


Galactica

Astronomy and Space Science Magazine



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Moon Phases And Planet Visibility
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Galactica is a monthly magazine about astronomy & space science published by SPACE India 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 the 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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ABOUT SPACE



Legacy of 24 years



Pioneer Organization



10000+ Activities Developed



1000+ Schools Associated



1.5M+ Students Engaged



10K+ Outreach Events



10+ Cities Presence

SPACE is the pioneer organization working towards the 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, and 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 the 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, and professional organizations, government agencies, and space observatories.

CMD's Message



Dr. Sachin Bahmba,
CMD, SPACE

Space and Astronomy are 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 for students wherein they explore the real world of science, I wish for young students to let their ambitions soar and think big as they are the future of our country.

Co-founder's Message

Astronomy education is important as it builds curiosity, critical thinking, and problem-solving skills, helping young minds prepare for the future. It encourages innovation, exploration, and a scientific mindset.



Ms. Shalini Bahmba,
Co-founder, SPACE

Young learners build creativity and confidence through hands-on, experiential learning, preparing them for careers in space science and technology. We aim to cultivate future innovators who will lead progress, discovery, and global advancement.

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Space Insights

EXPLORING THE COSMOS: SPACE ARCADE'S MONTHLY OBSERVATION

In January 2025, SPACE ARCADE hosted its much-anticipated Monthly Telescopic Observation event, drawing astronomy enthusiasts from Chennai for an enchanting evening under the stars. Over 30 participants, armed with telescopes, binoculars, and other celestial gear, gathered to explore the night sky's wonders. Unfortunately, the Delhi event was canceled due to unfavorable weather conditions.



Attendees marveled at breathtaking views of the Moon, Venus in its gibbous phase, Jupiter and its moons, and Saturn. The highlight of the night was Mars, dazzling brightly as it reached one of its closest approaches to Earth.

The SPACE ARCADE team guided participants through the assembly and calibration of various telescopes, offered insights into the unique features of each model, and answered a range of questions. They also introduced foundational astrophotography techniques, sparking inspiration among attendees to document their stellar observations.

A wide variety of telescopes were showcased during the event, including the Space Voyage 8" F/6 Dobsonian Telescope, 200mm SCT on a Computerized EQ5 Mount, NexStar 8SE Computerized GoTo Telescope, Space Launcher 76mm, Space Voyage 150 EQ, Celestron

Astromaster 70AZ, and Celestron Astromaster 130EQ. Each provided participants with a distinct and memorable perspective of the cosmos.

With its focus on interactive learning and shared exploration, the event left a lasting impression on all who

attended. SPACE ARCADE looks forward to welcoming even more stargazers to future sessions, continuing to inspire curiosity and wonder about the universe.

Stay updated on upcoming events by following SPACE ARCADE on Instagram: @SpaceArcadeInd!



A Cosmic Evening at Vatika City

On 13th January 2025, residents of Vatika City witnessed a spectacular celebration of Lohri, as a Cosmic Evening event was organized in the heart of the city. The event, which was a unique blend of astronomy and festive fun, drew a large crowd of enthusiastic participants.

The event featured an interactive stall that offered a range of exciting activities. The highlights of the event included:

- Planetary pop art: Where kids could create their own planet. They painted vibrant colours on inflatable planets which they took home as a memento of the memorable evening.
- Cosmic ink: Visitors had the opportunity to get temporary tattoo stickers of their favourite celestial bodies.
- Air rocketry: Participants were left in awe after launching the model rockets they designed. Participants were filled with wonder when they saw their rockets soar through the sky.



- Virtual reality: Visitors understood what life in space is like through a thrilling tour of the International Space Station (ISS).
- Telescope observation: The standout event where participants could gaze at the wonders of the night sky. Visitors were left mesmerized by the sheer beauty of the universe as they gazed at the moon and planets which were on full display.

The event was a resounding success, with visitors of all ages having an absolute blast. The feedback was overwhelmingly positive, with many praising the organizers for their innovative approach to celebrating a traditional festival.

The Cosmic Evening event in Vatika City was a shining example of how astronomy can be made accessible and fun for everyone. As the city gears up for more such events, the residents of Vatika City are eagerly looking forward to the next cosmic celebration.

ONLINE INTERACTION

Unlocking the Secrets of Winter Solstice

On the evening of 21st December 2024, SPACE India hosted an insightful webinar titled "Unlocking the Secrets of Winter Solstice." This engaging event brought together astronomy enthusiasts and experts to delve into the mysteries of this astronomical phenomenon, which marks the shortest day and longest night of the year. The session was hosted by Rishita Sharma, an educator passionate about astronomy and science outreach.



The webinar highlighted the significance of the Winter Solstice, explaining how this day symbolizes the Sun reaching its lowest position in the sky. The event was a celebration of SPACE India's mission to popularize astronomy and space science education. With initiatives like the All India Asteroid Search Campaign (AIASC) in collaboration with NASA and Astro Night Sky Tourism, SPACE India continues to inspire curiosity and knowledge about space exploration.



The event featured two distinguished speakers who brought their wealth of knowledge and expertise to the audience:

Dr. Arun Bhardwaj, a Senior Scientist/Engineer-SG at ISRO, shared his experiences from iconic space missions such as INSAT, Cartosat, Chandrayaan-1, and Mangalyaan. His insights into these groundbreaking achievements underscored the

dedication and innovation driving ISRO's success. Dr. Bhardwaj's contributions offered participants a deeper appreciation of the science behind space exploration and its impact on our understanding of the universe.

Mr. Vikrant Narang, the Chief Technology Officer of SPACE India, shared his journey of setting up an astronomical observatory in

NCR and his efforts to inspire a culture of space exploration among young minds. His discussion on the importance of accessible astronomy education resonated deeply with the audience, encouraging them to explore the cosmos and dream big.

As the webinar concluded, gratitude was expressed to Dr. Bhardwaj and Mr. Narang for their enlightening sessions and to the enthusiastic participants who contributed to the event's success.



WITH AN ASTRONOMER

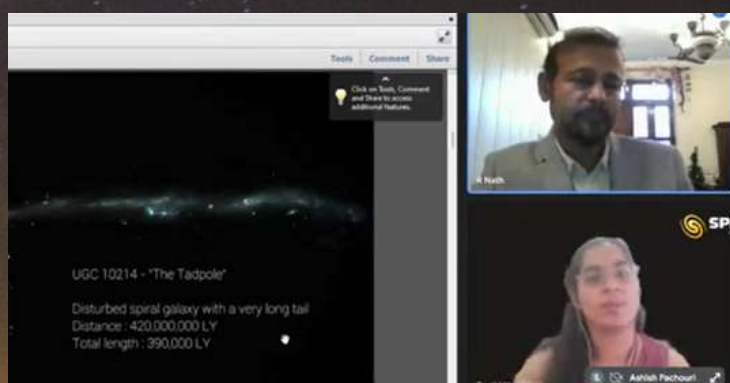
Exploring the Wonders of the Universe



On 25th January 2025, Space India hosted another webinar with renowned astronomer and space scientist, Dr. Rintu Nath. During the live YouTube session titled 'Exploring the Wonders of the Universe' he enthralled audiences. The session brought together astronomy enthusiasts from all walks of life, offering them an extraordinary chance to interact with an expert deeply passionate about the cosmos.

Dr. Nath began the session by introducing the vast and awe-inspiring scope of astronomy. He detailed the significance of cosmic events, such as supernovae and gamma-ray bursts, as He explained how this fascinating field encompasses everything from studying celestial objects to unraveling the universe's secrets. Touching on the scale of the cosmos, he described the enormity of galaxies, the enigmatic nature of black holes and the discovery of exoplanets. These topics, he emphasized, are not only key to understanding our place in the universe but also spark endless curiosity. He addressed the complexities of interstellar travel, which he called the future of the space exploration. He emphasized the importance of innovation, collaboration, and resilience in overcoming the technical and physiological barriers to deep space missions focussing on the challenges of human space exploration.

Dr. Nath's interaction with the participants was the highlight of the event. Participants were deeply engaged, and his Q&A session added a personal touch to the event. He addressed a range of questions, from the search for extraterrestrial life to the future role of artificial intelligence in space missions. His ability to simplify complex concepts left the audience inspired and eager to explore more. The session concluded with an emphasis on careers in STEM



and space research. He encouraged students to pursue their dreams in these fields, highlighting the transformative impact they could have on humanity's understanding of the cosmos. This live session was not just a conversation but a journey through the wonders of the universe, leaving participants with newfound knowledge about the infinite mysteries that lie beyond our world.

The two interactive sessions allowed students to engage directly with the experts, asking questions ranging from technical aspects of space missions to the significance of celestial events. The thoughtful responses from the speakers created valuable learning moments, enriching the experience for all attendees.

Both webinars exemplified SPACE India's commitment to fostering a love for astronomy and space science. Participants left with newfound knowledge and a renewed sense of wonder, inspired to continue their exploration of the universe. With such events, SPACE India continues to lead the way in making the cosmos accessible and inspiring for future generations.

Stargazing Extravaganza at NTPC Gadarwara

SPACE India's stellar event ignites astronomical curiosity at NTPC Gadarwara.

On the 6th and 7th of January 2025, Space India recently orchestrated a captivating two-day, two-night astronomy event at NTPC Gadarwara, Madhya Pradesh. The event provided a unique and immersive experience, sparking a passion for astronomy in young minds. Students were treated to engaging solar observation sessions where they learned about the Sun's various features and dynamic nature. This hands-on experience ignited their curiosity and provided a foundational understanding of our closest star. As night fell, participants had the opportunity to observe planets and deep-sky objects through telescopes guided by experts who shared fascinating facts and stories about the celestial wonders. For many, this was their first glimpse of a night sky unpolluted by city lights, creating a truly memorable experience.

The event went beyond simple observation. Interactive and educational activities were also incorporated, engaging students. Students explored the intersection of art and astronomy through laser painting, creating artistic representations of celestial bodies and phenomena. Students also delved into the technical aspects of astrophotography, learning how to capture the beauty of the night sky through a camera lens.



The activities provided a well-rounded learning experience, with creativity blended with scientific exploration. The event was a resounding success, with students and parents alike expressing their delight with the unique and educational experience. It fostered a sense of wonder about the universe while inspiring the next generation of astronomers. This showcases Space India's commitment to education and outreach.



At the end of the event, a lasting impact on the young participants fostered a deeper understanding and a newfound appreciation of the universe around us.

COSMIC MIND FORUM AT K. R. MANGALAM WORLD SCHOOL, VAISHALI

On January 20, 2025, K. R. Mangalam World School, Vaishali, in collaboration with SPACE India, hosted the "Cosmic Mind Forum - Inspiring Young Scientist." The event aimed to inspire young minds and ignite a passion for space exploration and scientific discovery among grade VII students.

The forum featured an enlightening session by Dr. Vineeta Kumari, Scientist - C at the WISE KIRAN Division, Department of Science and Technology. Dr. Kumari captivated the audience with her insights on space exploration, the pivotal role of satellites, and India's remarkable achievements in space research. She highlighted India's advancements through missions like SpaDeX and the ambitious Gaganyaan project, instilling a sense of pride and curiosity in the young learners.



Students actively participated, engaging Dr. Kumari with thought-provoking questions about the cosmos and space technology. Her patient and detailed responses encouraged further exploration and inquiry, making the session both interactive and inspiring.



This event successfully fostered a spirit of curiosity and innovation among students, reaffirming the school's commitment to nurturing future scientists and explorers. The Cosmic Mind Forum was not just a learning experience but a step toward inspiring a generation to dream beyond the stars.

PLANETARY PARADE AT DPS GREATER FARIDABAD

On 25th January 2025, Delhi Public School, Greater Faridabad, in collaboration with Space India, organized a spectacular planetary parade observation event. The evening brought together the school community, including RWA members and staff families, to witness the marvels of the night sky. The event was graced by the presence of Dr. Rohit Jainendra Jain, Pro-Vice Chairman of the school, and Smt. Shail Bala, the patron.



Visitors had the rare opportunity to observe celestial wonders such as Saturn and its magnificent rings, Venus, Jupiter along with its moons, and the fiery red Mars through advanced telescopes. The event offered a mix of learning and fun, featuring a vibrant game station that included exciting activities such as tattoo stations, solving Moon phases puzzles, exploring Virtual Reality experiences, understanding the working of telescopes, and the engaging "Ring the Planet" game.



The event was a resounding success with over 500 visitors since it started at 6:00 PM. Attendees were thrilled to engage in interactive activities while deepening their understanding of astronomy. The planetary parade not only fostered curiosity about space exploration but also created lasting memories for all who attended, leaving them inspired by the wonders of the universe.

EXPLORING THE COSMOS: A JOURNEY THROUGH SPACE

On 28th January 2025, Space India's Sector 11, Dwarka office transformed into a portal to the cosmos. Young minds from various schools across the NCR came together for the exciting 9th workshop Space India is conducting in collaboration with the American Center. Titled "Mission ISS - A Virtual Reality Astronaut Experience," this event aimed to educate and inspire students about the International Space Station (ISS) and the life of astronauts in space, providing them with hands-on experiences that brought space science to life. Students from Mahavir Senior Model School, Maxfort School, Prudence School, Amity International School, K.R. Mangalam World School, Sachdeva Global School, and many more arrived with excitement and eagerness. The space team welcomed teachers, parents, and participants with a warm welcome that set the tone for an enriching day of discovery and learning.

