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Galactica

Astronomy and Space Science Magazine

What's Inside?

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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

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.

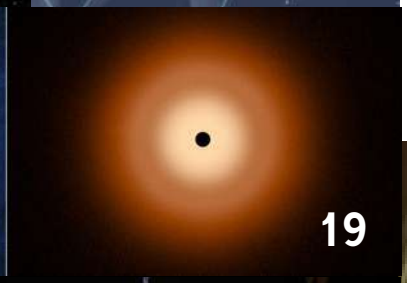
MD's Message

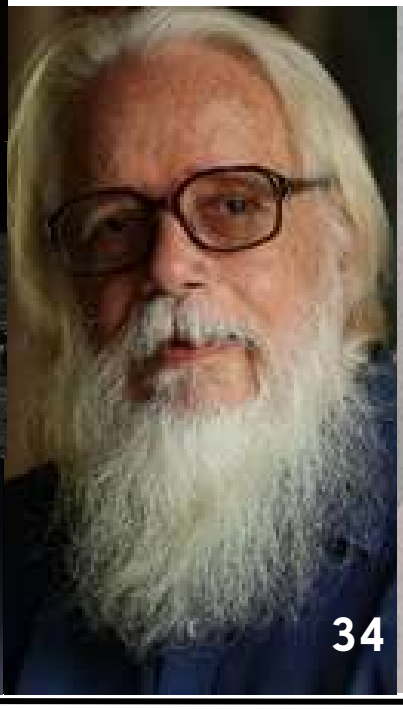
Mr. Shivam Gupta, MD, SPACE

Education is integral to humankind growth and it strongly contributes towards innovation and developments. Space is transforming India to provide better learning opportunities through Experiential and Hands-on learning in the very niche field of Astronomy and Space Science. Our mission to build from the grassroots level is what drives us stronger and to inculcate scientific temperament so the next generation can be entrepreneurs, scientists, and astronauts!

LIST OF

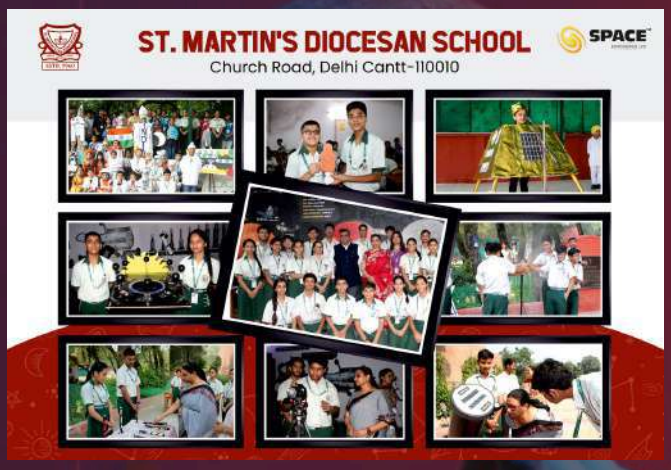
CONTENTS





SPACE INSIGHTS

ST. MARTIN STUDENTS SHINE: A VISIT TO THE PRESIDENT'S OFFICE ON CHILDREN'S DAY



On the occasion of Children's Day, students of St. Martin Diocesan School, Delhi Cantt., had the unique honour of visiting the President's Office to meet President Smt. Droupadi Murmu. This special visit was not only a celebration of the day dedicated to the youth of the nation but also a chance for the students to showcase their passion for science and astronomy.

The students, filled with excitement and pride, arrived at the President's Office, eager to present a special collage of the astronomy activities they had been working on at their school. The collage depicted a variety of hands-on activities the students had engaged in, from stargazing sessions to building model solar systems. Each piece in the collage highlighted the depth of their interest in the cosmos, as well as their creative efforts to understand and explore the wonders of space.

During the visit, the students took the opportunity to explain the significance of their school's Astronomy Lab to the President. They described its advanced features, such as telescopes, star charts, and interactive displays that help students learn about celestial bodies, the universe, and the science behind space exploration. The lab serves as a vital space where students can immerse themselves in the study of astronomy, fostering curiosity and expanding their knowledge beyond the classroom.

