Volume 51 Number 2 February 2025

The Celestial Mechanic

The Official Newsletter of the Astronomy Associates of Lawrence

Coming Events

Monthly Meeting
February 23, 2025, 7:00PM
Baker Wetlands Discovery Center

Public Observing
February 23, 2025, 8:00PM
Baker Wetlands Discovery Center

Club Officers
President
Rick Heschmeyer email

AICOR
William Winkler email

NSN Coordinator
Howard Edin email

Faculty Advisor
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Inside This Issue

Report From the Officers

By Rick Heschmeyer

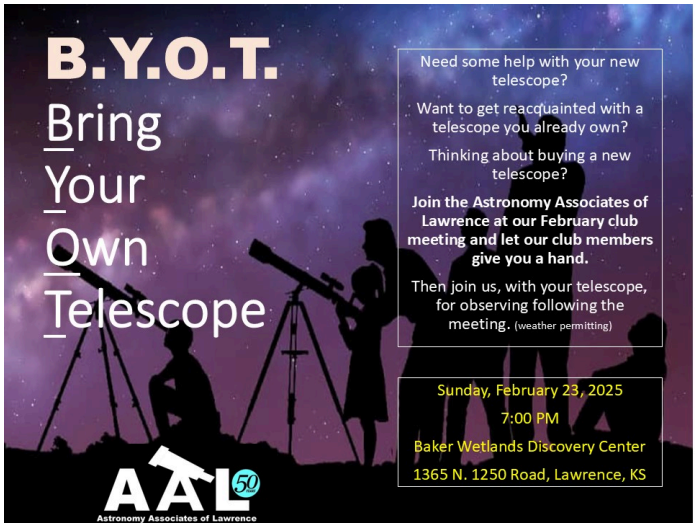
Welcome back! I hope everyone's holiday season went well and you survived the heavy snows and bitter cold we had to deal with in January.

Our first club meeting of 2025, originally scheduled for Sunday, January 26 was postponed to allow everyone to watch the Kansas City Chiefs play in the AFC Championship game that evening. The meeting will now take place on Sunday, February 2 starting at 7:00 PM at Baker Wetlands Discovery Center. Thanks to the Discovery Center staff and to AAL Member David Kolb for being flexible on the meeting date. David will discuss and display his homebuilt spectroheliograph, that he constructed in late 2023, in a presentation entitled "Amateur Spectroheliography with Sol'Ex". The meeting will be followed by public observing, weather permitting.

I hope everyone had a chance to watch the Moon occult the planet Mars on January 13. It was cold and clear. The celestial pair put on quite the show as the Moon passed in front of Mars just before 8:00 PM only to reappear after a little more than an hour. Check out a couple of videos of the beginning and end of the occultation on the club's Facebook page.

The next KU Public Telescope Night will take place on February 9, 2025. Once I receive the flyer for the event, I will share with everyone.

Our February club meeting on Sunday, February 23rd, will be a B.Y.O.T. (Bring Your Own Telescope) event. We need to get the word out to anyone you know who may have just received a new telescope for the holidays, anyone who needs help with a telescope they already own, anyone that has a telescope but is just out of practice using it, or any AAL member who wants to share views of the night sky through their equipment. Have them bring their telescope to the meeting and AAL members will help them learn about it and how to use it, and then everyone will go outside and use their telescopes to observe. This will be a great way to interact with the public and get more people looking up. Please plan on attending this meeting so we have plenty of help.



NASA's Webb Finds Planet-Forming Disks Lived Longer in Early Universe

HUBBLESITE, DECEMBER 16, 2024

Summary

New data confirms Hubble finding and refutes current theories of planet formation in universe's early days.

Thanks to its extraordinary sensitivity and resolution, Webb just solved a mystery more than two decades old. In 2003, the Hubble Space Telescope saw evidence of a massive planet around an ancient star. This puzzled astronomers, who knew that such stars in the early universe lacked a lot of the heavier elements considered essential for building planets. Current models predict that the disks around this type of star have short lifetimes, so short that planets cannot grow large, or maybe even form at all. Yet, there it was!

Astronomers then turned to a nearby proxy for the early universe – the star-forming region NGC 346. There, Hubble saw signs that planet-forming disks existed around stars 20 to 30 million years old, much older than theories predicted such disks could survive.

The Hubble findings were intriguing, but without a way to obtain spectra , scientists could not be sure they were witnessing genuine accretion and the presence of disks. Now, using Webb, researchers have confirmed the presence of planet-forming disks in NGC 346, and discovered that these disks are long-lived. The finding affirms the Hubble result, and it is causing scientists to rethink current models of planet formation.

NASA's James Webb Space Telescope just solved a conundrum by proving a controversial finding made with the agency's Hubble Space Telescope more than 20 years ago.

In 2003, Hubble provided evidence of a massive planet around a very old star, almost as old as the universe. Such stars possess only small amounts of heavier elements that are the building blocks of planets. This implied that some planet formation happened when our universe was very young, and those planets had time to form and grow big inside their primordial disks, even bigger than Jupiter. But how? This was puzzling.

To answer this question, researchers used Webb to study stars in a nearby galaxy that, much like the early universe, lacks large amounts of heavy elements. They found that not only do some stars there have planet-forming disks, but that those disks are longer-lived than those seen around young stars in our Milky Way galaxy.

"With Webb, we have a really strong confirmation of what we saw with Hubble, and we must rethink how we model planet formation and early evolution in the young universe," said study leader Guido De Marchi of the European Space Research and Technology Centre in Noordwijk, Netherlands.

A Different Environment in Early Times

In the early universe, stars formed from mostly hydrogen and helium, and very few heavier elements such as carbon and iron, which came later through supernova explosions.

