot-wide skylights in igloo-like domes, and you've got the makings of an unforgettable stargazing experiences. The brand-new Oculis Lodge, a stargazing resort that will be set deep in the Cascade Mountains, is designed to help travelers experience the wonders of nature — from star-studded skies to the remoteness of the mountains — in complete luxury. The first domes on property will be ready to receive guests in spring 2023.

Each dome will have a private six-person Jacuzzi, four-person sauna, and a heated deck for practicing yoga or working out (gear will be provided). A private fire pit, hammock, and telescope will round out the offerings, which are all designed to enhance the stargazing experience.

Those who don't want to brave the mountain chill will instead cozy up inside and view the stars from the expansive, 15-foot-wide skylight on the roof of the dome. The modern, bright domes will provide up to six guests with 700-square-feet of space, including a bedroom, a four-person sleeping loft, a bathroom with bathtub, a washer and dryer, and a full kitchen. The centerpiece of the dome — the round skylight — will provide nonstop views of the skies above.

# Gigantic Quake Recorded on Mars Was as Powerful as All Others Combined

By Michelle Starr
Sciencealert, December 16, 2023

A tremendous, record-breaking quake that rocked Mars in May of this year was at least five times larger than the previous record-holder, new research has revealed.

It's unclear what the source of the quake was, but it was definitely peculiar. In addition to being the most powerful quake recorded yet on Mars, it was also the longest by a significant amount, shaking the red planet for 10 hours.

"The energy released by this single marsquake is equivalent to the cumulative energy from all other marsquakes we've seen so far," says seismologist John Clinton of the Swiss Federal Institute of Technology in Switzerland, "and although the event was over 2000 kilometers (1200 miles) distant, the waves recorded at InSight were so large they almost saturated our seismometer."

The new analysis of the quake, published in Geophysical Research Letters, set its magnitude at 4.7. The previous record-holder was a magnitude 4.2 quake detected in August 2021.

That might not sound like a big quake by Earth standards, where the most powerful quake ever recorded tipped a magnitude of around 9.5. But for a planet that had been thought seismically inactive until NASA's InSight probe started recording its interior in early 2019, it's impressive.

Although Mars and Earth have a lot in common, there are some really key differences. Mars doesn't have tectonic plates; and nor does it have a coherent, global magnetic field, often interpreted as a sign that not much is happening in the Martian interior, since Earth's magnetic field is theorized to be the result of internal thermal convection.

InSight has revealed that Mars isn't as seismically quiet as we'd previously assumed. It creaks and rumbles, hinting at volcanic activity under the Cerberus Fossae region where the InSight lander squats, monitoring the planet's hidden innards.

But determining the activity status of the Martian interior isn't the only reason to monitor marsquakes. The way seismic waves propagate through and across the surface of a planet can help reveal density variations in its interior. In other words, they can be used to reconstruct the structure of the planet.

This is usually done here on Earth, but hundreds of quakes recorded by InSight have allowed scientists to build a map of the Martian interior, too.

The May quake may have been just one seismic event, but it seems it was an important one.

"For the first time we were able to identify surface waves, moving along the crust and upper mantle, that have traveled around the planet multiple times," Clinton says.

In two other, separate papers in Geophysical Research Letters, teams of scientists have analyzed these waves to try to understand the structure of the crust on Mars, identifying regions of sedimentary rock and possible volcanic activity inside the crust.

But there's more to be done on the quake itself. Firstly, it originated near, but not from, the Cerberus Fossae region, and could not be traced to any obvious surface features. This suggests that it could be related to something hidden below the crust.

Secondly, marsquakes usually have either a high or a low frequency, the former characterized by quick, short tremors, and the latter by longer, deeper waves with bigger amplitudes. This quake combined both frequency ranges, and the researchers aren't entirely sure why. However, it's possible that previously recorded high- and low-frequency marsquakes analyzed separately may be two parts of the same seismic event.

This could mean that scientists need to rethink how marsquakes are understood and analyzed, revealing even more secrets hiding under the deceptively quiet Martian surface.