The students emphasized the importance of such a specialized facility in nurturing a generation of scientifically literate young minds. The Astronomy Lab not only provides a platform for practical learning but also instils a sense of wonder and discovery in students, motivating them to pursue careers in science, technology, and space exploration. By being actively engaged in these activities, students gain a deeper understanding of the universe and the scientific principles that govern it.

President Smt. Droupadi Murmu commended the students' enthusiasm for learning and praised the school's efforts in fostering scientific curiosity, emphasizing education's role in shaping future leaders in science and technology.

The visit was a memorable Children's Day tribute, offering students a unique chance to engage with one of the nation's highest offices and share their passion for astronomy and education.

Filled with pride, the students left, knowing they had made a lasting impression. Their visit symbolized a bright future where young minds will continue to explore the stars and achieve new heights.

ADVENTURES OF WATER ROCKETRY: SPACE INDIA & THE AMERICAN CENTRE JOIN FORCES

Space India, in collaboration with the American Centre, hosted the engaging 'Adventures of Water Rocketry' on 19th November at its Dwarka Sector 11 office in Delhi. Despite foggy weather and school closures, students, parents, and teachers enthusiastically attended, eager for the hands-on experience. The beautifully decorated venue captured the spirit of space exploration, creating an immersive atmosphere.

Led by an experienced astronomer, the workshop introduced participants to rocketry using water as a propellant. Students built and launched hydro rockets, learning fundamental principles of rocket science through interactive activities. The session demonstrated how rocketry mechanics apply universally, from hydro rockets to spacecraft heading to Mars.

Schools like Prudence School, Imperial High School, Amity School, and others actively participated, showcasing their passion for space science despite the weather. Students were captivated by the science of rocket design and launch, thrilled to see their creations soar.

In addition, a special workshop was organized for parents and teachers which was led by another astronomer. This segment focused on creating sky maps by using celestial coordinates to locate stars and other celestial objects in the night sky. Participants engaged in a hands-on activity with celestial globes, which allowed them to explore the stars and constellations like never before. The parents and teachers found the experience enriching and enjoyable, with many sharing that it gave them a chance to reconnect with their own student experiences while learning something new.

The Adventures of Water Rocketry workshop was more than just an educational event. It was a memorable journey into the world of space exploration and technology. The enthusiasm and curiosity sparked by the workshop were clear in the active participation of the students. As Space India and the American Centre continue to collaborate on such educational initiatives, they play an essential role in inspiring the next generation of scientists, engineers, and space explorers. These efforts ensure that the spirit of discovery and innovation continues to thrive, fostering a future where young minds are equipped with the knowledge and excitement to push the boundaries of space exploration.

Colorful Cosmos: A Celestial Showcase at Delhi Public School, Faridabad

On 25th October 2024, Delhi Public School, Sector-19 Faridabad, hosted Colorful Cosmos, an enchanting evening dedicated to unraveling the marvels of the universe. This stellar event welcomed students, parents, and esteemed members of the Delhi Public School Society to the school's observatory, transforming the campus into a hub of astronomical discovery. Led by an expert team of astronomers from Space India, the session offered attendees an unforgettable journey through the cosmos.

Despite the urban challenges of light pollution, the observatory, equipped with state-of-the-art technology, delivered awe-inspiring views of the night sky. The centerpiece of the setup was the Celestron Edge HD 14-inch telescope, renowned for its precision and clarity. Complemented by the ZWO ASI 385 MC camera, the team demonstrated how advanced imaging technology reveals the true colors and intricate details of celestial objects–features that remain hidden to the naked eye.


Bow Tie Nebula (NGC 40)


Andromeda Galaxy (M31)


Blue Snowball Nebula (NGC 7662)

The celestial tour began with the majestic Saturn, its iconic rings drawing gasps of wonder from attendees. The telescope then guided viewers to the Andromeda Galaxy (M31), our nearest galactic neighbor, whose sprawling spiral arms were a sight to behold. The dazzling Ring Nebula (M57), with its vibrant hues, showcased the remnants of a dying star, while the Bow Tie Nebula (NGC 40) and Snowball Nebula (NGC 7662) offered glimpses of their ethereal beauty. The Globular Cluster (M15), densely packed with ancient stars, provided a profound connection to the early universe, sparking curiosity about the origins of time and space.

