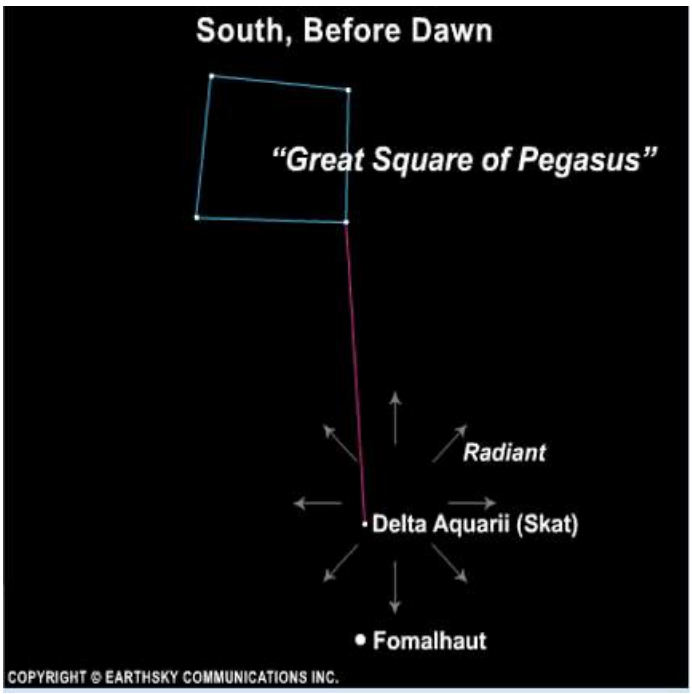
Education & Public Outreach
July 2025, Part 1

July Special Events:

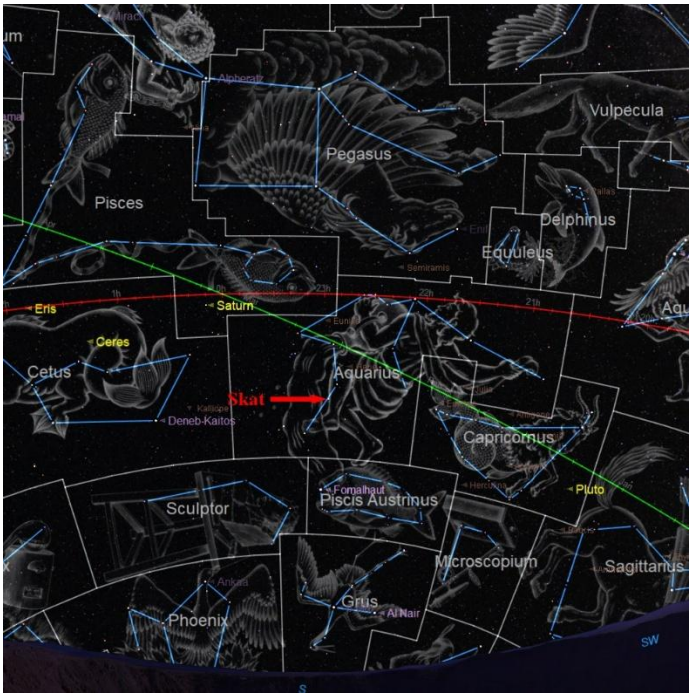
From mid-July until mid-August, after midnight until the sky gets light, you will be able see the Southern Delta Aquariid meteor shower. The shower peaks on July 31 this year. Fortunately, this year, the peak occurs when it is about first quarter Moon, so the Moon sets around midnight and will not interfere with the shower. This is not one of the most spectacular showers, peaking at only about 15–25 meteors per hour, but some meteors leave trails.



EarthSky has a nice article, again this year about the shower. Comet 96P/Machholz is the parent of this and a total of eight meteor showers. The breakup of the original comet seems to be related to two Sun-approaching comet groups as well as one asteroid (has lost all of its surface volatiles, so looks asteroid- like). Here are links to the EarthSky article as well as the abstract about the related comet groups and asteroid. The EarthSky article includes a writeup about the discovery of Comet 96P/Machholtz by its discoverer, Don Machholtz. I should note that the Perseid meteor shower starts around July 17 and peaks in mid-August, so you may see some meteors from that shower! The EarthSky image has not been updated for this year and so does not show the presence of Saturn. I have pointed out Delta Aquarii (Skat) in the Starry Night image on the right. This is what the sky will look like (without the images and stick figures) at around 4:00 a.m. DST (3:00 in Arizona and Hawaii) on July 31.

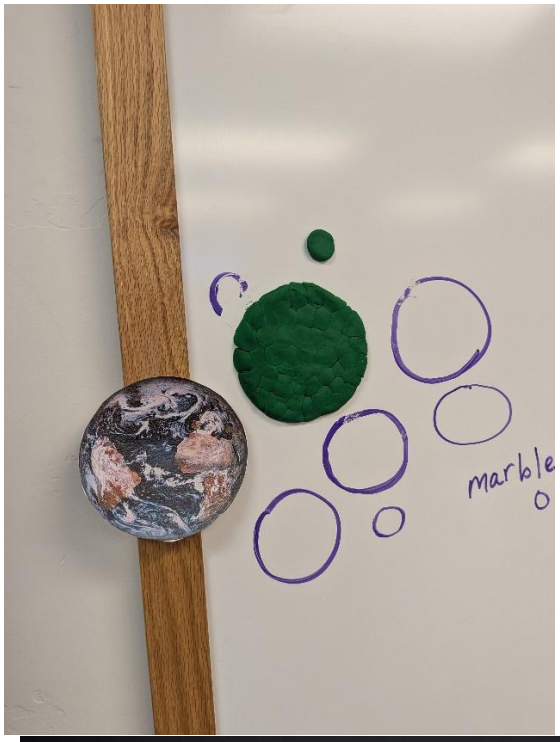
https://earthsky.org/astronomy-essentials/everything-you-need-to-know-delta-aquarid-meteor-shower/

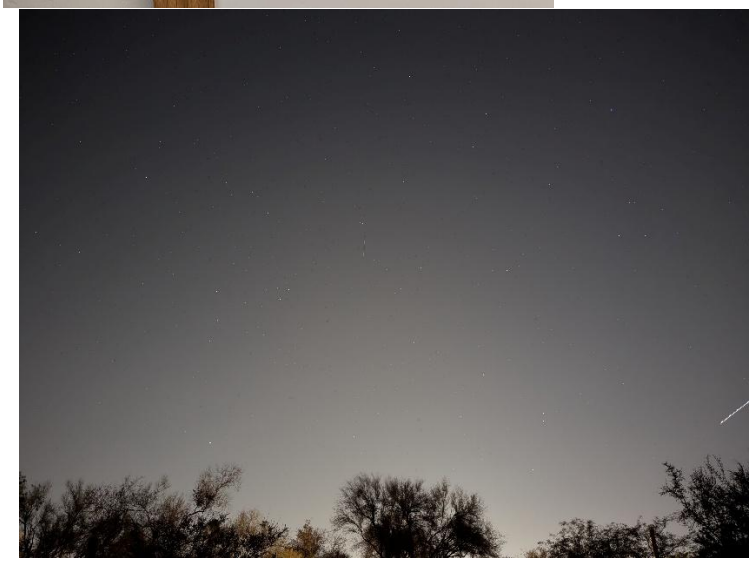
https://ui.adsabs.harvard.edu/abs/2018OAst...27..303K/abstract



Some Pictures:

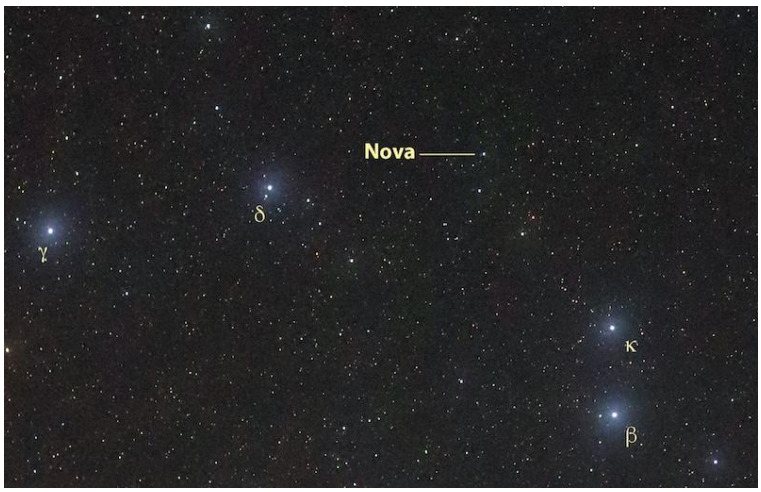
Here are a few pictures from our teacher workshop, highlighting the Moon. The left image are the teachers' guesses for the size of the Moon relative to the Earth. If you did the activity with us at Astronomy Camp, we also did the volume comparison. One of the teachers flattened the "Earth" clay and the "Moon" clay and made a fairly good comparison.