"Current models predict that with so few heavier elements, the disks around stars have a short lifetime, so short in fact that planets cannot grow big," said the

Webb study's co-investigator Elena Sabbi, chief scientist for Gemini Observatory at the National Science Foundation's NOIRLab in Tucson. "But Hubble did see those planets, so what if the models were not correct and disks could live longer?"

To test this idea, scientists trained Webb on the Small Magellanic Cloud, a dwarf galaxy that is one of the Milky Way's nearest neighbors. In particular, they examined the massive, star-forming cluster NGC 346, which also has a relative lack of heavier elements. The cluster served as a nearby proxy for studying stellar environments with similar conditions in the early, distant universe.

Hubble observations of NGC 346 from the mid 2000s revealed many stars about 20 to 30 million years old that seemed to still have planet-forming disks around them. This went against the conventional belief that such disks would dissipate after 2 or 3 million years.

"The Hubble findings were controversial, going against not only empirical evidence in our galaxy but also against the current models," said De Marchi. "This was intriguing, but without a way to obtain spectra of those stars, we could not really establish whether we were witnessing genuine accretion and the presence of disks, or just some artificial effects."

Now, thanks to Webb's sensitivity and resolution, scientists have the first-ever spectra of forming, Sun-like stars and their immediate environments in a nearby galaxy.

"We see that these stars are indeed surrounded by disks and are still in the process of gobbling material, even at the relatively old age of 20 or 30 million years," said De Marchi. "This also implies that planets have more time to form and grow around these stars than in nearby star-forming regions in our own galaxy."

A New Way of Thinking

This finding refutes previous theoretical predictions that when there are very few heavier elements in the gas around the disk, the star would very quickly blow away the disk. So the disk's life would be very short, even less than a million years. But if a disk doesn't stay around the star long enough for the dust grains to stick together and pebbles to form and become the core of a planet, how can planets form?

The researchers explained that there could be two distinct mechanisms, or even a combination, for planet-forming disks to persist in environments scarce in heavier elements.

First, to be able to blow away the disk, the star applies radiation pressure. For this pressure to be effective, elements heavier than hydrogen and helium would have to reside in the gas. But the massive star cluster NGC 346 only has about ten percent of the heavier elements that are present in the chemical composition of our Sun. Perhaps it simply takes longer for a star in this cluster to disperse its disk.

The second possibility is that, for a Sun-like star to form when there are few heavier elements, it would have to start from a larger cloud of gas. A bigger gas cloud will produce a bigger disk. So there is more mass in the disk and therefore it would take longer to blow the disk away, even if the radiation pressure were working in the same way.

"With more matter around the stars, the accretion lasts for a longer time," said Sabbi. "The disks take ten times longer to disappear. This has implications for how you form a planet, and the type of system architecture that you can have in these different environments. This is so exciting."

The science team's paper appears in the Dec. 16 issue of The Astrophysical Journal.

The James Webb Space Telescope is the world's premier space science observatory. Webb is solving mysteries in our solar system, looking beyond to distant worlds around other stars, and probing the mysterious structures and origins of our universe and our place in it. Webb is an international program led by NASA with its partners, ESA (European Space Agency) and CSA (Canadian Space Agency).

The Hubble Space Telescope has been operating for over three decades and continues to make ground-breaking discoveries that shape our fundamental understanding of the universe. Hubble is a project of international cooperation between NASA and ESA (European Space Agency). NASA's Goddard Space Flight Center in Greenbelt manages the telescope and mission operations. Lockheed Martin Space, based in Denver also supports mission operations at Goddard. The Space Telescope Science Institute in Baltimore, which is operated by the Association of Universities for Research in Astronomy, conducts Hubble science operations for NASA.

☀

The expansion of the universe could be a mirage, new theoretical study suggests

By Robert Lea

LiveScience, June 20, 2023

New research looking at the cosmological constant problem suggests the expansion of the universe could be an illusion.

Astronomers use the light from distant stars, such as the Helix Nebula seen here, to measure the apparent expansion of the universe.

The expansion of the universe could be a mirage, a potentially controversial new study suggests. This rethinking of the cosmos also suggests solutions for the puzzles of dark energy and dark matter, which scientists believe account for around 95% of the universe's total energy and matter but remain shrouded in mystery.

The novel new approach is detailed in a paper published June 2 in the journal Classical and Quantum Gravity, by University of Geneva professor of theoretical physics Lucas Lombriser.

Scientists know the universe is expanding because of redshift, the stretching of light's wavelength towards the redder end of the spectrum as the object emitting it moves away from us. Distant galaxies have a higher redshift than those nearer to us, suggesting those galaxies are moving ever further from Earth.

More recently, scientists have found evidence that the universe's expansion isn't fixed, but is actually accelerating faster and faster. This accelerating expansion is captured by a term known as the cosmological constant, or lambda.

The cosmological constant has been a headache for cosmologists because predictions of its value made by particle physics differ from actual observations by 120 orders of magnitude. The cosmological constant has therefore been described as "the worst prediction in the history of physics."

Cosmologists often try to resolve the discrepancy between the different values of lambda by proposing new particles or physical forces but Lombriser tackles it by reconceptualizing what's already there..

"In this work, we put on a new pair of glasses to look at the cosmos and its unsolved puzzles by performing a mathematical transformation of the physical laws that govern it," Lombriser told Live Science via email.

In Lombriser's mathematical interpretation, the universe isn't expanding but is flat and static, as Einstein once believed. The effects we observe that point to expansion are instead explained by the evolution of the masses of particles — such as protons and electrons — over time.