The team of astronomers from Space India enhanced the experience with their engaging explanations and in-depth knowledge. They guided attendees through each observation, shedding light on the scientific phenomena behind the breathtaking sights and answering a myriad of questions from curious students and parents. The event seamlessly blended scientific rigor with the sheer wonder of exploration, igniting a passion for astronomy in the hearts of all present.


M57 - Ring Nebula


Pegasus Cluster (M15)


Saturn

This rare opportunity to witness the universe's grandeur through powerful telescopes left an indelible mark on attendees, many of whom expressed newfound interest in stargazing and astrophotography. Colorful Cosmos was more than an event–it was an inspiring celebration of humanity's connection to the cosmos, sparking imaginations and encouraging the pursuit of knowledge about the infinite expanse of space.

The evening was hailed as a resounding success, leaving participants in awe and fostering a deeper appreciation for the celestial wonders that lie beyond our earthly horizons.

Lunar and Planetary Party: A Stellar Evening of Exploration at Bal Bharati Public School

On 8th November 2024, SPACE India, in collaboration with Bal Bharati Public School, Pitampura, hosted the "Lunar and Planetary Party" under its UITS program, offering an unforgettable evening of celestial exploration for students, parents, and educators. This engaging event highlighted SPACE India's commitment to transforming STEM education through hands-on activities, powerful telescope observations, and student-led initiatives.

The event's core mission was to bring space science alive beyond textbooks. Students, acting as enthusiastic amateur astronomers, presented detailed models and explained complex space concepts, demonstrating the dynamic learning fostered by SPACE India's educational programs. Their confidence and passion captivated attendees, showcasing the effectiveness of interactive education.

The "Lunar and Planetary Party" featured a variety of activities for all ages. At the crater-making station, participants learned how meteoroids shape the Moon's surface. The "Comet Kitchen" allowed families to build comet models using materials that mimicked their composition, making abstract scientific ideas tangible. Young students guided families through the phases of the Moon, enhancing understanding through engaging demonstrations.

One of the evening's highlights was the telescopic observation session. Attendees marvelled at the Moon's craters and valleys through Dobsonian telescopes provided by SPACE India, experiencing the awe of observational astronomy firsthand. Meanwhile, the hydro rocketry activity demonstrated physics and engineering principles as water-powered rockets soared skyward, captivating both children and adults.

Through events like the "Lunar and Planetary Party," SPACE India aligns with the National Education Policy's vision of experiential learning. By creating immersive and interactive educational experiences, they spark scientific curiosity and critical thinking among young minds. This partnership with Bal Bharati Public School exemplifies the power of community-focused education, bringing the mysteries of the cosmos closer to home and inspiring a new generation of space enthusiasts and explorers.

Exploring Space and Heritage: A Stellar Exhibition at KR Mangalam World School

On 16th November, KR Mangalam World School, Gurgaon, hosted a vibrant and engaging space exhibition as part of the middle wing's broader cultural showcase. The event spotlighted students from Classes 2 to 5, with each class representing the scientific and cultural achievements of a particular country.
The space stall stood out as a hub of knowledge and creativity, themed around "Astronomy in Ancient India" and the advancements of the Indian Space Research Organisation (ISRO).

The students brought history and modern science to life with meticulously crafted models of:

- Jantar Mantar, showcasing India's early astronomical brilliance.
- Aryabhata, India's first satellite, honouring the legacy of its namesake mathematician and astronomer.
- A tribute to Dr. APJ Abdul Kalam, the "Missile Man of India."
- ISRO's Satellite Launch Vehicle (SLV), demonstrating the country's leaps in space exploration.
- The Nakshatras (constellations), reflecting ancient Indian celestial studies.
- Interactive models for solar observation and a hands-on pop rocket activity that captivated younger audiences.