The workshop began with an enthralling presentation by an expert astronomer, guiding students through the vast realm of space exploration. A major highlight has been the intense discussion on ISS, an embodiment of international cooperation and an inevitable stepping stone for future interplanetary missions. The excitement crested when the participants went aboard the ISS via a virtual reality mission using Oculus Meta Quest VR headsets and witnessed the problems and wonders of microgravity themselves. Students also participated in hands-on activities to help them understand better astronaut life, building a space suit cooling system that would keep temperature regulation manageable by using plastic tubing and bottles, constructing a solar panel array to find out how exactly solar energy powers the Space Station, and learning about maximum absorption garments as a method of hygiene and comfort in space.



While students extensively went about learning space science through virtual experiments and hands-on experiments, parents and teachers attended a special interactive session led by the other astronomer. This segment introduced the Stellarium app, an important utility for amateur astronomers to find celestial bodies in the night sky, and upcoming the planetary parade event. Teachers and parents found the session inspiring, as it rekindled their own fascination with space and encouraged students to dive deeper into scientific exploration.

The astronomy workshop was a resounding success, blending state-of-the-art technology, hands-on learning, and expert guidance to ignite a passion for space science. It was an unforgettable journey beyond Earth, leaving participants with a newfound appreciation for the universe and its infinite possibilities. Students, teachers, and parents departed from the event with bright eyes and curious minds. The event turned out to be a stepping stone for young dreamers who would eventually stand in the frontlines of humanity in their quest for exploring the stars.

Astroport: Transforming Tourism and Education Through Science and Adventure

Astroport is transforming how we experience tourism in India by bringing together science, adventure, and exploration in the most captivating way. Imagine gazing at the stars, learning about the universe, and exploring breathtaking landscapes—all in one trip. That's the magic of Astroport. Each Astroport destination is a gateway to both the cosmos and the beauty of nature. Whether it's the lush greenery of Dwarasamudra in Karnataka, the peaceful charm of Dhela and Dhikuli in Uttarakhand, or the rugged terrains near Sariska Tiger Reserve in Rajasthan, every location has something unique to offer. The pristine Neil Islands in the Andaman and Nicobar Islands, the iconic dunes of Nubra, and the crystal-clear waters of Pangong Lake in Ladakh further add to the allure. And the journey doesn't stop there. With an upcoming Astroport in Leh, the adventure is set to reach new heights—both literally and figuratively. Astroport isn't just about tourism; it's about sparking curiosity, inspiring minds, and creating unforgettable memories under the stars.



G.I.C. Inter College,
Dhikuli Ramnagar, Uttarakhand

A Journey Through the Cosmos

Astroport's community outreach programs are known for their immersive and hands-on approach to learning, and the solar observation activity was no exception.

With professional telescopes and stargazing expert guidance, students observed the Sun, including fascinating features like sunspots. The sessions were designed to be interactive, ensuring that students not only observed but also comprehended the scientific phenomena they witnessed.

In addition to observing sunspots, the program included a detailed explanation of the features and functioning of telescopes. Students learned how these instruments are designed to safely observe the Sun, filtering harmful radiation and providing clear views of the sun. This practical understanding of the equipment added another layer of engagement to the sessions.

The program was conducted at multiple Astroport locations, each bringing the magic of astronomy to life for eager young minds. Here's a glimpse into the schools and dates where this remarkable initiative unfolded:

Astroport, a pioneering name in stargazing experiences, recently conducted an inspiring solar observation community program under the banner "Taare Zameen Par".

This initiative, aimed at fostering curiosity and scientific temperament among students, was offered free of cost in government schools across various locations in India. The program provided a unique opportunity for students to delve into the wonders of our nearest star, the Sun, and understand its role in our solar system.



Government Senior Secondary School, Tehla, Alwar, Rajasthan

G.I.C. Inter College, Dhela Ramnagar, Nainital, Uttarakhand

Nestled in the serene landscapes of Nainital, the students of G.I.C. Inter College were introduced to the Sun's secrets through an advanced telescope. The session sparked awe and left students with a deeper appreciation for the cosmos.

G.I.C. Inter College, Dhikuli Ramnagar, Uttarakhand

In the heart of Ramnagar, the program continued to inspire student at G.I.C. Inter College, Dhikuli. The interactive discussions and live observations ignited a wave of curiosity among the participants.

Government High School, Bikkodu, Belur, Hassan, Karnataka

Taking the program to southern India, Astroport reached the Government High School in Bikkodu. The students marvelled at the detailed views of the Sun, gaining insights into its dynamic behaviour and significance.

Government Senior Secondary School, Tehla, Alwar, Rajasthan

The program concluded at Tehla, Alwar, where students explored solar phenomena in a hands-on session. The experience fostered a sense of wonder and inspired many to consider careers in science and astronomy.



Government High School, Bikkodu, Belur, Hassan, Karnataka



Government High School, Bikkodu, Belur, Hassan, Karnataka

Bridging the Gap in Science Education

Astroport's initiative is a testament to the power of community programs in bridging the gap between theoretical knowledge and practical understanding. By bringing professional-grade telescopes and stargazing experts to government schools, Astroport ensured that students from all backgrounds had access to high-quality scientific learning experiences.

Inspiring the Next Generation of Scientists

One of the most remarkable aspects of the program was its ability to inspire students to dream big. For many participants, this was their first exposure to the world of astronomy. The excitement of observing the Sun firsthand left a lasting impression, encouraging students to explore science beyond textbooks.

The program also emphasized the importance of sustainability and environmental awareness. Discussions on solar energy and its potential as a renewable resource resonated deeply with the students, highlighting the practical applications of their newfound knowledge.

Looking Ahead

Astroport's solar observation program is just one of many steps in its mission to make astronomy accessible to all. By continuing to organize such initiatives, Astroport aims to nurture a generation of scientifically literate individuals who are curious, innovative, and driven to explore the universe. Astroport's efforts have not only illuminated the Sun but also brightened the future of countless young minds.

Through initiatives like these, Astroport reaffirms its commitment to democratizing science education and inspiring the next generation to reach for the stars.

HIGHLIGHTS OF JANUARY 2025

BLACK HOLES SUPPRESS STAR FORMATION: INSIGHTS FROM JAMES WEBB SPACE TELESCOPE



Image credit: ESA/Webb, NASA & CSA. H. Dannerbauer

NASA's James Webb Space Telescope (JWST) has uncovered new evidence that supermassive black holes can suppress star formation in galaxies. By studying 19 galaxies in the Spiderweb protocluster, located 11 billion light-years away, astronomers revealed that galaxies with active black holes at their centers produce fewer stars compared to those without.

Star formation occurs when cold hydrogen gas collapses under gravity, heating up and triggering nuclear fusion. This process releases a specific type of radiation detectable by JWST's Near Infrared Camera (NIRCam). However, galaxies hosting supermassive black holes lack such signs of star formation. Instead, these black holes can expel gas from galaxies through relativistic jets, stripping away the material necessary for new stars.

The Spiderweb protocluster, one of the oldest known galaxy clusters, provides a unique laboratory for studying this phenomenon. Observations show that galaxies within the cluster, observed as they appeared less than 3 billion years after the Big Bang, follow this pattern. Eight galaxies with active black holes exhibited almost no star formation, while the remaining 11 showed more activity.

Massive black holes grow as galaxies merge, reaching millions of solar masses. As matter spirals into these black holes, some of it is expelled at high speeds, depleting star-forming gas. This process may explain why elliptical galaxies, which form from galactic collisions, are largely devoid of new stars. The findings also align with data from NASA's Chandra X-ray Observatory, which detects powerful X-rays emitted by these black holes. While the JWST findings highlight the role of black holes in halting star formation, lead researcher Rhythm Shimakawa emphasizes that other mechanisms might also contribute.

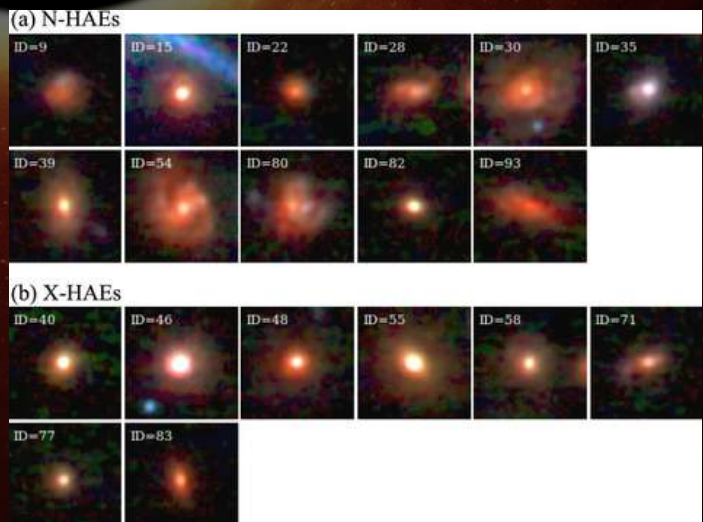


Image credit: Shimakawa et al.

The study, published in the Monthly Notices of the Royal Astronomical Society, underscores the need for continued exploration of the intricate relationship between black holes and their host galaxies.

INDIA ACHIEVES HISTORIC FIRST WITH SUCCESSFUL SATELLITE DOCKING



Image Credit: ISRO

India has achieved a significant milestone in its space exploration journey by successfully completing its first-ever in-space satellite docking, joining the ranks of the United States, Russia, and China. The Indian Space Research Organization (ISRO) announced on January 15 that its Space Docking Experiment (SpaDeX) was a success, marking a historic moment for the nation's ambitious space program.

"Spacecraft docking successfully completed! A historic moment," ISRO said in an X post, celebrating the achievement. The two satellites

involved, named "Target" and "Chaser," were launched on December 30, 2024, aboard a Polar Satellite Launch Vehicle (PSLV) rocket. Each satellite weighs 485 pounds (220 kilograms) and was designed to test India's automated docking technology, critical for future space missions.

SpaDeX demonstrated the maneuvering capabilities of both satellites, which initially positioned themselves 50 feet (15 meters) apart. The duo gradually closed the distance to just 10 feet (3 meters) before executing a flawless docking sequence. Post-docking, ISRO confirmed successful control of the satellites as a single unit, with undocking and power transfer tests to follow in the coming days.

This achievement is a stepping stone for India's future space endeavors. Docking technology is essential for ambitious projects such as the Bharatiya Antariksh Station (BAS), India's planned Earth-orbiting space station, which is targeted for assembly by 2035. Additionally, this capability will play a pivotal role in upcoming missions like Chandrayaan-4, a robotic lunar sample-return mission scheduled for 2028.

India's entry into the exclusive group of nations capable of in-space docking highlights the maturity of its space program. While countries like Japan and the European Space Agency (ESA) have developed cargo spacecraft for the International Space Station (ISS), ISRO's achievement marks a fully autonomous docking operation.

With this success, ISRO has further solidified India's reputation as a rising force in space exploration, paving the way for more advanced missions and inspiring confidence in the nation's space capabilities.



An illustration of India's two SpaDex satellites nearing each other in orbit ahead of a historic docking. (Image credit: ISRO)



SpaDeX Chaser (SDX01) and Target (SDX02) spacecrafts during testing. (Image Credit: ISRO)

COMET G3 ATLAS SHINES BRIGHT IN ASTRONAUT'S STUNNING SPACE PHOTO

Astronauts aboard the International Space Station (ISS) had a front-row seat to one of the brightest celestial events of 2025—the appearance of comet C/2024 G3 ATLAS. Captured in a breathtaking image, the comet was seen streaking across the sky, its luminous tail trailing behind. The photograph, shared on January 11, highlights the awe-inspiring sight of the comet just above Earth's horizon, bathed in a glow of atmospheric light known as airglow.

"It is totally amazing to see a comet from orbit," remarked NASA astronaut Don Pettit, a flight engineer on Expedition 72, in a post on X (formerly Twitter). "Atlas C2024-G3 is paying us a visit." The comet's visible tail, composed of gas and dust, is a result of its icy nucleus vaporizing as it approaches the sun.

G3 ATLAS is an ancient traveler, believed to have an orbital period of approximately 160,000 years. The comet reached its peak brightness this week during its perihelion, the closest point in its orbit to the sun, on January 13. Experts suggest it may be the brightest comet of the year, adding to its celestial allure.

The comet wasn't just spotted from the ISS. The joint NASA/ESA Solar and Heliospheric Observatory (SOHO), which typically focuses on the sun's corona, captured a timelapse of the comet between January 11 and January 13. These observations showcased G3 ATLAS's remarkable brightness as it passed near the sun.

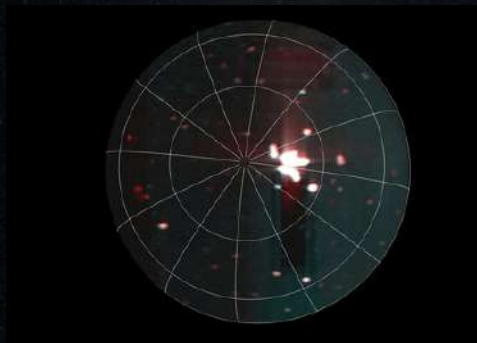
Despite its brilliance, observing the comet directly from Earth is risky. Its proximity to the sun makes it difficult to see, and attempting to view it without proper eye protection could cause serious retinal damage or blindness. Astronomers and enthusiasts are advised to enjoy the spectacle through images and videos shared by observatories and agencies.

As this ancient comet continues its journey, it serves as a reminder of the dynamic and ever-changing nature of our solar system. Stay tuned for more updates and photos from this dazzling visitor, whose presence adds yet another chapter to humanity's exploration of the cosmos.