In this picture, these particles arise from a field that permeates space-time. The cosmological constant is set by the field's mass and because this field fluctuates, the masses of the particles it gives birth to also fluctuate. The cosmological constant still varies with time, but in this model that variation is due to changing particle mass over time, not the expansion of the universe.

In the model, these field fluctuations result in larger redshifts for distant galaxy clusters than traditional cosmological models predict. And so, the cosmological constant remains true to the model's predictions.

"I was surprised that the cosmological constant problem simply seems to disappear in this new perspective on the cosmos," Lombriser said.

A recipe for the dark universe

Lombriser's new framework also tackles some of cosmology's other pressing problems, including the nature of dark matter. This invisible material outnumbers ordinary matter particles by a ratio of 5 to 1, but remains mysterious because it doesn't interact with light.

Lombriser suggested that fluctuations in the field could also behave like a so-called axion field, with axions being hypothetical particles that are one of the suggested candidates for dark matter.

These fluctuations could also do away with dark energy, the hypothetical force stretching the fabric of space and thus driving galaxies apart faster and faster. In this model, the effect of dark energy, according to Lombriser, would be explained by particle masses taking a different evolutionary path at later times in the universe.

In this picture "there is, in principle, no need for dark energy," Lombriser added.

Post-doctoral researcher at the Universidad ECCI, Bogotá, Colombia, Luz Ángela García, was impressed with Lombriser's new interpretation and how many problems it resolves.

"The paper is pretty interesting, and it provides an unusual outcome for multiple problems in cosmology," García, who was not involved in the research, told Live Science. "The theory provides an outlet for the current tensions in cosmology."

However, García urged caution in assessing the paper's findings, saying it contains elements in its theoretical model that likely can't be tested observationally, at least in the near future. ☀

Pluto may have captured its moon Charon with a kiss

The pair of Kuiper belt objects linked up in a “kiss-and-capture” collision

By Lisa Grossman

SCIENCENEWS, JANUARY 6, 2025

Pluto and Charon’s meet-cute may have started with a kiss. New computer simulations of the dwarf planet and its largest moon suggest that the pair got together in a “kiss-and-capture” collision, where the two bodies briefly joined up before settling into their current positions.

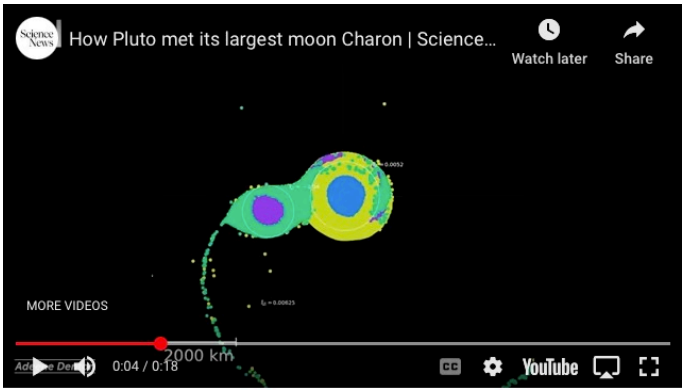
“It’s a U-Haul situation,” says planetary scientist Adeene Denton of the Southwest Research Institute in Boulder, Colo., who reports the results January 6 in Nature Geoscience. “They kiss and they say, ‘Yeah, this is it. I want to build a system together with you.’ And then they do.”

At half Pluto’s size and 12 percent of its mass, Charon is an unusually large moon. Since the 1990s, planetary scientists have thought that Charon could have formed in a similar way to Earth’s moon: An impact on the main body splashed hot molten material into orbit, where it eventually coalesced into a large natural satellite.

But, just like with Earth’s moon, the details are fuzzy. “It goes, something hit Pluto, question mark question mark question mark, Charon is now there,” Denton says.

Computer simulations of such collisions seemed to result in a system like Pluto and Charon. But those simulations treated the rocky, icy protoplanets as fluids, ignoring their material strength. That’s a decent assumption for large objects like gas giants or galaxies, which do behave like fluids when something hits them. But Pluto and Charon are ice-wrapped rocks. And it turns out you can’t ignore that.

The New Horizons spacecraft flyby in 2015 captured these images of Pluto (lower right) and its large moon Charon (upper left). While this is a composite, and not to scale, new simulations reveal the pair’s close relationship.



Simulations of Pluto’s and Charon’s first encounter show that each body remained mostly intact after a brief but intense impact. Pluto’s core is shown in blue, Charon’s core is purple. Pluto’s solid ice is shown in yellow, and Charon’s ice is green. The encounter shown here lasts about 60 hours.

The real collision would have been a lot less splashy, Denton says. She and her colleagues ran collision simulations that included Pluto's and Charon's rocky cores and icy mantles and crusts. The team found that the protoplanets had an instant connection.

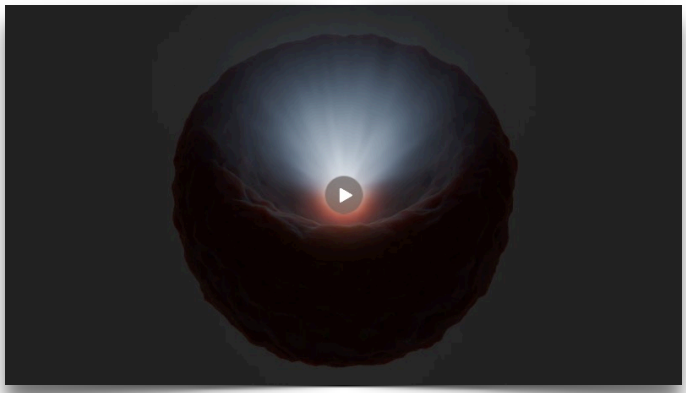
The pair joined up and rotated together, but each body remained basically intact. After about 30 hours of contact, Charon separated from Pluto and began to migrate into the orbit it has today.