Scorpius

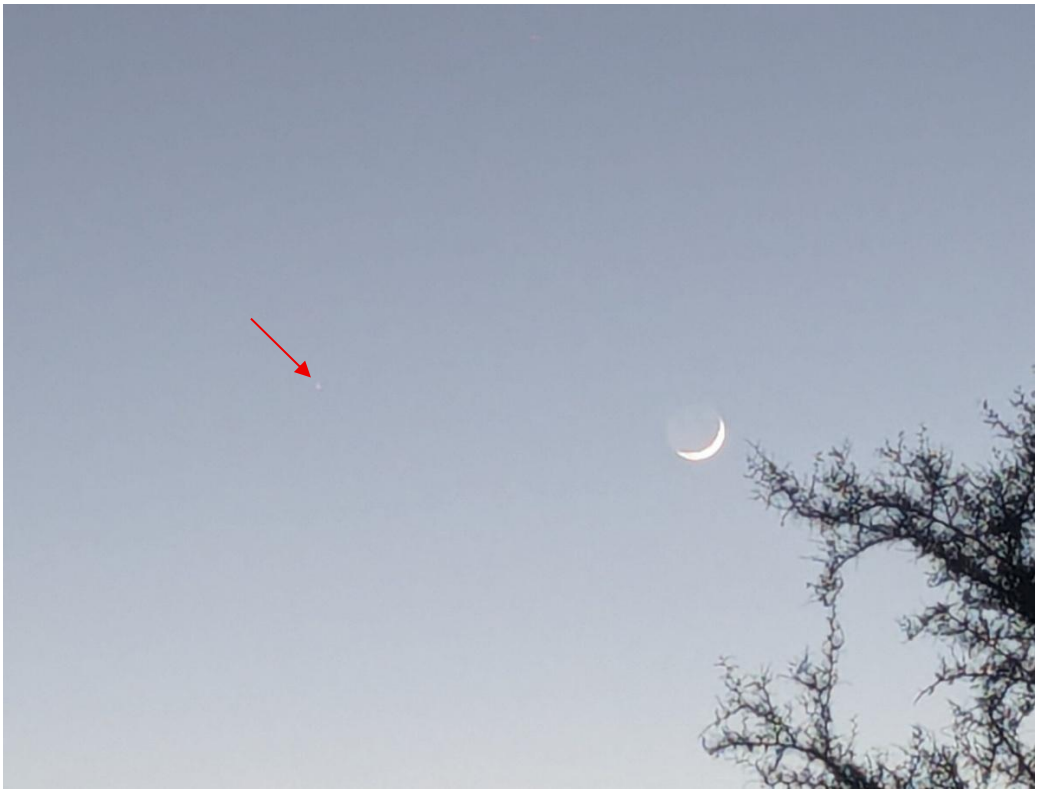
Satellite



There was a supernova visible for a week or so in mid-June in Lupus. It got up to about magnitude 5. However, being really low is the south, over Tucson, I did not do a good job of capturing it. A better picture from the southern hemisphere (Stephen O'Meara) was posted in earthsky.org. I had just been on Mt. Graham and the skies were OK, but there was a haze layer over southern Arizona. That probably contributed to the poor picture I got (excuses, excuses).

Supernova https://ecp.earthsky.org/community-photos/entry/76231/

I had a little more success with the Moon and Mercury. On the right is the 1.7-day-old Moon 3.5 degrees away from Mercury at 8:15 p.m. MST (40 minutes after sunset). This was about a 1-second exposure. This image was using the telephoto setting on my camera and I cropped it to half its original size. Mercury was easily visible to the naked eye (magnitude 0.15).



Science and Religion:

VOSS and the Pope:

Every two years, the Vatican Observatory organizes a 4-week summer school that brings young scientists to Castel Gandolfo, Italy. The theme this year was *Exploring the Universe with the James Webb Space Telescope*. . The students and staff were fortunate to be able to have an Audience with His Holiness Pope Leo XIV, even though his papacy only began in early May. The link below has more images, but most, importantly are the "Remarks of His Holiness Pope Leo XIV to the Students of the Vatican Observatory Summer School." It is worth reading in the context of Science/Astronomy and Religion. I think that this is the first time that Brother Guy Consolmagno met His Holiness (born Robert Francis Prevost).

https://mailchi.mp/vaticanobservatory/papal-audience-with-2025-voss-students

Statement on Freedom of Science:

Within a day or two of the Audience, another document came out "A Statement of Concern from the Pontifical Academy of Sciences on Protecting Freedom of Science and Preventing Distortion of Scientific Truth," "Erosion of Scientific Freedom and the Crisis of Truth." Its 80 members including a Cardinal, several Nobel laureates, and numerous academicians, including Br. Guy. Again, this is worth reading.

https://www.pas.va/content/dam/casinapioiv/pas/pdf-vari/PAS-Statement-freedom-of-science-16-6-25.pdf

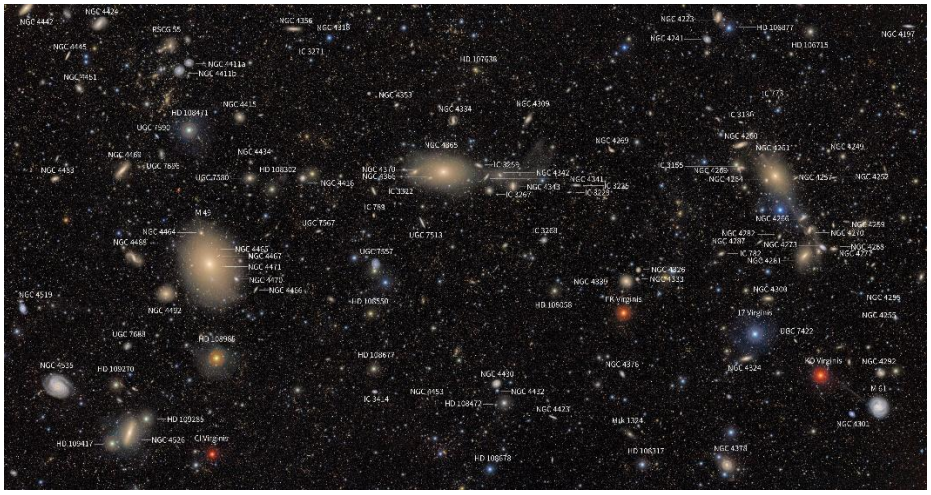
Astronomy in the News

The Future of Astronomy:

I normally just include articles about new discoveries in space. However, with the new proposed NASA budget, many of the missions and the research that are making these discoveries will never happen. The new NASA budget has a 24% decrease in NASA's overall budget and a 47% decrease in NASA's Science Mission Directorate (research and missions). This budget reduction includes the cancelling of more than 40 space-based missions (in the planning stage [funded] as well as on-going missions). These include spacecraft that study Earth's climate, Solar System missions, and astrophysics missions. Also, cut completely out of the budget are **all** education programs. Dr. Amanda Hendrix, the new Planetary Science Institute CEO just wrote an OpEd that I have attached.

Rubin Observatory:

The first images from the Vera C. Rubin telescope have just been released. I have included two of them in this email. The first three links below will provide you with information about the images and the telescope. The last link is one to the site where you can find newly released images. One thing that was not in any of the on-line articles was the size of these images, both of them made up of 700 to 1,100 individual images (7 to 10 hours of observations taken over several weeks). The field of view is 3.5 degrees, so I am assuming that the image number is for each detector times six filters. Once fully operational, the telescope will cover the entire southern sky once every week. The 3.2-gigapixel camera is comprised of 189 16-megapixel CCD detectors. It is estimated that the camera will take 200,000 images per year. For those of you who attended Astronomy Camp, the mirror was made at the University of Arizona's Mirror Lab, poured in 2008 (I do not remember how long it took to polish). What is not in the articles but is on the NOIRLab website are the sizes of the images. The top one is 98,000 x 51,500 pixels, 5.5 degrees by 2.9 degrees. The bottom image is 84,000 x 51,500 pixels, 4.7 degrees by 2.9 degrees. One other bit of information. The articles claim that the telescope, in these images, discovered 2,200 previously unknown asteroids. However, thanks to several (many) amateur asteroid observers, they have found that about 600 of these were actually previously observed (discovered recently or found in archival data). Still, the discoveries will keep a lot of us busy doing follow-up observations! **A final note**. The Rubin telescope is a wide-field camera. One "picture" (30-



An annotated version of the Rubin's image of the Virgo Cluster of galaxies showing some of the 10 million galaxies captured in the observatory's first image. (Image credit: RubinObs/NOIRLab/SLAC/NSF/DOE/AURA)

"Here's one of the first images from the Vera C. Rubin Observatory. This image combines 678 separate images and just over 7 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 right) and the Lagoon nebula, which are several thousand light-years away from Earth. Image via NSF-DOE Vera C. Rubin Observatory."

second exposure) is 189 individual CCD images (189 4,000 x 4,000-pixel CCDs) that can be put together to make its 3.5-degree by 3.5-degree single image of the sky. Because of its unique design, the telescope has the effective light gathering equivalent of a 6.5-meter telescope. For comparison, the Catalina Sky Survey telescope has one 10,000 x 10,000-pixel CCD on a telescope that is 1.5 meters in diameter. Its field of view is 2.25 degrees by 2.25 degrees.

https://www.space.com/astronomy/vera-c-rubin-observatory-reveals-1st-stunning-images-of-the-cosmos-scientists-are-beyond-excited-about-whats-coming

https://earthsky.org/space/vera-c-rubin-observatory

https://www.livescience.com/space/astronomy/staggering-first-images-from-vera-c-rubin-observatory-show-10-million-galaxies-and-billions-more-are-on-the-way

https://noirlab.edu/public/images/archive/category/rubin/

Georgia Daylight Fireball:

On June 26, at 12:25 p.m., a fireball lit up the sky over southeast Georgia. It is estimated that the incoming meteoroid was about a meter in diameter and weighed about a ton. It broke up at an altitude of 27 miles (43 kilometers), entering the atmosphere at a speed of 30,000 mph (13.5 kilometers per second). This is fairly slow for a meteor, which entered the atmosphere at speeds of 11 kps to 72 kps. At Asteroid Lunch today (Monday June 30), we discussed the possibility that this meteor was related to the Tunguska Event on June 30, 1908 (this is why June 30 is Asteroid Day). It is estimated (most accepted model) that the Tunguska chondritic (stone) meteoroid (small asteroid) had a diameter of between 50 and 80 meters and entered the Earth's atmosphere at 15 kps, so there may be a relationship! Pieces of the meteorite have been recovered (one went through the roof of a house).