Comet C/2024 G3 ATLAS photographed from the International Space Station. (Image credit: Don Pettit/NASA)

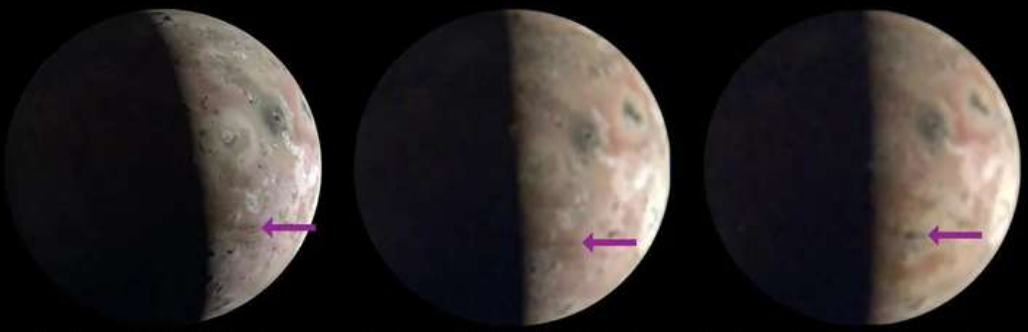
JUNO CAPTURES MOST INTENSE VOLCANIC ERUPTION EVER SEEN ON IO



A massive hotspot – larger than Earth’s Lake Superior – can be seen just to the right of Io’s south pole in this annotated image taken by the JIRAM infrared imager aboard NASA’s Juno on Dec. 27, 2024, during the spacecraft’s flyby of the Jovian moon. (Image credit: NASA/JPL-Caltech/SwRI/ASI/INAF/JIRAM)

NASA’s Juno spacecraft has captured the most powerful volcanic eruption ever recorded on Jupiter’s moon Io, the most volcanically active body in the solar system. The eruption, observed in December 2024, originates from a newly discovered hotspot region in Io’s southern hemisphere, estimated to be larger than Lake Superior on Earth. This extreme volcanic event released energy equivalent to six times the total power output of all Earth’s power plants combined.

Juno’s mission team gathered data from flybys in December 2023 and February 2024, coming as close as 930 miles (1,500 kilometers) to Io’s surface.



Perijove 60 - April 9, 2024 Perijove 66 - October 22, 2024 Perijove 68 - December 27, 2024

Images of Io captured in 2024 by the JunoCam imager aboard NASA’s Juno show significant and visible surface changes (indicated by the arrows) near the Jovian moon’s south pole. (Image credit: NASA/JPL-Caltech/SwRI/MSSS Image processing by Jason Perry)

During the latest flyby on December 27, 2024, Juno observed the eruption from a distance of 46,200 miles (74,400 kilometers), using its Jovian Infrared Auroral Mapper (JIRAM) instrument to detect an area of extreme infrared radiance. The eruption was so intense that it saturated the instrument’s detector, revealing a cluster of hot spots likely linked to a vast subsurface magma chamber.

Io’s intense volcanic activity is driven by the immense gravitational forces of Jupiter. As Io orbits the gas giant every 42.5 hours, Jupiter’s gravity generates powerful tidal forces that stretch and compress the moon’s interior. This frictional heating melts rock, fueling the 400 active volcanoes that continuously erupt molten lava, spewing gas and ash into Io’s thin atmosphere.

Juno’s JunoCam instrument also captured visible-light images of the volcanic region, allowing scientists to compare recent surface changes with past images. The team observed shifts in surface coloring, indicating volcanic deposits rich in sulfur and sulfur dioxide. The next flyby, scheduled for March 3, 2024, will help scientists analyze how the eruption has reshaped the landscape.

“This new hotspot can do much more than rewrite records,” said Juno’s principal investigator, Scott Bolton. “It can enhance our understanding of volcanism, not just on Io, but on other worlds as well.”

INDIA ADVANCES HUMAN SPACEFLIGHT GAGANYAAN CREW CAPSULE COMPLETED



The capsule that will one day ferry Indian astronauts to space and return them to Earth has been fitted with the key technology required for the task. (Image credit: ISRO)

India has taken a significant step toward its first human spaceflight mission with the completion of the Gaganyaan crew module. This marks a major milestone in the country's efforts to develop homegrown technology for astronaut missions.

The Indian Space Research Organisation (ISRO) announced on January 22 that the Gaganyaan crew module was assembled at its Bengaluru center and fitted with a crucial liquid propulsion system. This system will control the capsule's orientation and trajectory during reentry, ensuring a safe descent until the parachute deployment for landing. The module is designed to endure the intense heat and forces of reentry, ensuring astronaut safety during their return to Earth.

The crew module is now being transported to the Vikram Sarabhai Space Centre in Kerala, where it will be integrated with essential electronics for communication, navigation, and power management. These components are critical for maintaining precise control and coordination during flight. Once these upgrades are complete, the module will be sent to ISRO's spaceport in Sriharikota, Andhra Pradesh, for integration with the orbital module.

India's ambitious Gaganyaan mission aims to send astronauts into low Earth orbit, with the first crewed flight expected no earlier than 2026. Before that, ISRO plans at least four uncrewed test missions. The first, G1, will test critical technologies such as reentry, parachute deployment, and a safe splashdown in the Bay of Bengal. A humanoid robot named Vyomitra ("space friend" in Sanskrit) will be onboard to validate the systems. While ISRO has not officially announced a date for G1, reports suggest a possible launch in early 2025.

India's space program has made remarkable strides in recent years, including the successful Chandrayaan-3 moon landing and the launch of the Aditya-L1 solar probe. The nation now aims to establish a space station by 2035 and send astronauts to the moon by 2040. With the Gaganyaan program progressing steadily, India is set to join an elite group of nations capable of independent human spaceflight, reinforcing its position as a major space power.

ORGANIC MYSTERIES OF CERES: DID ASTEROIDS DELIVER LIFE'S BUILDING BLOCKS?



An image of dwarf planet Ceres captured by NASA's Dawn mission. (Image credit: NASA)

New research suggests that organic molecules on Ceres may have been delivered by asteroids rather than originating from within the dwarf planet itself. Using artificial intelligence (AI) to analyze data from NASA's Dawn spacecraft, scientists have mapped regions rich in organic compounds, uncovering insights into their origin.

Ceres, the largest object in the asteroid belt between Mars and Jupiter, was once classified as an asteroid but was redefined as a dwarf planet in 2006 due to its size and unique properties. Unlike typical rocky bodies, Ceres exhibits cryovolcanism, where icy material erupts instead of molten rock. Scientists initially believed that its organic molecules were produced internally and transported to the surface through this cryovolcanic activity. However, new AI-driven analysis suggests otherwise.

NASA's Dawn mission, which orbited Ceres from 2015 to 2018, previously detected organic materials by examining the light reflected from its surface. These findings hinted at the presence of aliphatic hydrocarbons—complex organic compounds that could be linked to the chemistry of life. However, the exact nature and origin of these compounds remained uncertain.

By systematically analyzing Dawn's full dataset, AI revealed that organic-rich sites on Ceres were not associated with cryovolcanic or tectonic activity. Instead, they were concentrated near Ernutet crater in the northern hemisphere, with no evidence of volcanic domes, trenches, or deep impact craters nearby. These findings suggest that Ceres' organic material did not originate from within but was likely delivered by slow-moving asteroid impacts.

Computer simulations support this theory, showing that asteroids from the outer belt frequently collide with Ceres at low velocities, allowing organic molecules to survive impact. This discovery strengthens the idea that organic compounds may have been widespread in the outer solar system and potentially contributed to life's origins on Earth.

EYES IN SPACE- JANUARY 2025

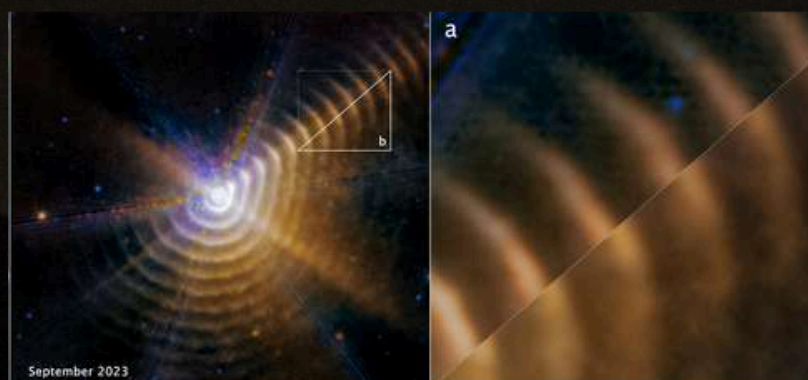
NASA's Webb Reveals Intricate Layers of Interstellar Dust, Gas



NASA's James Webb Space Telescope has captured groundbreaking images of a light echo—a phenomenon caused by light from an exploded star interacting with interstellar dust. This light, originating from the Cassiopeia A supernova 350 years ago, illuminated surrounding material, causing it to glow in infrared. Webb's NIRCarn revealed unprecedented details, such as intricate, sheet-like structures and dense, knot-like regions resembling wood grain. These features, some only 400 astronomical units across, suggest interstellar magnetic fields shape the interstellar medium.

This study, likened to a cosmic CT scan, provides a 3D view of the interstellar medium's structure and marks a significant step forward in understanding space environments. Future research will use Webb's spectroscopic capabilities to observe how light echoes evolve, offering insights into molecular changes and dust composition. These findings highlight the telescope's transformative power, unveiling the universe's beauty and complexity while advancing astronomical science.

"Webb Observes Formation and Expansion of Carbon-Rich Dust Shells in Star System"



Astronomers using NASA's James Webb Space Telescope have explored how carbon, essential for life, spreads across the universe by studying the Wolf-Rayet 140 binary star system in the Milky Way. This system's two massive stars produce carbon-rich dust when their stellar winds collide during close orbital passes, forming dust shells every eight years. Webb's mid-infrared images revealed 17 expanding dust shells moving at over 1,600 miles per

second, persisting for over 130 years.

The dust distribution is uneven, with clumps as large as the solar system and particles as tiny as one-hundredth the width of a human hair. The Wolf-Rayet star, nearing the end of its life, will eventually explode as a supernova or collapse into a black hole, potentially preserving the dust shells. These findings shed light on how binary star systems contribute to the galaxy's carbon-rich dust, crucial for the formation of rocky planets and solar systems.

"Andromeda Galaxy: A Naked-Eye Wonder and Cosmic Time Capsule"



On a clear autumn night, the Andromeda galaxy, the closest spiral galaxy to the Milky Way, is visible to the naked eye as a faint, spindle-shaped patch near Pegasus. Its light, originating 2.5 million years ago, links us to ancient Earth when early humans, like *Homo habilis*, appeared. Over a century ago, Edwin Hubble identified Andromeda as a galaxy far beyond the Milky Way, expanding our understanding of the universe.

Using the Hubble Space Telescope, astronomers created a stunning 2.5-billion-pixel mosaic of Andromeda, capturing 200 million stars. This decade-long project unveiled details of its structure and evolution, highlighting its complex history of mergers and star formation. Despite sharing origins with the Milky Way, Andromeda's active past, featuring young stars and stellar collisions, sets it apart. Its study helps unravel galaxy formation, offering crucial insights into the universe and our galactic neighborhood.

Hubble unraveling the Cosmic Tale of a Rare Triple-Star System

Evolution of "Blue Lurker" Star System



A rare triple-star system has unveiled an extraordinary story of cosmic evolution, as revealed by NASA's Hubble Space Telescope. Located in the star cluster M67, 2,800 light-years away, the system once hosted three stars. About 500 million years ago, two of these stars merged, forming a massive star that later collapsed into an unusually heavy white dwarf.

The remaining star, nicknamed the "blue lurker," gained mass and an accelerated spin by siphoning material from the merged companion. This unusual star spins once every four days, far faster than typical Sun-like stars, which rotate every 30 days. Hubble's ultraviolet spectroscopy revealed the white dwarf's high mass and temperature, suggesting its merger origins. These findings highlight the complexity of triple-star systems, which comprise about 10% of Sun-like stars, and their potential to produce unique stellar phenomena. This system offers a rare glimpse into the intricate evolutionary processes shaping such dynamic interactions.

SPACEX LAUNCHES IN FEBRUARY 2025

LUNAR TRAILBLAZER & NOVA-C IM-2

Date: February 2025, Rocket: Falcon 9 Block 5, Agency: SpaceX, Country: USA
Launch Site: Kennedy Space Center, Launch Complex 39A, Florida.

The Lunar Trailblazer and Nova-C IM-2 mission marks a significant step in lunar exploration under NASA's Commercial Lunar Payload Services (CLPS) program. This mission will deliver two critical payloads to advance lunar science and exploration.

The Nova-C IM-2 lunar lander, developed by Intuitive Machines, is equipped with NASA's PRIME-1 (Polar Resources Ice Mining Experiment-1). This innovative payload aims to demonstrate the feasibility of in-situ resource utilization (ISRU) by drilling lunar regolith using its TRIDENT drill and analyzing the extracted material with the MSolo mass spectrometer. The mission will target a polar region of the Moon, focusing on detecting and characterizing water ice and other volatiles critical for supporting future human exploration.

Additionally, the Lunar Trailblazer satellite, developed by Caltech, will be deployed to map the Moon's surface and identify regions rich in water ice and volatile elements. This satellite will complement PRIME-1's ground-level analysis by providing orbital data, enabling comprehensive insights into the Moon's resources.

SpaceX's Falcon 9 Block 5, known for its efficiency and reusability, will deliver the payloads into a precise lunar trajectory. This mission is pivotal for NASA's Artemis program, laying the groundwork for sustainable lunar operations by leveraging commercial partnerships.