Denton and colleagues found that two other pairs of objects, dwarf planet Eris and its moon Dysnomia and dwarf planet Orcus and its moon Vanth, could also be explained by "kiss-and-capture" collisions. She plans to extend the work to other objects with different masses and compositions.

"Can this still work? I'm pretty confident that it does," she says. "If that's true, kiss-and-capture happened all over the Kuiper Belt in the solar system's history. It's very romantic." ☀

How Many Black Holes Are Hiding? NASA Study Homes in on Answer

Jpl, January 13, 2025



A thick torus of gas and dust surrounding a supermassive black hole is shown in this artist's concept. The torus can obscure light that's generated by material falling into the black hole

An effort to find some of the biggest, most active black holes in the universe provides a better estimate for the ratio of hidden to unhidden behemoths.

Multiple NASA telescopes recently helped scientists search the sky for supermassive black holes — those up to billions of times heavier than the Sun. The new survey is unique because it was as likely to find massive black holes that are hidden behind thick clouds of gas and dust as those that are not.

Astronomers think that every large galaxy in the universe has a supermassive black hole at its center. But testing this hypothesis is difficult because researchers can't hope to count the billions or even trillions of supermassive black holes thought to exist in the universe. Instead they have to extrapolate from smaller samples to learn about the larger population. So accurately measuring the ratio of hidden supermassive black holes in a given sample helps scientists better estimate the total number of supermassive black holes in the universe.

The new study published in the Astrophysical Journal found that about 35% of supermassive black holes are heavily obscured, meaning the surrounding clouds of gas and dust are so thick they block even low-energy X-ray light. Comparable searches have previously found less than 15% of supermassive black holes are so obscured. Scientists think the true split should be closer to 50/50 based on models of how galaxies grow. If observations continue to indicate significantly less than half of supermassive black holes are hidden, scientists will need to adjust some key ideas they have about these objects and the role they play in shaping galaxies.

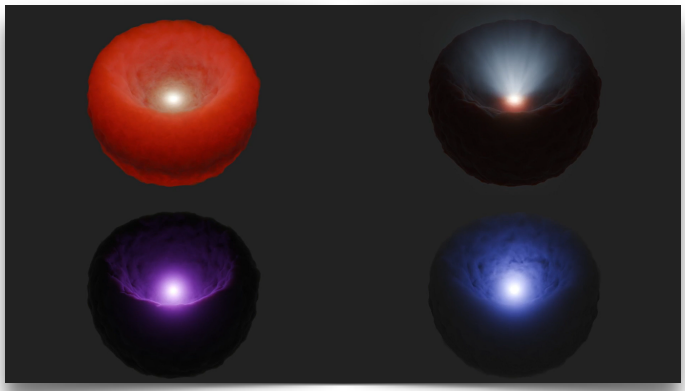
Hidden Treasure

Although black holes are inherently dark — not even light can escape their gravity — they can also be some of the brightest objects in the universe: When gas gets pulled into orbit around a supermassive black hole, like water circling a drain, the extreme gravity creates such intense friction and heat that the gas reaches hundreds of thousands of degrees and radiates so brightly it can outshine all the stars in the surrounding galaxy.

The clouds of gas and dust that surround and replenish the bright central disk may roughly take the shape of a torus, or doughnut. If the doughnut hole is facing toward Earth, the bright central disk within it is visible; if the doughnut is seen edge-on, the disk is obscured.

Most telescopes can rather easily identify face-on supermassive black holes, though not edge-on ones. But there's an exception to this that the authors of the new paper took advantage of: The torus absorbs light from the central source and reemits lower-energy light in the infrared range (wavelengths slightly longer than

what human eyes can detect). Essentially, the doughnuts glow in infrared.



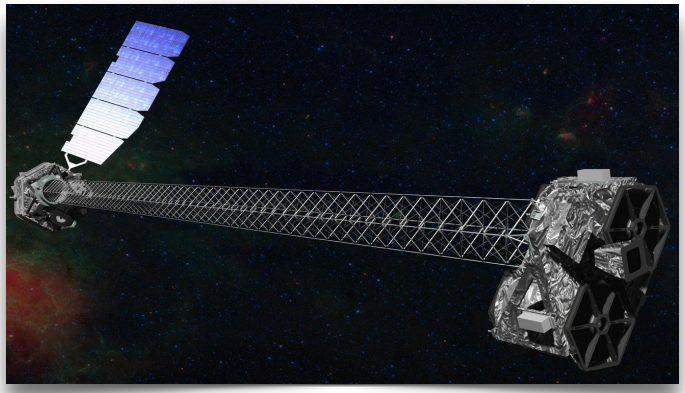
A supermassive black hole surrounded by a torus of gas and dust is depicted in four different wavelengths of light in this artist's concept. Visible light (top right) and low-energy X-rays (bottom left) are blocked by the torus; infrared (top left) is scattered and reemitted; and some high energy X-rays (bottom right) can penetrate the torus

These wavelengths of light were detected by NASA's Infrared Astronomical Satellite, or IRAS, which operated for 10 months in 1983 and was managed by NASA's Jet Propulsion Laboratory in Southern California. A survey telescope that imaged the entire sky, IRAS was able to see the infrared emissions from the clouds surrounding supermassive black holes. Most importantly, it could spot edge-on and face-on black holes equally well.