This frame capture shows the daylight fireball that blazed over the Southeast U.S. on June 26th.
Ed Albin / AllSky7 Global Network

Here is a picture of a meteorite collector friend of mine, Roberto Vargas, and one of the pieces he found.

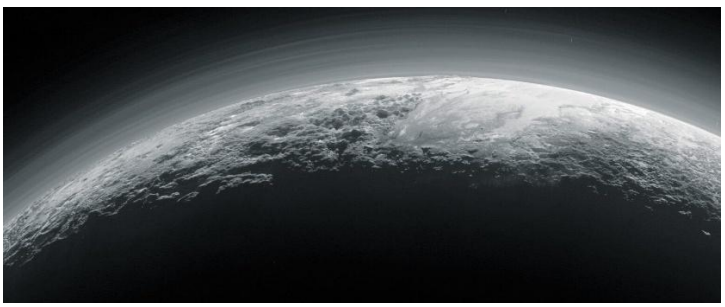
https://www.space.com/stargazing/rare-daytime-fireball-bright-enough-to-be-seen-from-orbit-may-have-punched-a-hole-in-a-house-in-georgia

https://skyandtelescope.org/astronomy-news/observing-news/exploding-fireball-drops-meteorites-over-georgia/

NASA, ESA, and Other Missions:

JWST, Pluto's Atmosphere:

Astronomers have used JWST's Mid-InfraRed Instrument, MIRI, to study in detail the atmospheric haze around Pluto. Pluto's atmosphere is mostly nitrogen, along with some methane and carbon monoxide. Similar to what is seen in the atmosphere of Saturn's moon Titan, solar ultraviolet radiation acting on this atmosphere creates a haze layer. Note that Pluto's atmosphere is 1/100,000 as dense as Earth's atmosphere and Titan's atmosphere



"NASA's New Horizons spacecraft captured this image of Pluto's surface shrouded in atmospheric haze. (Credit: NASA/JHUAPL/SwRI)"

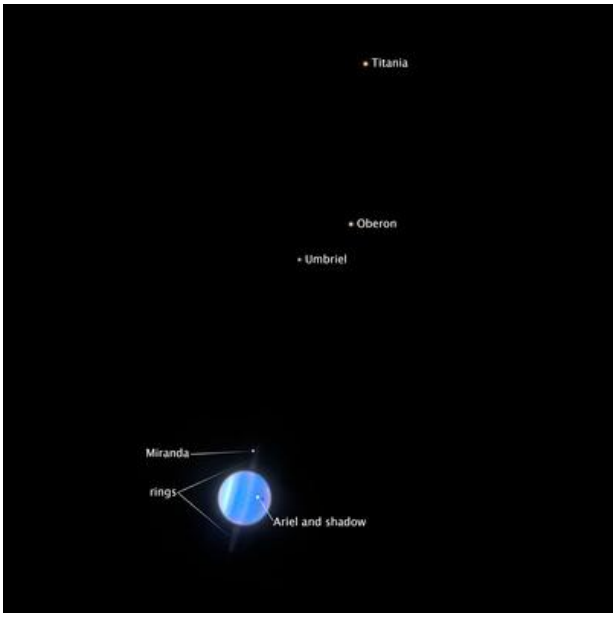
is 1.5 times that of Earth. Despite one of the statements in the second article, the haze layer on Pluto has been known for about 40 years, since the first stellar occultations detected an atmosphere and a haze layer that blocked the light from the star. The haze layer was also detected by the New Horizons spacecraft both from stellar occultations and from scattered light observations of the blue haze around Pluto. What the scientists did discover is that the dust particles in the haze heat the upper atmosphere, allowing some of the atmosphere to escape, with some of this escaped atmosphere being deposited on Pluto's moon Charon.

https://www.universetoday.com/articles/webb-watches-haze-rise-and-fall-in-plutos-atmosphere

https://www.space.com/astronomy/james-webb-space-telescope/plutos-hazy-skies-are-making-the-dwarf-planet-even-colder-james-webb-space-telescope-finds

HST, Moons of Uranus:

Astronomers, using the UV spectrometer on the Hubble Space Telescope have measured the leading and trailing sides of the four largest moons of Uranus. Uranus has 13 small inner moons, 5 larger "main" moons, and 10 irregular outer moons (probably captured Kuiper belt or Oort cloud objects). The moons of Uranus are named after characters from Shakespear plays and an Alexander Pope poem. All of the inner and main moons are tidally locked and it was assumed that, as Uranus rotated (faster than the moons revolve), Uranus' magnetosphere would radiation darken the trailing sides of the moons. They found that there was no difference in reflectance between the leading and trailing sides of the two main moons closer to Uranus and that the leading sides of the two outer main moons were darker. They concluded that radiation darkening was not occurring and that the outer moons were sweeping up dark material from the outer, darker irregular moons. This study was done for Ariel, Umbriel, Titania, and Oberon. They did not study Miranda. It is fainter and closer to Uranus and may have been too faint to observe.



Uranus and its largest moons

https://www.stsci.edu/contents/news-releases/2025/news-2025-018.html

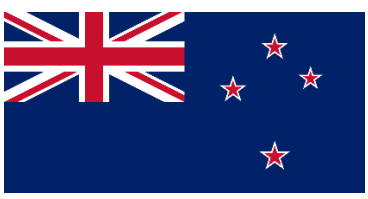
https://earthsky.org/space/uranus-largest-moons-magnetosphere-dust-hubble/

July Night Sky

Sky Stories:

Rather than a sky story this month, I have a quiz (not a difficult one). What do Australia, Cocos (Keeling Islands, a territory of Australia), New Zealand, Tokelau (a New Zealand territory), Papua New Guinea, Samoa. Sonsorol (one of sixteen states of the Republic of Palau), and Brazil have in common? The stars on their flags depict constellations! All of them have the stars of the Southern Cross. Brazil has 23 stars that represent four bright stars and 5 constellations. There are many flags that have the Sun, the Moon, and individual stars. One flag of interest is Chile. Its flag has the "lone star," in this case the "star" is actually Venus! Several US states also have a constellation, the Moon the Sun, or representations of the Sun. I have also included the flag of the Cherokee Nation. This is an activity you can do with your Scouts/students—flags (countries, US, etc., that have constellations, the Sun, the Moon, etc.)

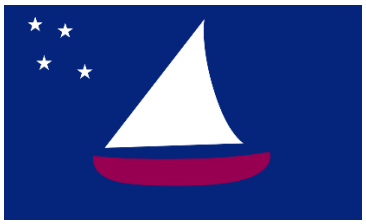





Australia

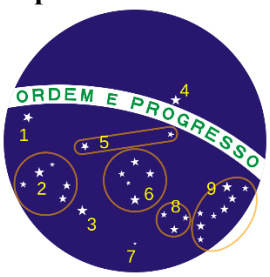
Cocos (Keeling) Islands (unofficial), Australia Terr.