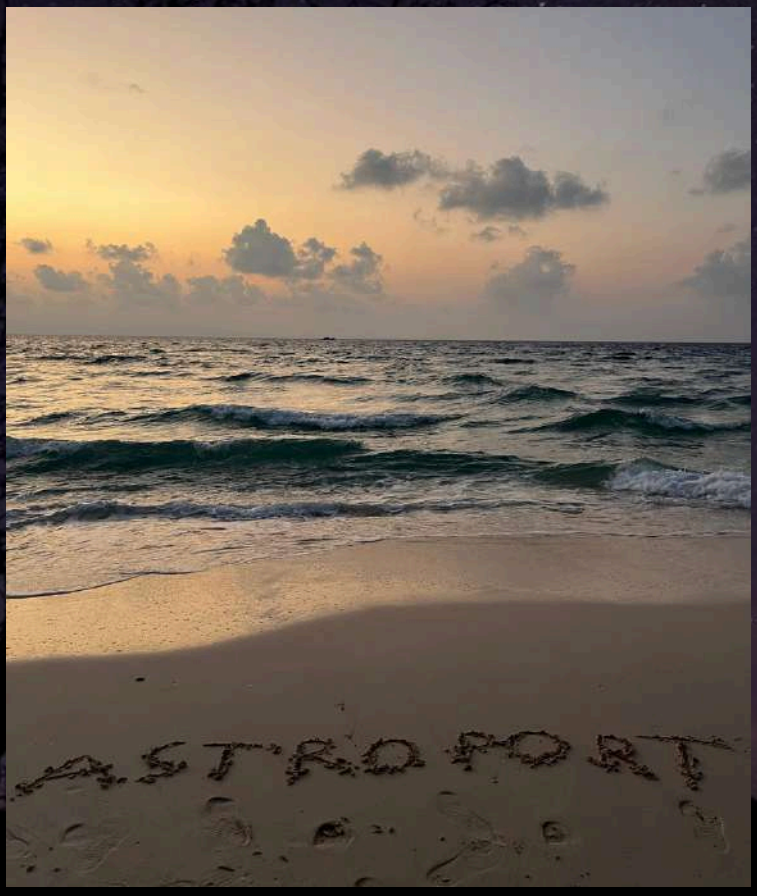
The exhibition saw an impressive turnout of nearly 200 parents who praised the students' efforts and enthusiasm. Visitors appreciated the blend of historical and contemporary themes, as well as the interactive learning experiences provided by the young presenters.
This event not only highlighted the scientific spirit of ancient and modern India but also fostered curiosity and creativity among students, leaving parents and participants inspired by the wonders of space and Indian ingenuity. The school continues to shine as a beacon for innovative learning, making science both educational and enjoyable for all.

India's Premier Stargazing Destination is Now in Andaman and Nicobar Islands

Astroport is excited to announce its new stargazing venture at the Pearl Park Beach Resort on Neil Island, part of the Andaman and Nicobar Islands. This expansion offers a unique opportunity for stargazers to enjoy astronomy-focused experiences in one of India's most scenic and tranquil locations.

The Allure of the Andaman and Nicobar Islands

Known for their pristine beaches and rich biodiversity, the Andaman Islands are also an ideal location for stargazing. The islands benefit from minimal light pollution, offering an unobstructed view of the night sky where constellations, planets, and even distant galaxies are visible. With consistent clear skies, especially from November to May, Neil Island provides an excellent environment for stargazing year-round. Additionally, the island's isolation enhances the serenity of the experience, allowing visitors to focus fully on the wonders of the cosmos.



Why Choose Neil Island?

Neil Island was chosen for Astroport's expansion due to its natural beauty and exceptional stargazing conditions. The Pearl Park Beach Resort, located on a quiet beachfront away from urban distractions, offers a serene environment perfect for stargazing activities. The resort provides a balance of comfort and adventure, with cozy accommodations and amenities designed to complement Astroport's offerings.

Visitors can look forward to guided stargazing sessions led by experts, equipped with high-quality telescopes and binoculars, providing an educational yet magical experience. This combination of expert guidance and the pristine natural surroundings makes Neil Island a truly unique stargazing destination.

The Andaman Astroport Experience: What Visitors Can Expect

Astroport's Neil Island location caters to all levels of stargazers, from beginners to experienced observers. Upon arrival, guests are introduced to the stargazing experience, including equipment usage and tips for maximizing their session.

As the sun sets, expert guides lead visitors on a journey through the night sky, identifying constellations, planets, and deep-sky objects like galaxies and nebulas. For those interested in astrophotography, Astroport offers opportunities to capture stunning images of the night sky, aided by experts who provide photography tips. After the stargazing session, visitors can unwind on the beach, enjoying the peaceful surroundings and reflecting on the experience.