"This was definitely the biggest marsquake that we have seen," says planetary scientist Taichi Kawamura of the Paris Globe Institute of Physics in France. ☀

# Spot the Messenger: Observe Mercury

By David Prosper

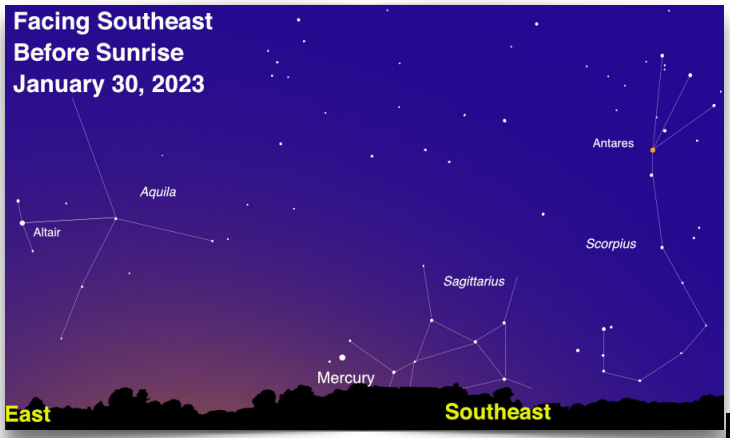
NIGHTSKYNETWORK, JANUARY 2023

Most planets are easy to spot in the night sky, but have you spotted Mercury? Nicknamed the Messenger for its speed across the sky, Mercury is also the closest planet to the Sun. Its swift movements close to our Sun accorded it special importance to ancient observers, while also making detailed study difficult. However, recent missions to Mercury have resulted in amazing discoveries, with more to come.

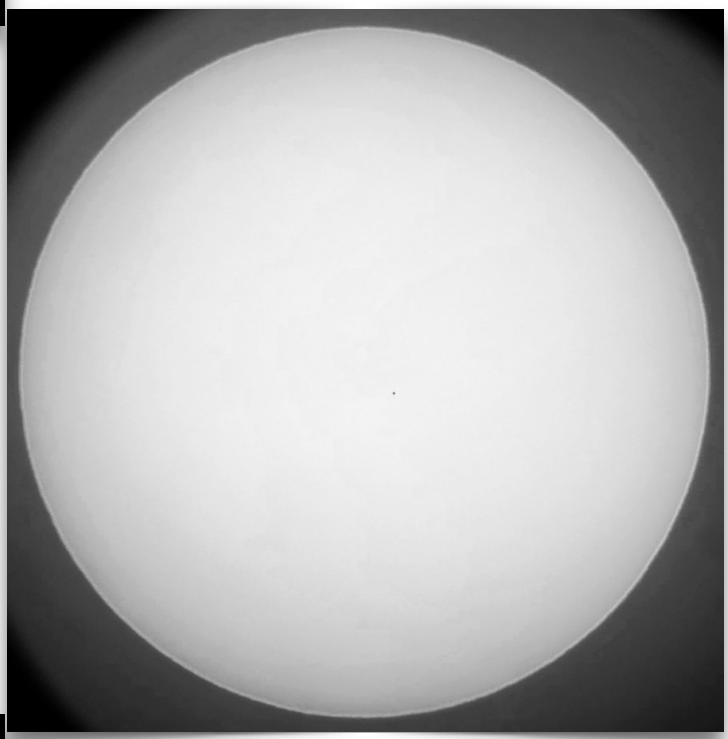
Mercury can be one of the brightest planets in the sky – but also easy to miss! Why is that? Since it orbits so close to the Sun, observing Mercury is trickier than the rest of the "bright planets" in our solar system: Venus, Mars, Jupiter, and Saturn. Mercury always appears near our Sun from our Earth-bound point of view, making it easy to miss in the glare of the Sun or behind small obstructions along the horizon. That's why prime Mercury viewing happens either right before sunrise or right after sunset; when the Sun is blocked by the horizon, Mercury's shine can then briefly pierce the glow of twilight. Mercury often appears similar to a "tiny Moon" in a telescope since, like fellow inner planet Venus, it shows distinct phases when viewed from Earth! Mercury's small size means a telescope is needed to observe its phases since they can't be discerned with your unaided eye. Safety warning: If you want to observe Mercury with your telescope during daytime or before sunrise, be extremely careful: you don't want the Sun to accidentally enter your telescope's field of view. As you may already well understand, this is extremely dangerous and can not only destroy your equipment, but permanently blind you as well! That risk is why NASA does not allow space telescopes like Hubble or the JWST to view Mercury or other objects close to the Sun, since even the tiniest error could destroy billions of dollars of irreplaceable equipment.