IRAS caught hundreds of initial targets. Some of them turned out to be not heavily obscured black holes but galaxies with high rates of star formation that emit a similar infrared glow. So the authors of the new study used ground-based, visible-light telescopes to identify those galaxies and separate them from the hidden black holes.

To confirm edge-on, heavily obscured black holes, the researchers relied on NASA's NuSTAR (Nuclear Spectroscopic Telescope Array), an X-ray observatory also managed by JPL. X-rays are radiated by some of the hottest material around the black hole. Lower-energy X-rays are absorbed by the surrounding clouds of gas and dust, while the higher-energy X-rays observed by NuSTAR can penetrate and scatter off the clouds. Detecting these X-rays can take hours of observation, so scientists working with NuSTAR first need a telescope like IRAS to tell them where to look.

"It amazes me how useful IRAS and NuSTAR were for this project, especially despite IRAS being operational over 40 years ago," said study lead Peter Boorman, an astrophysicist at Caltech in Pasadena, California. "I think it shows the legacy value of telescope archives and the benefit of using multiple instruments and wavelengths of light together."



NASA's NuSTAR X-ray telescope, depicted in this artist's concept, has helped astronomers get a better sense of how many supermassive black holes are hidden from view by thick clouds of gas and dust that surround them.

Numerical Advantage

Determining the number of hidden black holes compared to nonhidden ones can help scientists understand how these black holes get so big. If they grow by consuming material, then a significant number of black holes should be surrounded by thick clouds and potentially obscured. Boorman and his coauthors say their study supports this hypothesis.

In addition, black holes influence the galaxies they live in, mostly by impacting how galaxies grow. This happens because black holes surrounded by massive clouds of gas and dust can consume vast — but not infinite — amounts of material. If too much falls toward a black hole at once, the black hole starts coughing up the excess and firing it back out into the galaxy. That can disperse gas clouds within the galaxy where stars are forming, slowing the rate of star formation there.

"If we didn't have black holes, galaxies would be much larger," said Poshak Gandhi, a professor of astrophysics at the University of Southampton in the United Kingdom and a coauthor on the new study. "So if we didn't have a supermassive black hole in our Milky Way galaxy, there might be many more stars in the sky. That's just one example of how black holes can influence a galaxy's evolution."

More About NuSTAR

A Small Explorer mission led by Caltech and managed by NASA's Jet Propulsion Laboratory in Southern California for the agency's Science Mission Directorate in Washington, NuSTAR was developed in partnership with the Danish Technical University and the Italian Space Agency (ASI). The spacecraft was built by Orbital Sciences Corp. in Dulles, Virginia. NuSTAR's mission operations center is at the University of California, Berkeley, and the official data archive is at NASA's High Energy Astrophysics Science Archive Research Center at NASA's Goddard Space Flight Center. ASI provides the mission's ground station and a mirror data archive. Caltech manages JPL for NASA.

For more information on NuSTAR, visit: www.nustar.caltech.edu ☀

Mapping the Heavens: Art, Astronomy, and Exchange between the Islamic Lands and Europe

Nelson Atkins Museur of Art

December 14, 2024 January 11, 2026 Gallery 203

Where are we? When are we?

These fundamental questions drove the development of astronomical sciences and religious practices across different times, regions, and faiths, to map and understand our place in the world and its relationship with the heavens.

The story of Mapping the Heavens begins in the Islamic World during the Early Middle Ages (c. 500s – 1200s CE), where Muslim scientists preserved and advanced the study of astronomy. Access to these scientific texts– many collected and translated in Spain in the 1200s and widely disseminated in books after the invention of the printing press in the 1400s– fueled a revolution of new discoveries and created a shared astronomical knowledge across Europe.

The works presented in this exhibition introduce the advancement of astronomy as a multi-cultural and multi-faith dialogue between scholars and scientists, showcasing the beauty and importance of the books, instruments, and images that communicated these discoveries. ☀

A Sage Advises Khusraw When to Attack from the series The Khamsa of Nizami, Perisan, late 15th century. Ink, opaque watercolor, and gold on paper, 4 x 3/4 inches (10.16 x 9.53 cm). The Nelson-Atkins Museum of Art, Purchase: William Rockhill Nelson Trust, 47-44/1.

Andreas Cellarius, German (c. 1596 – 1665). Harmonia macrocosmica. Amsterdam, Jan Janszoon, 1661. Book; paper and printing ink bound in leather over boards, with hand-colored engraved plates, 20.8 x 13.7 x 2.8 inches (53 x 34.8 x 7.2 cm). Courtesy of Linda Hall Library of Science, Engineering and Technology, Kansas City, MO.

The Backyard Observer, February 2025

By Rick Heschmeyer

ORION

To locate this month's constellation, let us first return to last month's, Orion, the Hunter. If we follow Urion's three belt stars to the south and east we soon arrive at a bright star, Sirius. We have reached our destination, the constellation Canis Major, the Great Dog, who accompanies Orion on his hunt across the heavens. Canis Major, besides being the home of Sirius, the "Dog Star", is also home to several excellent star clusters for the backyard observer, three of which we will discuss this month.

Alpha Canis Major is Sirius, often called the "Dog Star," and named after its host constellation. It was once known to the Egyptians as the "Nile Star" because its heliacal rising signaled the annual flooding of the Nile. Sirius is the brightest star in the heavens, shining with a brilliant blue/white color at magnitude -1.46. It is the fifth nearest to Earth and the nearest naked eye star for Northern Hemisphere viewers. Sirius' distance is 8.7 light years. In other words, the light we see this month left Sirius in the spring of 2016. In comparison, the light from the Sun reaches the Earth in about eight and one-third minutes! Sirius is a double star. Its companion known as Sirius B or the "Pup. It was discovered in 1862 by Alvan Clark, the famous American telescope builder. The six-inch refractor that was housed at K.U.'s former Tombaugh Observatory was built by Alvin Clark in 1885. Sirius B is an extremely difficult object for amateur astronomers to observe because of its nearness to and the brightness of Sirius itself.

