

What's Inside?

Highlights From August
Moon Phases And Planet Visibility
What's Awaiting in September
Student's Corner
Historical Events Happened In September
Events By SPACE
Train Your Brain

Galactica

Astronomy and Space Science Magazine

Galactica is a monthly magazine about astronomy & space science published by SPACEIndia targeting amateur astronomers. Each monthly issue includes astronomy news, space launches, what's up in the sky every month, events and announcements done by the space team, Astrophotographs and articles on astronomy & astrophysics submitted by the readers for general audience, and the article about historical missions & events of astronomy and more. All of this comes in an easy-to-understand user-friendly style that's perfect for astronomers at any level.

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CONTENTS

TOPICS	Page no.
About SPACE	4
Highlights of August 2022	5
HST Captures Spectacular Mirror Image of Galaxy	5
From the eyes of Webb - August 2022	6
ESA recruits 'Shaun' the Sheep for Artemis 1 Moon mission	10
China is building a huge ring of telescopes to study the Sun	11
NASA's "Lucy" mission has picked up its ninth target	14
Moon's origin: Earth's signature gas discovered in Lunaites	15
What's up in the sky - September 2022	16
Rocket launches in September 2022	17
NASA's Artemis 1 moon mission launch Rescheduled	18
SpaceX Launches	20
Delta IV heavy to launch NROL-91	23
Astronomical events - September 2022	24
The September Equinox	24
Jupiter opposition	25
Conjunctions for the month	26
Student's corner	27
Historical events that happened in September	31
Events by SPACE	34
Astrophotographs by Space Team	36
Train Your Brain	37

ABOUT SPACE

SPACE is the pioneer organization working towards development of science and astronomy in India. It aims to create a scientifically aware society and contribute to the technological and social development of the country.

SPACE organization belongs to an astronomical league, diligently working towards development in astronomy and space science through astronomical tutorials, modules, curriculum for education requirements of schools & students in India. We constantly engage in offering introductory astronomy, science about space, astrophysics, telescopes and internet astronomy to masses.

Vision: To popularize hands on space science & STEM Education through various fun filled pioneering concepts, services and programs.

Mission: To develop and popularize space science & STEM Education in India and establish a global association with national & international space science agencies, societies, amateur, professional organisations, government agencies and space observatories.

#SpaceForAll

We have reused more than 40,000 Plastic Bottles ♻️ for carrying rocketry sessions at schools Engaged more than 1M+ Students & 1,000+ Schools in our 22 years of journey towards excellence and in an effort to imbibe scientific Temperament.

Contact us to know about hosting Astronomy and Space Science activities at schools.



Mr. Sachin Bahmba
CMD, Space.

CMD'S MESSAGE:

Space and Astronomy is the future for the young generation of our country. This is a great means to inculcate scientific temperament among the masses. Such astronomy sessions will provide a hands on learning platform to students wherein they explore the real world of science. I wish for the young students to let their ambitions soar and think big as they are the future of our country.

HIGHLIGHTS OF AUGUST 2022

HUBBLE TELESCOPE CAPTURES SPECTACULAR MIRROR IMAGE OF GALAXY CREATED BY GRAVITATIONAL LENSING

The lensing could also enable astronomers to study star formation in early galaxies.

The new image from the Hubble Space Telescope captures a galaxy named SGAS J143845+145407, located in the northern constellation Boötes – one of the largest constellations in the sky. The mirror image of the galaxy at the center of this new photo is the result of strong gravitational lensing, which is an astronomical phenomenon that can warp, magnify or even duplicate the appearance of distant galaxies.

"Gravitational lensing occurs when a massive celestial body – such as a galaxy cluster – causes a sufficient curvature of spacetime for the path of light around it to be visibly bent, as if by a lens," according to a statement from the European Space Agency (ESA). "Appropriately, the body causing the light to curve is called a gravitational lens, and the distorted background object is referred to as being 'lensed.'"

At the center of the new Hubble image, the bright light emanating from SGAS appears as an arc or ring around either side of the object that lies between the distant galaxy and the space telescope. The image also captures several other galaxies and celestial objects scattered across space.



(Gravitational lensing has resulted in a mirror image of the galaxy at the center of this image.

Image credit: NASA and ESA)

Gravitational lensing also allows astronomers to observe objects that would otherwise be too far away or too faint to be seen. The distortion caused by the foreground object acts as a natural magnifying glass, zooming in on more distant celestial objects. The recent image of galaxy SGAS J143845+145407 was taken as part of a larger Hubble initiative to study galaxies of the early universe using gravitational lensing to examine the galaxies up close.

"The lensing reveals details of distant galaxies that would otherwise be unobtainable, and this allows astronomers to determine star formation in early galaxies," ESA officials said in the statement. "This in turn gives scientists a better insight into how the overall evolution of galaxies has unfolded."

FROM THE EYES OF WEBB - AUGUST 2022

Summer is almost over, and it's hard to believe it's been over a month since the James Webb Space Telescope (JWST) images were first released, and seemingly everyone was ooh-ing and aah-ing over the very pretty pictures. This August, JWST has been hard at work, churning out marvelous images that deserve your attention.

The Cartwheel galaxy:

At the beginning of the month, JWST captured images of the Cartwheel galaxy. The Cartwheel, located about 500 million light-years away from Earth in the constellation Sculptor in the southern sky, is a rather rare type of galaxy that astronomers call a ring galaxy. Scientists believe that long ago, the Cartwheel was a common spiral galaxy, similar to our Milky Way.

This galaxy formed as the result of a high-speed collision that occurred about 400 million years ago. The Cartwheel is composed of two rings, a bright inner ring and a colorful outer ring. Both rings expand outward from the center of the collision like shockwaves.

However, despite the impact, much of the character of the large, spiral galaxy that existed before the collision remains, including its rotating arms. This leads to the "spokes" that inspired the name of the Cartwheel Galaxy, which are the bright red streaks seen between the inner and outer rings. These brilliant red hues, located not only throughout the Cartwheel, but also the companion spiral galaxy at the top left, are caused by glowing, hydrocarbon-rich dust.



(The Cartwheel galaxy. Credits: NASA, ESA, CSA, STScI)

In this near- and mid-infrared composite image, MIRI data are colored red while NIRCam data are colored blue, orange, and yellow. Amidst the red swirls of dust, there are many individual blue dots, which represent individual stars or pockets of star formation. NIRCam also defines the difference between the older star populations and dense dust in the core and the younger star populations outside of it.

Webb's observations capture the Cartwheel in a very transitory stage. The form that the Cartwheel Galaxy will eventually take, given these two competing forces, is still a mystery. However, this snapshot provides perspective on what happened to the galaxy in the past and what it will do in the future.

GALACTICA

Webb's Jupiter Images Showcase Auroras, Hazes:

JWST's Near-Infrared Camera (NIRCam) captured two images of our solar system's largest planet. In the striking close-up directly above, taken through three different filters, Jupiter displays numerous cloud bands, as well as storms and auroral emissions. The Equatorial Zone spans the planet's girth and looks bright white because its high-altitude hazes reflect lots of sunlight. For the same reason, the massive Great Red Spot in Jupiter's southern hemisphere shows up as a bright oval. Smaller storms across the planet appear whitish or reddish white.

The cyan hues, meanwhile, reveal clouds buried deeper in the jovian atmosphere, showing light reflected from the planet's main cloud level at a pressure of about one bar. The image also reveals the transition between the banded structures seen at equatorial and mid-latitude regions that earthbound observers know so well, plus more complex vortices at higher latitudes.



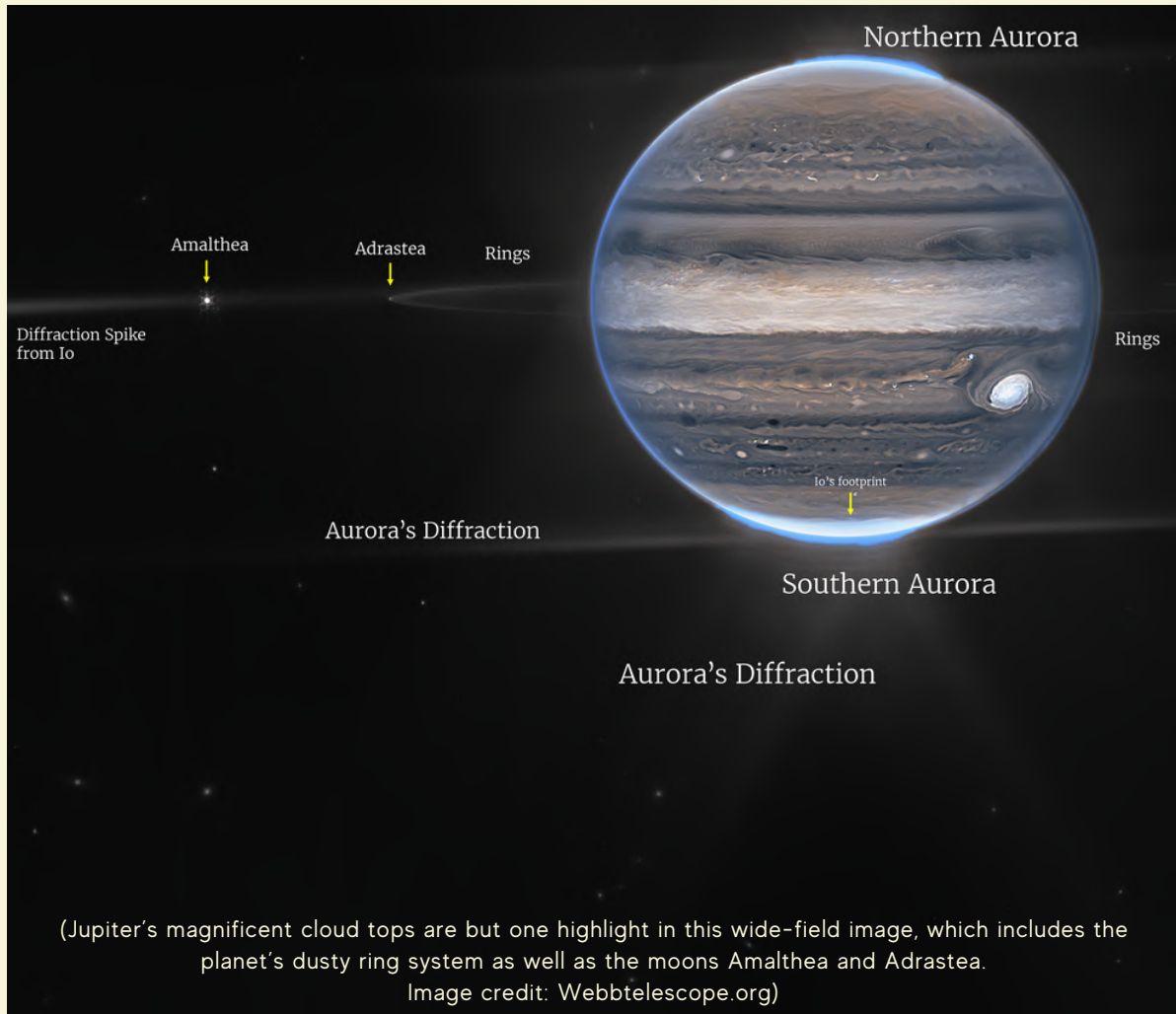
(Jupiter's Equatorial Zone and Great Red Spot stand out in this infrared image from the James Webb Space Telescope because their high-altitude hazes reflect sunlight well. Also note the bright auroral emissions near the giant planet's north and south pole. Image credit: Webbtelescope.org)

The spectacular wide-field view of Jupiter below combines images through two infrared filters. The jovian clouds and aurorae still stand out, but many more details appear in this composite photo. The power of JWST is exemplified by its ability to capture Jupiter's faint and dusty rings in the same image as the bright planet itself, which shines 1 million times brighter than the rings.

Also present are two faint inner moons: Amalthea (155 miles in diameter in its longest dimension) and Adrastea (12 miles across). Adrastea appears as a dim dot at the edge of the rings while Amalthea lies about twice as far from Jupiter's limb.

A rich background of scattered light also permeates the image. The most obvious sources are diffraction spikes from Jupiter's aurorae and the bright moon Io – the innermost of the planet's four Galilean moons – which lies just beyond the left hand edge of the image. The latter spike intersects the two visible moons. (Diffraction spikes arise in reflecting telescopes like Webb when light interacts with the struts that support its secondary mirror.) A more intriguing form of background light appears toward the bottom of this view: Scientists think the numerous fuzzy dots are actually distant galaxies that photobombed the image.

The colors in these images don't match what the human eye would see when observing Jupiter. After all, our vision does not pick up infrared radiation. But the image processors for these stunning shots – citizen scientist Judy Schmidt and Ricardo Hueso of the University of the Basque Country in Spain – mapped longer infrared wavelengths to the red end of the visible spectrum and shorter wavelengths toward the blue, mimicking how the human eye perceives visible light. In the close-up image of Jupiter's disk, the researchers mapped wavelengths of 3.6 micrometers to red-orange, 2.12 micrometers to yellow-green, and 1.5 micrometers to cyan. In the wide-field view showing the world's surroundings, they mapped wavelengths of 3.35 micrometers to cyan and 2.12 micrometers to orange.



NASA's Webb Detects Carbon Dioxide in Exoplanet Atmosphere:

After years of preparation and anticipation, exoplanet researchers are ecstatic. NASA's James Webb Space Telescope has captured an astonishingly detailed rainbow of near-infrared starlight filtered through the atmosphere of a hot gas giant 700 light-years away.

The transmission spectrum of exoplanet WASP-39 b, based on a single set of measurements made using Webb's Near-Infrared Spectrograph and analyzed by dozens of scientists, represents a hat trick of firsts: Webb's first official scientific observation of an exoplanet; the first detailed exoplanet spectrum covering this range of near-infrared colors; and the first indisputable evidence for carbon dioxide in the atmosphere of a planet orbiting a distant star.

The results are indicative of Webb's ability to spot key molecules like carbon dioxide in a wide variety of exoplanets – including smaller, cooler, rocky planets – providing insights into the composition, formation, and evolution of planets across the galaxy.