Despite being a small and seemingly barren world, Mercury is full of interesting features. It's one of the four rocky (or terrestrial) planets in our solar system, along with Earth, Venus, and Mars. Mercury is the smallest planet in our solar system and also possesses the most eccentric, or non-circular, orbit of any planet as well: during a Mercurian year of 88 Earth days, the planet orbits between 29 million and 43 million miles from our Sun – a 14-million-mile difference! Surprisingly, Mercury is **not** the hottest planet in our solar system, despite being closest to the Sun; that honor goes to Venus, courtesy its thick greenhouse shroud of carbon dioxide. Since Mercury lacks a substantial atmosphere and the insulating properties a layer of thick air brings to a planet, its temperature swings wildly between a daytime temperature of 800 degrees Fahrenheit (427 degrees Celsius) and -290 degrees Fahrenheit (-179 degrees Celsius) at night. Similar to our Moon, evidence of water ice is present at Mercury's poles, possibly hiding in the frigid permanent shadows cast inside a few craters. Evidence for ice on Mercury was first detected by radar observations from Earth, and followup observations from NASA's MESSENGER mission added additional strong evidence for its presence. Mercury sports a comet-like tail made primarily of sodium which has been photographed by skilled astrophotographers. The tail results from neutral atoms in its thin atmosphere being pushed away from Mercury by pressure from the nearby Sun's radiation.

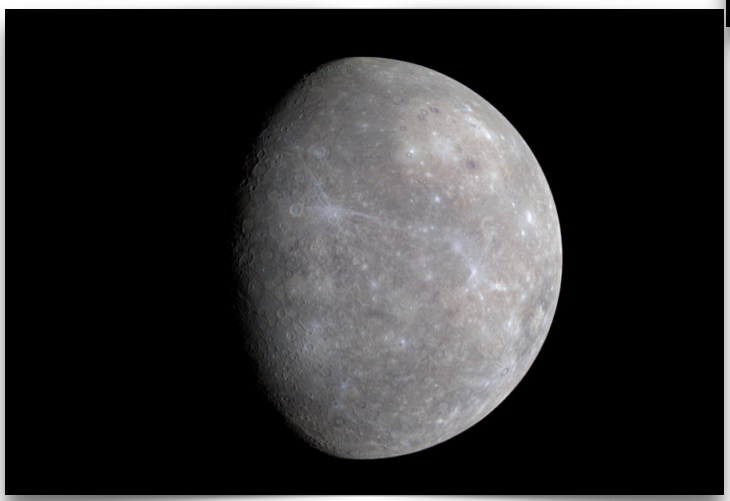
NASA's Mariner 10 was Mercury's first robotic explorer, flying by three times between 1974-1975. Decades later, NASA's MESSENGER first visited Mercury in 2008, flying by three times before settling into an orbit in 2011. MESSENGER thoroughly studied and mapped the planet before smashing into Mercury at mission's end in 2015. Since MESSENGER, Mercury was briefly visited by BepiColombo, a joint ESA/JAXA probe, which first flew by in 2021 and is expected to enter orbit in 2025 - after completing six flybys. Need more Mercury in your life? Check out NASA's discoveries and science about Mercury at solarsystem.nasa.gov/mercury/, and visit the rest of the universe at nasa.gov. ☀




Mercury reaches maximum western elongation on the morning of January 30, which means that your best chance to spot it is right before sunrise that day! Look for Mercury towards the southeast and find the clearest horizon you can. Observers located in more southern latitudes of the Northern Hemisphere have an advantage when observing Mercury as it will be a bit higher in the sky from their location, but it's worth a try no matter where you live. Binoculars will help pick out Mercury's elusive light from the pre-dawn glow of the Sun. Image created with assistance from Stellarium



On rare occasion, Earthbound observers can observe Mercury, like Venus, transiting the Sun. Mercury frequently travels between Earth and the Sun, but only rarely does the geometry of all three bodies line up to allow observers from Earth to view Mercury's tiny shadow as it crosses our star's massive disc. You can see one such event in this photo taken by Laurie Ansorge of the Westminster Astronomical Society on November 11, 2019. If you missed it, set a reminder for Mercury's next transit: November 13, 2032.