By combining scientific innovation and cutting-edge technology, this mission exemplifies humanity's drive to expand the boundaries of lunar exploration.



SPHEREx & PUNCH

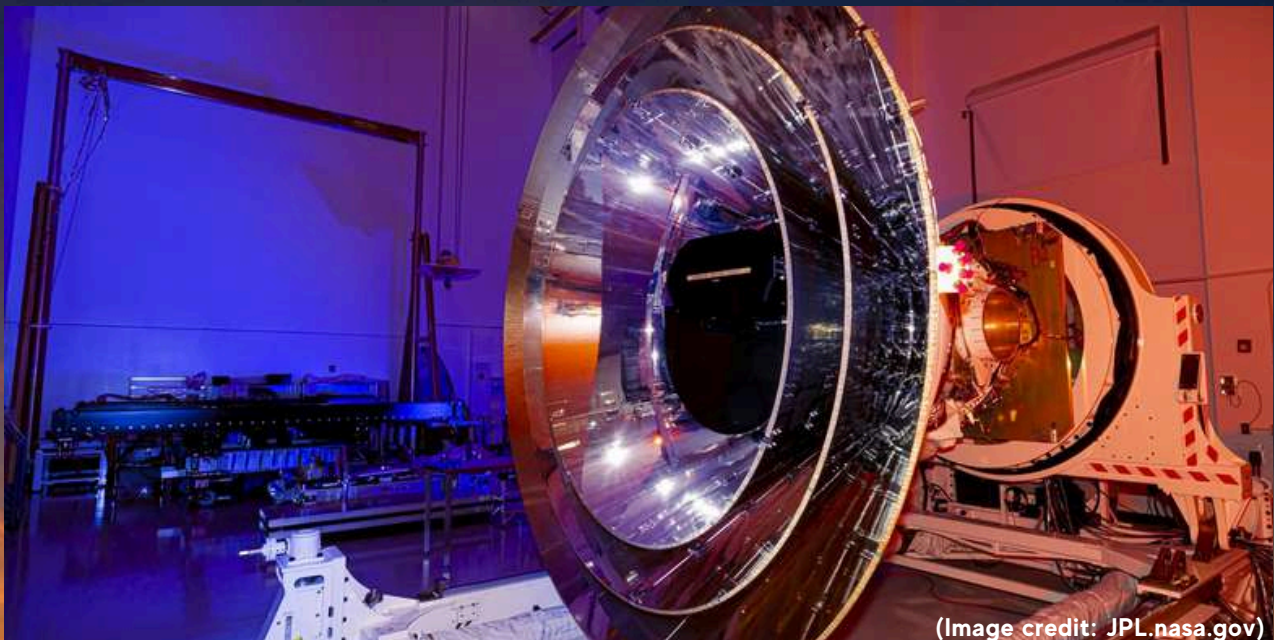
Date: February 2025, Rocket: Falcon 9, Agency: NASA, Country: USA, Launch Site: Vandenberg Space Force Base, California, USA

The SPHEREx mission (Spectro-Photometer for the History of the Universe, Epoch of Reionization, and Ices Explorer) is a highly ambitious astrophysical observatory scheduled to launch in February 2025 aboard SpaceX's Falcon 9 rocket. Designed to map the entire sky in 3D, SPHEREx will capture data in 102 different wavelengths of light. Its objectives are focused on unraveling mysteries of the cosmos, such as Cosmic Inflation, Galactic Light, Building Blocks of Life.

The satellite, about the size of a small car, will orbit in a polar trajectory and generate two full-sky maps annually for its two-year mission. It will provide critical data for understanding the origins and evolution of the universe while uncovering the chemical composition of planetary-forming regions within our galaxy.

The PUNCH (Polarimeter to Unify the Corona and Heliosphere) mission will ride alongside SPHEREx on the same Falcon 9 rocket. It is composed of four small satellites designed to observe the Sun's corona in 3D. This mission focuses on understanding how the outer atmosphere of the Sun transitions into the solar wind, which plays a crucial role in space weather phenomena. Such as Observing how solar material flows outward, creating the solar wind. Understanding the structure and dynamics of the Sun's corona in unprecedented detail. Providing essential data for predicting space weather events that can affect Earth's technological systems.

The mission is led by the Southwest Research Institute in Colorado and managed by NASA's Goddard Space Flight Center. The insights gained from PUNCH will contribute to safeguarding satellites, power grids, and communication networks from solar storms.



(Image credit: JPL.nasa.gov)

****Note: Launch dates of the missions are scheduled to be launched in FEBRUARY 2025 but may subject to change.**

Tour de Universe

Ophiuchus: The Serpent Bearer Among the Stars



Ophiuchus is most often associated with the Greek demigod Asclepius, a son of Apollo, the god of prophecy and light. Asclepius was no ordinary mortal; he was gifted with extraordinary healing abilities. His skill in medicine was so profound that it was said he could even bring the dead back to life.

The legend begins with a tragedy. Glaucus, the young son of King Minos of Crete, had drowned in a jar of honey. When Asclepius arrived at the scene, he witnessed an extraordinary sight. A serpent slithered toward Glaucus' lifeless body, but Asclepius killed the creature. Soon after, another serpent appeared, carrying an herb in its mouth. This herb revived the first serpent, bringing it back to life before Asclepius' astonished eyes.

Inspired, Asclepius took the herb and used it to revive Glaucus. Word of his miraculous abilities spread far and wide, and Asclepius became a symbol of hope and healing. Taught by Chiron, the wise centaur associated with the constellation Centaurus, Asclepius mastered the art of medicine. The goddess Athene further blessed him with the blood of the Gorgon Medusa. This gift, however, came with a warning: blood from Medusa's right side could heal and resurrect, while blood from her left side was deadly poison.

The Wrath of Zeus

Asclepius' power to defy death itself did not go unnoticed by the gods. Zeus, the king of the gods, feared that Asclepius' gift would upset the natural order, making humans immortal and robbing the Underworld of souls. Hades, the god of the dead, was particularly incensed and demanded action.

In a dramatic climax, Zeus struck Asclepius down with a thunderbolt. Yet, even in death, Asclepius' legacy could not be forgotten. To honor his noble deeds and extraordinary gift, Zeus placed him among the stars, creating the constellation Ophiuchus. Here, he is depicted holding a serpent, a symbol of wisdom, healing, and renewal.

Exploring the Constellation

Ophiuchus is more than a mythical figure; it is a treasure trove of astronomical wonders. It is the 11th largest constellation, sprawling across 948 square degrees in the sky. Nestled in the third quadrant of the southern hemisphere, it is bordered by other legendary constellations such as Hercules, Sagittarius, and Scorpius.

The constellation's brightest star, Rasalhague, shines with a magnitude of 2.08, marking the head of the serpent bearer. But Ophiuchus holds more than just stars. It is home to numerous deep-sky objects, including:

- **Barnard's Star:** One of the closest stars to Earth, known for its rapid motion across the sky.
- **Kepler's Supernova:** The remnant of a stellar explosion observed in 1604, a brilliant spectacle visible to the naked eye.
- **Globular Clusters:** Seven remarkable Messier objects, including Messier 10 and Messier 107, glitter in Ophiuchus' domain.
- **Nebulae:** The Twin Jet Nebula, with its stunning bipolar jets, and the mysterious dark nebulae, like Barnard 68 and the Snake Nebula, invite curiosity and wonder.

Ophiuchus is also associated with four meteor showers—the Ophiuchids, Northern May Ophiuchids, Southern May Ophiuchids, and Theta Ophiuchids—making it a dynamic constellation to observe.

Legacy and Symbolism

In modern times, Ophiuchus has taken on new roles. It has intrigued astrologers as a "hidden" zodiac sign, though its inclusion in the zodiac remains a topic of debate. Regardless, Ophiuchus continues to symbolize transformation, healing, and the mysteries of life and death.

As you gaze up at the stars tonight, look for Ophiuchus, the Serpent Bearer. Remember the tale of Asclepius, whose compassion and skill defied the limits of mortality. Within those stars lies the story of a healer, a serpent, and the eternal dance between life and death, written in the ink of the cosmos.



Barnard's Star



Kepler's Supernova



Crucifix Cluster



Snake Nebula

WHAT'S UP IN THE SKY - FEBRUARY 2025

LUNAR CALENDAR

IMPORTANCE OF MOON PHASES FOR STARGAZERS

One might wonder why it is important to refer to moon phases for star gazing. The reason is that the phases of the Moon reflect 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.

Monthly Lunar Calendar February 2025



PLANETS VISIBILITY

Mercury

Superior conjunction 9 Feb. Visible 30 minutes after sunset on 25 Feb, 1.5° from Saturn.



Venus

Evening planet, visible soon after sunset. Near 13%-lit waxing Moon on 1 Feb.



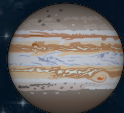
Mars

Evening planet over 60° altitude when due south. Very near Moon on 9 Feb.



Jupiter

Well-placed evening planet. Near waxing gibbous Moon on the morning of 7 Feb.



Saturn

Deteriorating evening planet. Best at start of February. Near Moon and Venus on 1 Feb.



Uranus

Well positioned evening planet in Aries, best at the start of the month.



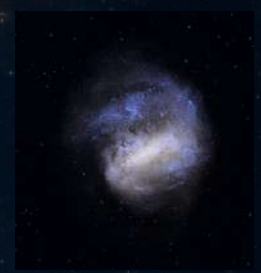
Neptune

Evening planet in Pisces which becomes too low to be viable after 7 Feb.



BRIGHT DEEP SKY OBJECTS

Large Magellanic Cloud (LMC), or Nubecula Major (PGC 17223) is a dwarf irregular galaxy and a satellite of our galaxy located in the constellation Dorado. It has an apparent magnitude of 0.9 and is best observed from southern hemisphere. It was first documented by Al - Sufi (Persian astronomer) in 964 CE.



Seven Sisters also known as M45 or Pleiades Star Cluster is located in Taurus constellation with apparent magnitude of 1.2. With naked eyes it looks like a small copy of Big Dipper with group of six stars. Binoculars can show more stars. This cluster is about 444 light years away from us.

Bode's Galaxy, M 81 or NCG 3031 is a bright spiral one, located in Ursa Major constellation with an apparent magnitude of 6.9. It is one of the brightest galaxies which can even be seen under light polluted sky. It was discovered by Johann Elert Bode in 1774.



Hand Cluster also known as NGC 3114 or Cr 215, is best observed from the southern hemisphere. It has an apparent magnitude of 4.2 and can be observed through naked eye, while binocular or a small telescope can make it easier to observe in a dark and clear sky. It can be found in the Carina constellation.

ASTRONOMICAL EVENTS - FEBRUARY 2025

PLANETARY ALIGNMENT: A CELESTIAL SPECTACLE

On February 22, skywatchers will witness a remarkable celestial event as five planets—Mercury, Saturn, Venus, Jupiter, and Mars—align in a striking arc across the night sky. This rare phenomenon provides a unique opportunity to marvel at the cosmic precision of our solar system.

What is a Planetary Alignment?

A planetary alignment occurs when planets appear to line up in the sky from Earth's perspective. Though not physically aligned in space, their positions relative to Earth create this visual spectacle, governed by the planets' orbital mechanics.

What to Expect

The alignment will feature:

- **Mercury:** Visible near the horizon shortly after sunset. Its proximity to the Sun makes a clear view of the western horizon essential.
- **Saturn:** Higher in the sky with a golden hue. A telescope can reveal its iconic rings.
- **Venus:** The brightest planet, easily spotted as the "Evening Star."
- **Jupiter:** Shining brightly alongside its moons, which can be seen with binoculars or a small telescope.
- **Mars:** Recognizable by its reddish hue, completing the lineup.

Viewing Tips

1. **Timing:** Look shortly after sunset while Mercury and Saturn remain above the horizon.
2. **Location:** Choose a spot with an unobstructed western horizon.
3. **Equipment:** Binoculars or telescopes enhance the experience, revealing details like Jupiter's moons and Saturn's rings.
4. **Weather:** Clear skies are crucial, so check the forecast.

Significance

This alignment showcases the harmony of our solar system, a result of the planets' distinct orbits. Such events are relatively rare and hold cultural significance, often regarded as omens or symbols throughout history. Today, they inspire awe and curiosity about the universe.

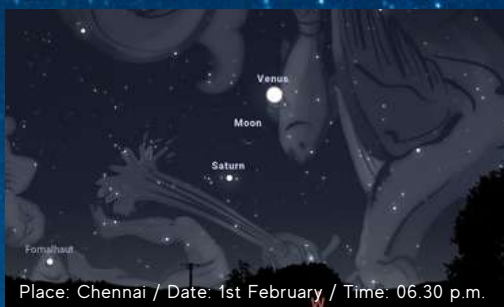
Conclusion

The February 22 planetary alignment is a chance to connect with the cosmos. Whether you're an avid astronomer or casual stargazer, don't miss this extraordinary display. Mark your calendar and prepare for an unforgettable evening under the stars!

CONJUNCTIONS FOR THE MONTH

A phenomenon grabs the imagination of scientists and stargazers alike in the vast panorama of the night sky, where stars shine like distant diamonds and planets roam over the cosmic canvas. Conjunctions, those ethereal moments in the heavens when heavenly bodies appear to collide, provide a mesmerizing sight that connects us to the beauty of the cosmos. The word "Conjunction" comes from Latin, meaning to join together.

From Earth's perspective, a conjunction occurs when two planets or a planet and the Moon or Sun align. Solar conjunctions are invisible to us. Moon-planet conjunctions occur throughout the month, every month, as the Moon passes past each planet. The planets in The Great Conjunction and when multiple align are rare and captivating conjunctions. 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.