New Zealand



Tokelau, New Zealand Territory

Papua New Guinea



Samoa

1. Procyon, 2. Canis Major, 3. Canopus, 4. Spica, 5. Hydra, 6. Crux Australis, 7. Sigma Octantis (southern pole star), 8. Triangulum Australis, 9. Scorpius

Sonsorol

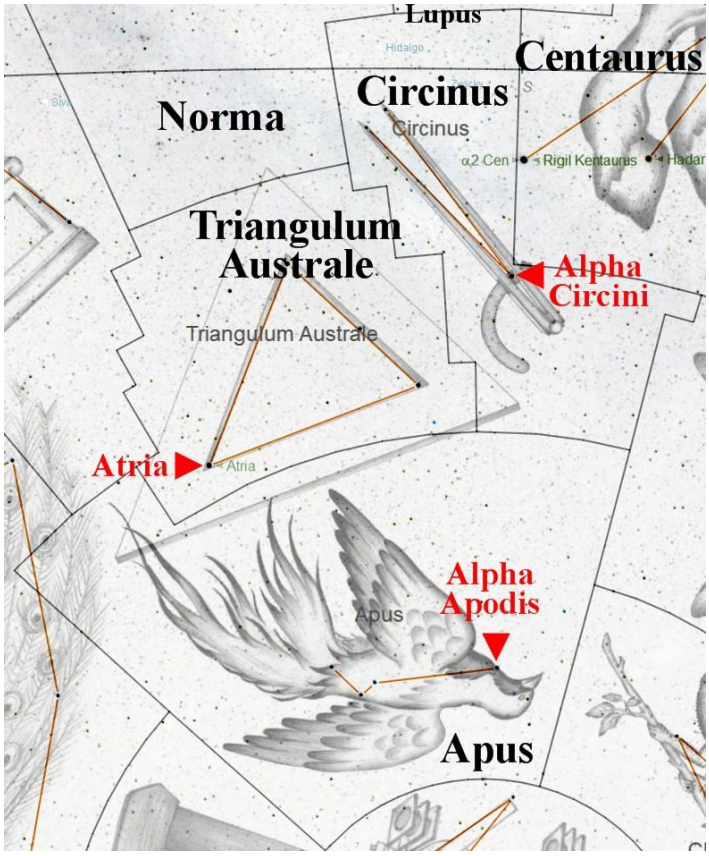
Brazil

Cherokee Nation

Featured Constellations: Apus, Circinus, and Triangulum Australe

Our featured constellations this month are Apus, Circinus, and Triangulum Australe. The Starry Night image on the right shows the usual stick figures. I have included illustrations of these constellations and a few surrounding ones. You will notice in the image that I have removed the horizon (black line near the top of the image) so that you can see the constellations that are below my horizon (and anyone farther north). As you can see, the stars in these constellations are all below my horizon. With a clear horizon, you would just be able to see the top of Circinus and maybe Triangulum Australe if you lived south of Miami or south of Houston (or Hawaii). As I mentioned a few months ago, Apus (Bird of Paradise, from the Greek, without feet [you do not want to know]) and Triangulum Australe (the Southern [draftsman's] Triangle were first depicted by Petrus Plancius in 1598; and Circinus (a Draftsman's Compass) was first depicted by Nicolas-Louis de Lacaille in 1756. From Wikipedia: "Plancius called the constellation [Apus] *Paradysvogel* ["Bird of Paradise"] *Apis* [Latin for "bee, so probably a typo for avis, "bird"] *Indica*).

Apus has two stars between magnitudes 3.0 and 3.99, and an additional four stars between magnitudes 4.00 and 4.99. Circinus has one star between magnitudes 3.00 and 3.99, and an additional three stars between magnitudes 4.00 and

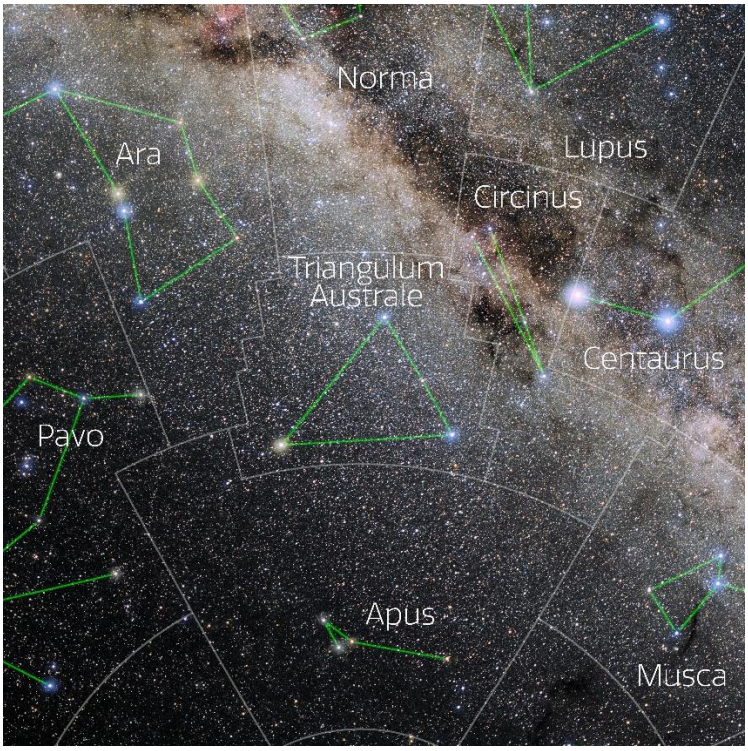


Looking South at about 9:15 p.m. (DST) on July 15 (without horizon)

4.99. Triangulum Australe has one star between magnitudes 1.00 and 1.99, two stars between magnitudes 2.00 and 2.99, one star between magnitudes 3.00 and 3.99, and an additional two stars between magnitudes 4.00 and 4.99.

Apus has 16 known (both confirmed and candidate) exoplanets orbiting nine stars (three of these are binary star systems with all the exoplanets orbiting the primary star). Circinus has five known exoplanets orbiting four stars and one exoplanet orbiting a pulsar. Triangulum Australe has two known exoplanets orbiting one star and one star that is orbited by a binary pair of brown dwarfs.

The brightest star in Apus is Paradys (Alpha Apodis) at magnitude 3.8. The brightest star in Circinus is Xami (Alpha Circini) at magnitude 3.2. The brightest star in Triangulum Australe is Altria (Alpha Trianguli Australis).



Above: Photo of the constellations Apus, Circinus, and Triangulum Australe with annotations from IAU and Sky & Telescope. Credit: E. Slawik/ NOIRLab/NSF/AURA/M. Zamani

Paradys (from Paradysvogel; officially approved by the IAU Working Group on Star Names on May 25, 2025!) is a K3 III (orange) giant star that has evolved off of the Main Sequence. Paradys has a surface temperature (visible surface) of 4,100 K. It is about 1,000 times as luminous as the Sun with a mass that is about 4.5 times that of the Sun and a diameter that is about 60 to 65 times that of the Sun. Paradys is about 500 light-years from us. I have not found an estimated age for Paradys. Xami (from Wikipedia, "refers to an indigenous South African asterism 'Eyes of the Lion,' consisting of Alpha Centauri and Beta Centauri," with the face of the lion covering Xami; approved by the IAU Working Group in December 2024)is a A7 Vp (white) Main Sequence star. Xami has a surface temperature (visible surface) of 7,500 K. It is about 10 times as luminous as the Sun with a mass that is about 1.6 times that of the Sun and a diameter that is about 2.0 times that of the Sun. Xami is about 54 light-years from us. It is estimated to be about 12 million years old. The Ap designation means that it belongs to a class of variables known as rapidly oscillating Ap stars and has a period of 6.8 minutes. Xami has a K dwarf companion star, Alpha Circini B. Atria (a contraction of ***Alpha Tri**anguli **Australis***) is a K2 Ib-IIa (orange) supergiant or bright giant star that has evolved away from the Main Sequence. Atria has a surface temperature (visible surface) of 4,150 K. It is about 5,500 times as luminous as the Sun with a mass that is about 7 times that of the Sun and a diameter that is about 150 times that of the Sun. Atria is about 390 light-years from us. Atria is estimated to be about 48 million years old. Atria appears to display solar flares, unusual for an evolved star. Instead, these flares could be coming from a solar-mass binary companion to Atria.

Telescope, Binocular, and Camera Targets:

In early July, both Mercury and Mars will be visible in the evening sky. However, both will be setting less than two hours after sunset. If you get up before sunrise, you will get to see Venus and Saturn. Jupiter will be joining them in mid to late July. By mid-August, Saturn will be visible in the late evening sky. This is a great time of year to see the Milky Way, if you can go to a fairly dark site. I found some nice images on a site called lonelyspeck that will help you find the Milky Way. Compare these images with the ones below from Starry Night. I have marked the center of the Milky Way Galaxy in the Starry Night chart for the evening of July 15.

Moon and Planets:
New Moon was on June 25. First Quarter Moon is on July 2. July's Full Moon, the Buck Moon, is on July 10. Last Quarter Moon is on July 17. The next New Moon is on July 24.