First Clear Detection of Carbon Dioxide

The research team used Webb's Near-Infrared Spectrograph (NIRSpec) for its observations of WASP-39 b. In the resulting spectrum of the exoplanet's atmosphere, a small hill between 4.1 and 4.6 microns presents the first clear, detailed evidence for carbon dioxide ever detected in a planet outside the solar system.

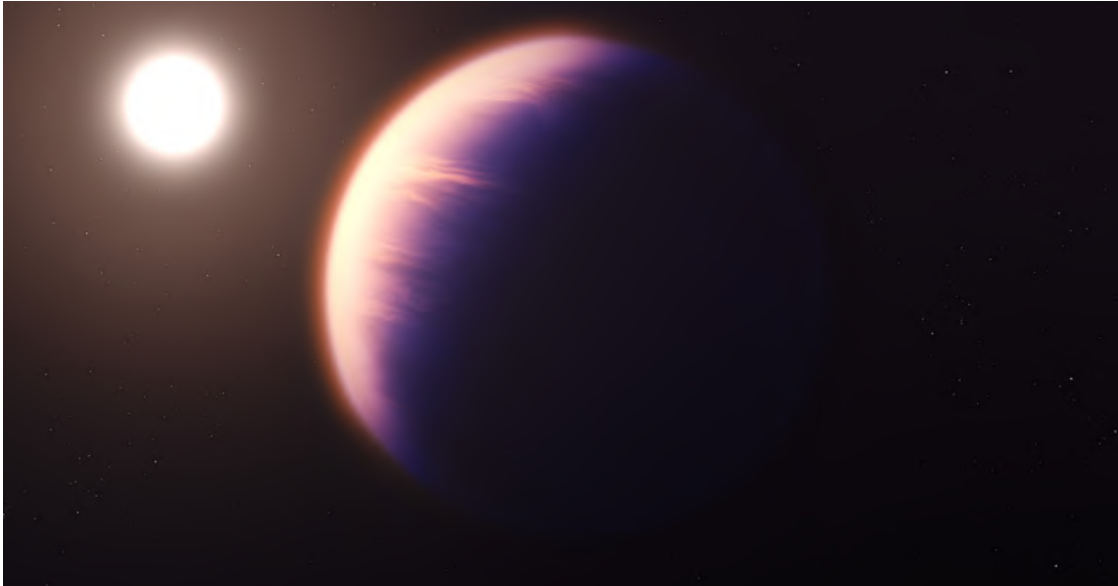
"As soon as the data appeared on my screen, the whopping carbon dioxide feature grabbed me," said Zafar Rustamkulov, a graduate student at Johns Hopkins University and member of the JWST Transiting Exoplanet Community Early Release Science team, which undertook this investigation. "It was a special moment, crossing an important threshold in exoplanet sciences."

No observatory has ever measured such subtle differences in brightness of so many individual colors across the 3 to 5.5-micron range in an exoplanet transmission spectrum before. Access to this part of the spectrum is crucial for measuring abundances of gases like water and methane, as well as carbon dioxide, which are thought to exist in different types of exoplanets.

GALACTICA

Detecting such a clear signal of carbon dioxide on WASP-39 b bodes well for the detection of atmospheres on smaller, terrestrial-sized planets,” said Natalie Batalha of the University of California at Santa Cruz, who leads the team.

Understanding the composition of a planet’s atmosphere is important because it tells us something about the origin of the planet and how it evolved. “Carbon dioxide molecules are sensitive tracers of the story of planet formation,” said Mike Line of Arizona State University, another member of this research team. “By measuring this carbon dioxide feature, we can determine how much solid versus how much gaseous material was used to form this gas giant planet. In the coming decade, JWST will make this measurement for a variety of planets, providing insight into the details of how planets form and the uniqueness of our own solar system.”



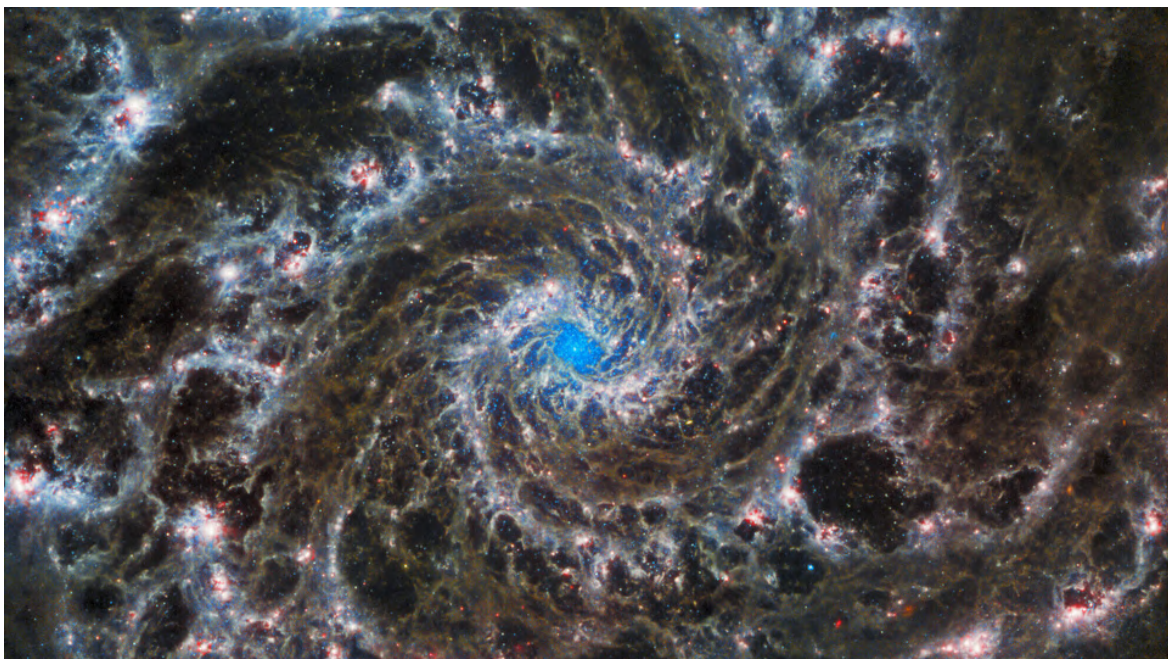
(Exoplanet WASP-39 b and Its Star (Illustration). Image credit: Webbtelescope.org)

'Phantom Galaxy' in unprecedented detail:

The James Webb Telescope captured this image that shows the heart of the Phantom Galaxy, which is officially known as M74. The stunning image reveals the delicate filaments of gas and dust in the spiral arms of the galaxy. The lack of gas at the center of the galaxy also provides a view of the nuclear star cluster.

The Phantom galaxy is classified as a “grand design spiral,” which means that it has prominent and well-defined spiral arms, which is not the case for all spiral galaxies as some have patchy and ragged structures.

The Webb telescope observed M74 with its Mid-InfraRed Instrument (MIRI) to help scientists learn more about the earliest phases of star formation in our local universe. These Webb observations are part of the PHANGS (Physics at High Angular resolution in Nearby Galaxies) collaboration’s efforts to study neighboring star-forming galaxies.



(Phantom Galaxy across the spectrum. Image credit: Webbtelescope.org)

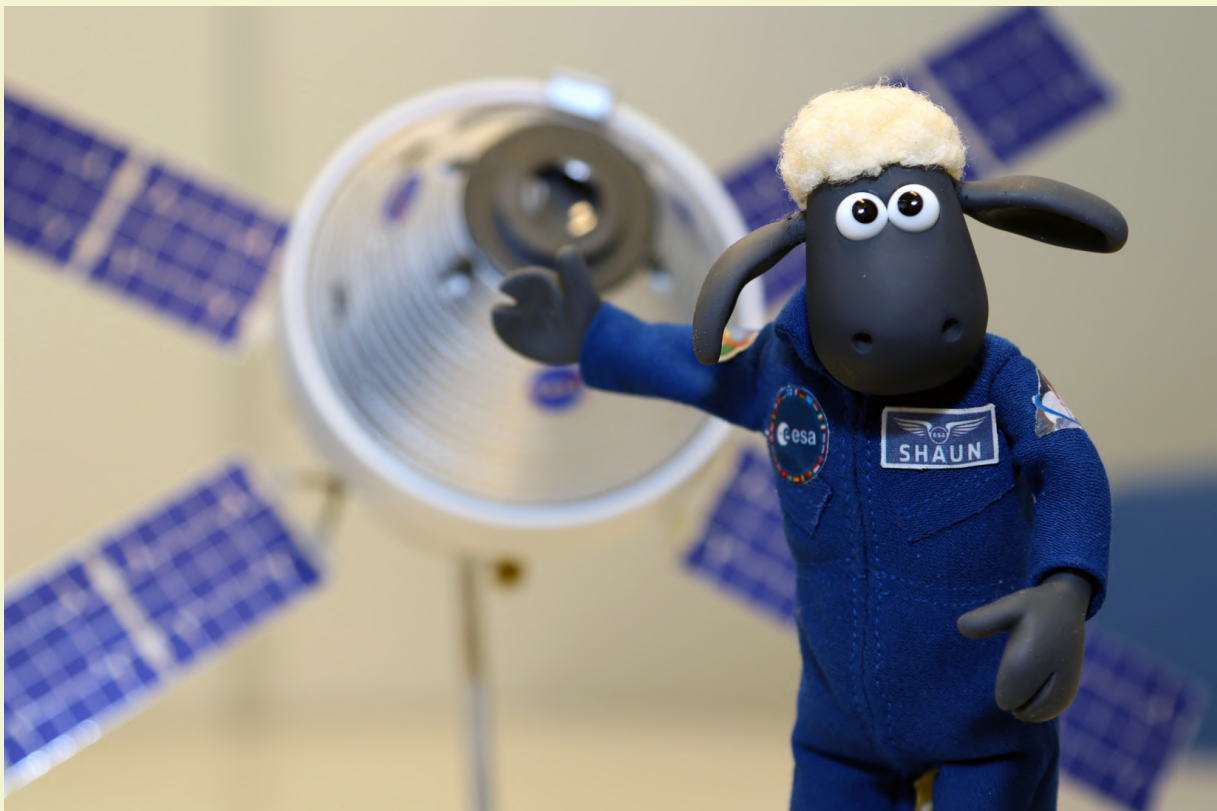
ESA RECRUITS 'SHAUN' THE SHEEP FOR ARTEMIS 1 MOON MISSION

'It's a giant leap for lambkind.' The specially trained woolly astronaut, Shaun the Sheep, has been assigned a seat on the Artemis I mission to the Moon. Shaun's assignment was announced by ESA's Director for Human and Robotic Exploration Dr. David Parker.

Shaun will be flying on the Artemis I mission, which will be the first flight of NASA's Orion spacecraft with an ESA European Service Module, planned to go around the Moon and back. This mission is not carrying a human crew but will instead be controlled from the ground with its woolly specialist as a passenger.

Orion and its European Service Module will be launched by the Space Launch System from the Kennedy Space Center in Florida, USA. The spacecraft will enter a low-Earth orbit before the rocket's upper stage fires to take it into a translunar orbit.

The spacecraft will perform a flyby of the Moon, using lunar gravity to gain speed and propel itself 70 000 km beyond the Moon, almost half a million km from Earth – farther than any human, or sheep, has ever travelled.



(Shaun with a model of the Artemis I mission's Orion spacecraft and its European Service Module.
Image credit: ESA.int)

With a keen passion for exploring, Shaun took flight on the special Airbus 'Zero G' A310 aircraft during one of its parabolic flights that recreates the 'weightless' conditions similar to those experienced in space.

Under the supervision of an ESA team, this flight prepared Shaun for his role as a space traveller in his film 'A Shaun the Sheep Movie: Farmageddon', released in 2019. It offered insight into the rigorous training that all astronauts undertake to prepare for spaceflight, which he will now experience for real.

Lucy Wendover, Marketing Director at Aardman says, "Aardman is excited to be joining ESA in making history by launching the first 'sheep' into space. As one of the first astronauts to fly an Artemis mission, Shaun is leading the way in lunar exploration, a great honour for our woolly adventurer! 2022 marks the 15th anniversary of Shaun's first TV series, so what better way to celebrate than by travelling farther than any sheep has gone before."

CHINA IS BUILDING A HUGE RING OF TELESCOPES TO STUDY ERUPTIONS ON THE SUN



Aerial view of the parabolic antennas in a circle at the construction site of the Solar Radio Telescope (the Meridian Project phase II) in Daocheng County.

A 1.95-mile-circumference array of dishes will enable new solar research.

China is building the world's largest array of telescopes dedicated to studying the sun with the aim to improve the understanding of coronal mass ejections which can cause chaos on and above Earth.

The Daocheng Solar Radio Telescope (DSRT) is under construction on a plateau in Sichuan province, southwest China. When completed, it will consist of 313 dishes, each with a diameter of 19.7 feet (6 meters), forming a circle with a circumference of 1.95 miles (3.14 kilometers).

The telescope array will image the sun in radio waves to study coronal mass ejections (CMEs), large eruptions of charged particles from the sun's upper atmosphere, the corona.

CMEs are triggered by realignments in the star's magnetic field that occur in sunspots. When directed at Earth, these eruptions can wreak havoc on power grids, telecommunications, orbiting satellites and even put the safety of astronauts at risk. On the other hand, CMEs are also responsible for the colorful aurora displays that can be observed in the night sky in polar regions.



The development is part of a ground-based space environment monitoring network called the Chinese Meridian Project (Phase II).

The project also includes the Chinese Spectral Radioheliograph for monitoring solar activity, which is being constructed in Inner Mongolia.

The radioheliograph will consist of 100 dishes in a three-arm spiral arrangement and will study the sun in a wider band of frequencies than DSRT to further Chinese research of the sun, solar physics and space weather.

INDIA'S SSLV ROCKET FAILS TO PUT SATELLITES IN RIGHT ORBIT IN DEBUT LAUNCH

India's new Small Satellite Launch Vehicle deployed its two payload in the wrong orbit. They are "no longer usable" informed by ISRO.

The maiden flight of India's Small Satellite Launch Vehicle (SSLV) ended in failure when the rocket failed to insert its payloads into the target orbit.