Astroport's Vision for Astronomy in India

Astroport's mission to make astronomy accessible to everyone is reinforced by its expansion to Neil Island. By offering curated stargazing experiences, Astroport aims to inspire a new generation of astronomy enthusiasts and foster a lasting appreciation for the night sky.

Why Visit Astroport at Neil Island?

Astroport at Neil Island provides a rare chance to stargaze in one of India's most pristine environments. Whether you're a passionate stargazer or simply looking for a unique experience, the combination of clear skies, expert guidance, and the natural beauty of the island makes it a must-visit destination.

In conclusion, Astroport's new venture on Neil Island enhances India's stargazing landscape. With its blend of natural beauty and expert-led experiences, the location offers a one-of-a-kind opportunity to explore the cosmos. Join us at Neil Island for an unforgettable adventure under the stars.

EXPLORING THE COSMOS: SPACE ARCADE'S MONTHLY OBSERVATION

On November 16, 2024, SPACE ARCADE organized its Monthly Telescopic Observation event, drawing stargazers to Delhi for an evening of celestial exploration. While rain led to the cancellation of the Chennai session, the Delhi gathering thrived with participants arriving armed with telescopes, binoculars, and other astronomical gear.

Attendees were treated to remarkable views of the Moon, Venus, Saturn, and Jupiter. The session highlighted intricate lunar craters, the shifting phases of Venus, Saturn's stunning rings, and Jupiter's cloud bands along with its Galilean moons.

The SPACE ARCADE team guided participants in assembling and calibrating telescopes, explaining the features of different models, and answering queries. They also introduced foundational techniques for astrophotography, inspiring many to capture their cosmic observations.

The event showcased a variety of telescopes, including the Space Voyage 8" F/6 Dobsonian, NexStar 8SE Computerized GoTo Telescope, Space Launcher 76mm, and Celestron Astromaster 130EQ, each offering distinct perspectives of the night sky.

With its focus on interactive learning and shared discovery, the event created a lasting impression on all who attended. SPACE ARCADE looks forward to hosting future sessions, welcoming more enthusiasts to experience the magic of astronomy.

HIGHLIGHTS OF NOVEMBER 2024

SpaceX Launches India's 4,700-kg GSAT-20 into Space

SpaceX achieved another milestone on November 18 by launching its first-ever mission for the Indian Space Research Organisation (ISRO). A Falcon 9 rocket carried ISRO's GSAT-N2 communications satellite into orbit, lifting off from Cape Canaveral Space Force Station at 1:31 p.m. EST (1831 GMT).

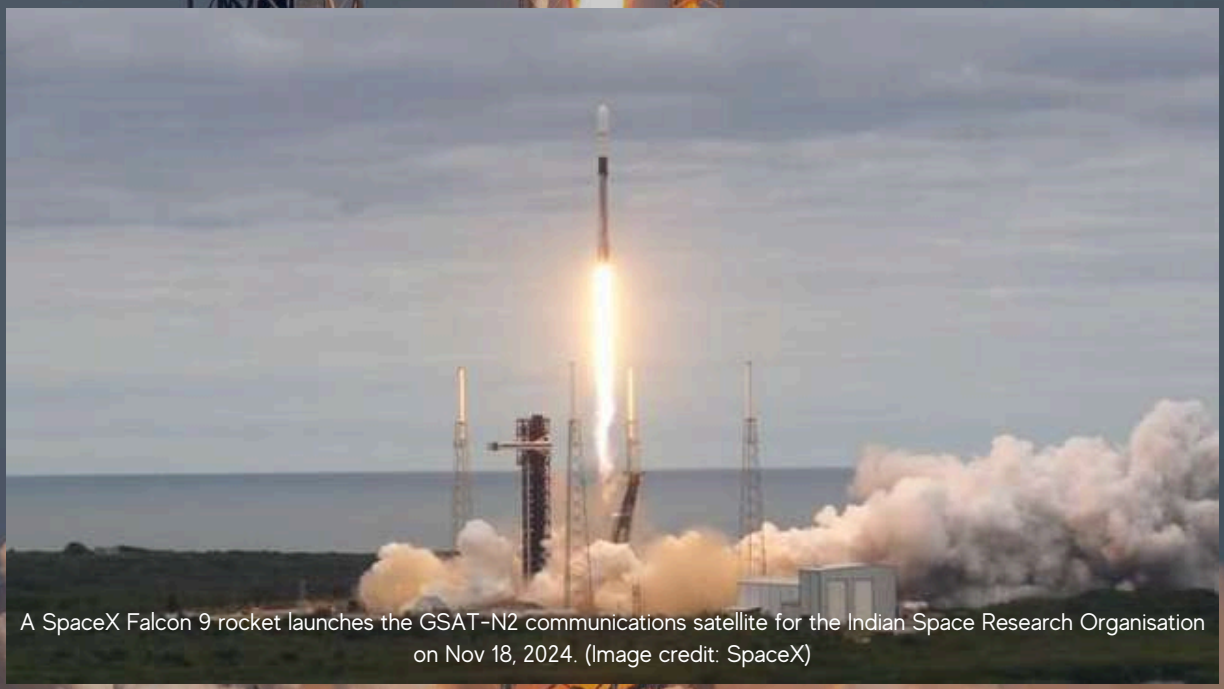
The mission showcased SpaceX's reusable rocket technology. Falcon 9's first stage returned to Earth about 8.5 minutes after liftoff, landing on the droneship "Just Read the Instructions" in the Atlantic Ocean. This marked the 19th successful flight for this particular booster, highlighting SpaceX's efficiency and reliability.