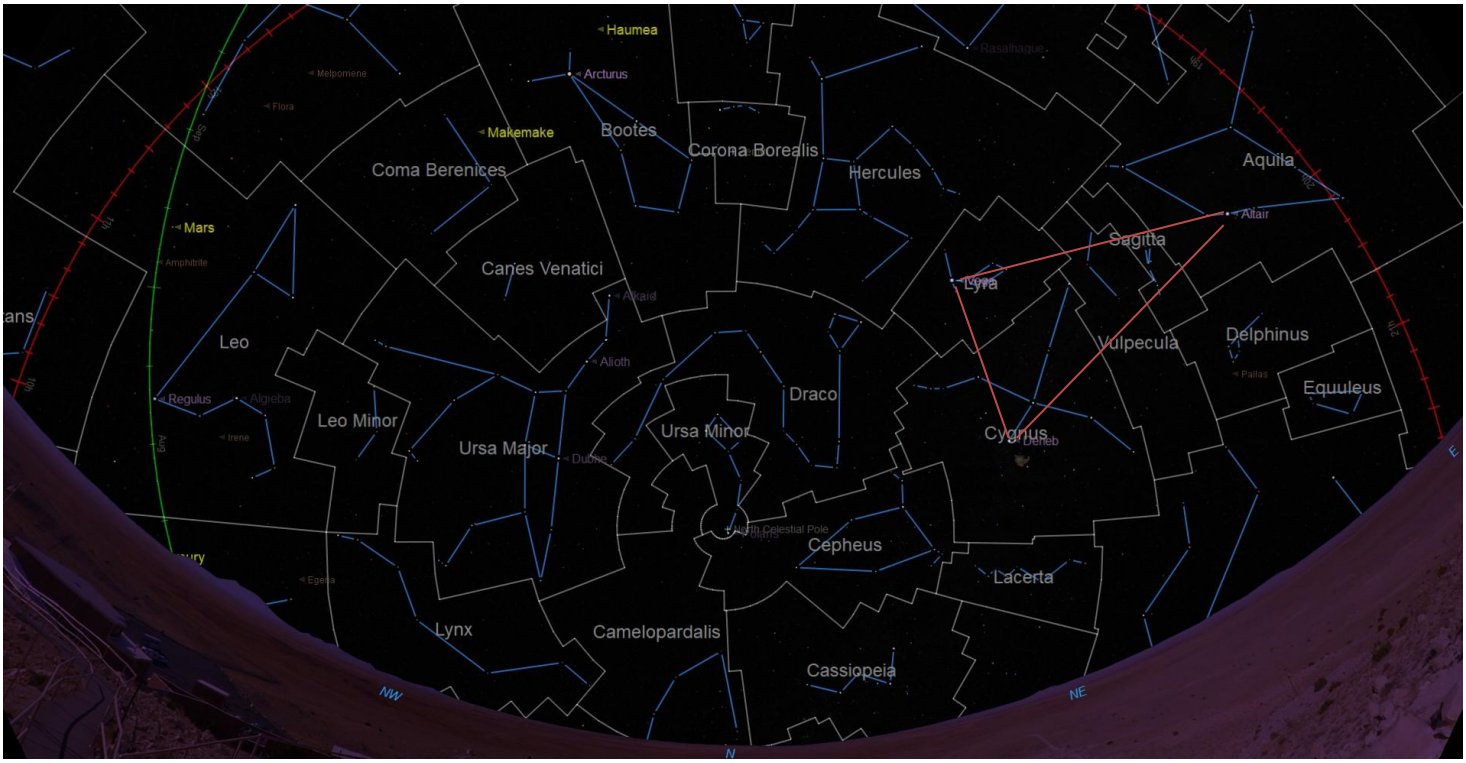
> *From Timeanddate.com:*
> "In July, the Full Moon is the Buck Moon, named after the new antlers that emerge from a buck's forehead around this time of the year. It is also called Thunder Moon, Hay Moon, and Wyrt Moon.
>
> "In July, the Full Moon is called Buck Moon to signify the **new antlers that emerge on a deer buck's forehead** around this time.
>
> "Male deer, or bucks, shed their antlers and grow new ones every year. Deer belong to the Cervidae family along with elk, moose, reindeer, and other species.
>
> **"Thunderstorms and Hay Harvest**
>
> "Other Native American tribes call it **Salmon Moon, Raspberry Moon, and Thunder Moon** because of the frequent thunderstorms in the summer.
>
> "In Celtic, this Moon was known as the **Claiming Moon, Wyrt Moon, Herb Moon, and Mead Moon**, indicating that July is the time to gather herbs (or wyrts) to dry and use as spices and remedies. The Anglo-Saxons called it the **Hay Moon** after the hay harvest in July."
>
> *From Space.com:*
> "The Full Buck Moon occurs when the new antlers of buck deer push out from their foreheads in coatings of velvety fur. It was also often called the Full Thunder Moon, thunderstorms being now most frequent. Sometimes also called the Full Hay Moon."

The Moon will be at perigee (368,939 km [228,689 miles] from Earth) on July 20. The Moon is at apogee (404,626 km [251,423 miles] from the Earth) on July 4.

On July 3, the Earth is at Aphelion (farthest from the Sun), 152.1 million km (94.5 million miles). While Thursday will see a cooling trend, it was 109 degrees on Sunday and expected to be 112 degrees on Monday (it is not the distance to the Sun that gives us the seasons). On July 5, the waxing gibbous Moon passes 0.8 degrees south of the star Spica at 6:00 p.m. (EDT). Observe this that evening. On July 7, the nearly Full Moon passes 0.4 degrees south of the star Antares at 2:00 p.m**.** On July 16, the waning gibbous Moon passes 4 degrees north of Saturn at 7:00 a.m. (this is visible from the western part of the US). On July 21, the waning crescent Moon passes 7 degrees north of Venus at 3:00 p.m. On July 22, the waning crescent Moon (15 hours before New Moon) passes 5 degrees north of Jupiter at midnight (well before they rise and fairly close to the Sun when they finally rise). On July 28, the waxing crescent Moon passes 1.3 degrees south of Mars at 4:00 pm (EDT). I am sorry that most of these events occur during the day or when the objects are not above the horizon.

Early Evening Sky Viewing:

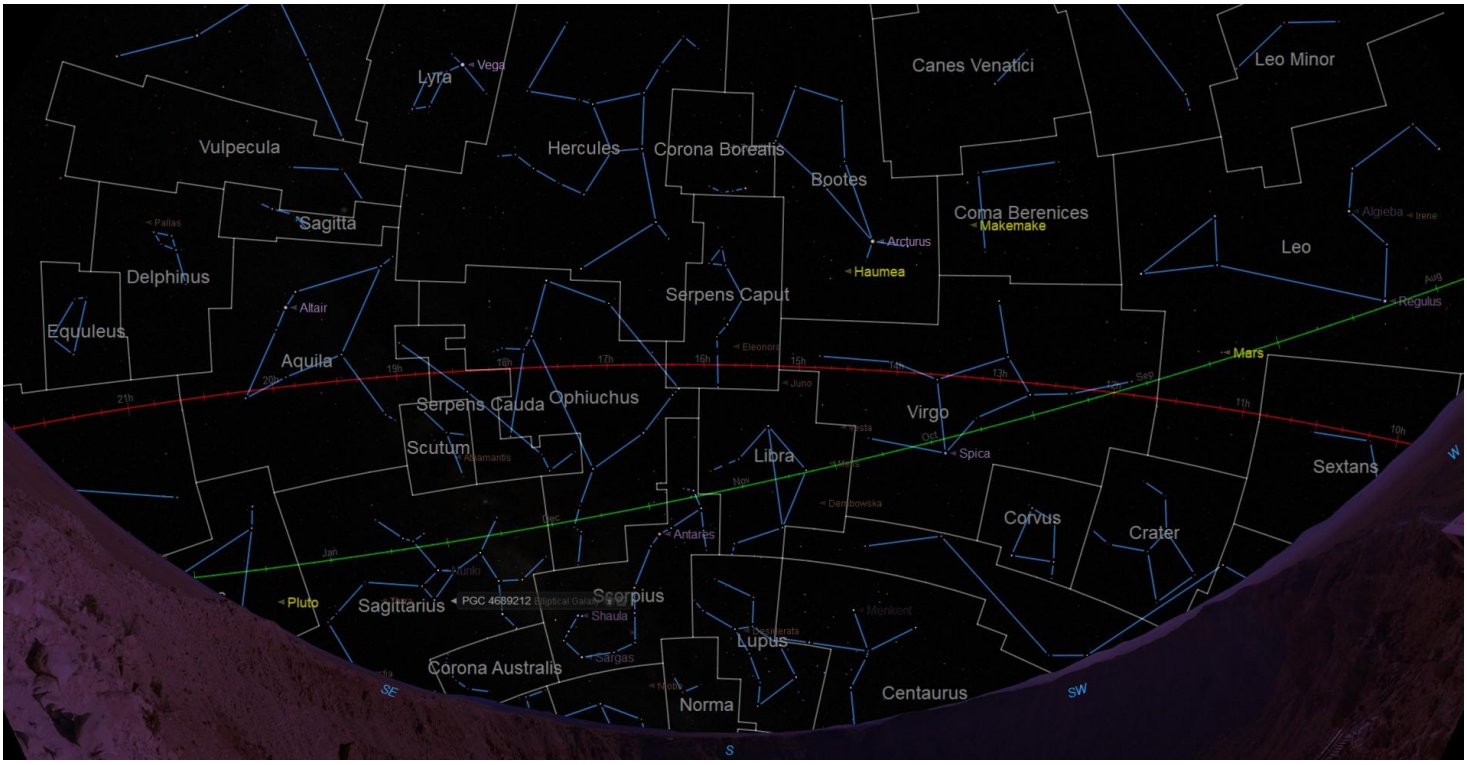
All times in this paragraph are for Tucson (Standard Time), so, since the rest of the country is now on Daylight Saving Time, we are now in the same zone as California. Any other differences will be related only to your latitude and location in your time zone. In Tucson, on the evening of July 15, 2025, sunset is at 7:31 p.m. (no change from June 15), Civil Twilight is at 7:58 p.m. (2 minutes earlier), Nautical Twilight is at 8:32 p.m. (3 minutes earlier), and Astronomical Twilight is at 9:08 p.m. (4 minutes earlier). You may see a few of the brightest stars and planets after Civil Twilight. You start seeing fainter stars and planets by around Nautical Twilight and the sky is darkest by Astronomical Twilight. The length of the day in Tucson is 14 hours and 03 minutes on July 15 (12 minutes shorter than on June 15). **Times will also vary depending on where you are in your time zone and your latitude. In New York, sunset is at 8:25 p.m. on July 15 (4 minutes later than on June 15). The length of the day in New York is 14 hours 48 minutes on July 15 (17 minutes shorter than on June 15).**



July 15, 2025, looking North at 9:30 p.m. (DST, 8:30 MST and HST). The + marks the Zenith (overhead). This is close Nautical Twilight, so the sky is fairly dark. The red line is the celestial equator, the projection of Earth's equator onto the sky and the green line is the ecliptic, the path of the Sun through the sky.