India Space Research Organization (ISRO), the country's space agency, confirmed on Twitter that the satellites "are no longer usable" after the rocket's kick stage placed the satellites into an elliptical, rather than circular, orbit.

The vehicle took off from Satish Dhawan Space Centre. In a video statement, ISRO's Chairman Shri Somanath confirmed all three rocket stages performed nominally. The rocket also has a terminal stage, the velocity trimming module, which was tasked with deploying the payload. The satellites separated from this final stage at around 356 kilometers, which is when ISRO noticed the anomaly, Somanath said.



India's Small Satellite Launch Vehicle (SSLV) launches for the first time, on Aug. 6, 2022. (Image credit: ISRO)

"We found that this issue related to the SSLV has been reasonably identified, but we will go deeper into it," he said, calling the issue "failure of a logic to identify a sensor failure." Because the satellites were injected into an elliptical orbit, rather than a circular one, they were essentially pulled back down into Earth's atmosphere at the orbit's lowest point.

"But for that problem, we couldn't see any other anomaly since, Every other new element that has been incorporated in this rocket has performed very well," he added. He said a committee has been assembled to investigate the anomaly and provide a set of recommendations for implementation before SSLV's second developmental flight.

Isro's failed SSLV mission



09.18am

SSLV carrying EOS-2 and Azaadisat satellites from Sriharikota launched

10.00am

Data loss reported 12 minutes into terminal stage of rocket

2.30pm

"Orbit achieved was less than expected, which makes it unstable", says Isro

2.45pm

Isro says satellites placed in wrong orbit, no longer usable

SSLV is India's answer to the burgeoning small satellite launch market, standing at 111-feet tall and capable of lifting up to 500 kilograms to low Earth orbit. It is designed, according to ISRO, as a "launch-on-demand" solution. The vehicle was carrying two payloads: an Earth observation satellite designed by ISRO called Eos-02, and an 8U CubeSat carrying 75 payloads built by students from rural India.

India has a long history of developing its own launch vehicles, starting with Satellite Launch Vehicle which had its first successful mission in 1980. SSLV is India's answer to the burgeoning small satellite launch market, and it joins three other operational rockets as part of the country's fleet.

NASA's Perseverance Mars rover has made oxygen 7 times in exploration milestone



After landing on the surface of Mars, NASA's Perseverance rover took its first breath. Or rather, one of its instruments did. Led by the Massachusetts Institute of Technology (MIT), the Mars Oxygen In-Situ Resource Utilization Experiment (MOXIE) is a small instrument on the Perseverance rover that's designed to transform carbon dioxide, which comprises some 96% of the atmosphere on Mars, into breathable oxygen. Oxygen, of course, is crucial for a human mission to Mars. Since February 2021, the device has run seven times, each time producing about 6 grams of oxygen per hour. That's on par with the abilities of small trees here on Earth.

"This is the first demonstration of actually using resources on the surface of another planetary body, and transforming them chemically into something that would be useful for a human mission," MOXIE deputy principal investigator Jeffrey Hoffman, a professor of the practice in MIT's and a former NASA astronaut, said in a statement. "It's historic in that sense."

MOXIE has now operated in a variety of conditions on Mars, both day and night, through all four seasons. The researchers expect that a version of the instrument approximately 100 times larger than MOXIE could potentially create breathable oxygen for future astronauts who visit the Red Planet. If explorers can't make their own oxygen on Mars, supplies from Earth would take up valuable mass on a spacecraft.

Furthermore, MOXIE's products could also be used as an ingredient for rocket fuel – pretty crucial to ensuring the mission isn't one-way. A rocket would need 33 to 50 tons (30 to 45 metric tons) of liquid oxygen propellant in order to launch humans off Mars.

"We have learned a tremendous amount that will inform future systems at a larger scale," said Michael Hecht, principal investigator of the MOXIE mission at MIT's Haystack Observatory.

The team's research was published Wednesday (Aug. 31) in the journal *Science Advances*.



The Mars Oxygen In-Situ Resource Utilization Experiment (MOXIE) instrument is lowered into the Perseverance rover, March 21, 2019 at NASA's Jet Propulsion Laboratory, in Pasadena, Calif.

NASA'S "LUCY" MISSION HAS PICKED UP ITS NINTH TARGET

NASA's Lucy spacecraft was launched on October 16 last year aboard the United Launch Alliance's Atlas V rocket to study the trojan asteroids around Jupiter. Scientists spotted a 9th target for NASA's Lucy asteroid mission

In preparation for the Lucy mission to explore a distant class of asteroids called the Trojans, astronomers have been monitoring the targeted space rocks. One day in March, mission personnel gathered 26 different teams from around the world to watch one of those asteroids, 17-mile-wide (27 kilometers) Polymele, appear to pass in front of a star in what scientists call an occultation.

By comparing observations from many different locations on Earth, scientists can precisely measure the shadow an asteroid casts on a star during such an event, allowing them to precisely study the size and shape of the space rock. But during the March observations, which were briefly reported at the time, two of the participating teams saw something different.

"We were thrilled that 14 teams reported observing the star blink out as it passed behind the asteroid, but as we analyzed the data, we saw that two of the observations were not like the others," Marc Buie, a Lucy scientist at the Southwest Research Institute in Colorado, said in a statement.

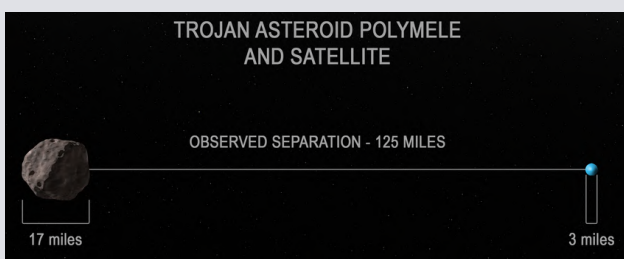


An artist's depiction of the Lucy spacecraft flying past two Trojan asteroids. (Image credit: NASA/Southwest Research Institute)

Astronomers reviewing the data concluded that those observations indicated a previously undiscovered space rock orbiting Polymele about 125 miles (200 km) away. "It had to be a satellite," Buie said. The scientists could even determine the newly found asteroid's size: about 3 miles (5 km) across.

The still-unnamed asteroid has since been added to Lucy's ambitious itinerary of space rock flybys. The new detection is the second time that scientists have spotted an extra satellite; in 2020, researchers announced they had spotted a satellite orbiting Eurybates, which Lucy will fly past just a month before Polymele.

Like most of Lucy's destinations, Polymele, is a Trojan: an asteroid that drifts around the sun in about the same orbit as Jupiter due to the large gas giant's immense gravitational pull. Scientists believe that these "fossil" rocks are the rubble left over from planet formation and could therefore teach us about the early days of our solar system.



MOON'S ORIGIN: EARTH'S SIGNATURE GAS DISCOVERED IN LUNAITES

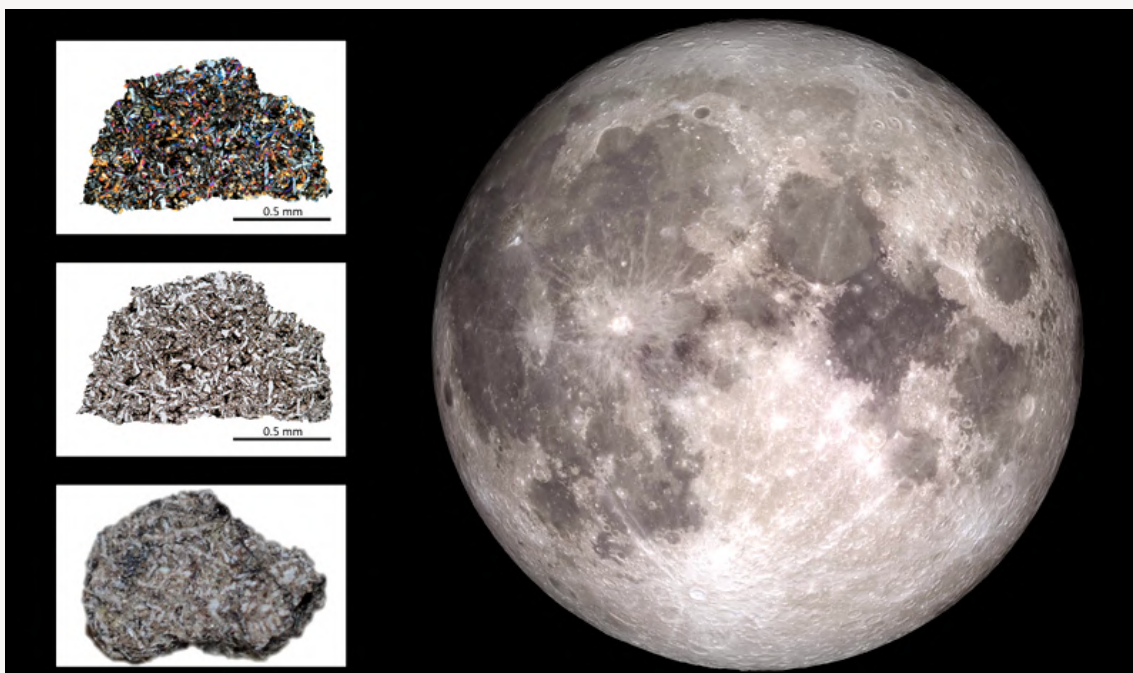
Moon rocks aren't just about the rock – the gas trapped inside is just as intriguing.

Moon meteorites found on Earth contain trace gasses that lend further support to the widely held belief that our largest natural satellite formed from chunks of our planet that were ejected in a massive impact.

Patrizia Will, a doctoral research student at ETH Zurich, studied six separate Moon rocks picked up by NASA in Antarctica, and discovered traces of helium and neon trapped inside the chunks of lunar basalt.

The discovery, Will said, is a first: "Finding solar gases, in basaltic materials from the Moon that are unrelated to any exposure on the lunar surface was such an exciting result."

Will and her fellow scientists concluded that the helium and neon traces found in the rocks were of Earth origin because of how they were likely involved in the Moon's formation. As it formed, the scientists said, the Moon pushed magma up to its surface, where it rapidly cooled into rocks, like the ones later found on Earth.



Samples of lunar meteorites add support to the idea the moon was formed when a massive space rock struck the Earth. (Image credit: NASA/ETH Zurich/Patrizia Will)

Additional basalt formed over the top of the earliest hardened magma, protecting the older rocks and their gasses from cosmic rays and solar winds.

The gasses themselves were trapped in particles of glass, leaving behind isotopic signatures indicating that they were present from the earliest days of the Moon's formation. While some noble gasses are present on the Moon's surface, the ETH Zurich team said the presence in lunar basalt indicates the gasses came from the interior of the early Moon, not external sources like solar winds.

According to the team, the noble gas mass spectrometer used to test the rocks confirmed that fact. The team also able to detect helium and neon in much higher quantities than expected, suggesting it didn't come from chance gusts of interplanetary wind. "we able to measure sub-millimeter glass particles from the meteorites and rule out solar wind as the source of the detected gases," ETH Zurich said.

Professor Henner Busemann of ETH Zurich's Earth sciences department said he believes the discovery will lead to a race to find heavy noble gasses and isotopes in other meteorites. He speculates future experiments may look for xenon and krypton, which are harder to identify, as well as volatile compounds like hydrogen and halogens. Busemann is interested in learning more about how such gasses survived the "brutal and violent" formation of the Moon, which may help shed light into the origins of life.

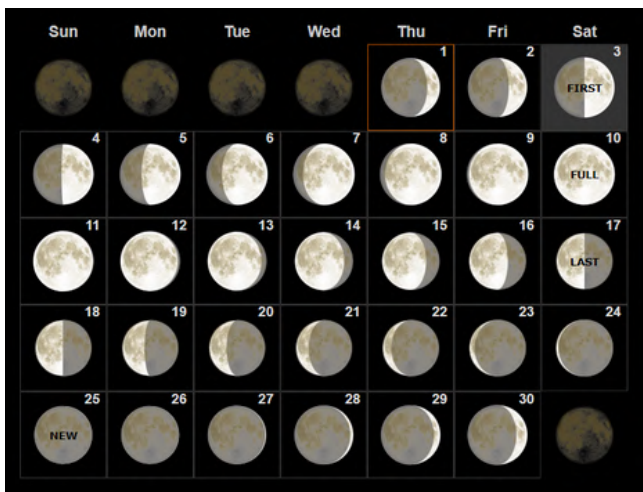
WHAT'S UP IN THE SKY - SEPTEMBER 2022

LUNAR CALENDAR

IMPORTANCE OF MOON PHASES FOR STARGAZERS

One might wonder why it is important to refer moon phases for star gazing. The reason is that the phases of the Moon reflects a great deal of illumination, and because the Moon is so close to us, it overrides the brightness of other celestial objects.

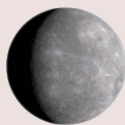
So, What Moon phase is best for stargazing? "The New Moon and the days immediately before and after the new moon (Crescent phases)" are among the best times for stargazing. Whereas the Remaining phases like Full Moon, waxing or waning gibbous, the first or third quarter Moon offers a time to zoom in and witness the features of the Moon.



PLANETS VISIBILITY

Mercury

Poor at start of month but improves toward the end of September in the morning sky.



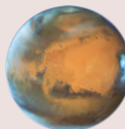
Venus

Morning planet. Ultra-thin waning crescent Moon close on 25 September.



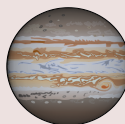
Mars

Bright morning planet. Near Orion at the start of September. Placed high in the sky at sunrise.



Jupiter

Opposition on 26 September. It will be visible in the night sky throughout the month of September.



Saturn

Well positioned planet. Bright waxing gibbous Moon nearby on evenings of 7 and 8 September.



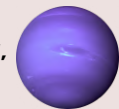
Uranus

Conjunction with the Moon on 14 September.



Neptune

Reaches opposition on 16 September, attaining highest altitude of 30 degree.