Place: Chennai / Date: 1st February / Time: 06.30 p.m.

Conjunction of Moon and Saturn

On 1st February, the Ringed planet Saturn and the Moon will have the closest approach in the evening sky after the sunset. The Moon will be at magnitude -10.38, and Saturn at magnitude 1.15. And it will be visible around 06.30 p.m. till 11.00 p.m.



Place: Chennai / Date: 2nd February / Time: 06.30 p.m.

Conjunction of Moon and Venus

On 2nd February the Hottest planet Venus and the Moon will have the closest approach in the evening sky after the sunset. The Moon will be at magnitude -11.00, and Venus at magnitude -4.48. And it will be visible around 06.30 p.m. till 11:00 p.m.



Place: Chennai / Date: 10th February / Time: 06.30 p.m.

Conjunction of Moon and Mars

On 10th February, the Red planet Mars and the Moon will have the closest approach in the evening sky in the Eastern direction. The Moon will be at magnitude -12.61, and Mars at magnitude -0.80. And it will be visible from 06.30 p.m.



Place: Chennai / Date: 22nd February / Time: 06.30 p.m.

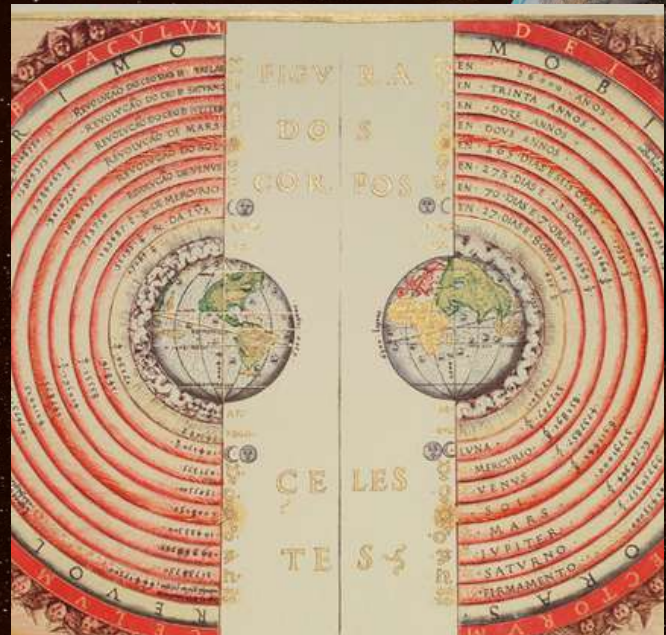
Conjunction of Mercury and Saturn

On 22nd February, the Ringed planet Saturn and the Dead planet Mercury will have the closest approach in the evening sky western horizon immediately after sunset. The Mercury will be at magnitude -1.20, and Saturn at magnitude 1.15. And it will be visible around 06.30 p.m. till 10.15 p.m.

WHAT WE SEE IS NOT ALWAYS TRUE, THE HELIOCENTRIC SAGA

The Dawn of Geocentrism: For ancients the universe seemed clear, Earth was the center of everything. After all, the Sun rose in the east and set in the west, stars circled the heavens, and everything seemed to orbit around Earth. To Babylonian and early Greek thinkers, the cosmos was a divine, Earth-centered construct—a view that Aristotle would later formalize. Aristotle envisioned Earth as a stationary sphere surrounded by concentric celestial spheres. This model gained immense traction, supported by observations that seemed to affirm its accuracy. The Moon's phases, the wandering paths of planets, and the predictability of eclipses fit comfortably within the geocentric framework. But Aristotle's cosmos wasn't merely scientific; it was philosophical, with Earth at the heart of creation. Ptolemy refined this idea with his *Almagest*. To account for the erratic motion of planets (particularly their retrograde motion), he introduced epicycles—small circular orbits within larger ones. Ptolemy's geocentric system became the gold standard for over a millennium, enshrined by religious and intellectual authorities as the unquestionable truth.

Cracks in the Celestial Sphere: Seeds of Doubt By the Islamic Golden Age (8th-13th centuries), astronomers began poking holes in the Ptolemaic model. Scholars like Al-Tusi and Ibn al-Shatir developed mathematical tools to simplify planetary motion, challenging the complexity of epicycles. Alhazen, a pioneer of empirical observation, argued that science must align with evidence, setting the stage for future skepticism about geocentrism.

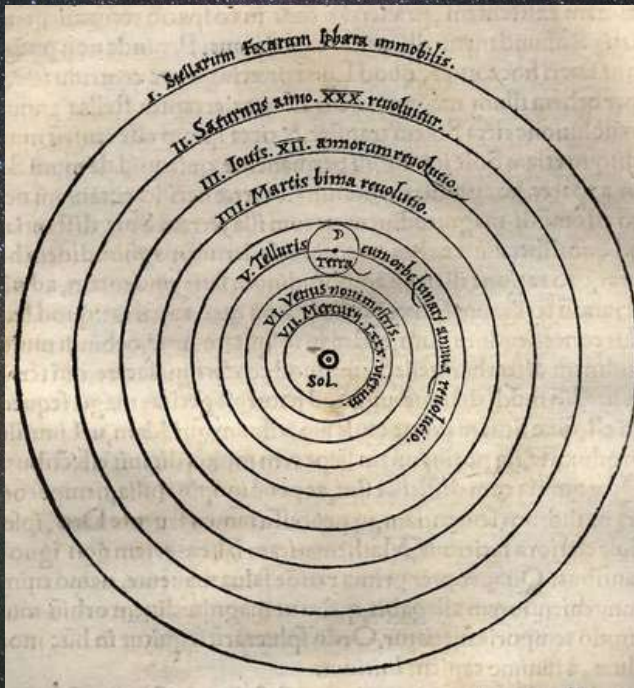


The Revolutionary Idea: Copernicus and Heliocentrism In 1543, Nicolaus Copernicus published *De revolutionibus orbium coelestium*, proposing that the Sun, not Earth, was the center of the universe. This heliocentric model turned centuries of belief on its head. Copernicus argued that placing the Sun at the center simplified the explanation of planetary motion, eliminating the need for cumbersome epicycles. Yet, Copernicus' ideas were met with resistance. The notion of Earth spinning on its axis and hurtling through space defied common sense. Religious authorities, particularly in Europe, saw heliocentrism as a threat to scripture, which placed Earth—and humanity—at the center of God's creation. Copernicus himself presented his theory cautiously, aware of its potential to ignite controversy.

The Price of Truth: Martyrs of Heliocentrism The struggle to establish heliocentrism wasn't just scientific; it was a battle of life and death. Giordano Bruno was one of the boldest advocates for a Sun-centered cosmos. But Bruno's views extended further—he proposed that the universe was infinite, with countless stars hosting their own planets. This radical idea, combined with his critique of Church doctrine, led to his excommunication, imprisonment, and eventual execution. In 1600, Bruno was burned at the stake, a tragic symbol of the era's barbaric suppression of dissent. Galileo narrowly escaped Bruno's fate but suffered years of house arrest after his trial. The Church's grip on intellectual thought during this period was ironclad, using fear and violence to maintain its authority. These actions starkly contrast with the spirit of inquiry that would eventually triumph.

Newton's Universe: Heliocentrism Confirmed Isaac Newton's *Principia Mathematica* (1687) provided the final nail in geocentrism's coffin. Newton's laws of motion and universal gravitation explained why planets orbited the Sun. His work united terrestrial and celestial mechanics, proving that the same forces governed both Earth and the heavens. Heliocentrism was no longer a theory; it was a fact.

A Reluctant Paradigm Shift Despite the overwhelming evidence, heliocentrism faced fierce opposition. It challenged not just scientific norms but deeply ingrained worldviews. The Church's initial resistance softened over time, and by the 18th century, heliocentrism was widely accepted. The Sun, once just a daily companion in the sky, became the center of a dynamic, evolving solar system.



Conclusion: The Power of Inquiry The transition from geocentrism to heliocentrism is a testament to humanity's capacity for questioning and growth. From Aristotle's spheres to Newton's equations, each step in this journey was marked by courage, controversy, and discovery. Today, as we explore the cosmos, we stand on the shoulders of those who dared to challenge the existing status. The next time you gaze at the sky, take a moment to honor those who sacrificed their lives to uncover truths we now often take for granted. Every scientific discovery, whether from the past or present, has endured the test of time and countless challenges. That's what makes the pursuit of science not just meaningful, but one of the most rewarding endeavors in life.

(All Image credits: Universetoday.com)

Big Data and AI: Revolutionizing Astronomy

Astronomy is being revolutionized by AI and Big Data, enabling scientists to process immense datasets from telescopes and satellites. These technologies uncover hidden patterns, identify exoplanets, map galaxies, and predict cosmic events. By accelerating discoveries and theories, AI and Big Data are transforming our understanding of the universe like never before.

In recent years, AI has been increasingly employed in astronomical research. Deep learning, a subset of AI, demands massive datasets, making astronomy a perfect application. AI-powered machines aid in data analysis tasks, such as detecting new stars, exoplanets, and even dark matter. Big Data platforms enable efficient data mining, extracting valuable insights from these extensive datasets and uncovering new patterns in the cosmos.

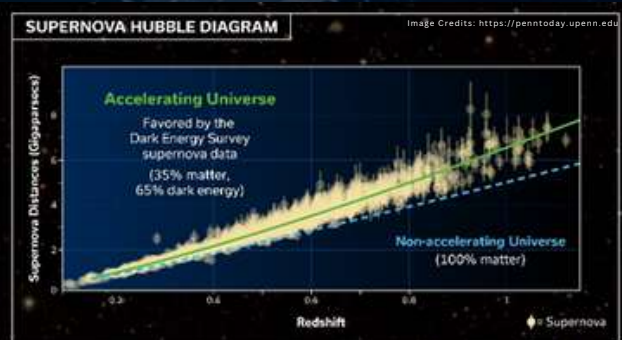
Exoplanets Exploration



Big Data and AI transform exoplanet discovery by analyzing vast datasets from missions like Kepler, TESS, and Gaia. AI algorithms detect planetary transits in light curves, while machine learning refines radial velocity data and predicts exoplanet properties like size and orbit. Multi-wavelength data enhances atmospheric studies, identifying habitability markers like water vapor. Citizen science platforms leverage AI to engage the public in data analysis. As missions grow and telescopes improve, AI enables faster, more accurate discoveries, expanding our understanding of distant worlds and their potential for life.

Dark Matter and Dark Energy

Big data revolutionizes dark matter and dark energy research by processing massive datasets from galaxy surveys, CMB studies, and supernova observations. Projects like SDSS, Euclid, and DES map galaxy clustering and gravitational lensing, revealing dark matter's distribution. AI and machine learning analyze data, refining models. Dark energy studies use Type Ia supernovae, baryon acoustic oscillations, and redshift surveys to map cosmic expansion. Simulations like Illustris TNG model the interplay of dark matter and energy, providing deeper insights into the unseen forces shaping cosmic evolution and the universe's expansion.



Happy Birthday



February 4, 1906

Clyde Tombaugh

Clyde William Tombaugh (February 4, 1906 – January 17, 1997) was an American astronomer best known for discovering Pluto in 1930. He also identified star clusters, galaxies, and studied the distribution of extragalactic nebulae. Tombaugh made significant observations of Mars, Venus, Jupiter, Saturn, and the Moon. After high school, he built his own telescope using plans from *Popular Astronomy* and sent sketches of Jupiter and Mars to Lowell Observatory, leading to his employment there. Tombaugh's work expanded our understanding of the solar system, leaving a lasting legacy as a pioneer in planetary science and the discoverer of the once-ninth planet, Pluto.

Fritz Zwicky

Fritz Zwicky (February 14, 1898 – February 8, 1974) was a Swiss astronomer and physicist known as the "father of dark matter." In 1933, he used the virial theorem to propose the existence of unseen mass, coining the term "dark matter." Zwicky, along with Walter Baade, also introduced the term "supernova" and hypothesized that supernovae were the transformation of stars into neutron stars, contributing to the origin of cosmic rays. His pioneering research significantly advanced cosmology and astrophysics, leaving a lasting legacy in our understanding of the universe, particularly through his work on dark matter and supernovae.



February 14, 1898

Galileo Galilei

Galileo Galilei (15 February 1564 – 8 January 1642) known as the "Father of Modern Science and Astronomy," was an Italian astronomer, physicist, and engineer. He pioneered the experimental scientific method and was the first to use a refracting telescope for significant astronomical discoveries. In 1610, he discovered Jupiter's four largest moons, observed the phases of Venus, and studied sunspots, supporting the heliocentric model. Galileo was the first to show that the Milky Way is not just a hazy cloud but is made up of millions of stars packed so closely together that they look like clouds from Earth. His work laid the foundation for modern physics and observational astronomy, profoundly influencing scientific thought for centuries.



February 15, 1564

Happy Birthday



February 19, 1473

Nicolaus Copernicus

Nicolaus Copernicus (19 February 1473 – 24 May 1543) was a Polish astronomer who proposed the heliocentric model. His heliocentric theory proposed that the Earth and other planets revolve around the Sun, challenging the long-dominant Ptolemaic model, which placed the Earth at the center of the universe. His groundbreaking work, *De Revolutionibus Orbium Coelestium*, challenged the long-held geocentric model, laying the foundation for modern astronomy. Copernicus' ideas influenced later scientists like Galileo, Kepler, and Newton. Despite initial resistance, his theory transformed scientific thought and marked the beginning of the Scientific Revolution, revolutionizing humanity's understanding of the universe.