Looking North at about 9:30 p.m. (DST, 8:30 p.m. in Arizona and Hawaii) in mid-July, many of the constellations that were low in the West last month have set or are setting as the constellations and their stars rise earlier/set earlier. Now that we have passed the Summer Solstice (June 21) the Sun is setting earlier (and rising later), so the nights are getting longer. Low in the west (soon to set) are Lynx (the Lynx), Leo (the Lion), and Leo Minor (the Little or Smaller Lion). Mars is in Leo (Mercury has just set in the west). Low in the northwest is Camelopardalis (the Giraffe), a little below the northern horizon for those of us in the southern part of the US. Above Camelopardalis is Ursa Major (the Great Bear), now on his tail and due west of Polaris, the North Star. Above Ursa Major and just west of due north are Canis Venatici (the Hunting Dogs), Coma Berenices (Berenice's Hair), and Boötes (the Herdsman). Draco (the Dragon) and Ursa Minor (the Lessor Bear) are both above Polaris. Just east of due north is Cepheus (the King). Below Cepheus and very low in the northeast is Cassiopea (the Queen)—it is a circumpolar constellation and so it will be higher above the horizon for those of you in the northern US. Above Draco and a little east of north are Hercules (the Hero) and Corona Borealis (the Northern Crown). High in the northeast are Lyra (the Lyre), Cygnus (the Swan), and Aquila (the Eagle). The brightest stars in these three constellations are Vega, Deneb, and Altair—the asterism of the Summer Triangle (marked above). Below Cygnus

and east (right) of Cepheus is Lacerta (the Lizard). Within the Summer Triangle are Sagitta (the Arrow) and Vulpecula (the Little Fox). Low in the east (rising) are Delphinus (the Dolphin) and Equuleus (the Little Horse). Pegasus (the Flying Horse) is just rising.

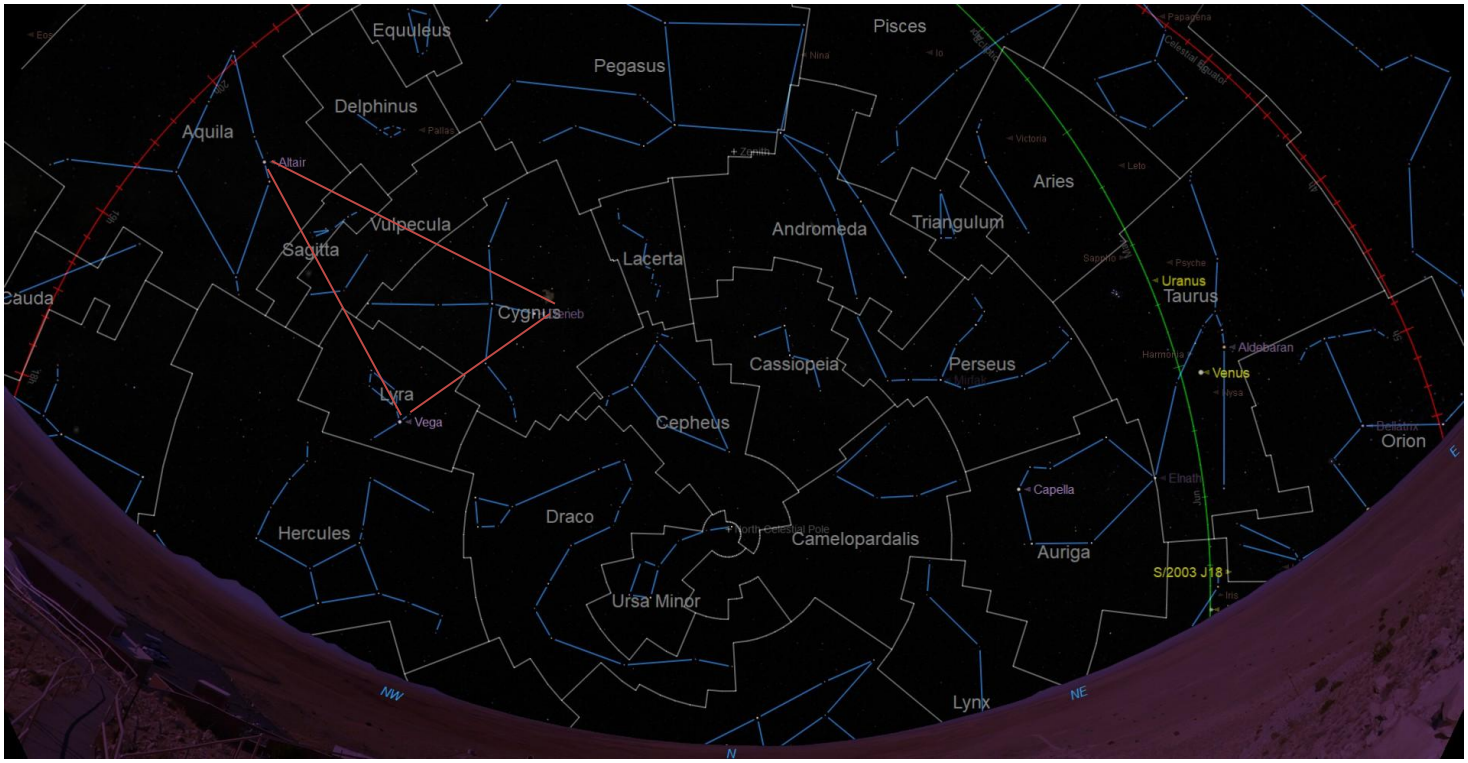


July 15, 2025, looking South at 9:30 p.m. (DST). The + marks the Zenith (overhead).

Describing constellations not discussed above, looking South, at 9:30 p.m., by mid-July, Hydra, the largest constellation, is almost completely set in the southwest. Above Hydra, west along the horizon are Corvus (the Crow), Crater (the Crater), and Sextans (the Sextant). Higher in the southwest is Virgo (the Maiden). Low and setting in the southwest is Centaurus (the Centaur). Lupus (the Wolf) and Norma (the Carpenter's Square) lie along the southern horizon (below them are our Featured Constellations, hidden by the horizon). Above these and due south are Libra (the Scales) and Scorpius (the Scorpion). Above Libra and Scorpius are Serpens Caput (the Head of the Serpent), Ophiuchus (the Serpent Bearer), and Serpens Cauda (the Tail of the Serpent).Below Serpens Cauda and east of due south is Scutum (the Shield). Below Scutum and east of Scorpius, Corona Australis (the Southern Crown) and Sagittarius (the Archer) are just rising. In the southeast Capricornus (the Horned Goat) is just rising.