The rocket's upper stage deployed the 10,360-pound (4,700-kilogram) GSAT-N2 satellite into geosynchronous transfer orbit 34 minutes after launch. Developed by New Space India Limited, ISRO's commercial arm, GSAT-N2 is designed to enhance India's telecommunications and broadband capabilities. The satellite will now travel to its final destination in geostationary orbit, 22,236 miles (35,786 kilometers) above Earth.

This launch marked a particularly busy time for SpaceX, being its third mission in less than 24 hours, demonstrating the company's operational agility.

The collaboration between SpaceX and ISRO represents a significant moment for both organizations. It emphasizes ISRO's willingness to leverage global partnerships to expand its capabilities and SpaceX's role as a trusted provider of heavy-lift launch services.

As GSAT-N2 begins its operational journey, it symbolizes a step forward in India's space ambitions. The mission is a testament to innovation and international cooperation, paving the way for advancements in global space exploration and connectivity.



A SpaceX Falcon 9 rocket launches the GSAT-N2 communications satellite for the Indian Space Research Organisation on Nov 18, 2024. (Image credit: SpaceX)

INDIA DELAYS FIRST-EVER GAGANYAAN ASTRONAUT LAUNCH TO 2026

ISRO's Launch Vehicle Mark-3 (LVM3) rocket will ferry a humanoid robot to space on a test flight later this year and carry astronauts in 2026. (Image credit: ISRO)

India's ambitious Gaganyaan mission, which aims to launch astronauts into space for the first time in the country's history, has been rescheduled to no sooner than 2026, according to Indian Space Research Organisation (ISRO) Chairman S. Somanath. Speaking at an event in New Delhi, Somanath attributed the delay to extreme caution being exercised to ensure crew safety, as well as the challenges in developing homegrown technologies that are critical to the mission's success.

The Gaganyaan mission, approved by the Union Cabinet, has already seen significant progress. Initial uncrewed flight tests are slated to begin in December 2024, marking a critical step toward human spaceflight. Somanath emphasized the importance of rigorous testing, saying, "Although Gaganyaan is ready for launch by the end of the year, we should proceed with caution. I don't want what happened to the Boeing Starliner."

This reference highlighted NASA's experience with the Boeing Starliner spacecraft, where unexpected issues extended astronauts' stay on the International Space Station from eight days to eight months. Such incidents underline the need for meticulous preparation to avoid similar complications.

Meanwhile, ISRO is also preparing for another ambitious project: the Venus Orbiter Mission (VOM). Approved alongside Gaganyaan, the mission has been allocated ₹1,236 crore and is expected to launch in March 2028. Venus presents unique challenges, with an atmosphere 100 times denser than Earth's and extreme surface conditions. Despite its proximity to Earth, it is considered more demanding than Mars missions.Venus is vital for understanding planetary evolution. If Earth becomes uninhabitable, studying Venus and Mars will help secure humanity's future," Somanath said.Due to the seven-year timeline for developing the Next Generation Launch Vehicle (NGLV), the Venus mission will use the existing LVM3. India aims to join Russia, China, and Japan in launching Venus missions before 2030.