George Smoot

George Smoot (born on February 20, 1945), an American astrophysicist and cosmologist, won the Nobel Prize in Physics in 2006 alongside John C. Mather for their work on the Cosmic Background Explorer (COBE) satellite. Their research led to the discovery of the black body form and anisotropy of the cosmic microwave background (CMB) radiation, providing crucial evidence for the Big Bang theory. The COBE mission, launched in 1989, revealed tiny fluctuations in the CMB, offering insights into the universe's structure and the formation of stars and galaxies. Smoot's work has significantly influenced cosmology and popularized science through books and media appearances.



February 20, 1945

Pierre Janssen

Pierre Janssen (22 February 1824 – 23 December 1907) was a French astronomer who, in 1868, discovered helium and developed a method to observe solar prominences without an eclipse. He also demonstrated that some dark lines in the solar spectrum were caused by water vapor in Earth's atmosphere. Janssen pioneered the use of photography in solar physics and published an extensive series of solar photographs in 1904 in his *Atlas de Photographies Solaires*. His work set the standard for solar photography, which remained unsurpassed for decades. Janssen's contributions greatly advanced solar research, spectroscopy, and modern astronomy, and he was a member of the French Academy of Sciences.



February 22, 1824

STUDENT'S CORNER

Is Anyone Out There? The Search for Life Beyond Earth

Varsha S K, iAstronomer

Imagine standing outside on a clear, crisp night, gazing up at the stars. They twinkle like tiny diamonds scattered across the sky, and as you look, you can't help but wonder: What if some of those twinkling lights aren't just stars? What if there's something—or someone—out there, looking back at us? The universe is vast—vast in a way that's almost impossible to wrap your head around.

With over 5,000 exoplanets (planets outside our solar system) discovered so far, astronomers are finding more every day. Some of these planets are in the so-called "habitable zone," the sweet spot where conditions might just be right for life to exist. And if Earth can support life, why not somewhere else in the galaxy? But we're not just waiting for a UFO to land in our backyard. Thanks to projects like SETI (Search for Extraterrestrial Intelligence), scientists are listening for signals from alien civilizations.

No messages have been received yet, but each new discovery—whether it's a distant planet or an image from the James Webb Space Telescope—feels like we're one step closer to answering the ultimate question: Are we alone? We're also sending our own messages into the cosmos. From space probes to radio signals, humanity is actively reaching out, hoping someone, or something, is out there to hear it. Who knows?

Maybe, on some distant planet, an alien civilization is staring up at their sky, wondering the same thing about us. Every new mission, every telescope snapshot, and every discovery brings us a little closer to unraveling the mysteries of the universe. So, next time you're stargazing, remember: The universe might be full of surprises, and we just might not be the only ones looking up.

Artemis 2: A New Era of Space Exploration

Navya Kiran, astronomer

ABOUT IT

Artemis Mission 2 is a major milestone in NASA's Artemis program, which is focused on returning humans to the Moon and eventually preparing for human exploration of Mars. Set for launch in April 2026, Artemis 2 will be NASA's first crewed mission to the Moon in more than 50 years. Artemis 2's primary objective is to test the integrated system performance of the Orion spacecraft and the SLS rocket, providing crucial data for future lunar landings.

IMPORTANCE

- **Return to the Moon:** Artemis 2 is part of NASA's broader effort to return humans to the Moon, marking the first crewed mission to the Moon since Apollo 17 in 1972. This mission sets the stage for the establishment of a sustainable lunar presence.
- **Gateway for Mars:** The mission also serves as a key step in the long-term goal of sending humans to Mars. The technologies tested in Artemis 2 will be critical for future deep space missions.

UNIQUE FEATURES

- **Orion Spacecraft:** Artemis 2 will be the first mission to use the Orion spacecraft with crew aboard. Orion is designed for deep-space travel, equipped with advanced life support, radiation shielding, and communication systems.
- **Space Launch System (SLS):** The mission will launch atop the Space Launch System (SLS), the most powerful rocket ever built, capable of sending astronauts far beyond low Earth orbit to the Moon and beyond.
- **International Partnerships:** The European Space Agency (ESA) has provided the service module for Orion, representing a major international contribution to the Artemis program. This collaboration is part of a broader effort to build a multinational lunar gateway.

LAUNCH DATE

Artemis Mission 2 is scheduled to launch from Kennedy Space Center in Florida, using NASA's Space Launch System (SLS), the most powerful rocket ever developed. The mission will carry four astronauts aboard the Orion spacecraft. After launch, Orion will begin its journey toward the Moon, performing a flyby and entering into a distant lunar orbit. This trajectory will test the spacecraft's systems in the harsh conditions of deep space. The astronauts will test life support systems, communication tools, and navigation technology. After orbiting the Moon, the spacecraft will return to Earth, splashing down in the Pacific Ocean. The primary goal of the mission is to validate the performance of both the Orion spacecraft and the SLS rocket, ensuring they are ready for the first crewed lunar landing on Artemis 3.

A FOLLOW UP

Artemis 3, scheduled for 2025 or 2026, will follow Artemis 2 as the mission that finally lands astronauts on the Moon's surface. One of the key objectives of Artemis 3 will be to land the first woman and the next man at the lunar south pole, a region rich in water ice and other resources that could be vital for long-term human habitation. This mission will also deploy the Human Landing System (HLS), developed by private industry in partnership with NASA, to deliver astronauts safely to the Moon's surface. Artemis 3 will mark the start of NASA's sustainable presence on the Moon, setting the stage for future lunar exploration and deeper space missions.

CONCLUSION

Artemis Mission 2 is a significant leap forward in NASA's vision for deep space exploration. With a targeted launch date of April 2026, this crewed mission will lay the groundwork for subsequent lunar landings and human exploration of Mars. By testing critical technologies and systems in deep space, Artemis 2 will provide essential data to ensure the success of future missions. The mission also represents a new era of global cooperation and innovation, with international partnerships playing a key role in its success. As humanity embarks on this bold journey, Artemis 2 will undoubtedly have lasting impacts on space exploration, technology, and global collaboration, marking the beginning of a new chapter in the exploration of our solar system.

Hypervelocity Stars: The Cosmic Speedsters of Our Galaxy

Varsha S K, iAstronomer

In the vast expanse of the universe, most stars follow relatively predictable paths, cruising through space at steady speeds. However, some stars break the mold and defy the normal pace, becoming hypervelocity stars (HVSs). These stars are moving at speeds so high—often exceeding 1,500 km/s—that they can escape the gravitational pull of our very own galaxy, the Milky Way.

To put that in perspective, stars within the Milky Way generally travel at about 220 km/s, which is a far cry from the blistering speeds of HVSs. These rare, high-speed stars are not just astronomically fascinating; they offer a peek into the mysterious forces shaping our galaxy, and perhaps even the future of stars like our own Sun. So, how do stars reach such extreme velocities?

The answer lies in cosmic phenomena that push stars to their limits. One key process behind the formation of hypervelocity stars is the gravitational slingshot effect caused by interactions with a supermassive black hole. At the center of nearly every large galaxy—including our Milky Way—there resides a supermassive black hole, millions or even billions of times the mass of our Sun. When a star passes too close to this black hole, it is subject to the intense gravitational pull that warps spacetime.

This close encounter can fling the star into high-speed motion, hurling it out of the galaxy entirely. This phenomenon is known as gravitational ejection. But that's not the only way hypervelocity stars come to be. Another mechanism involves stellar explosions in binary star systems.

Binary systems are pairs of stars that orbit each other, sometimes in a very tight orbit. When one of the stars in the system reaches the end of its life and explodes in a supernova, the force of the explosion can transfer enough kinetic energy to the companion star, sending it speeding through space at escape velocity. This interaction, known as stellar dynamical ejection, can also propel a star to hypervelocity.

In fact, the first confirmed hypervelocity star was discovered in 2005, when astronomers observed a star speeding away from the Galactic Center. The star, later dubbed HVS 1, was moving fast enough to eventually leave the Milky Way. Since then, astronomers have identified more than 20 hypervelocity stars, many of which are thought to have been ejected by the supermassive black hole at the center of our galaxy. These discoveries have revealed fascinating insights into the behavior of black holes, the dynamics of our galaxy, and the ways in which stars can be expelled from their homes.

Hypervelocity stars are more than just fast-moving objects—they are key to understanding some of the most energetic and mysterious processes in astrophysics. By studying these runaway stars, scientists are able to map out the gravitational influences exerted by black holes on nearby stars and measure the distribution of mass within the galactic center. The study of their high-speed paths is also crucial for understanding the structure of the Milky Way and its surrounding halo, which is mostly invisible and poorly understood.

Moreover, these stars offer astronomers a unique opportunity to study the impact of black holes on their surroundings. Supermassive black holes, like the one at the center of the Milky Way, play a much larger role in shaping their galaxies than previously thought. By tracking hypervelocity stars and their trajectories, scientists can gain insight into how black holes influence stellar dynamics and contribute to galactic evolution.

With such extreme speeds, hypervelocity stars are unlikely to remain in the Milky Way forever. Over time, some may escape the galaxy's gravitational pull entirely, venturing into the vast emptiness of intergalactic space. Others might burn through their fuel at an accelerated rate due to their high energy output, possibly leading to earlier-than-expected deaths such as supernovae or stellar collisions.

If hypervelocity stars continue on their path, they may even end up being part of future cosmic events. Could they collide with other stars, triggering the formation of new stellar systems? Or could they encounter other galaxies, contributing to intergalactic interactions? The fate of these stars remains one of the many mysteries of the cosmos, but the discoveries they inspire will continue to shape our understanding of the universe.



Artist's View of Hypervelocity Star HE 0437-5439

NASA, ESA, and G. Bacon (STScI) • STScI-PRC10-19a

Hypervelocity stars are not just anomalies; they are windows into the violent and energetic processes that govern the cosmos. Through their incredible speeds, they reveal secrets about black holes, stellar life cycles, and the future of galaxies. As we continue to track these cosmic speedsters, we move closer to understanding the forces that shape our universe.

So, the next time you look up at the night sky, imagine that some of the stars you see might be racing away from the Milky Way, moving at speeds beyond our imagination, and carrying with them the stories of our galaxy's most extreme events. In a universe that moves at a pace we can barely fathom, these runaway stars are the ultimate explorers, charting a course into the unknown.

No Big Budget - India's Space Journey

Sourajit Mandal, Astronomy Camp Student

India's space journey is really interesting... have you ever wondered how a country with such humble beginnings has now become the world leader in space exploration?

It all started in 1969 when ISRO was established. Back then, there wasn't much to work with...no big budgets nor high-tech laboratories. The budget by 1972 was an astonishing.... ₹10 crores. Not a lot for building rockets and satellites... right? And yet, ISRO proved everyone wrong. ISRO built India's first satellite- Aryabhata in 1975 which was launched by the Soviet space agency. At that same time NASA, had a budget of BILLIONS of dollars and was busy doing its Apollo missions. How could India even try to catch up?

ISRO's humble beginnings are almost unimaginable. Rocket parts were transported on bicycles and heavier satellites- on bullock carts. Sounds a lot like a story, doesn't it? But it is true. While NASA was putting humans on the Moon, India was launching sounding rockets from a small fishing village. Dr Vikram Sarabhai, the founder of ISRO, believed that space technology could solve many of new India's problems- from communication to agriculture. This focus on utility, is what made ISRO a superpower.

Dr. APJ Abdul Kalam played a key role in revolutionizing India's rocket technology with groundbreaking yet cost-effective designs. Under his leadership, ISRO focused on simplifying complex technologies while making them affordable. His work on the Polar Satellite Launch Vehicle (PSLV) was a game-changer, achieving reliable launches with minimal resources. The PSLV's success made it a preferred option for many international clients, proving that India could do space exploration efficiently, without the high costs associated with other countries. Kalam's vision set the stage for ISRO's future achievements, including the Mars mission.

Just after a few decades, in 2014, ISRO stunned the world with its own Mars mission- Mangalyaan mission. India was trying to reach Mars on the very first attempt! And the mission cost... just ₹450 crores (about \$51 million today). For comparison, NASA's MAVEN Mars mission around the same time cost \$671 million. How did ISRO pull it off? They kept it simple, efficient, and innovative. They relied on homegrown talent and avoided expensive experiments. The Hollywood movie 'The Martian' in 2015 cost around \$108 million! It is hard to imagine the fact that one country's Mars mission can be cheaper than movies of Mars missions of another country.

Then came the Chandrayaan-3, which soft-landed on the Moon in 2023. The success was partial for Chandrayaan-2, as its lander could not successfully land, but for Chandrayaan-3, what made it special was the fact that it was the first to reach near the Moon's south pole. The cost was a JUST ₹615 crores ... and that is about \$74 million. Isn't it unbelievable?

All space agencies burn billions, while ISRO continues to land missions of world-class standards at the cheapest price. The story does not end there.

Let's talk about Spadex - the Space Docking Experiment. This recent mission demonstrated ISRO's ability to dock and undock two spacecrafts in orbit. Why is docking so important? Because it's a stepping stone to long-term space exploration. This is a critical skill for building space stations and for refueling missions.

Imagine India running its own space station or being part of manned missions to Mars! India is the 4th country to now have this technology but as usual, it is the first one in SUCH a low price. As usual, ISRO is doing it cost-effectively... Spadex is estimated at ₹1,000 crores (around \$120 million).

So, the secret to ISRO's success? Necessity? Ingenuity? It is probably a little bit of both. They simply reuse technology and do everything on a single platform; thus, they minimize waste. Results? Amazing missions with the smallest budgets. It's just wild thinking that a space agency born in the humblest circumstances today competes with the rest of the world's best. Moon base? Human missions to Mars? India is ready to shock the world again and again.