BRIGHT DEEP SKY OBJECTS

The Hercules Globular Cluster contains over 100K stars and is one of the brightest star clusters that can be seen in the northern hemisphere sky. It is about 25K lightyears from Earth and was discovered by Edmond Halley in 1714. With an apparent magnitude of 5.8, this glittering metropolis of stars in the constellation Hercules can be spotted easily in the evening sky.



The Andromeda Galaxy, also known as M31, or NGC 224 and originally the Andromeda Nebula, is a barred spiral galaxy with an apparent magnitude of 3.4, the Andromeda Galaxy is among the brightest of the Messier objects, and is visible to the naked eye from Earth on moonless nights, even when viewed from areas with moderate light pollution.

The Pleiades, also known as The Seven Sisters and Messier 45 has an apparent magnitude of 1.6. It is an asterism and an open star cluster containing middle-aged, hot B-type stars in the north-west of the constellation Taurus. At a distance of about 444 light years, it is among the nearest star clusters to Earth.



M57, or the Ring Nebula, is a planetary nebula, the glowing remains of a sun-like star. The tiny white dot in the center of the nebula is the star's hot core, called a white dwarf. M57 is about 2,000 light-years away in the constellation Lyra. The Ring Nebula has an apparent magnitude of 8.8 and can be spotted with moderately sized telescopes.

ROCKET LAUNCHES IN SEPTEMBER 2022

The 'Owl Spreads Its Wings' launch from Rocket Lab in mid-September

Rocket Lab USA, Inc.'s upcoming 30th Electron launch will deliver the company's 150th payload and 300th Rutherford engine to space – this mission is a dedicated launch for Japanese Earth-imaging satellite constellation operator, Synspecive.

"The Owl Spreads Its Wings" mission is scheduled to lift-off from Pad B at Rocket Lab Launch Complex 1 in New Zealand during a launch window that opens in mid-September (September 14, 2022). The mission is the second of a bulk buy of three Electron launches by Synspecive to deliver their StriX satellites to LEO.

StriX-1 is Synspecive's first commercial satellite for its synthetic aperture radar (SAR) satellite constellation to deliver imagery that can detect millimeter-level changes to the Earth's surface from space, independent of weather conditions on Earth and at any time of the day or night. "The Owl Spreads Its Wings" will be Rocket Lab's third mission for Synspecive after successful launches in December of 2020 and February of 2022.



About the Rocket:

Family: Electron

Length: 18 m / Diameter: 1.2 m / Launch Mass: 13 Tonnes

Low Earth Orbit Capacity: 300 kg

The Electron was manufactured by Rocket Lab Ltd with the first launch on 2017-05-25. Electron has 26 successful launches and 3 failed launches with a total of 29 launches. Electron is a two-stage orbital expendable launch vehicle developed by the American aerospace company Rocket Lab. Electron is a small-lift launch vehicle designed to launch small satellites and cubesats to sun-synchronous orbit and low earth orbit. The Electron is the first orbital class rocket to use electric-pump-fed engines, powered by the 9 Rutherford engines on the first stage.

Rocket Lab founder and CEO, Peter Beck, said, "From launching Synspecive's first demonstration spacecraft to now helping to build their SAR constellation with this launch of their first commercial StriX satellite, it's an honor to once again be the trusted launch partner for Synspecive. As the sole payload on this dedicated Electron launch, Synspecive are able to build their constellation to a specific LTAN that couldn't be achieved if StriX was launched on a rideshare mission with other satellites – a highly important differentiator when building a new satellite constellation."

This mission for Synspecive will be Rocket Lab's 30th launch of its Electron rocket. From its first launch in 2017, Electron quickly made regular and reliable launch to space accessible for smallsats.

The single StriX-1 satellite manifested on this Electron launch will bring Rocket Lab's tally of satellites delivered to orbit to 150 – a quarter of those delivered to space in the past three months alone, including the CAPSTONE satellite to the Moon for NASA and spacecraft conducting Earth-imaging, technology demonstrations, marine monitoring, space junk removal tests, and internet connectivity.



NASA'S ARTEMIS 1 MOON MISSION LAUNCH RESCHEDULED

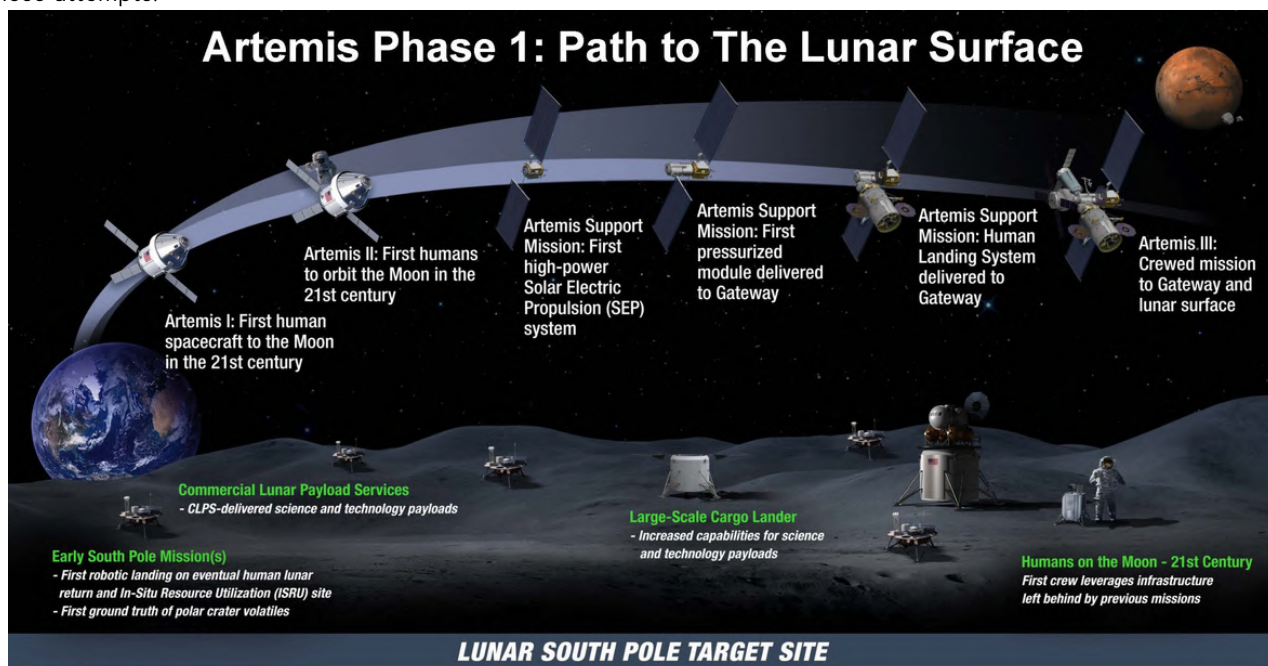
NASA's Artemis 1 mission will launch on the first Space Launch System rocket and its Orion spacecraft on Saturday, Sept. 3.

Artemis 1, the first uncrewed test flight of NASA's Artemis programme to return astronauts to the moon, is set to take off on Saturday from Pad 39B of the Kennedy Space Centre in Cape Canaveral (Sept. 3) Weather permitting, lift-off is currently scheduled for 18.17 GMT. With Artemis missions, NASA will land the first woman and first person of color on the Moon, using innovative technologies to explore more of the lunar surface than ever before

NASA has repeatedly stated that Artemis 1 is primarily a test flight. It is the first deep-space flight of the agency's new mega rocket, the Space Launch System (SLS), as well as the first flight of the new Orion spacecraft. There may be technical glitches that come up during the launch countdown that warrant a delay. In fact, an engine cooling issue forced NASA to cancel an Aug. 29 launch attempt. The September 2 launch attempt is the second of three possible in NASA's current window.

A delay could also be caused by bad weather. According to an Aug. 31 forecast from the Space Launch Delta 45 weather group at Cape Canaveral Space Force Station, there is a 60% chance of good weather at launch time. Thick clouds, surface electrical fields from lightning, and the possibility that the SLS will have to fly through rain on its ascent are the primary concerns. The weather group will issue daily weather updates through launch.

If the Artemis 1 mission is delayed due to technical issues or bad weather, NASA has some options. The mission was originally scheduled to launch on Monday, Aug. 29, with two backup launch dates in Artemis 1's current flight window: Friday, Sept. 2 and Monday, Sept. 5. Each date has its own extended launch window. In fact, there are launch opportunities on September 2, 3, 4, and 5, but only if NASA does not fully fuel the rocket on the first of those attempts.



NASA was forced to postpone the launch due to engine cooling issues. Instead of September 2, the agency chose the September 3 launch window on Saturday. That launch date has a two-hour window for success. According to NASA's flight date calendar, this target still allows for a longer mission of between 38 and 42 days.

If NASA is unable to launch on September 3, the next available date is September 5. According to NASA officials, it will take 48 hours to replenish the supply of liquid hydrogen propellant required for the SLS rocket's launch.

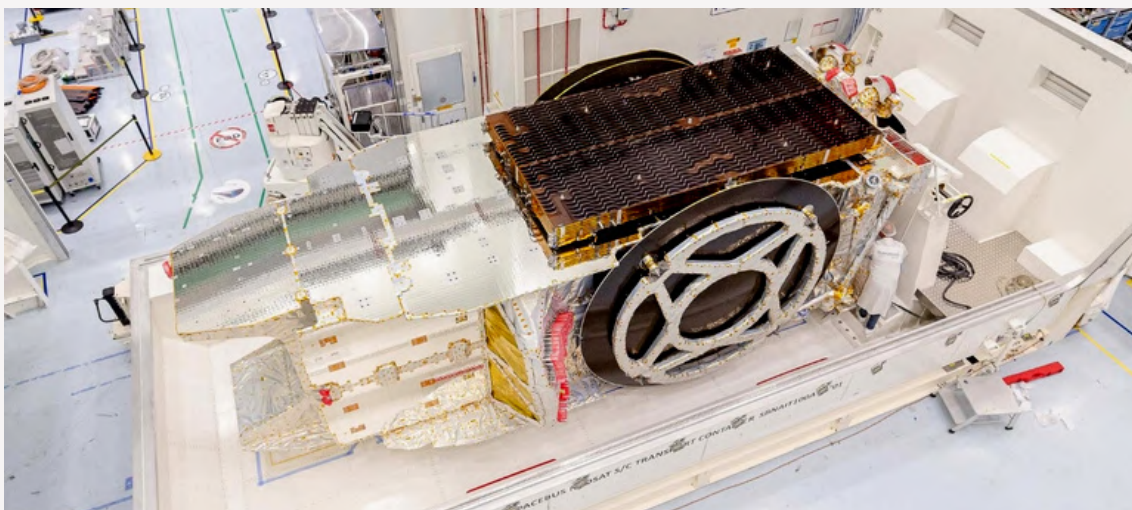
The launch date of September 5 is scheduled for 22.12 GMT. This date's launch window is slightly shorter, 90 minutes rather than two hours, but it allows NASA to pursue a longer 42-day flight. The landing would take place on October 17. NASA would have to fall back on a series of additional launch windows that run throughout the rest of the year and early 2023 if it is unable to launch the Artemis 1 mission during the Aug. 29 to Sept. 5 period.

Arianespace will launch the Eutelsat Konnect VHTS communications satellite

Lift Off Date: September 7, 2022

The launch will be performed in Kourou, French Guiana, on September 6th. The launcher will be carrying a total payload of approximately 6.4 tons.

EUTELSAT KONNECT VHTS was built in France by Thales Alenia Space around the Spacebus NEO all-electric propulsion platform. It carries a cutting-edge payload using disruptive technologies developed with the support of the French Government, via the Centre National d'Etudes Spatiales (CNES) and the "Investing in the Future" program (PIA), together with the European Space Agency (ESA). The payload notably comprises the most powerful digital processor in the world that combines agile capacity allocation, optimized spectrum use and support, and gradual deployment of network coverage on the ground.



Eutelsat Konnect VHTS, built by Thales Alenia Space.

The satellite packs a lot of performance into that large frame.

"With an instantaneous rate of 500 Gbps [gigabits per second], Eutelsat Konnect VHTS will provide high-speed internet access throughout Europe, in particular in isolated regions with low coverage, offering a service comparable to fiber optic networks in terms of performance and cost, thus making a significant contribution to bridging the digital divide," Arianespace representatives wrote in the mission description.

"Eutelsat Konnect VHTS will also address the broadband connectivity needs of fixed and mobile telecommunications networks, on land, sea or in the air," they added.

The satellite is designed to operate for at least 15 years in Earth orbit.

The mission was one of just a handful remaining for the venerable Ariane 5, which debuted in the mid-1990s and has more than 100 missions under its belt. Arianespace is developing the rocket's successor, the Ariane 6, which is expected to fly for the first time next year.



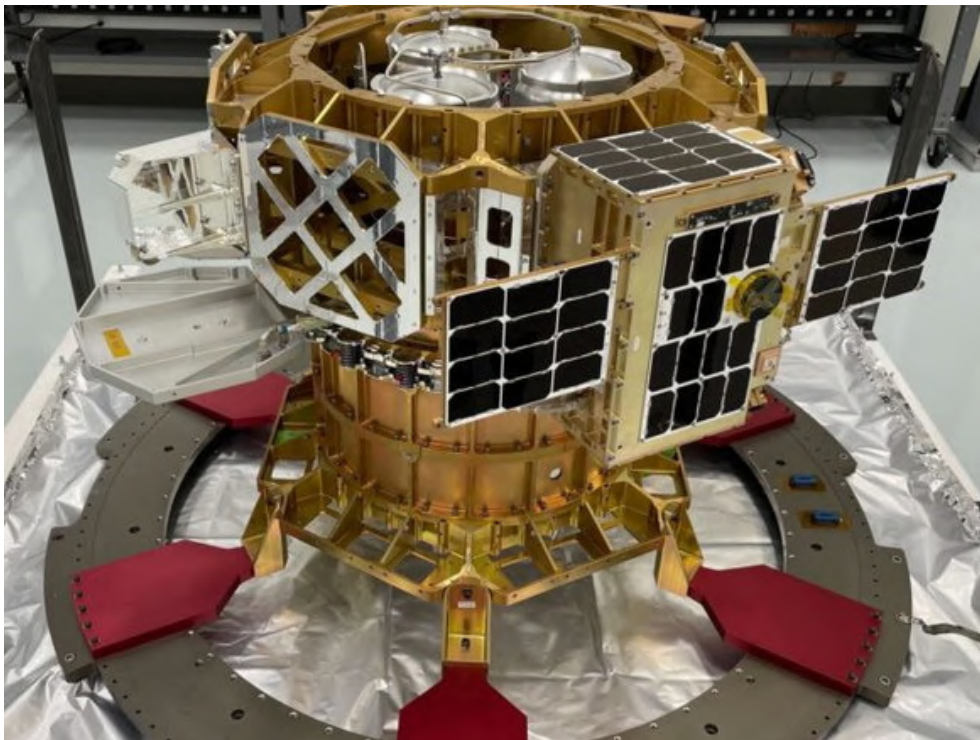
SpaceX Launches - September 2022

STARLINK GROUP 4-20 & VARUNA | SEPT 5, 2022

SpaceX will launch a batch of Starlink satellites for their high-speed low earth orbit internet constellation on 5th September 2022 from SLC-40, Cape Canaveral SFS, Florida, USA.