Somanath also expressed optimism about India's growing private space sector. Speaking at the Bengaluru Space Expo, he highlighted startups' contributions to satellite development, calling it a sign of India's transition to a robust space economy.With Gaganyaan and the Venus mission, ISRO continues to push the boundaries of India's space exploration capabilities, balancing bold ambitions with a commitment to safety and innovation.

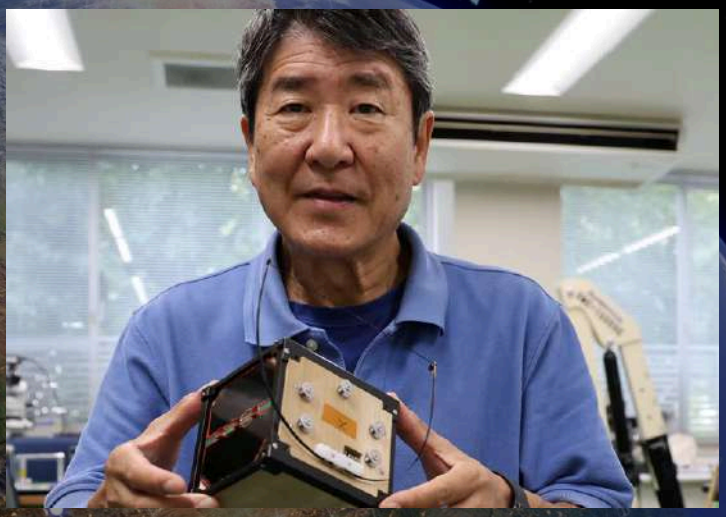
WORLD'S FIRST WOODEN SATELLITE ARRIVES AT ISS FOR KEY ORBITAL TESTS

(Image credit: STR/JIJI PRESS/AFP)

A groundbreaking milestone in space exploration was achieved as the world's first wooden satellite, LignoSat, arrived at the International Space Station (ISS) on November 5, aboard a SpaceX Dragon cargo capsule. This tiny Japanese spacecraft, measuring just 4 inches (10 centimeters) on each side, is set to conduct pivotal in-space tests that could revolutionize the sustainability of future satellites.

LignoSat is the result of a collaborative effort between researchers and engineers aiming to explore the potential of wood as a satellite material. While the concept of a wooden satellite may seem counterintuitive, it holds significant promise for reducing the environmental impact of space exploration. Meghan Everett, deputy chief scientist for NASA's ISS program, explained during a press briefing on November 4, "Researchers hope this investigation demonstrates that a wooden satellite can be more sustainable and less polluting for the environment than conventional satellites."

Currently, most satellites are constructed primarily from aluminum, a material prized for its strength and lightweight properties. However, when satellites burn up in Earth's atmosphere at the end of their operational lifetimes, they release aluminum oxides. These compounds can harm the planet's ozone layer and alter Earth's thermal balance. In contrast, wood burns cleanly, leaving no harmful residues, making it a potentially eco-friendly alternative.



Takao Doi, an astronaut and professor at Kyoto University, holding an engineering model of LignoSat. (Image credit: Irene Wang/Reuters)

LignoSat's primary objective is to test the durability and behavior of wood in the harsh conditions of space, including extreme temperatures, intense radiation, and microgravity. If successful, this innovative material could pave the way for a new class of sustainable satellites, addressing concerns about the environmental impact of the growing number of decommissioned spacecraft.

The arrival of LignoSat at the ISS is a testament to the ingenuity and determination of researchers exploring unconventional solutions to modern challenges. While small in size, the mission's implications are vast, offering a glimpse into a more sustainable future for space exploration. As the satellite begins its orbital journey, scientists worldwide are keenly observing its performance, hoping it will inspire further innovation in environmentally conscious space technology.

India Plans to Build a Moon-Orbiting Space Station by 2040

Artist's illustration of an American-led base on the moon. (Image credit: NASA)

India has unveiled an ambitious roadmap to establish a long-term presence beyond Earth, aiming to build a moon-orbiting space station by 2040. This lunar outpost will serve as a hub for crewed missions, scientific research, and resource exploration, cementing India's growing role in global space exploration.