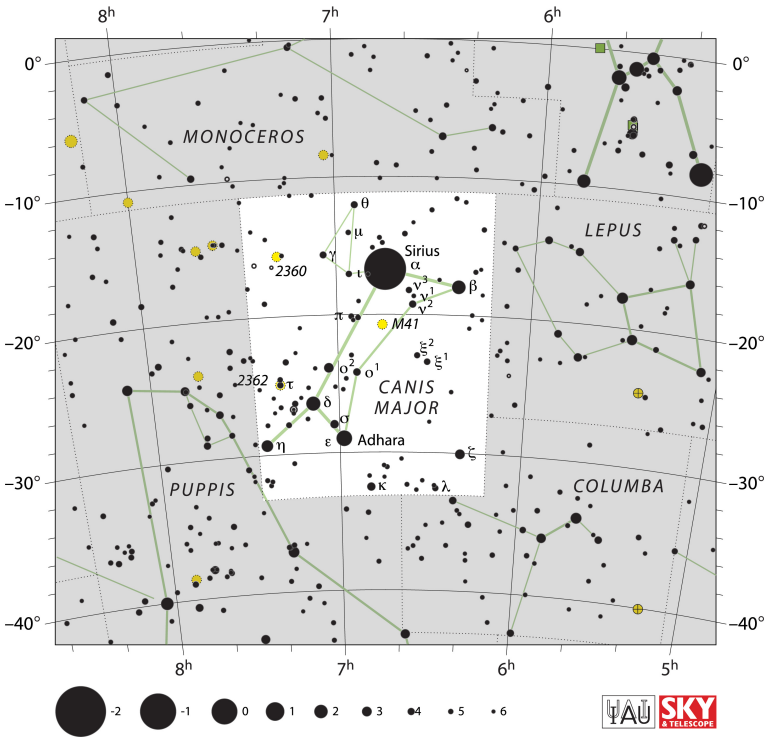
Epsilon Canis Majoris is a fine double star. The brighter component is actually the 22nd brightest star in the sky. The dimmer is of only the eighth magnitude. The system is approximately 660 light years distant.

Messier 41 (NGC 2287) is one of the best open or galactic clusters in the sky for observers with small telescopes. It is just visible to the naked eye in a dark sky, and is very easy to observe with binoculars. Located almost directly south of Sirius, small scopes reveal 25-30 of the brightest members. Larger apertures will reveal many more of the nearly 100 stars known to be members of the cluster. The brightest star in the cluster is red/orange in color and lies near the center of the cluster. It should be an easy target for a two-inch or larger telescope.

NGC 2362 is a beautiful cluster surrounding the star Tau Canis Majoris, its brightest member, and is sometimes referred to as the Tau Canis Majoris Cluster. The other 40-50 stars in the cluster are dimmer and seem to be huddled around Tau for protection. Tau is sometimes called the Jumping Star because it can appear to "jump around" the cluster in relation to other cluster stars due to its marked difference in brightness. NGC 2362 seems to be one of the youngest known galactic clusters, with an age of only a million years or so. A small telescope is needed to resolve the individual members, but binoculars reveal a small, hazy patch of light surrounding Tau. The cluster lies at a distance of about 5000 light years from us.

NGC 2354 lies just southwest of NGC 2362. This cluster covers a slightly larger area of the sky but is also dimmer than its neighbor. Due to its distance of over 4000 light years, a small telescope will be needed to resolve this cluster's stars, close to 100 in all. The thirty or so brightest members are visible in binoculars or small telescopes. Unlike NGC 2362 which is bright and compact, NGC 2354 is looser and fainter. Look for a bright double star near the center of the cluster.