Varuna-TDM

Boeing's Varuna Technology Demonstration Mission (Varuna-TDM) will test V-band communications for a proposed constellation of 147 non-geostationary broadband satellites. The satellite will be deployed from Spaceflight's Sherpa-LTC2 orbital transfer vehicle (OTV) after Sherpa-LTC2 transport its customer payload to a 1000-kilometer low Earth orbit.



Varuna in preparations to be delivered (credits: Spaceflight Inc.)

STARLINK GROUP 4-2 & BLUEWALKER 3 | SEPT 10

SpaceX is scheduled to launch a Falcon 9 rocket as part of the Starlink Group 4-2 & BlueWalker 3 mission. The launch window for the Communications mission is on 09/11/2022 01:49 UTC from Kennedy Space Center, Florida, USA.

Mission: Starlink Group 4-2 & BlueWalker 3

A batch of satellites for Starlink mega-constellation - SpaceX's project for space-based Internet communication system. BlueWalker 3 is a rideshare test satellite for AST SpaceMobile's planned space-based cellular broadband network.

Rocket: Falcon 9

Falcon 9 is a two-stage rocket designed and manufactured by SpaceX for the reliable and safe transport of satellites and the Dragon spacecraft into orbit. The Block 5 variant is the fifth major interval aimed at improving upon the ability for rapid reusability.



STARLINK SATELLITE SERIES

Starlink Group 4-34 | Starlink Group 4-35 | Starlink Group 4-36

SpaceX will launch 3 more batches of Starlink satellites in the month of September for their high-speed low earth orbit internet constellation on Falcon 9 Block 5 rocket from Space Launch Complex 4, Vandenberg Space Force Base, California.

Starlink Group 4-34: Monday • September 12, 2022

Falcon 9 Block 5 | Cape Canaveral, Florida | Date may change

Starlink Group 4-35: Friday • September 30, 2022

Falcon 9 Block 5 | Cape Canaveral, Florida | Date may change

Starlink Group 4-36: Friday • September 30, 2022

Falcon 9 Block 5 | Cape Canaveral, Florida | Date may change



Growing numbers amid controversy

According to Wikipedia, as of July 2022 SpaceX has launched more than 3,000 Starlink satellites in low Earth orbit. Though not all remained operational. Astronomer Jonathan McDowell of the Harvard-Smithsonian Center for Astrophysics keeps a web page tracking Starlink statistics, and as of September 5, 2022, he reported 2,389 operational Starlink satellites.

Love 'em or hate 'em, these Starlink satellites are part of SpaceX's vision for a global internet communication satellite constellation. They deliver high-speed internet service worldwide, mainly to locations where ground-based internet is unreliable, unavailable or expensive. Starlink currently has about 500,000 subscribers. The private company is well-known for launching batches back to back, several times a month, regularly lofting 60 satellites at a time. And SpaceX plans to build up to perhaps as many as 30,000 eventually.

Many people thought seeing the first few Starlink satellites traveling together in the night sky was exciting. But then more were launched, and then more. And astronomers began to worry.

Because Starlinks are bright, astronomers say they're photobombing astronomical images. They're interfering with the professional astronomical observations that have brought us our modern-day view of the cosmos. And although SpaceX has tried to address the issue, they remain far from what astronomers say is acceptable.



(Image credit: Irix team)

SpaceX To Launch NASA's Crew-5 Mission With Russian Cosmonaut

The Crew-5 mission to the International Space Station (ISS) will now launch on October 3 when the launch window opens at 10:15 pm IST instead of September 29 as originally planned (12:45 pm EDT). Four people make up the Crew-5 team: two NASA astronauts (Mission Commander Nicole Mann and Pilot Josh Cassada), one representative from the Japan Aerospace Exploration Agency (Koichi Wakata), and one Russian cosmonaut (Anna Kikina). These crew members will launch from NASA's Kennedy Space Center's Launch Complex 39A in the Dragon spacecraft "Endurance" atop a Falcon 9 rocket from SpaceX.

Crew-5 is being sent to replace the astronauts of Crew-4, who will be returning to the orbiting outpost after a six-month stay. NASA astronauts Kjell Lindgren, Robert Hines, and Jessica Watkins, as well as European astronaut Samantha Christoforetti, arrived at the ISS on April 28. The Crew-5 mission would be historic in that it would see the first Russian cosmonaut (Kikina) board a commercial US spacecraft bound for the International Space Station. Kikina, who is preparing for her first mission, is Russia's only active cosmonaut, and she would be the first Russian woman to travel in an American-made spacecraft. Her journey is part of an agreement between NASA and Roscosmos (Russia's space agency) under which the latter will also send a NASA astronaut aboard a Soyuz capsule.

About the Crew-5 team members



(Photo credit: NASA)

Nicole Mann: Mann, who was chosen by NASA in 2013, is a Marine Corps colonel who has served as a test pilot for the F/A-18 Hornet and Super Hornet. She has also served on aircraft carriers twice in support of combat operations in Iraq and Afghanistan.

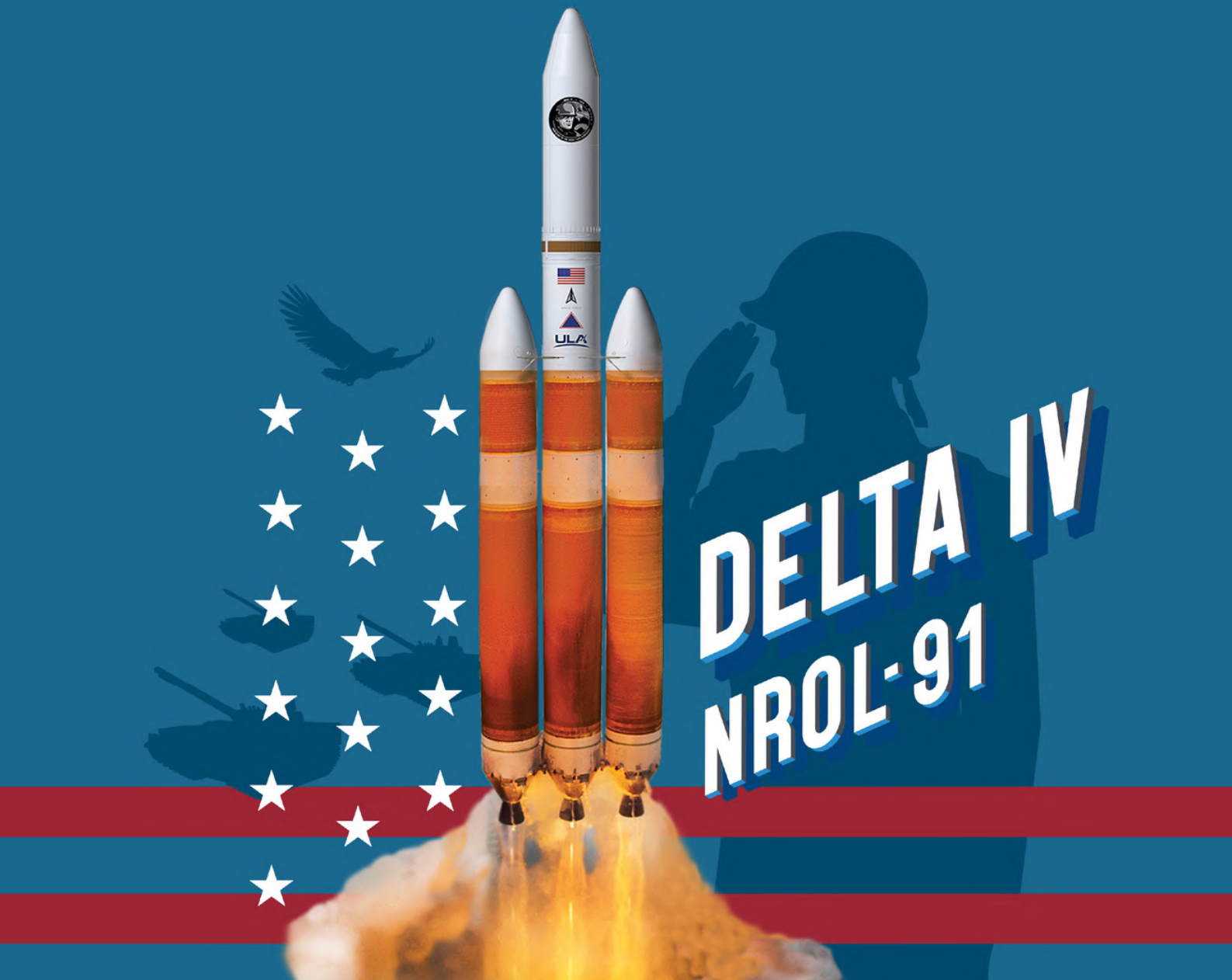
Koichi Wakata: Wakata will go on his fifth space mission after previously serving on long-duration ISS missions such as Expeditions 18, 19, and 20. He travelled into space on the STS-72 satellite retrieval mission in 1996, and again on the STS-92 ISS building mission in 2002.

Anna Kikina: Kikina was chosen as a Roscosmos cosmonaut candidate in 2012 and was added to the Roscosmos cosmonaut corps in 2014. As flight engineer No. 1, she participated in the SIRIUS international isolation experiment in 2017, which replicates a lunar mission and related experiments on the lunar surface. Kikina is a licenced airborne instructor with 153 parachute jumps. She is a Master of Sports in polyathlon and rafting.

Josh Cassada: Cassada, a physicist and US Navy test pilot, was also chosen by NASA in 2013. He received his B.A. in Physics from Albion College and his Ph.D. in Experimental High Energy Physics from the University of Rochester, where he worked at the Fermi National Accelerator Laboratory. Cassada has over 4,000 flight hours in 45 different aircraft after working as an instructor at the US Naval Test Pilot School.



(Photo credit: NASA/Ben Smegelsky)



(Image credit: ulalaunch.Com)

DELTA IV HEAVY TO LAUNCH NROL-91

A United Launch Alliance (ULA) Delta IV Heavy rocket will perform the NROL-91 mission in service to the National Reconnaissance Office (NRO) and the Space Force's Space Systems Command (SSC). Liftoff will occur from Space Launch Complex-6 at Vandenberg Space Force Base, California.

Launch Date: Sept. 24, 2022

MISSION OVERVIEW

When the United States needs eyes and ears in critical places where no human can reach – be it over the most rugged terrain or through the most hostile territory – it turns to the NRO. The NRO is the Department of Defense organization responsible for developing, acquiring, launching and operating America's reconnaissance satellites, as well as operating associated data processing facilities in support of national security.

The NRO uses a variety of satellites to meet mission needs—from small sats to more traditional, larger satellites. This allows the NRO to pursue a hybrid architecture designed to provide global coverage against a wide range of intelligence requirements, carry out research and development efforts, and assist emergency and disaster relief efforts in the U.S. and around the world. The NRO never loses focus on who they are working to protect: our nation and its citizens.



****Note: Launch dates of missions are scheduled to be launched in September 2022 but may subject to change.**

ASTRONOMICAL EVENTS - SEPTEMBER 2022

THE SEPTEMBER EQUINOX

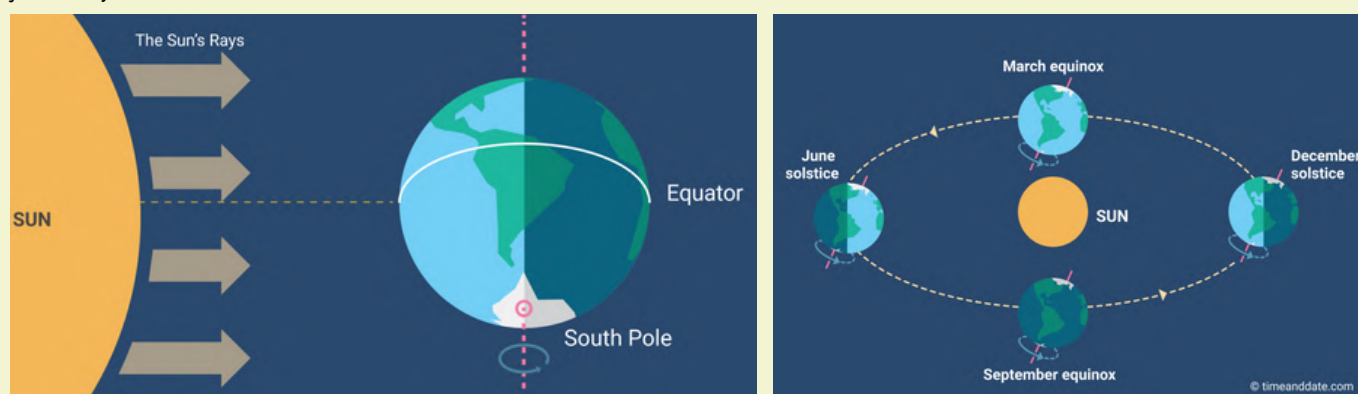
There are two equinoxes every year: one in September and one in March. In September, the Sun crosses the equator from north to south.