ASTROPHOTOGRAPHS FROM SPACE ASSOCIATED ASTRONOMERS



Jupiter with Io's shadow captured by Bhaargav



Moon captured by Varsha S K



Rho Ophiuchi cloud captured by Ekansh Tardeja



Messier 42 captured by Shaurya Salunkhe

ASTROPHOTOGRAPHS FROM SPACE TEAM



Mars with Polar Ice Caps & Jupiter, Captured by Mr. Shiril - Senior Technical Executive - GAPL



Mars & jupiter captured by Mr. Dinesh & Mr. Shanawaz - Educators, STEPL.



HISTORICAL EVENTS HAPPENED IN FEBRUARY

BRUCE MCCANDLESS: THE FIRST "LIVING MOON" OF EARTH



Astronaut Bruce McCandless II, STS-41-B mission specialist, uses his hands to control his movement above the Earth – just a few meters away from the space shuttle Challenger – during the first-ever spacewalk which didn't use restrictive tethers and umbilicals. Image credits: NASA

Before stepping into the void, McCandless humorously remarked, "It may have been a small step for Neil, but it's a heck of a big leap for me." Reflecting on the experience, he later said, "It was fun. But I thought it would be sort of ethereal in terms of quietness, and I was wrong." His comments highlighted the human connection to this extraordinary event.

A trained engineer and veteran astronaut, McCandless had rigorously tested the MMU in underwater simulations and aboard Skylab. His pioneering work demonstrated the feasibility of free movement in space, paving the way for critical missions, such as satellite repairs and space station assembly.

McCandless's untethered spacewalk represented more than just a technical milestone; it was a profound moment in the story of exploration. For a brief time, McCandless became what some described as a "living moon," orbiting Earth alone and embodying humanity's boundless curiosity and determination to venture into the unknown.

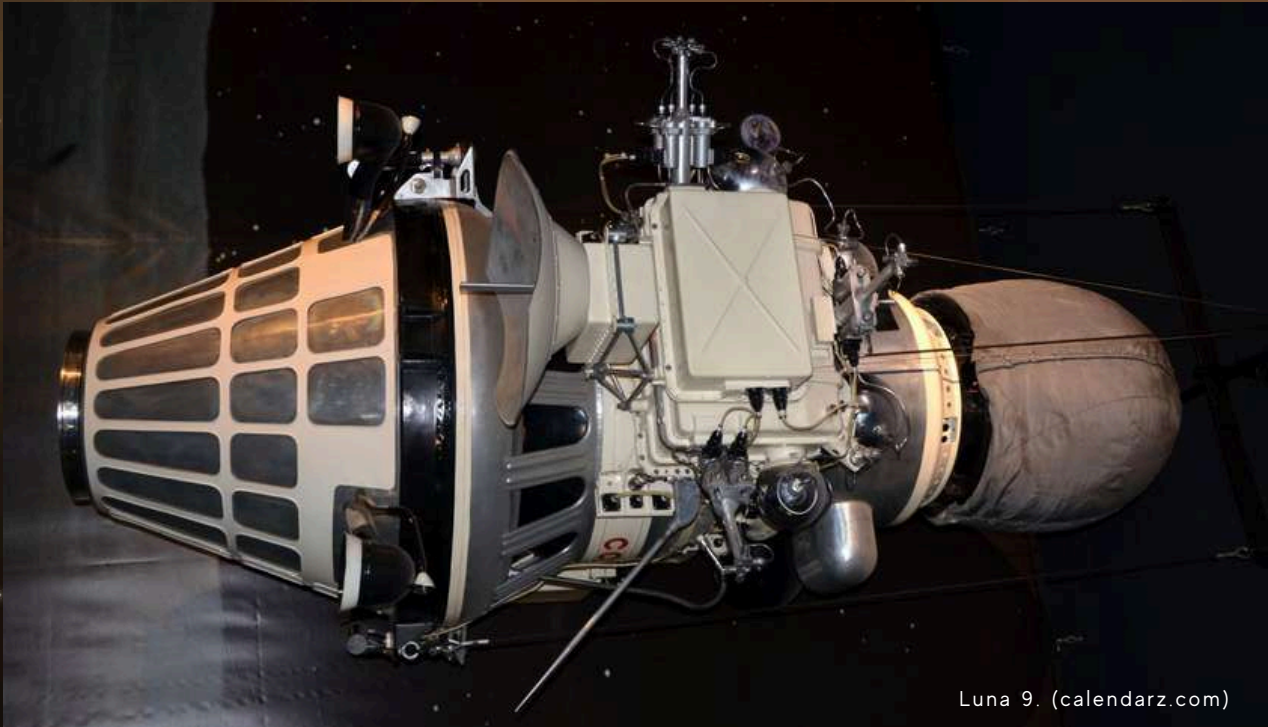
Though McCandless passed away in 2017, his legacy endures as a beacon of inspiration for astronauts, engineers, and dreamers. His achievement continues to remind us of the extraordinary possibilities that lie beyond our home planet.

On February 7, 1984, NASA astronaut Bruce McCandless II made history as the first person to perform a spacewalk untethered to a spacecraft. As a mission specialist on the STS-41-B mission aboard the Space Shuttle Challenger, McCandless used the Manned Maneuvering Unit (MMU), a nitrogen-propelled backpack, to float freely in the vacuum of space. This iconic achievement captured the world's imagination and symbolized humanity's progress in space exploration.

The MMU, controlled with hand grips and thrusters, enabled McCandless to maneuver with precision. He and fellow astronaut Bob Stewart conducted separate untethered spacewalks, traveling more than 300 feet from the shuttle. McCandless's crewmates photographed him drifting away from Challenger, silhouetted against the vast blackness of space and the brilliant blue curvature of Earth. This unforgettable moment showcased human ingenuity and resilience.



THE FORGOTTEN MOON LANDING



Luna 9. (calendarz.com)

On 3rd February 1966, a spacecraft bounced on the lunar surface. It bounced once twice, several times before coming to rest on the Ocean of Storms or Oceanus Procellarum. Once it came to rest, it unfurled its petals and deployed its antennas. Luna 9, the USSR's 12th attempt, has successfully soft landed on the Moon, a landing that an astronaut could survive.

Launched a few days earlier, on 31st January, Luna 9 comprised of two parts with a total mass of 1538 kg. The lunar station that achieved soft landing was a spherical body weighing 99 kg. The station consisted of a hermetically sealed container which held the radio system, programming device, batteries, thermal control system and scientific apparatus and four antennas outside the compartment that automatically opened after landing.

Of the systems aboard, were a lightweight panoramic television camera, an SBM-10 radiation detector. For the camera to get a 360 degree coverage, a mirror on an 8 cm turret was mounted on the top of the lander above it.

Within 15 minutes of landing, Luna 9 had captured its first photo of the Lunar surface, the first photo of another world's ground. It included views of the nearby rocks and the horizon that was 1.4 km away from the craft. Throughout its operating life, Luna 9 captures 4 panoramas and collected radiation data; 30 millirads a day.

The success of the Luna 9 mission was a significant step for the future exploration of the moon as the data gathered was important for planning future lunar missions. Additionally, the spacecraft also proved that the lunar surface could support the weight of a lander, solving a conundrum at the time.

Luna 9's mission ended on 6th February 1966, when the batteries powering the systems ran out.

Potrait of Planets

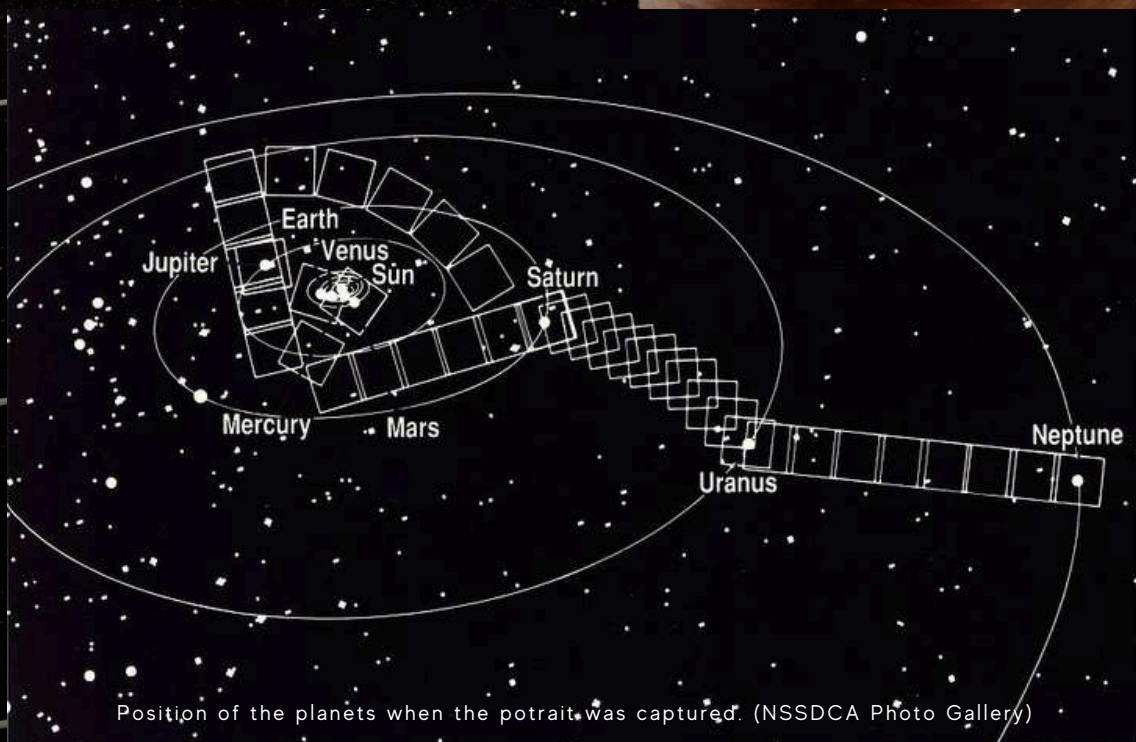
On Valentines Day, 1990, after years of campaigning, NASA commanded Voyager 1 to turn back towards its home system and take a series of photos. The collective mosaic, made from 60 images, is the only family portrait of the solar system till date.

3 spacecrafts till date have acquired the conditions to capture a photographic portrait of the solar system; Voyager 1, Voyager 2 and New Horizons. However, Voyager 1 is the only spacecraft take the portrait as it has a better vantage point compared to Voyager 2 and New Horizons was too close to the elliptical to capture all the planets. Even Voyager 1 was unable to capture all 8 (at the time,9) planets.

At 6 billion km from the Sun, Voyager 1 was 32 degrees above the elliptical when it captured the series of images. In the portrait, 6 planets; Jupiter, Earth, Venus, Saturn, Uranus, and Neptune, along with the Sun are visible. Mercury couldn't get captured due to its closeness to the Sun while Mars got overshadowed by the scattered sunlight. Pluto, who was still considered a planet at the time, was too tiny to be captured.

To capture the portrait, a whole sequence of commands; selection of filter, time and place to point the camera, length of exposure, needed to be programmed in advanced due to instructions taking five and a half hours to reach Voyager 1. Each planet, depending on their position, required a different length of time for exposure, filter and filter. Later it was figured out that Mars could have also been captured for the portrait but by that time, the image capturing process had started.

The family portrait symbolizes NASA's exploration spirt and till date is the only kind of image we have of the solar system. After this, Voyager 1's camera was switched off in an endeavor to save power. The solar system was the last image it saw before continuing its lonesome journey through interstellar space.



THE DISCOVERY OF GRAVITATIONAL WAVES: A NEW ERA IN ASTROPHYSICS

On February 11, 2016, a groundbreaking announcement in the journal *Physical Review Letters* forever changed our understanding of the universe. The LIGO Scientific Collaboration and the Virgo Collaboration revealed the first direct observation of gravitational waves, ripples in space-time first predicted by Albert Einstein in his General Theory of Relativity. This discovery marked a monumental milestone in astrophysics and validated decades of theoretical and experimental research.

What Was Discovered?

The observation captured gravitational waves generated by the merger of two black holes approximately 1.3 billion years ago. It was the first direct evidence of such waves and the first-ever observation of a binary black hole merger. The colliding black holes, with masses about 29 and 36 times that of the Sun, released energy equivalent to three solar masses in the form of gravitational waves. These ripples traveled across the cosmos, finally reaching Earth and revealing their secrets to humanity.

How Was the Discovery Made?

The Laser Interferometer Gravitational-Wave Observatory (LIGO) detected the waves using two detectors located in Livingston, Louisiana, and Hanford, Washington. The detectors identified the minuscule distortions in space caused by passing gravitational waves. Advanced technology and precise calibration enabled LIGO to measure these distortions with unprecedented accuracy, proving Einstein's century-old prediction.

What Was the Event?

The event was a colossal collision between two stellar-mass black holes. Orbiting each other in a death spiral, they eventually merged, creating intense gravitational waves that rippled through space-time. The detection of this event confirmed the existence of binary black hole systems and demonstrated that such mergers occur within the universe's current age.

Significance of the Discovery

This monumental achievement opened a new window into the cosmos, allowing scientists to study the universe in a completely new way. It provided the first direct evidence of gravitational waves and confirmed the existence of binary stellar-mass black hole systems. Furthermore, the discovery proved that these cataclysmic mergers could occur and be observed within the age of the universe. It marked the beginning of gravitational wave astronomy, offering a powerful tool to probe phenomena that were previously invisible to traditional telescopes.