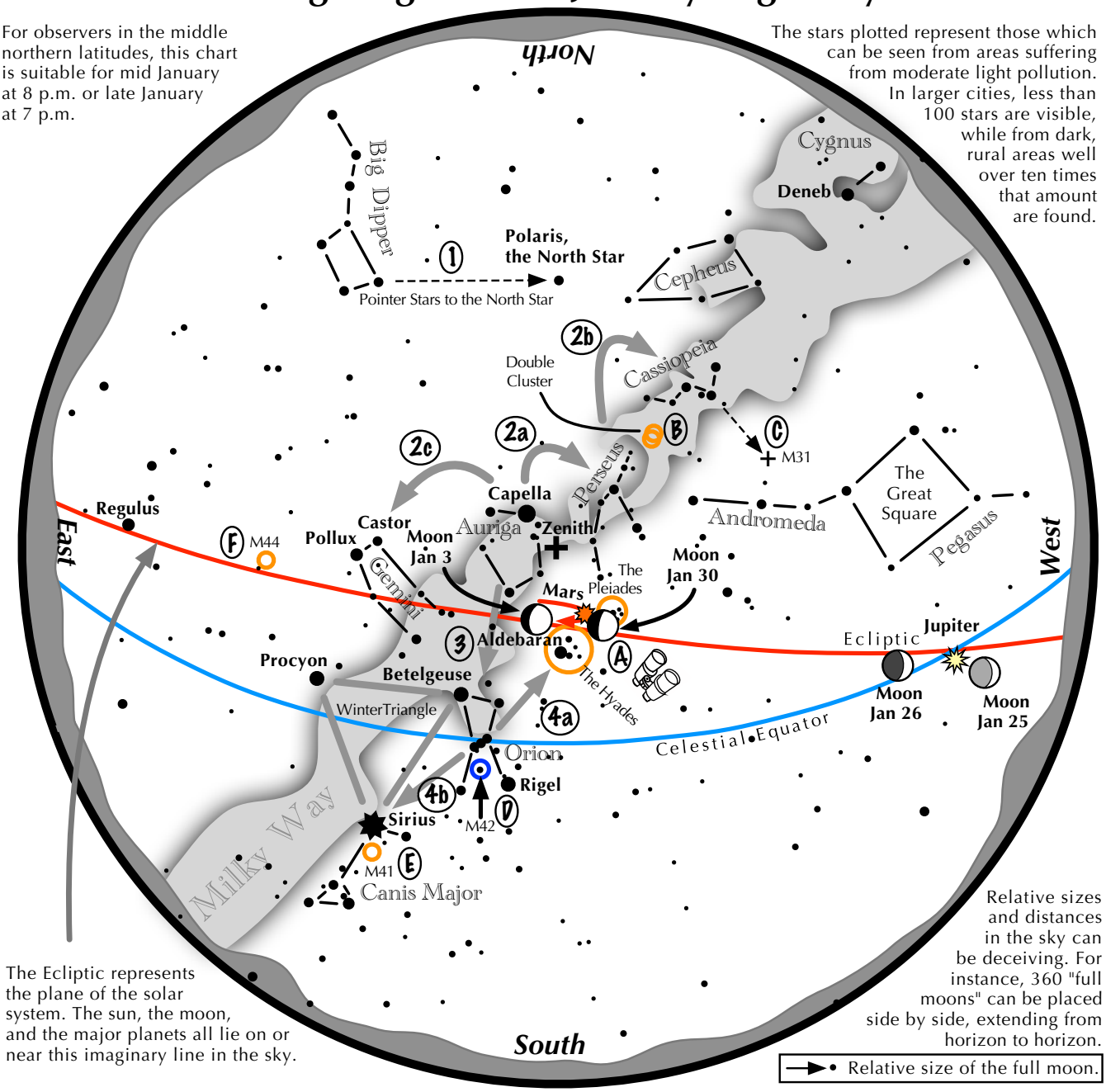


Mercury is hot, small, and heavily cratered across its gray surface, as seen in this image from NASA MESSENGER. Mercury is the most heavily cratered planet in our solar system, since it lacks either a substantial atmosphere or geologic activity to erode surface features like craters - similar in certain aspects to the surface of our own Moon.
Credit: NASA/Johns Hopkins University Applied Physics Laboratory/ Carnegie Source: https://solarsystem.nasa.gov/resources/439/mercurys-subtle-colors/

# Navigating the mid January Night Sky

For observers in the middle northern latitudes, this chart is suitable for mid January at 8 p.m. or late January 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 winter night sky: Simply start with what you know or with what you can easily find.