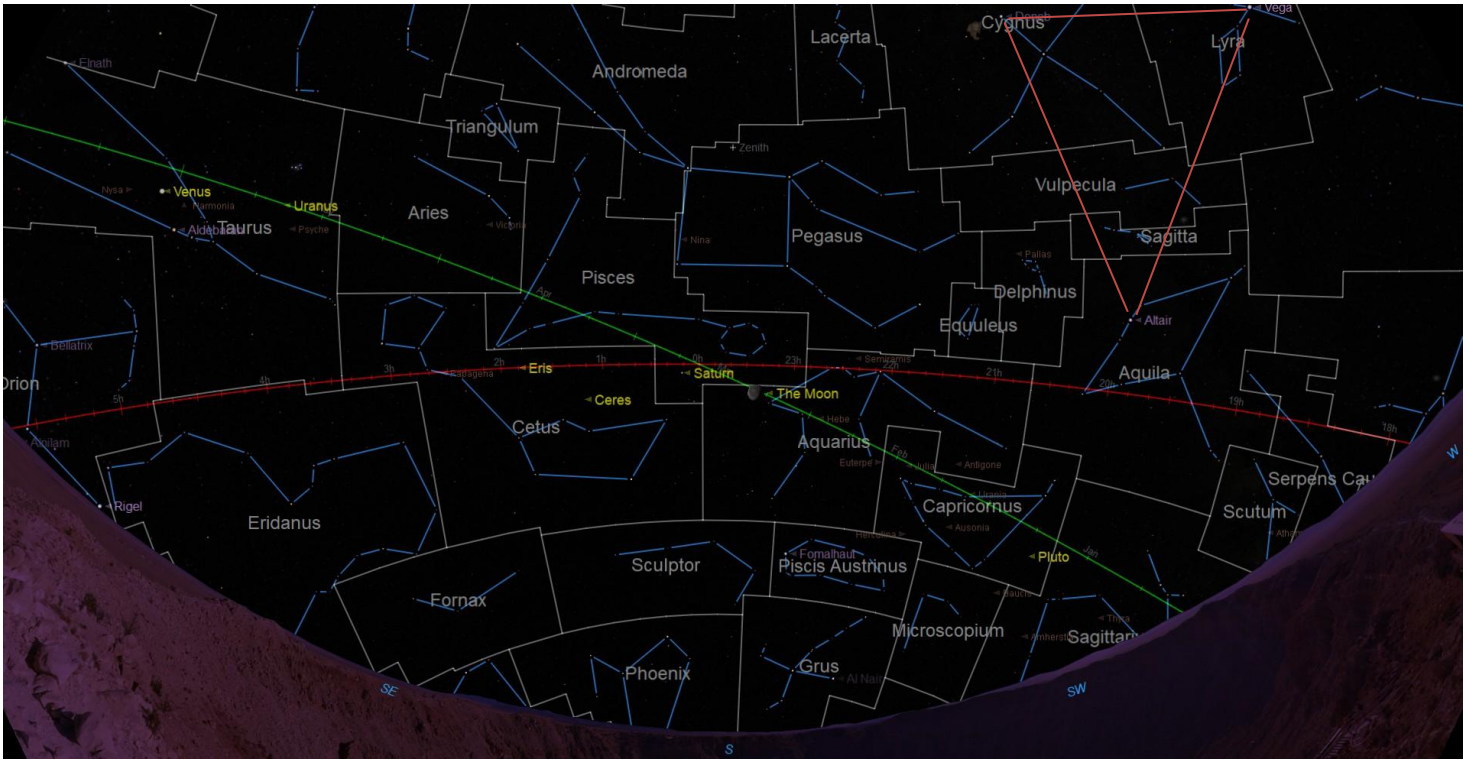
Early Morning Sky Viewing:

All times in this paragraph are for Tucson (Standard Time), so, since the rest of the country is now on Daylight Saving Time, we are now in the same zone as California. Any other differences will be related only to your latitude and location in your time zone. In Tucson, on July 15, in the morning, Astronomical Twilight is at 3:50 a.m. (14 minutes later than on June 15), Nautical Twilight is at 4:26 a.m. (13 minutes later), Civil Twilight is at 5:00 a.m. (12 minutes later), and sunrise is at 5:28 a.m. (12 minutes later). You start losing your fainter stars by around Nautical Twilight and lose all but the very brightest stars and planets before Civil Twilight. Times will also vary depending on where you are in your time zone and your latitude. Times will also vary depending on where you are in your time zone and your latitude. **Times will also vary depending on where you are in your time zone and your latitude. In New York, sunrise is at 5:38 a.m. on July 15 (14 minutes later than on June 15).**



July 15, 2025, looking North at 5:30 a.m. (DST). The + marks the Zenith (overhead). This is close to Nautical Twilight, so the sky is still fairly dark.

Looking North at 5:30 a.m. (DST, 4:30 a.m. in Arizona and Hawaii) in mid-July, the constellations that are just rising in the evening are the ones that are setting in the west and northwest before dawn. The constellations that are in the east before dawn were evening constellations one or two months ago (if they are not circumpolar). Serpens Cauda (the Tail of the Serpent) has almost completely set in the west. Also setting, in the northwest, is Hercules (the Hero). Higher in the northwest and west are Lyra (the Lyre), Sagitta (the Arrow), and Aquila (the Eagle). Even higher in the northwest and west are Cygnus (the Swan) and Vulpecula (the Little Fox). Below Cygnus and low in the northwest (west of Polaris) are Ursa Minor (the Little Bear) and Draco (the Dragon). Ursa Major (the Great Bear) is at is lowest point below Polaris and, while on his feet, is mostly below the horizon for those of us in the southern US. Lynx (the Lynx) is just rising in the northeast. East of Polaris is Camelopardalis (the Giraffe). Above Polaris are Cepheus (the King) and Lacerta (the Lizard). East of these and high in the north are Cassiopeia (the Queen). Pegasus (the Flying Horse), and Andromeda (the daughter of Cassiopeia). East of Cassiopeia and Andromeda are Perseus (the Hero), Triangulum (the Triangle), Aries (the Ram), and Pisces (the Fishes). Pisces is probably easier seen looking south. Low in the northeast is Auriga (the Charioteer). Jupiter is just below the horizon in the northeast. Low in the east is Taurus (the Bull), along with Venus and Uranus. Orion (the Hunter) is just rising in the east. You can still see the Summer Triangle early in the morning!



July 15, 2025 looking South at 5:30 a.m. (DST). The + marks the Zenith (overhead).

Looking South in mid-July at 5:30 a.m., for the constellations that are not mentioned looking North. In the south, low on the horizon, so they may not be visible for those in the northern US, and almost setting, are Microscopium (the Microscope), Grus (the Crane), and Sagittarius (the Archer). These are, or will be soon, evening constellations. More toward the west and setting (near Serpens Cauda) is Scutum (the Shield). Higher in the west/southwest are Capricornus (the Horned Goat), Piscis Austrinus (the Southern Fishes), and Aquarius (the Water Bearer). High in the south and just east of due south are Pisces (the Fishes, seen more easily looking south), Cetus (the Sea Monster or Whale), Sculptor (the Sculptor), and Phoenix (the Phoenix, low in the southeast). Saturn and Neptune (very close to Saturn, less than a degree apart) are in Pisces. East of Phoenix is Fornax. Just rising is Eridanus (the River).

Where are the Planets?

Mercury is at greatest eastern elongation (farthest east of the Sun) on July 4. Even though it will be getting closer to us and a little higher in the sky, Mercury will be fading as it goes from 45% illuminated on the first to about 22% illuminated on the 14th. It starts out the month at magnitude 0.4 and fades to magnitude 1.5 by mid-month and soon gets lost in evening twilight. Mercury is in Cancer all month.

Venus continues to be a morning object and visible in the morning sky all month. Venus starts the month at magnitude -4.1 and fades to magnitude -4.0 at the end of the month. Venus starts out the month in Taurus, moves through Taurus most of the month, moving into the very top of Orion on July 28/29, and ends up in Gemini on the last day of the month. The waning crescent Moon passes Venus on July 21.

Mars is in our evening/night sky all month but is setting between 10:30 and 11:00 p.m. (DST) by the end of June. Mars is in Leo most of the month, moving into Virgo on July 27, the day before the crescent Moon passes it. Mars starts out the month at magnitude 1.5 and fades to magnitude 1.6 by the end of the month.

Jupiter moved out of Taurus the last week of June (when it was on the far side of the Sun). It is in Gemini for the entire month of July. At magnitude -1.9, Jupiter will likely be visible low in the east toward the end of July.

Saturn continues to be a morning object, rising earlier and earlier every day. By the end of July, Saturn is rising at 11:00 p.m. DST. Saturn is in Pisces for the entire month. Saturn starts the month at magnitude 1.0 and ends the month at magnitude 0.8.

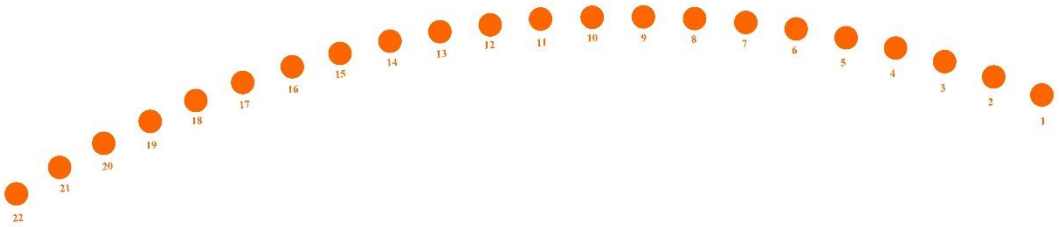
Uranus is still a difficult morning target for much of July. However, it will be easier to spot in early July when it is northeast of Venus. As I mentioned above, Uranus is only about 2.5 degrees away from Venus on July 4. It is only about 4 degrees away from the Pleiades all month. Uranus is at magnitude 5.8 all month. I will try to observe the Pleiades, Venus, and Uranus in early July, but that depends on what the weather does as the summer monsoons maybe be starting this week.

Neptune is in Pisces for all month. It is close to Saturn all month. Neptune is at magnitude 7.8 all month. With a telescope, Saturn is a good starting point to find Neptune in the sky. They are around 1.0 degrees apart all month.