The discovery of gravitational waves not only validated Einstein's theoretical predictions but also expanded humanity's capacity to explore the cosmos. It stands as a testament to human ingenuity and curiosity, inspiring further exploration into the universe's most profound mysteries.

Credits: The SXS (Simulating eXtreme Spacetimes) Project

DISCOVERING URANUS' FRANKENSTEIN MOON

On 16th February 1948, while observing the skies through Otto Struve Telescope, an optical Telescope at McDonald's, Gerard Kuiper discovered Miranda, Uranus' smallest major moon. Miranda was also the last moon discovered before Voyager 2's visit to the ice giant.

Named for daughter of Prospero in William Shakespeare's play, "The Tempest," Miranda was largely ignored by the community. That was, until Voyager 2, needing assistance to travel to Pluto, flew by the satellite, capturing images of it. Ever since then, astronomers have been captivated.

Miranda's features look like it is a jigsaw of puzzles from different pieces, almost like Frankenstein's monster. It has the strangest and most varied landscape which includes three large features known as "coronae" that appear polygonal in shape. It is a feature that is not seen on any known body in the Solar System. Coronae are a collection of ridges and valleys which are lightly cratered. These regions are separated from heavily cratered and older terrain by sharp boundaries. The coronae are different from the resurfaced regions seen on icy bodies elsewhere in the solar system because of the polygonal shape and the densely packed system of ridges observed within them. Overall, Miranda looks like mismatched patchwork on a large work.

The strange satellite also has a global rift system. It can be seen primarily in the corona, but it extends throughout the planet, varying in size. The tiny satellite also has the tallest cliff in the solar system which towers 20km above the surface. Due to the satellite's low gravity, an object dropped from this height would take over 10 minutes to reach the surface.

Miranda also has one of the thickest layers of regolith. Regolith is loose, unconsolidated deposits that cover a solid surface. The source of this dense layer is unknown though scientists have theorised multiple hypotheses for its existence. It may be a result from a giant impact or fallout from plume activity. It could also be deposits from Uranus' ancient ring when the satellite passed through as it migrated towards its current orbit.

Currently, scientists are not sure what processes are behind Miranda's features. One scenario is that the moon may have been smashed apart in a colossal collision, before its pieces reassembled. Another possibility is that the coronae are sites of large rocky or metallic meteorite strikes which then melted the icy subsurface which resulted in periods of slushy water rising to Miranda's surface and refreezing.

THE ELUSIVE PLANET

The search for the elusive planet started shortly after the discovery of Uranus when astronomers observed perturbation in the planet's orbit. In 1840s, Urbain Le Verrier used Newtonian mechanics to predict the position of Neptune, which was still undiscovered. When the planet was observed and identified, astronomers initially thought they solved the mystery.

That though was not the end for observations of Neptune led to astronomers, in late 19th century, to speculate that another planet was also disturbing Uranus's orbit. Thus started the rush to discover a new planet.

Percival Lowell joined the search in 1906, utilizing the observatory he founded in 1894, Lowell Observatory, to search of the planet he nicknamed "Planet X". Utilizing the mathematical calculations of Elizabeth Williams, Lowell suggested possible celestial coordinates for the planet and used them to aid his search until his death in 1916.

The elusive planet stayed hidden from view until 18th February 1930. When Clyde Tombaugh discovered Pluto. He was perusing the photographic plates of the night sky captured on 23rd and 29th January with a blink comparator when he spotted a possible moving object. After comparing with a photographic plate captured on 21st January, Later after going through the records, Lowell's surveys had captured a faint image of Pluto in 1915 though the planet was not identified as such. That was not the first time Pluto was observed but not noticed. The earliest observation of Pluto was made by the Yerkes Observatory on 20th August 1909.

After the discovery, astronomers questioned if Pluto had enough mass to disturb the orbits of Uranus and Neptune. The question floated around until 1978, when Charon, Pluto's largest moon was discovered. As Charon is approximately 50% of Pluto's size, the two bodies are sometimes classified as a double planet. Thus far, Pluto is the only planet, dwarf and regular, to have this classification in the solar system. As a double planet, pluto and Charon has enough mass to affect Uranus' and Neptune's orbit. Thus, ending the debate. However, the hunt for 'Planet X' continues.

Pluto was once thought to be an icy rock. However, data from New Horizons showed the dwarf planets had a level of physical diversity and complexity that was unexpected. The planet is also geologically active. Tiny Pluto, which is smaller than several countries on Earth, has bladed methane mountains, nitrogen glaciers, ice volcanoes, and a potential ocean inside the planet. It also has a nitrogen atmosphere that stretches far into its sky. All of this has caused planetary planetary scientists to rethink how complex and active small planets can be.

When Tombaugh peered through the blink comparator, he wouldn't have realized that he would revolutionize planetary science, His discovery opened the door to a new region of the Solar System, the Kuiper Belt, as well as a new class of planets, dwarf planets

SUPERNOVA 1987A HISTORIC DISCOVERY

Supernova 1987A, observed in the Large Magellanic Cloud (LMC), a dwarf galaxy located 160,000 light-years from Earth, stands as one of the most significant astronomical events in modern history. Discovered on February 23, 1987, by astronomers Ian Shelton, Oscar Duhalde, and Albert Jones, it was the first supernova visible to the naked eye since Kepler's Supernova in 1604. The event, which lasted for several months, was as bright as 100 million suns, capturing the attention of astronomers and the public alike.

This supernova was the result of the collapse of a massive star, which triggered an explosion known as a Type II supernova. The explosion released an immense amount of energy, and the star's core imploded to form a neutron star. One of the most extraordinary aspects of this event was the burst of neutrinos it produced. These elusive particles, which travel at nearly the speed of light, were detected on Earth by a network of neutrino detectors, marking the first time a supernova's neutrinos were observed directly.

Supernova 1987A became a focal point for astronomical research, offering unprecedented insight into the life cycle of massive stars and the processes involved in supernovae. The supernova was initially observed by ground-based telescopes, but its significance grew as space-based instruments studied it further. The ultraviolet space telescope Astron made observations in 1987, and the James Webb Space Telescope (JWST) continued the study in 2024, providing new data and improving our understanding of the remnants of the explosion.



SN 1987A in X-ray and Optical light from Chandra and Hubble. Credit: NASA

The explosion's aftermath left behind a neutron star, a dense remnant of the star's core, and the supernova's expanding shell of gas and debris. This remnant continues to be a subject of study, offering insights into the physical conditions of a neutron star and the surrounding interstellar medium.

Supernova 1987A remains a landmark in astrophysical research, helping astronomers refine theories about stellar evolution, supernova mechanics, and the behavior of fundamental particles.



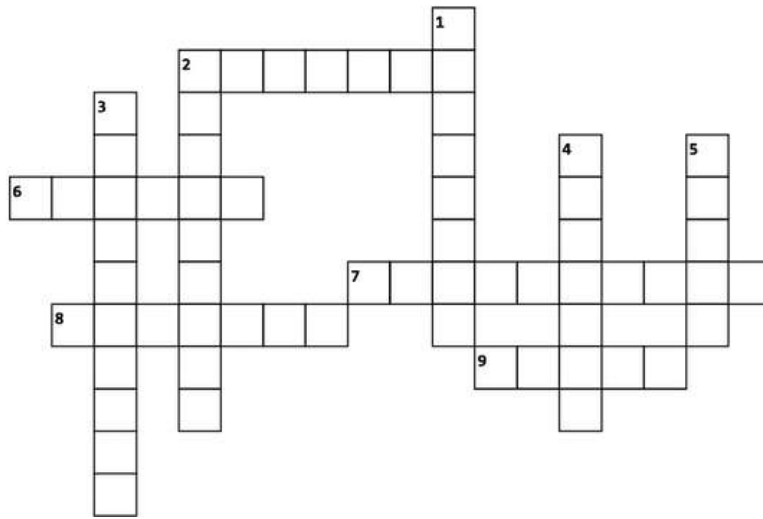
The Large Magellanic Cloud in optical light. Credit: Robert Gendler



Wide-field Optical Image of SN 1987A. Credit: NASA/STScI

TRAIN YOUR BRAIN

CROSSWORD



Across

Down

- 2. Who was the first person to see the Moon's cratered landscape through a telescope?
 - 6. What aspect of the Sun does Proba-3 aim to study with artificial solar eclipses?
 - 7. At which university was the first detailed image of a photon captured?
 - 8. What was the name of Andromeda's father, the king in Greek mythology?
 - 9. What are the dark basaltic plains on the Moon created by ancient lava flows called?
- 1. The Quadrantid meteor shower is best observed from which hemisphere?
 - 2. Which institute analyzed the Moon rock samples from Chang'e 6?
 - 3. What is the term for the closest point in Earth's orbit to the Sun?
 - 4. Which Space observatory captured the deepest image of Centaurus A?
 - 5. What is the name of the space program that lost three CubeSats to solar maximum activity?

Astronomy Word Puzzle

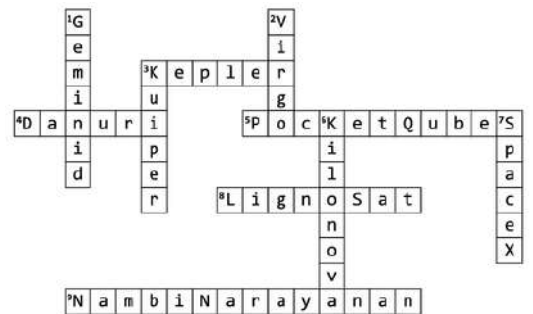
Let's hunt the asteroids, one name at a time!

Asteroids

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

- VESTA
- EGERIA
- IRIS
- EROS
- BAMBERGA
- PSYCHE
- EUPHROSYNI
- ASTRAEA
- PALLAS
- ITOKAWA
- ARTEMIS
- ANTIOPE
- CERES
- HYGEIA
- GASPR

Answers for last month puzzles.



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

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

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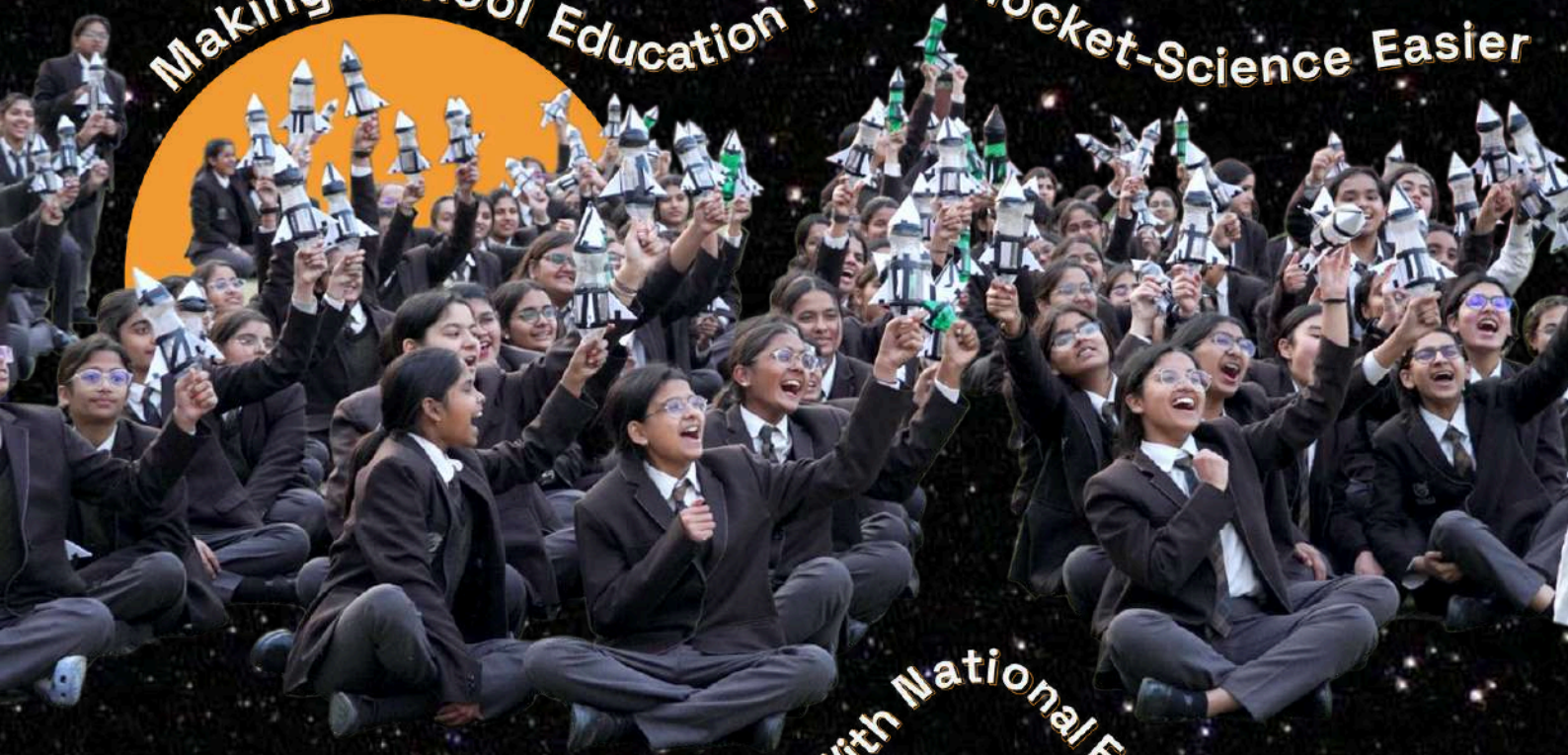
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