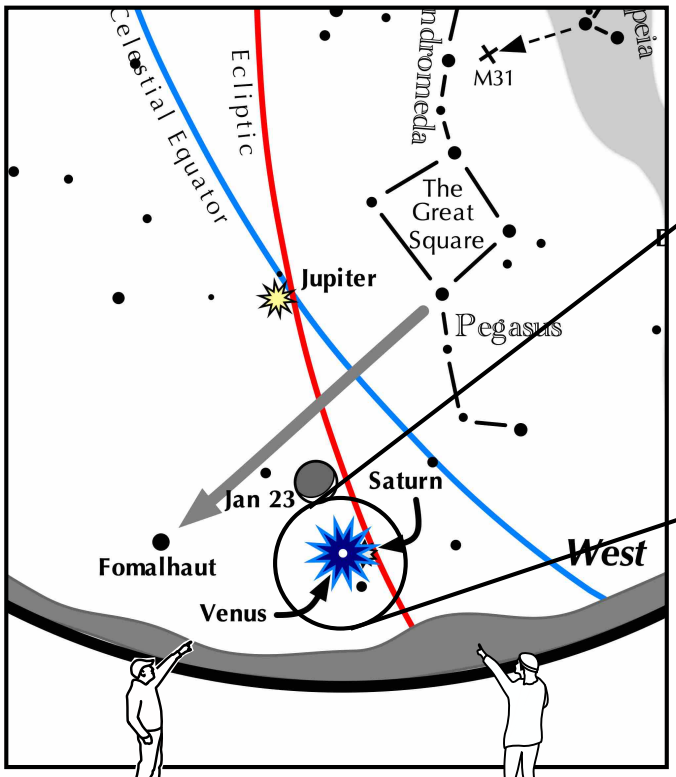
1. Above the northeast horizon rises the Big Dipper. Draw a line from its two end bowl stars upwards to the North Star.
2. Face south. Overhead twinkles the bright star Capella in Auriga. Jump northwestward along the Milky Way first to Perseus, then to the "W" of Cassiopeia. Next Jump southeastward from Capella to the twin stars Castor and Pollux of Gemini.
3. Directly south of Capella stands the constellation of Orion with its three Belt Stars, its bright red star Betelgeuse, and its bright blue-white star, Rigel.
4. Use Orion's three Belt stars to point to the red star Aldebaran, then to the Hyades, and the Pleiades star clusters. Travel southeast from the Belt stars to the brightest star in the night sky, Sirius.

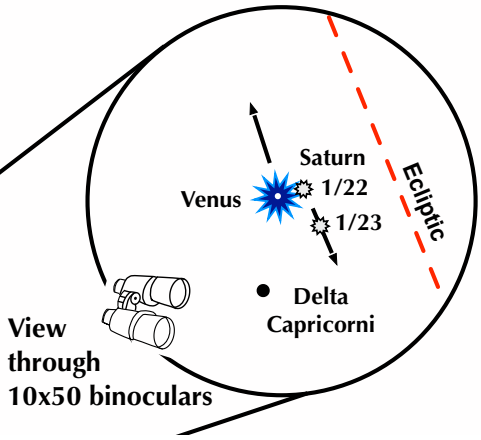
**Binocular Highlights**

**A:** Examine the stars of the Pleiades and Hyades, two naked eye star clusters. **B:** Between the "W" of Cassiopeia and Perseus lies the Double Cluster. **C:** The three westernmost stars of Cassiopeia's "W" point south to M31, the Andromeda Galaxy, a "fuzzy" oval. **D:** M42 in Orion is a star forming nebula. **E:** Look south of Sirius for the star cluster M41. **F:** M44, a star cluster barely visible to the naked eye, lies to the southeast of Pollux.

**Astronomical League** *www.astroleague.org/outreach; duplication is allowed and encouraged for all free distribution.*

## In the early evening of January 22, try this challenge:




View to the west-southwest on January 22 & 23 45 minutes after sunset

### Venus meets Saturn

On January 1, Venus appears very low above the west-southwestern horizon. As the month proceeds, the bright planet climbs higher each evening. Saturn, on the otherhand, begins the month much higher than Venus, and drops closer to the horizon each evening.

On January 22, the two planets reach their closest to each other. Look to the west-southwest 45 minutes after sunset for the pair. Binoculars will help pick Saturn out in the twilight.

On the following evening, the thin crescent moon floats to their upper left, seemingly full with earthshine.

## 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.