Sun Crosses Celestial Equator

The September equinox is the moment the Sun crosses the celestial equator—an imaginary line in the sky above Earth's equator—from north to south. This happens on September 22, 23, or 24 in most years.

Why Does the Sun Move North and South?

During the course of a year, the subsolar point—the spot on the Earth's surface directly beneath the Sun—slowly **moves along a north-south axis**. Having reached its northernmost point at the June solstice, it starts moving southward until it **crosses the equator** on the day of the September equinox. The December solstice marks the southernmost point of its journey.



(Image credit: Timeanddate.com)

The subsolar point moves north and south during the year because the Earth's axis is tilted at an angle of about 23.4° in relation to the ecliptic, an imaginary plane created by Earth's path around the Sun. In June, the Northern Hemisphere is tilted toward the Sun, and the subsolar point is north of the equator. As the Earth travels toward the opposite side of its orbit, which it reaches in December, the Southern Hemisphere gradually receives more sunlight, and the subsolar point travels south.

Why Is It Called "Equinox?"

On the days of the equinoxes, the Earth's axis is perpendicular to the Sun's rays, meaning that all regions on Earth receive about the same number of hours of sunlight. In other words, night and day are, in principle, the same length all over the world. This is the reason it's called an "equinox," derived from Latin, meaning "equal night."

However, this is literal translation not entirely true. In reality, equinox days don't have exactly 12 hours of daylight and 12 hours of dark.

Why Does the Date Vary?

The date of the equinoxes and solstices varies because a year in **our calendar does not exactly match** the length of the tropical year—the time it takes the Earth to complete an orbit around the Sun.

Today's Gregorian calendar has **365 days** in a common year and **366 days** in a leap year. However, our planet takes about **365.242199 days** to orbit the Sun. This means that the timing of the equinoxes and solstices slowly **drifts apart** from the Gregorian calendar, and the solstice happens about **6 hours later** each year. Eventually, the accumulated lag becomes so large that it falls on the following date.

To realign the calendar with the tropical year, a leap day is introduced (nearly) every four years. When this happens, the equinox and solstice dates **shift back to the earlier date** again.

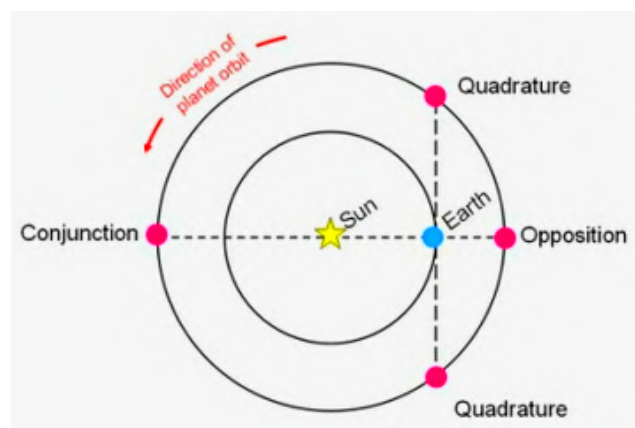
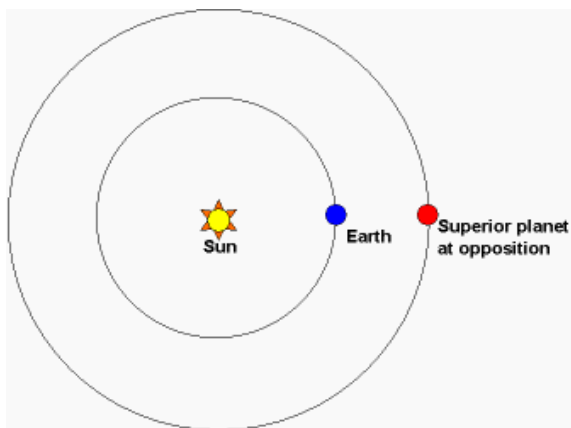
Other factors influencing the timing of the equinoxes and solstices include variations in the length of a tropical year and in the orbital and daily rotational motion of the Earth, such as the "wobble" in the Earth's axis (precession).

JUPITER AT OPPOSITION

Earth will sweep between the sun and Jupiter on September 26, 2022, placing the giant planet opposite the sun in our sky.

Jupiter in 2022: By the time of its September 26 opposition, Jupiter is rising in the east at sunset, and visible all night. For the rest of 2022, Jupiter is up in the evening. It continues shifting west, remaining visible in the evening sky through March of 2023.

When and where to watch: Jupiter will be in the constellation Pisces, the fishes, and so in city locations the planet will be the brightest star-like object in the eastern sky after sunset. How high Jupiter gets when it crosses the meridian – the line going through the zenith from north to south – depends on one's latitude.



(Opposition happens when Earth flies between an outer planet, like Saturn, and the sun.

Image credit: Heavens-Above.)

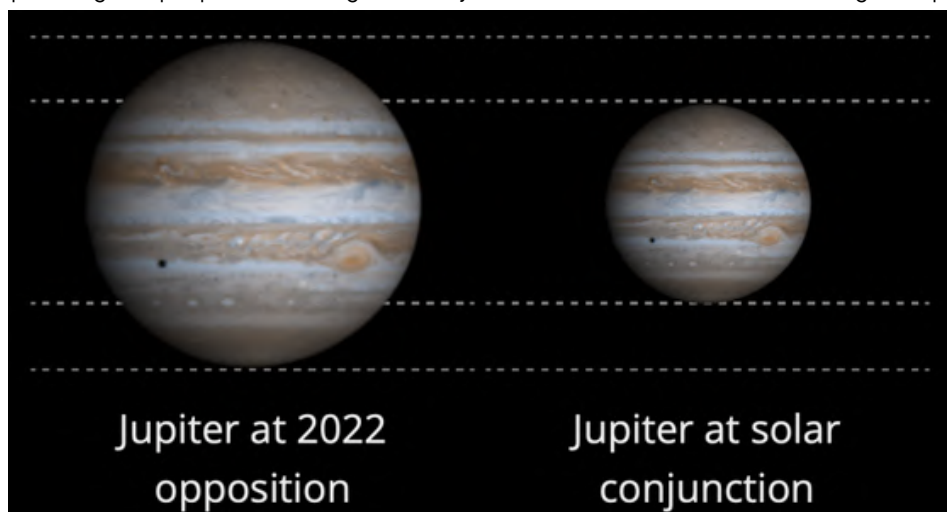
Brightness at opposition: Around opposition, the Giant planet shines at its brightest for 2022, at magnitude -2.9 .

Distance from Earth at opposition: Around opposition, Jupiter is at its least distance from Earth for 2022, at 33 light-minutes.

Constellation at opposition: Pisces, the fishes.

Through a telescope: Jupiter appears 50 arcseconds across.

Through binoculars: Jupiter reveals a bright disk. If you look closely, you'll see the Galilean satellites appearing as pinpoints of light, arrayed in a line that bisects the giant planet.



(A comparison of the apparent size of Jupiter at opposition (September 26, 2022) and when it is most distant from the Earth at solar conjunction (April 11, 2023). Image credit: Dominic Ford's In-the-Sky.org.)

How often does Jupiter reach opposition?

Jupiter comes to opposition roughly every 13 months. That's how long Earth takes to travel once around the sun relative to Jupiter. So – according to our earthly calendars – Jupiter's opposition comes about a month later each year. Recall that there are 12 constellations of the zodiac. And there are 12 months in a year. So Jupiter is in a new zodiacal constellation each year (last year – Capricornus; this year – Pisces).

CONJUNCTIONS FOR THE MONTH

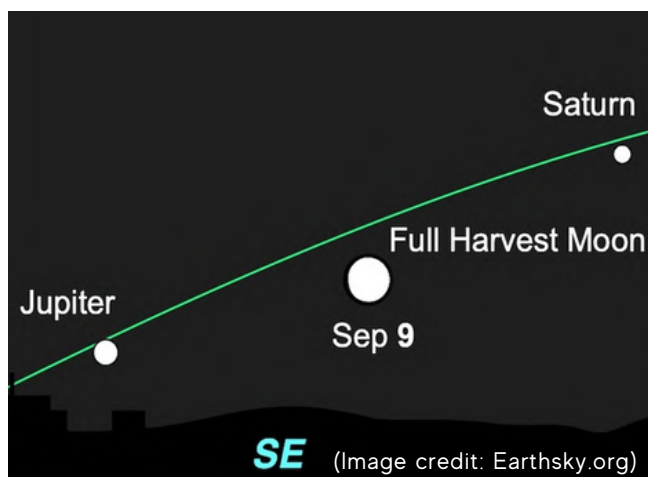
Conjunction - Occasionally two or more objects meet up with each other in our sky. Astronomers use the word conjunction to describe these meetings. Technically speaking, objects are said to be in conjunction in that instant when they have the same right ascension on our sky's dome. Practically speaking, objects in conjunction will likely be visible near each other for some days.

The word conjunction comes from Latin, meaning to join together. Maybe you remember the old Conjunction Junction cartoons from the 1970s. In language, conjunctions relate to clauses brought together in sentences with words like and. In astronomy, conjunctions relate to two or more objects brought together in the sky.

An astronomical conjunction describes a few different types of meetings. The first two types we're describing here - inferior and superior conjunctions - involve the sun and thus can't be seen.

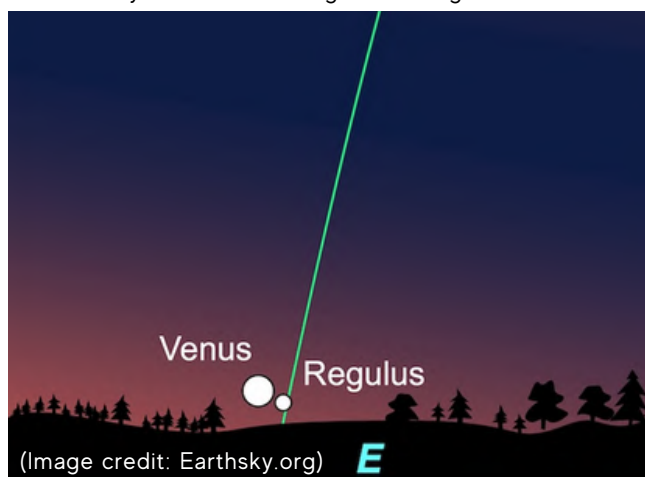
Conjunction of Moon with Jupiter and Saturn

On The evening of **September 9, 2022**, finds the full moon, known as the Harvest Moon, lighting the sky midway between Saturn to the west and Jupiter to the east.



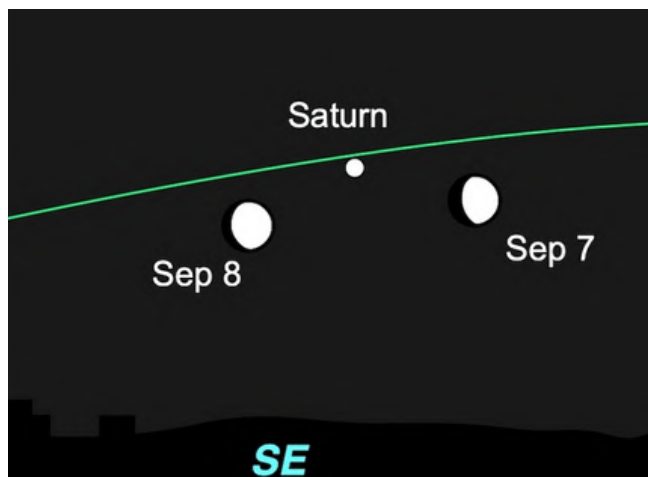
Close encounter of Regulus and Venus

Just before sunrise on **September 4, 5 and 6, 2022**, Venus lies very low in the east near the star Regulus in Leo the Lion. The planet passes the star on September 5, and drops below it by the following morning.



Conjunction of Gibbous Moon and Saturn

On the evenings of **September 7 and 8**, Saturn is the bright object near the waxing gibbous moon. They will be in the southeast as night begins and will cross the sky throughout the night, following the same path the sun travels during the day.



Conjunction of Moon and Pleiades

Date: 15th September, Moon will have a closer approach with the open star cluster Pleiades. The Moon is at a magnitude of -10.95, and Pleiades at a magnitude of 1.2. On this day, the Moon is 19.94 days old.



Place: Chennai / Date: 15th September / Time: 10.00PM

STUDENT'S CORNER

Alien plants

Sourajit Mandal

iAstronomer member, Space India.

Plants are living organisms that can synthesize their own food through the process of photosynthesis. It requires some basic components: - water, carbon dioxide and Sunlight. Sunlight is the most important here. It comes from the host star. But... stars are of different types. There are various types of stars with different sizes. Example, Solar type star, Hot blue star (bigger than our sun), Red giant stars (expanded stars like our sun at the end of their life) and white dwarfs (end stage of a sun like star, which has used all its fuel).

Now a question occurs, does the type of the host star even matter to plants? Yes, it does. Plants on Earth are green because our sun is neither too big nor too small. It is a yellow dwarf star. Plants are green because they reflect green light. They absorb the red and blue light only. But why? Tons of green light is produced by the sun. So why don't the plants use it?

The answer lies in Evolution. Plants have evolved to absorb only red and blue light. They do not absorb the other frequencies of light. Absorbing infrared light, would not give enough energy, but could overheat plants and eventually burn them. Absorbing ultraviolet light would overpower them and cause damage. So, the best way they found was to absorb red and blue light. They absorb a lot of red light, which provides energy but does not overheat them. While it absorbs blue light to get a lot of energy from less light. Even though the blue light provides too much energy to the plants, the plants use chemicals to lower down the energy just like the transformers are used to step down electricity.



But we still have not answered why plants are green in color? Why aren't they purple? Why don't they use the green light and reflect red and blue light?

The answer lies in ancient earth. Before the cyanobacteria who were the ancestors of plants, lived purple Sulphur bacteria on earth. They reflected red and blue light and used up the green light. When cyanobacteria first emerged in our planet, they did not have enough green light. All of it was being used by the sulfur bacteria. So, they started using the red and blue light instead of competing with the sulfur bacteria. The cyanobacteria eventually took over the purple sulfur bacteria and grew to be present day plants.