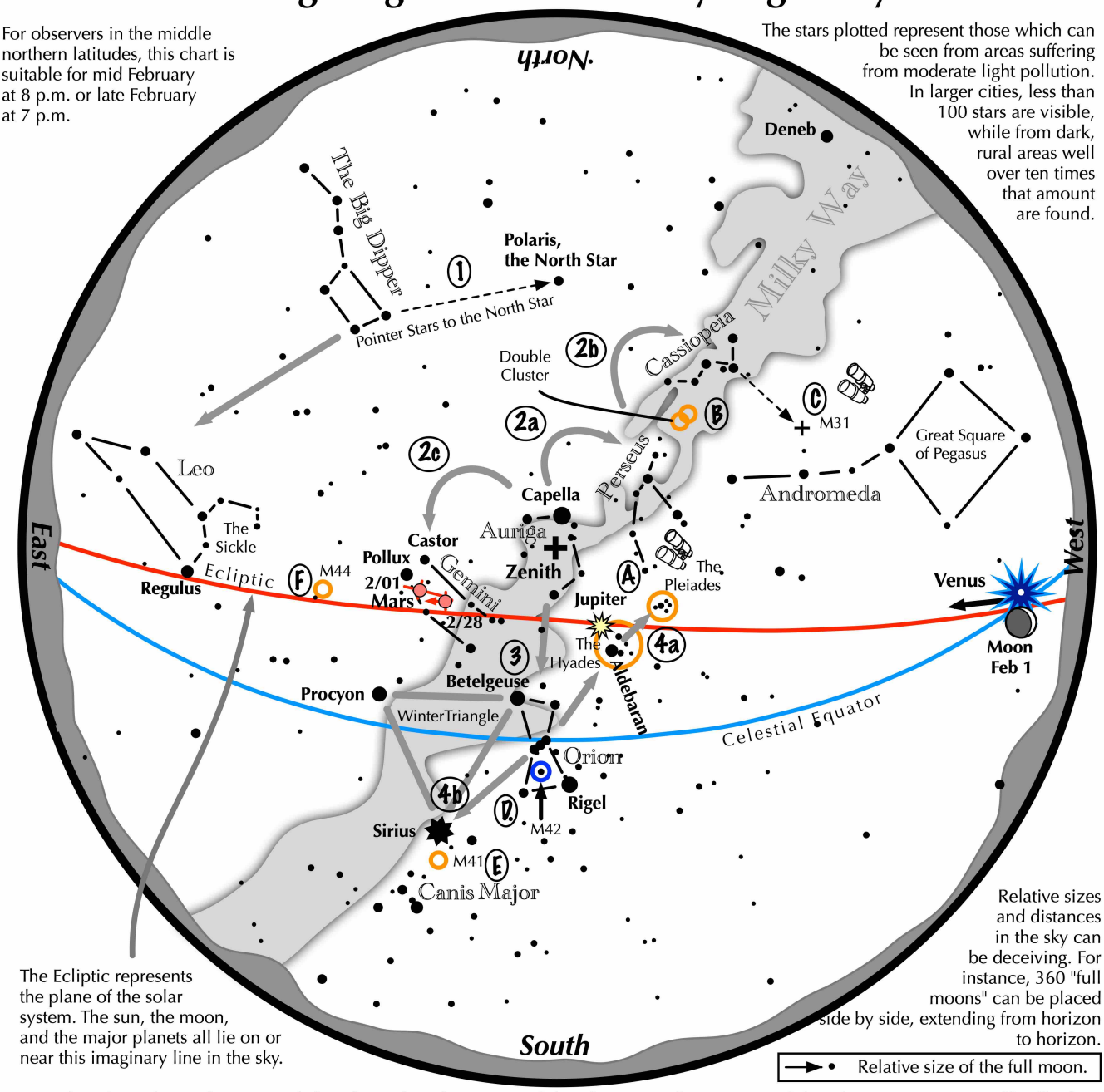
There are several other star clusters in Canis Major visible to anyone with binoculars or a small telescope. One evening this month scan the constellation with your binoculars and see if you can locate any on your own.



Navigating the mid February Night Sky

For observers in the middle northern latitudes, this chart is suitable for mid February at 8 p.m. or late February 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.

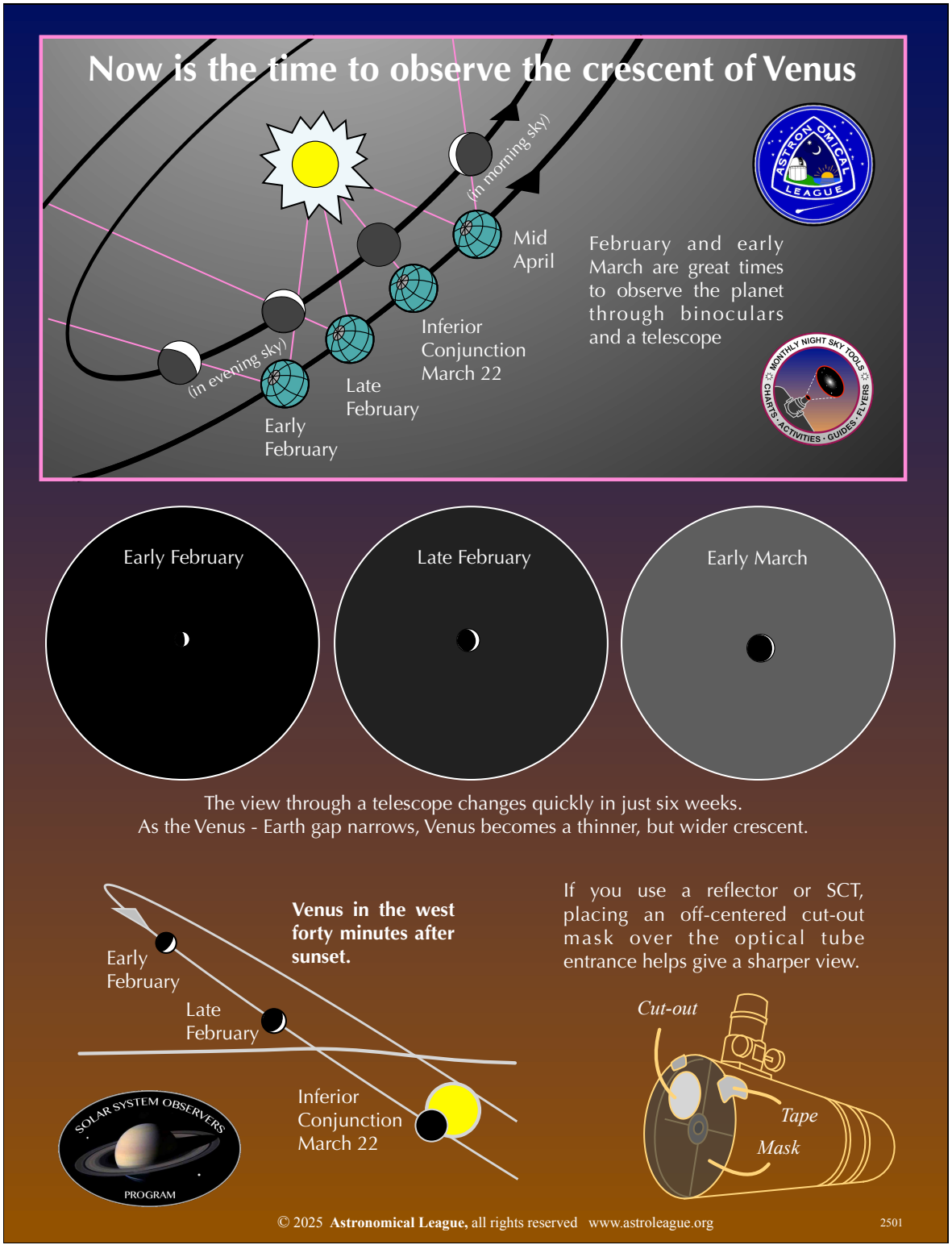
Navigating the February night sky: Simply start with what you know or with what you can easily find.