Connecting with the Human Orrery

Using the Orrery, it is easy to model the positions of the planets relative to each other and to the Sun. Because the stars in the constellations are not at their true relative distances (many kilometers away in this model), the positions of the planets relative to the constellations may be "off" by more than a constellation. The first Orrery image below shows the planets out to Saturn. Jupiter and Saturn are at their correct relative distances. When printed out on 8.5 inch by 11inch paper (standard paper), the scale is about 1.5 cm = 1 AU, the Sun-Earth distance. The second Orrery has circles relevant for July only. I have given the relative positions for July 20, 2025. Printed out on standard paper gives a scale of 5 cm =1 AU. On the page-sized scale, Jupiter is 26 cm from the Sun's position and Saturn is 48 cm from the Sun's position. Because Jupiter and Saturn are "off the page," the lines from the Earth to Jupiter and Saturn go off the page toward their true relative positions. I should note that the Orrery is not perfect. It uses circular rather than elliptical orbits. For this reason, the relative positions of the planets may be off by a few days.

Using the Orrery, if you are on the Earth, as the Earth rotates in a counterclockwise direction, just after the Sun sets (over your right shoulder as you stand on the Earth), on July 20, **Mercury** may be visible low in the southwest (the sky will be fairly bright and you will need a clear western horizon). At the same time, **Mars** is a little higher in the west (but lower than last month). You need to continue to rotate until just before midnight (the Sun at your back). It is only then that you can see **Saturn** (rising over your left shoulder just before midnight, 11:00 in Arizona and Hawaii) and then **Venus. Jupiter** should be visible by July 20, rising about 1.5 hours before the Sun. This model does not include Uranus and Neptune (or Pluto), but with binoculars or a small telescope, Neptune is visible at this time, near Neptune.



1 7/15/23
2 10/3/23
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4 3/11/24
5 5/30/24
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7 11/6/24
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9 4/15/25
10 7/4/25
11 9/22/25
12 12/11/25
13 3/1/26
14 5/20/26
15 8/8/26
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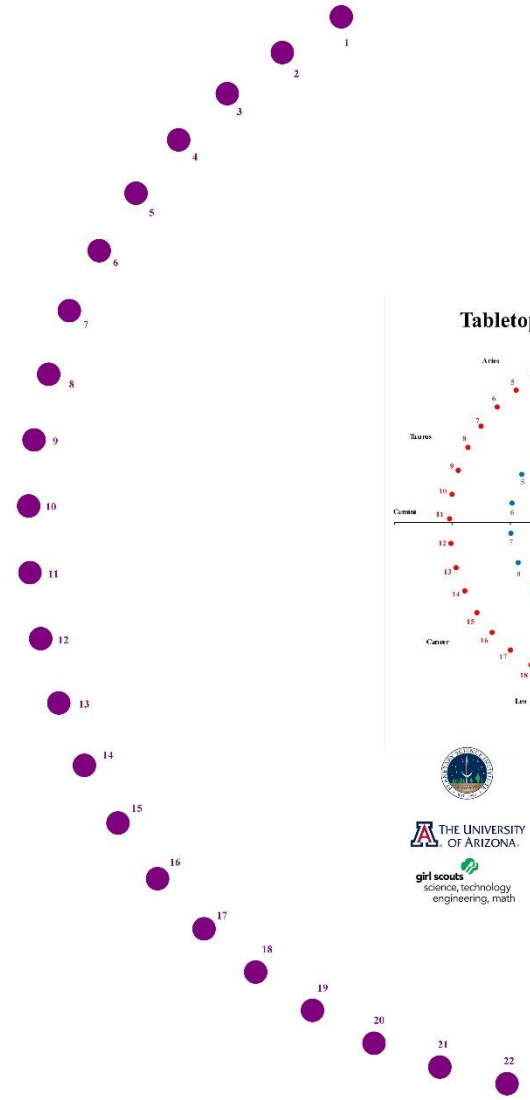
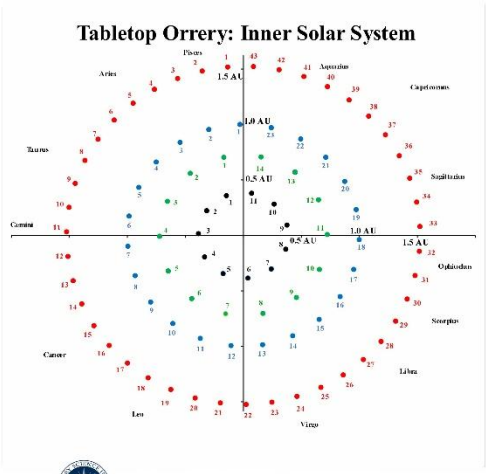
22 2/19/28





5 centimeters = 1 AU (Earth-Sun distance)
Step size: Mercury = 8 days
Venus, Earth, and Mars = 16 days
Jupiter and Saturn = 80 days

Mercury: 0.39 AU, orbital period = 88.0 days, 47.4 km/s
Venus: 0.72 AU, orbital period = 224.7 days, 35.0 km/s
Earth: 1.00 AU, orbital period =365.25 days, 29.8 km/s
Mars: 1.52 AU, orbital period = 687.0 days, 24.1 km/s
Jupiter: 5.2 AU, orbital period = 11.86 years, 13.1 km/s
Saturn: 9.6 AU, orbital period 29.46 years, 9.7 km/s

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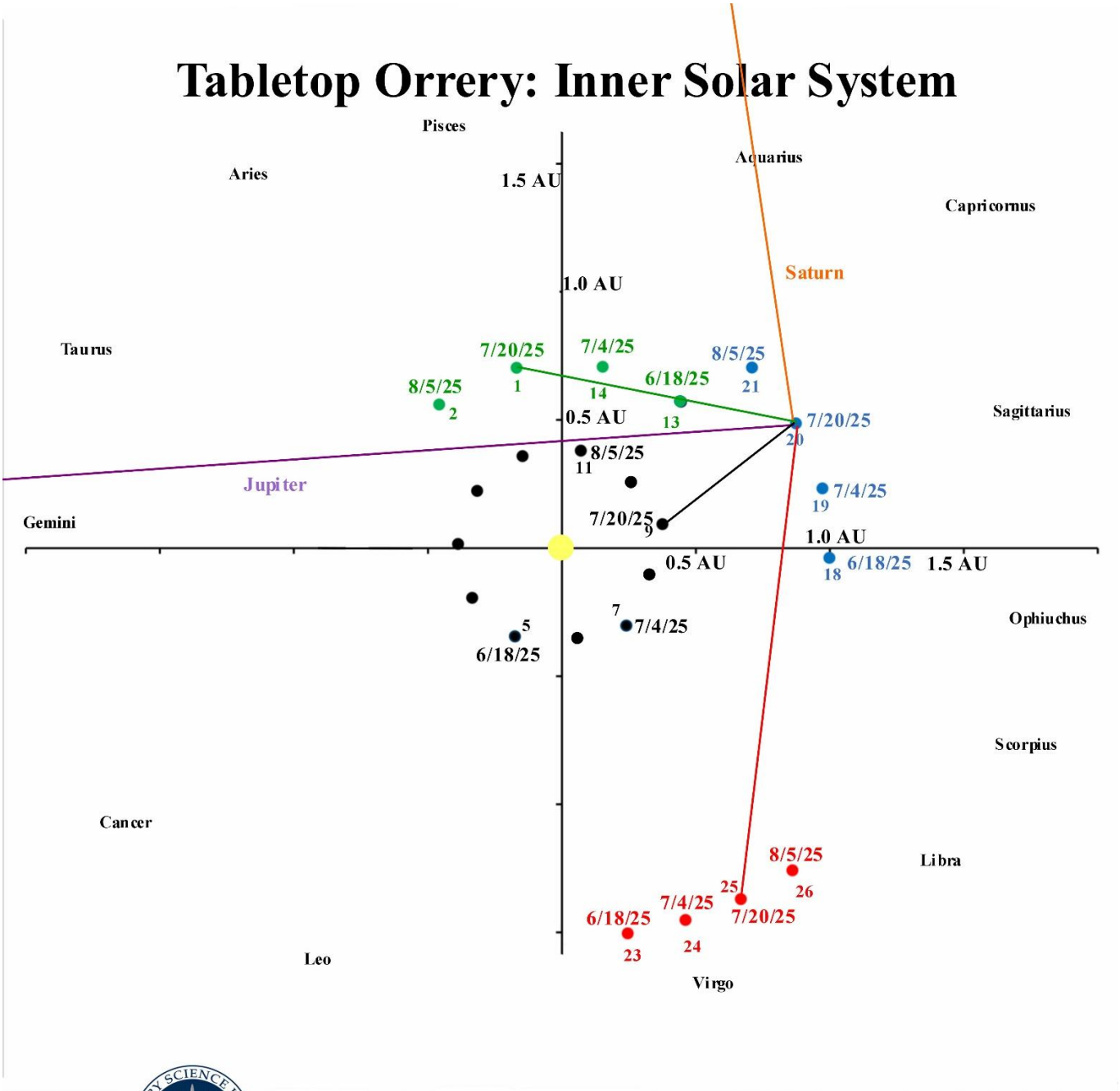
science, technology
engineering, math



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