Light which the plants would absorb will depend on the atmosphere and type of the star. Therefore, it is for the type of star the sun is, that the plants on Earth appear to be green. The same logic applies to plants on other planets as well, if there happens to be such plants. Plants on Earth are a sort of fingerprint, visible from space. It's the same for alien planets.

- F type stars are big and hot. They emit a lot of blue and ultraviolet light. This could mean that plants on planets orbiting here would need to reflect the high energy light and appear blue. They might also have evolved to use up this light and reflect green and red. To our eyes they would appear yellow.
- K and M type stars are smaller and dimmer than our sun. They reflect mainly infrared light. Plants on planets around those stars would require a lot of light and may look very dark or even black to our eyes.
- On G type stars like our own star, plants would be green or purple.

As plants are a fingerprint to life on a planet, if we can study the light reflected by such planets then there is a possibility for us to find the existence of plants on such planets.

Nature's Colorful wonder: Aurora Borealis

Hasini Krishna

iAstronomer member.

Have you ever heard about the Northern lights? You probably have, because they are beautiful. They are also known as, Nature's light show, Polar lights, Aurora Polaris and many others. Here's how our friend Wikipedia puts it, "is a natural light display in Earth's sky, predominantly seen in high-latitude regions." It is essentially particles from the sun's solar wind hitting the earth's ionosphere (earth's upper atmosphere). While the Northern Hemisphere calls it 'Northern lights' or 'Aurora Borealis' – Beautiful light in the northern sky, the Southern hemisphere calls it 'Southern lights' or 'Aurora Australis' – Beautiful lights in the southern sky. Both are equally amazing. To understand more about its origin let's dive into its history.



Many say that the lights were first recognized/recorded in a 30,000-year-old cave painting in France and ever since then civilizations around the world have admired this wonder. A proof of this can be understood from the uncountable myths about these lights. Vikings thought it was light reflecting off the armour of Valkyrie (females who decide who'll die in battles "chooser of the slain" – from Norse mythology). Inuit (people from Greenland) thought that the lights were the spirits of dead children dancing in the sky and the list goes on. But, the one who popularized it and coined the term 'Aurora Borealis' is our favorite Italian astronomer, Galileo Galilei in 1619. He named it after Aurora, the Roman Goddess of Dawn and Boreas, the Greek God of the North wind, I mean... of course, he named it after Roman and Greek gods. Isn't that what they all do?

Moving on, what about the color of these lights? Why are they green or purple sometimes? It's all thanks to the composition of the earth's atmosphere. The green is because of the oxygen, and the purple is from the nitrogen in the earth's atmosphere. Sometimes, if we're lucky we can also see we can see a hint of red or blue because of the difference in altitudes on the earth. Isn't it stunning to see these colors dancing in the sky? Nature's beauty goes unadmired most of the time and it is sad that we don't appreciate and celebrate them as much.



People who know about it probably do admire it, but what about the others? And for those who do, they see it in a different way. Beauty can be appreciated through various forms, like art! This is how I see the northern lights; how do you see it?

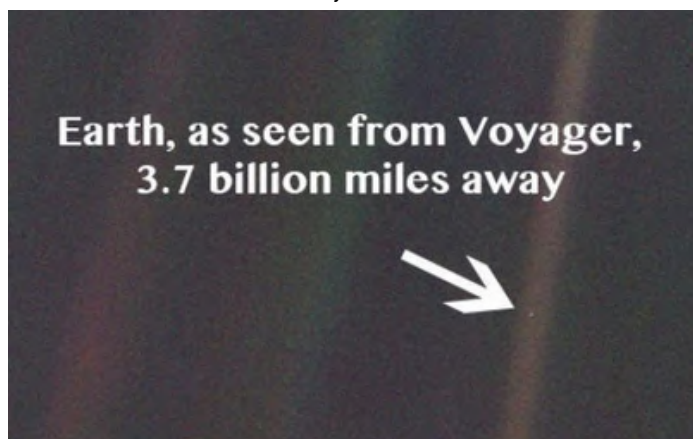


Hridhaan Solanki
iAstronomer member.

Voyager 1 is a masterpiece in comparison to another spacecraft. Everyone, at least once in their lives, would have heard about this spacecraft. It has gone far and beyond to discover the unknown and has greatly revolutionized the field of astrophysics and astronomy.

Voyager 1 is a part of the "Voyager" mission launched by NASA. It is the first spacecraft to go beyond the sun's heliosphere (a zone till Pluto's orbit). It was launched on 5th September 1977, 16 days after Voyager 2, though is still operational and is said to work till 2025. It is an 815 kg payload of the rocket, Titan IIIE, with the cost of 25 crores USD.

After launch, it was headed towards Jupiter and collected pictures of Mars on the way. In the April of 1979, it completed its Jupiter mission and sent around 19,000 pictures of Jupiter which revolutionized research on Jupiter as Jupiter photographs hadn't been taken before January. Then came what people say "It's best encounter", which was a flyby of Saturn's moon, Titan on the November of 1980. The flyby got attention as a year ago, 1979, NASA's Pioneer 11 reported that Titan's atmosphere was rather complex. Next, it changed its trajectory outwards from the solar system.



As it was outside the solar system now, it and its sister, Voyager 2, were taken part of the "Voyager Interstellar Mission" on 1st January 1990. They were hoped to contribute in the research at the Interstellar level.

Next month, On the 14th of February, it pointed its camera backwards and took a final image of the solar system where the earth looked like a blue dot in space. The image took media by a storm, and was named "The Pale Blue Dot".

Next, On 17th February 1988, it finally achieved the title of "**The Most Distant Man-Made Object.**" It did so by reaching a distance of 69.4 AU away from the sun (463.9 AU away from earth), snatching the title from the previous record holder, NASA's Pioneer 10.

After few years of no reports, On 13th December 2004, scientists announced that Voyager 1 had felt a high termination shock (Sudden change of magnetic forces) at a distance of 94 AU from the sun. This indicated that it had reached the Heliosheath (the outer region of the heliosphere where, due to the pressure from Interstellar region, solar winds become slower than the speed of sound, causing termination shock.) Years later came Voyager 1's biggest achievement, on 25th of August 2012, it became the first spacecraft to go through the heliopause and escaping the heliosphere, therefore reaching Interstellar space!

There haven't been any new accomplishments from the last 10 years, partially because only 4 out of its 11 devices are currently working, namely- Triaxial Fluxgate Magnetometer, Low Energy Charges Particle Instrument, Cosmic Ray System and Plasma Wave Subsystem.

This is the amazing history of one of the most important and revolutionary spacecrafts on earth as well as in the vast and mysterious space.

Indian Satellite Launching Vehicles

Daksh Rathi

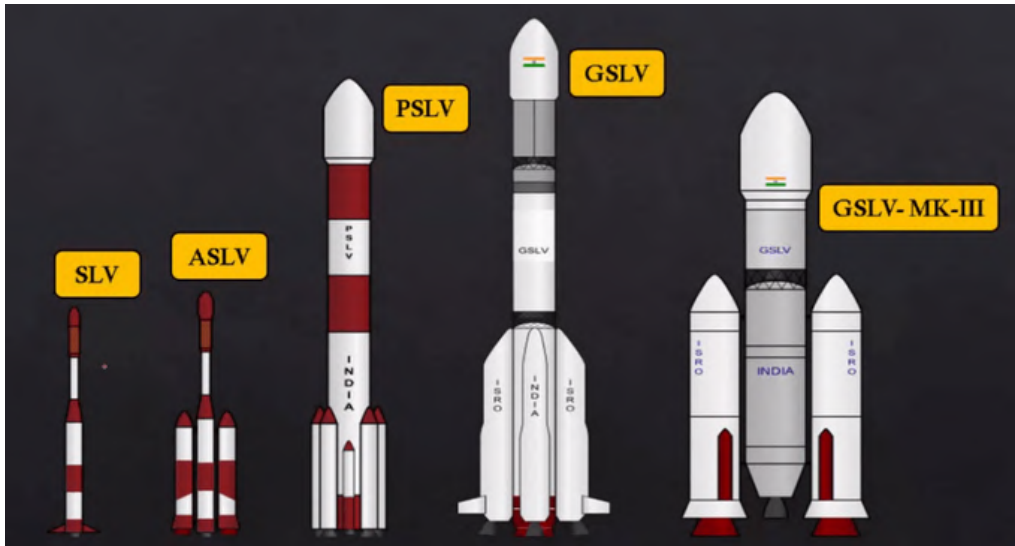
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Indian satellite launching vehicles are the Indian rockets which takes the satellites to space. These rockets are manufactured in India by ISRO (Indian Space Research Organization) Vikram Sarabhai Space Centre, located in Thiruvananthapuram, is responsible for the design and development of these launch vehicles. India currently has 3 operational vehicles,

*PSLV (Polar satellite launching vehicle)

*GSLV (Geosynchronous satellite launching vehicle)

*SSLV (Small satellite launching vehicle)



GSLV: This vehicle has 2 variants GSLV MK II & GSLV MK III Both of these vehicles launch satellites into the geosynchronous orbit. The following are the specifications of GSLV MK II,
Height: 49m.

Liftoff mass: 414 tons.

Payload mass: 2200 kg.

Propulsion: solid, liquid & cryogenic.

Specifications of GSLV MK III,

Height: 43m.

Liftoff mass: 640 tons.

Payload mass: 4 tons.

Propulsion: solid, liquid & cryogenic.

PSLV: This vehicle launches satellites in the sun synchronous polar orbit. The following are the specifications of PSLV,

Height: 44m.

Liftoff mass: 320 tons.

Payload mass: 1860 kg.

Propulsion: solid & liquid.

SSLV: This vehicle is different from the previous 2 vehicles. This vehicle can be manufactured at a low cost and can launch satellites in the sun synchronous orbit and was first launched on 7th August 2022. The following are the specifications of SSLV,

Height: 34m.

Liftoff mass: 120 tons.

Payload mass: 500 kg.

Propulsion: liquid.

The historic satellite launching vehicles of ISRO are,

*SLV (Satellite launching vehicle).

*ASLV (Augmented satellite launching vehicle).

The upcoming satellite launching vehicle:

*RLV-TD (Reusable launching vehicle - Technology Demonstrator).

HISTORICAL EVENTS HAPPENED IN SEPTEMBER

NASA's Viking 2 Landed On Mars - 3rd September 1976

NASA's Viking 2 was a joint orbiter-lander mission that saw the second US landing on Mars on September 3, back in 1976.

The Viking 2 mission was a part of the American Viking program to Mars and it consisted of an orbiter and a lander essentially identical to that of the Viking 1 mission. The second mission's lander operated on the surface for 1316 days and was turned off on April 12, 1980, when its batteries failed.

As the lander spent over three Earth years on the surface of the Red Planet, it took almost 16,000 images in 706 orbits around Mars. It analyzed the regolith in front of it and even conducted life experiments. Viking 2 took snapshots of craters, channels and other Mars feature from above as well.

The Viking program gave researchers a sense of what it's like to live and work on the Red planet. When the lander sent back the result of their life experiments, NASA reportedly said at that time that there was definitive evidence of life. That has been called into question in the decades since.

The primary mission objectives were,

1. To obtain high resolution images of the Martian surface
2. Characterize the structure and composition of the atmosphere and surface
3. Search for evidence of life.



Viking 2's biology experiment:

Furthermore, Viking 2 also carried a biology experiment whose purpose was to look for life. As per reports, second lander's biology experiment weighed 15.5kg and consisted of three subsystems - the Pyrolytic Release experiment (PR), the Labeled Release experiment (LR), and the Gas Exchange experiment (GEX). In addition, independent of the biology experiments, the second lander carried a Gas Chromatograph/Mass Spectrometer (GCMS) that could measure the composition and abundance of organic compounds in the Martian soil.

Both Viking 2 and its twin, Viking 1, carried primitive tools to search for Mars life. The Viking experiments had several parts to their life detection experiments. The landers didn't find any life, however, researchers in the years following were curious about whether the experiments were adequately designed to detect lifeforms.

Viking 2 Finds Martian Polar Cap Is Frozen Water:

The Viking II spacecraft has discovered that the permanent northern polar cap of Mars is composed entirely of frozen water, suggesting to scientists that the planet has much more water than had been expected.

This finding, announced today, led project scientists to liken Mars to a global iceberg. They said that the north polar cap may be only the tip of the iceberg, with the rest of it, in the form of permafrost, submerged in a "sea" of dust and rock.

At the same time, it was announced that other Viking instruments had detected traces of the rare gases krypton and xenon in the Martian atmosphere. This gave scientists the first strong and direct clue that the planet must have once had a considerably denser atmosphere and that it could have been much like the earth's had there not been an abundance of life and liquid water





ZOND5 - FIRST SOVIET SPACECRAFT TO ORBIT THE MOON

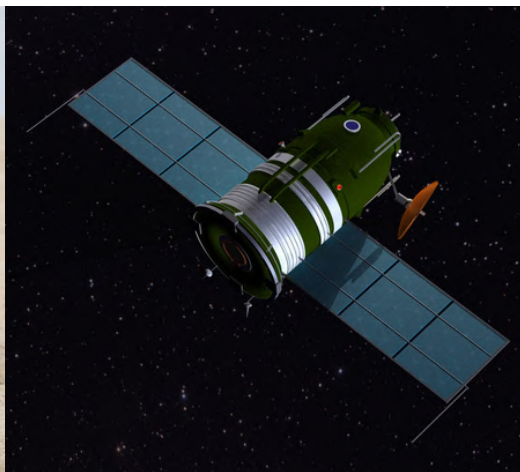
About the mission:

On 14 September 1968, a modified Soyuz capsule was launched from the Soviet Union. Its mission: to fly beyond the orbit of the Earth and to perform a lunar fly-by. The mission would last for nearly a week, and would become only the second time that a spacecraft launched from the Earth would reach the Moon.

But what really sets the Zond 5 apart from any other mission is its occupants: two unnamed Russian tortoises, or "steppe" tortoises as they are sometimes known. Along with samples of soil, seeds, and even some worms, the two reptiles were in space for a total of six and a half days as the capsule completed its circle of the Moon.