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 of Castor and Pollux in 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 northwest to the red star Aldebaran and the Hyades star cluster, then to the Pleiades star cluster. Travel southeast from the Belt stars to the brightest star in the night sky, Sirius, a member of the Winter Triangle.

Binocular Highlights

A: Examine the stars of two naked eye star clusters, the Pleiades and the Hyades.
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 southeast of Pollux.

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


Now is the time to observe the crescent of Venus
(in morning sky)
Mid April
Inferior Conjunction March 22
Late February
Early February
(in evening sky)
February and early March are great times to observe the planet through binoculars and a telescope
Early February
Late February
Early March
The view through a telescope changes quickly in just six weeks.
As the Venus - Earth gap narrows, Venus becomes a thinner, but wider crescent.
Venus in the west forty minutes after sunset.
Early February
Late February
Inferior Conjunction March 22
SOLAR SYSTEM OBSERVERS PROGRAM
If you use a reflector or SCT, placing an off-centered cut-out mask over the optical tube entrance helps give a sharper view.
Cut-out
Tape
Mask
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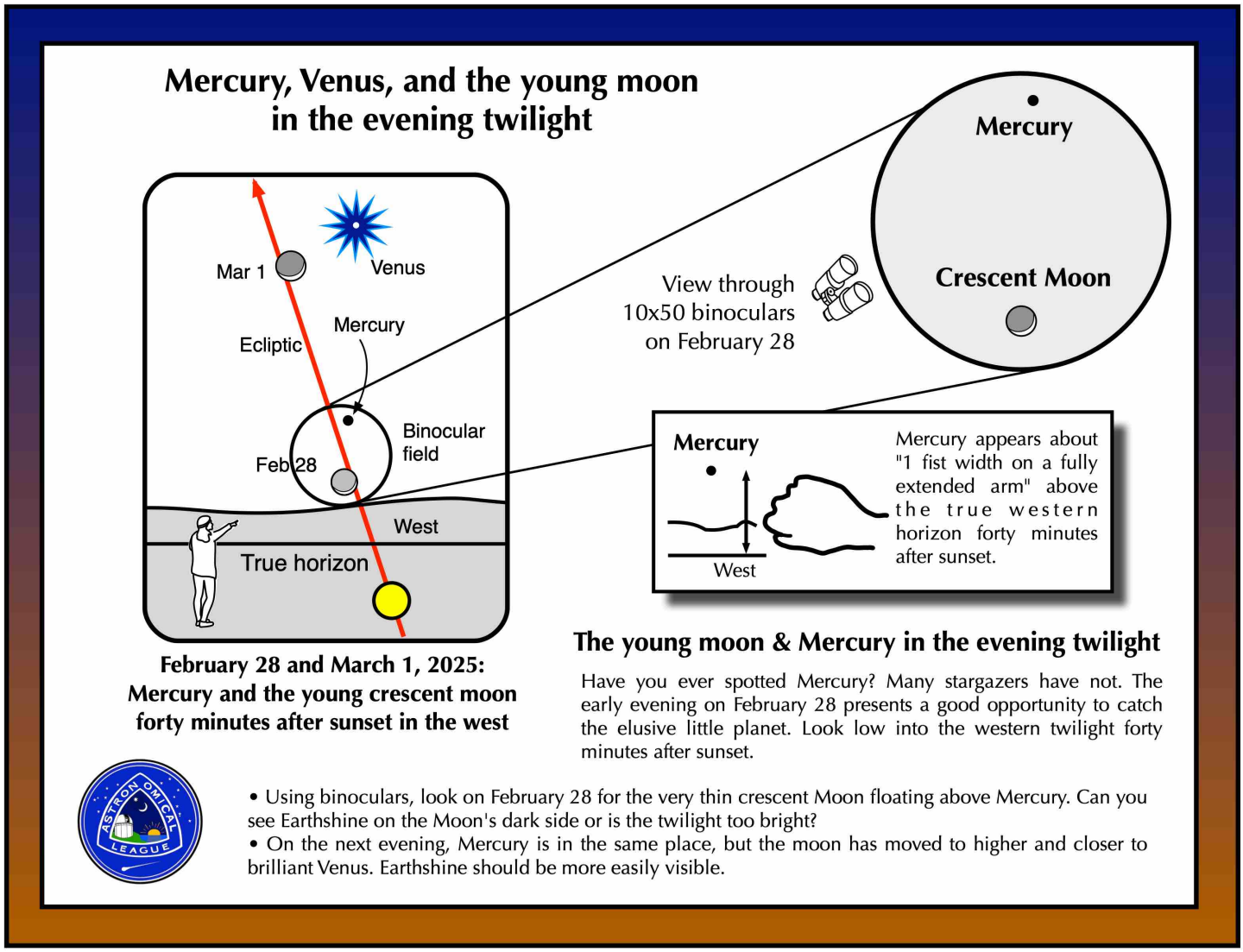

About Astronomy Associates

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.