Try to imagine what the two tortoises felt during their flight. They were probably very confused by the intense vibrations and extreme conditions of blastoff. Once in the weightless environment of space, they may have also felt disorientated and were probably wondering what on earth was happening to them!

Thankfully, the tortoises not only survived the journey, but returned to the Earth in good health.



On 21 September 1968, six days after the launch, Zond 5 was retrieved from the Indian Ocean after its steep parachute landing. The original plan was for the Zond 5 to land in Kazakhstan, but the capsule veered off course during its return flight. Rescue vehicles from the Soviet Union raced to where the capsule was floating, and the samples (including the tortoises!) were successfully retrieved from the capsule.

It was later found that while the tortoises were alive and well, they had lost some weight (about 10%) during their time in space. This continues to be a common occurrence in the bodies of astronauts due to the loss of bone and muscle mass in a weightless environment. But otherwise, both tortoises were in good condition, and scientists confirmed that the reptiles had healthy appetites and were being given nutritional meals to help them recover from their flight.

Although the Zond 5 tortoises remain unnamed to this day, they have become a significant and vital part of the story of the Space Race. Their journey into space was one of the key events that led up to the launch of the first manned flight to the Moon - Apollo 8 in 1968.

So the next time you find yourself gazing at the Moon, try to imagine the two tortoises that once flew around it. They were some of the first - and strangest - astronauts to ever venture there.



Luna 2's impact was the first time an object made by a human being made contact with a celestial body beyond Earth.

Sept. 12, 1959: Launch

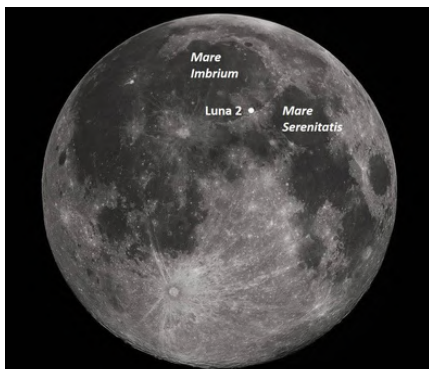
Sept. 14, 1959: Lunar Impact

Goals:

Luna 2, originally named the Second Soviet Cosmic Rocket, was the sixth Soviet attempt to send a probe crashing into the Moon. But it was the first successful attempt for any nation, making the Luna 2 probe the first human-made object to reach the surface of another celestial body. The spacecraft carried sensors to study interplanetary space and sodium gas to enable Earthbound observers to follow its progress.

Accomplishments:

Luna 2 was the first object of human origin to make contact with another celestial body. The spacecraft scattered spherical emblems of the Soviet Union on the lunar surface. The spacecraft's sensors found no evidence of a lunar magnetic field or radiation belt.



(Left: Photograph of the Moon showing the site where Luna 2 crashed. Right: A model of the sphere with Soviet pennants carried by Luna 2. Credits: Kansas Cosmosphere.)

In Depth:

After an aborted launch on Sept. 9, 1959, the Ye-1A probe, also known at the time as the Second Soviet Cosmic Rocket, successfully lifted off on Sept. 12, 1959.

When the spacecraft reached about 156,000 kilometers from Earth, it released one kilogram of sodium gas on Sept. 12 in a cloud that expanded to about 650 kilometers in diameter and was clearly visible from the ground.

Three days later, Luna 2 achieved escape velocity (the speed and direction required to travel beyond Earth's gravity). This sixth Soviet attempt at lunar impact was much more accurate than its predecessors, and the spacecraft reached the surface of the Moon on Sept. 14, 1959, becoming the first object of human origin to make contact with another celestial body. The probe collided with the moon at approximately 30 degrees north latitude and 0 degrees longitude on the slope of the Autolycus crater, east of Mare Serenitatis.

Luna 2 (as it was renamed in 1963) deposited Soviet emblems on the lunar surface carried in 9 x 15-centimeter metallic spheres. The spacecraft's magnetometer measured no significant lunar magnetic field as close as 55 kilometers to the lunar surface. The radiation detectors also found no hint of a radiation belt.

EVENTS & CELEBRATIONS BY SPACE

INDEPENDENCE DAY CELEBRATIONS



SPACE Team enthusiastically celebrated the 75th anniversary of India's Independence by hoisting the tricolour and singing the national anthem. On this occasion, we enjoyed the day with special independence day cake cutting and sharing sweet. Our culture at Space is what defines us and our mission to imbibe scientific temperament in all humans is what keeps us going.



MONTHLY TELESCOPIC OBSERVATION

SPACE ARCADE team conducted their 2nd Monthly Telescopic Experience session on 6th of August at two different places such as Delhi and Chennai respectively.

People from various places joined the observation with their own telescope, binocular and other astronomical equipment to learn and experience the breathtaking view of Moon! They also learnt about different types of telescope and cleared all their queries on Alignment of various telescopes then did basic Astrophotography.

Everyone enjoyed the view of moon and with its craters through the 8'' Dobsonian telescope setup by Space team.



ASTROPHOTOGRAPHS BY STUDENTS

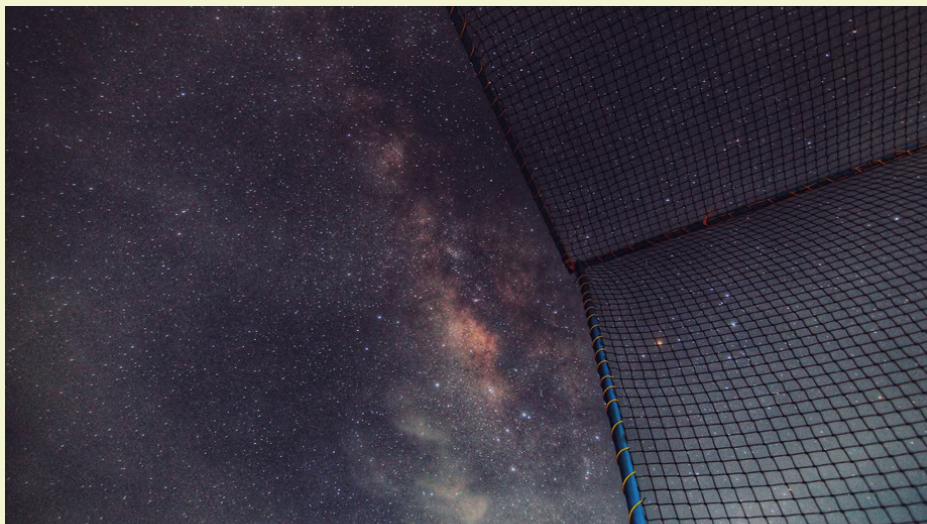


Daksh Rathi
iAstronomer member.



Vetrivel Thirunavukkarasu
iAstronomer member.

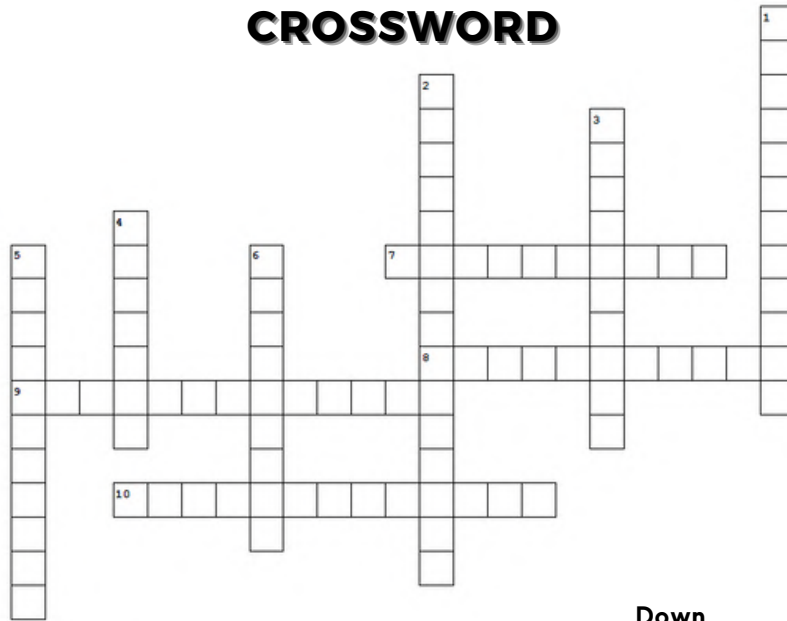
ASTROPHOTOGRAPHS BY SPACE



The above two Milkyway galaxy arm pictures are captured by SPACE Educator Mr. Ranjith Kumar.

TRAIN YOUR BRAIN

CROSSWORD



Across

- 7. Who is father of modern Indian astronomy?
- 8. The scientist who discovered that the Universe is expanding.
- 9. The first Indian to win a Nobel prize for astrophysics in 1983.
- 10. The first woman astronomer to discover a comet.

Down

- 1. Who was the first person to calculate the circumference of Earth?
- 2. The first astronomer to discover Uranus.
- 3. The first person to use longitude and latitude lines to identify places on the Earth.
- 4. Who discovered Saturn's largest moon Titan?
- 5. Who made the first reflecting telescopes?
- 6. The astronomer to Craft a Universal Message to Aliens.

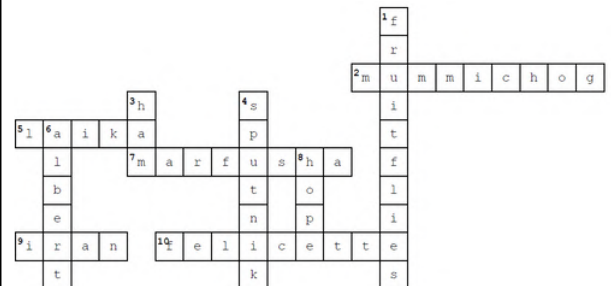
ASTRONOMY WORD PUZZLE

Find the names of some famous telescopes from the mixed letters and mark them.

S	E	R	J	A	M	E	S	W	E	B	B	R	L
P	K	C	E	K	B	M	O	B	O	T	R	M	A
I	H	W	L	G	K	R	B	E	B	N	E	L	R
T	S	O	N	U	E	A	L	S	I	A	T	A	G
Z	H	G	B	K	K	I	I	C	C	K	E	R	E
E	Z	N	O	B	L	E	T	L	E	E	M	G	B
R	L	O	A	A	Y	H	P	U	R	K	Y	E	I
T	H	R	G	C	R	E	R	L	A	L	T	Z	N
U	H	H	R	H	E	A	B	A	E	U	R	E	O
R	A	U	E	U	B	T	A	E	U	R	I	N	C
I	A	L	B	U	O	E	N	M	R	A	H	I	U
C	Z	K	S	B	E	Y	B	A	O	L	T	T	L
H	M	A	G	E	L	L	A	N	R	C	Y	H	A
R	E	N	U	E	S	E	E	I	B	G	H	E	R

- THIRTY METER
- HUBBLE
- SUBARU
- KEPLER
- SPITZER
- GRANTECAN
- HOBBY EBERLY
- LARGE BINOCULAR
- HOOKER
- GALILEO
- LARGE ZENITH
- JAMESWEBB
- KECK
- ARECIBO
- MAGELLAN

Answers for last month puzzles.



M	H	P	A	R	G	A	N	O	R	O	C	R	L
I	S	U	B	T	F	A	R	C	E	C	A	P	S
R	T	D	C	R	R	M	E	S	C	S	P	F	G
I	S	E	T	R	S	O	I	P	A	R	E	T	D
C	L	T	M	N	O	M	F	E	N	E	R	P	L
R	E	E	H	I	L	E	I	C	T	K	T	S	E
Y	N	C	S	R	A	N	L	T	E	C	U	R	I
O	A	T	H	C	R	T	T	R	N	A	R	O	H
C	P	O	C	A	A	U	E	O	N	R	E	R	S
O	R	R	I	M	R	M	R	G	A	T	M	R	N
O	A	S	N	O	R	F	S	R	A	R	A	I	U
L	L	R	C	P	A	L	R	A	M	A	S	M	S
E	O	T	T	E	Y	A	A	P	R	T	K	A	E
R	S	I	T	A	M	P	T	H	A	S	M	C	A

**Answers for this month puzzles will be shared in next magazine.

THERE IS A SCIENTIST IN EVERY CHILD LET'S DISCOVER IT



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PRISM SYSTEM: PORRO PRISM
PRISM GLASS: Bak-4
APERTURE: 70MM
EXIT PUPIL: 4.7MM
MAGNIFICATION: 15X
ANGULAR FOV: 6.4 Deg

CELESTRON SKYMASTER 20X80
PRISM SYSTEM: PORRO PRISM
PRISM GLASS: Bak-4
APERTURE: 80MM
EXIT PUPIL: 4MM
MAGNIFICATION: 20X
ANGULAR FOV: 3.7 Deg

CELESTRON SKYMASTER 25X100
PRISM SYSTEM: PORRO PRISM
PRISM GLASS: Bak-4
APERTURE: 100MM
EXIT PUPIL: 4MM
MAGNIFICATION: 25X
ANGULAR FOV: 3 Deg

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REFRACTOR TELESCOPES

SPACE LAUNCHER 60MM
TYPE: REFRACTOR
MOUNT: ALT-AZ
APERTURE: 60MM
FOCAL LENGTH: 700MM

CELESTRON POWERSEEKER 60EQ
TYPE: REFRACTOR
MOUNT: EQ
APERTURE: 60MM
FOCAL LENGTH: 900MM

SPACE PROBE 80EQ
TYPE: REFRACTOR
MOUNT: EQ
APERTURE: 80MM
FOCAL LENGTH: 400MM

REFLECTOR TELESCOPES

SPACE LAUNCHER 76MM
TYPE: REFLECTOR
MOUNT: ALT-AZ
APERTURE: 76MM
FOCAL LENGTH: 700MM

KSON 80MM NEWTONIAN
TYPE: REFLECTOR
MOUNT: ALT-AZ
APERTURE: 80MM
FOCAL LENGTH: 800MM

BRESSER 127EQ NEWTONIAN
TYPE: REFLECTOR
MOUNT: EQ3
APERTURE: 127MM
FOCAL LENGTH: 650MM

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