According to recent reports, the moon-orbiting space station is envisioned as the third and final phase of India's lunar exploration efforts. The first phase includes conducting robotic missions to the Moon, leveraging indigenous technology like the upcoming Chandrayaan 4 sample-return mission. The second phase will see Indian astronauts land on the Moon by 2040, followed by the establishment of a lunar surface base before 2050.

The lunar space station will be a cornerstone of Phase 3, designed to support long-term studies of the Moon's environment and resources, such as water ice, which is crucial for sustaining future missions. The outpost will also serve as a testing ground for life-support systems and other technologies necessary for deep-space exploration, including potential missions to Mars.

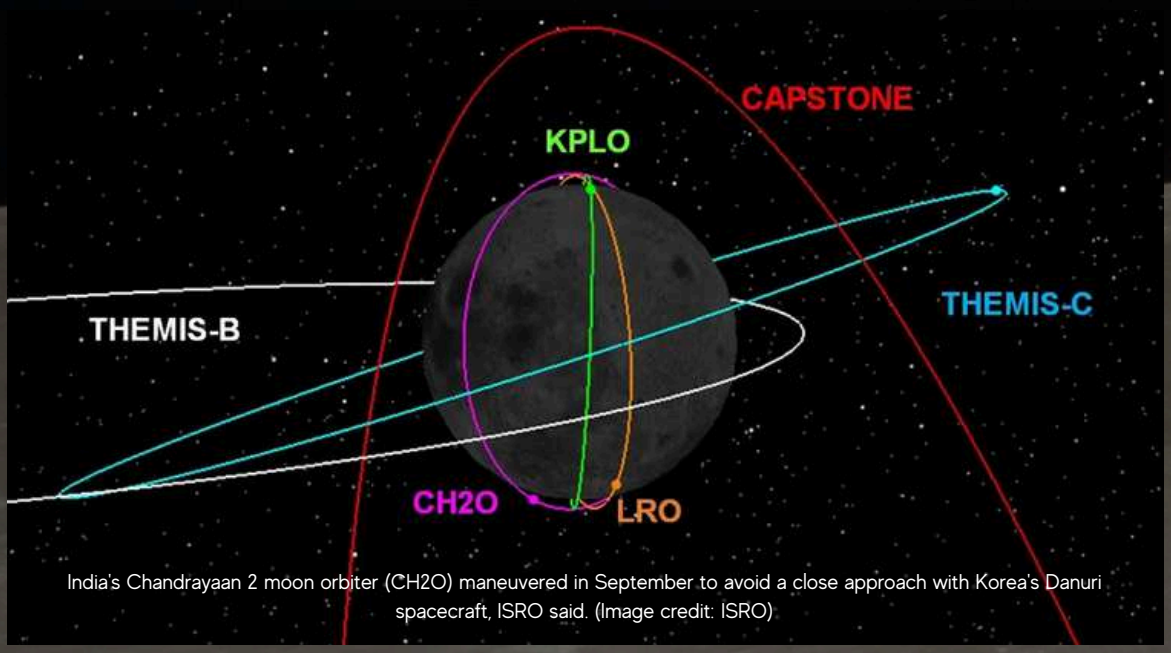
ISRO's first step toward realizing this goal is the Bharatiya Antariksha Station (BAS), India's first low-Earth orbit space station. Set to launch its first module by 2028, BAS will play a vital role in testing the technologies required for the lunar station. The phased approach ensures a systematic buildup of expertise and capabilities in human spaceflight and space station construction.

India's space program is advancing rapidly. Following the success of Chandrayaan-3, which made India the fourth country to land on the Moon, Prime Minister Narendra Modi has announced bold goals for the future. The plan to establish a moon-orbiting space station reflects the nation's commitment to scientific innovation and its aspiration to become a major player in global space exploration.

By combining robotic missions, crewed lunar landings, and a permanent orbital presence, India is laying a solid foundation for sustainable exploration of the Moon and beyond.

India's Chandrayaan-2 Avoids Collision with South Korea's Danuri Spacecraft

In a critical maneuver, India's Chandrayaan-2 lunar orbiter adjusted its trajectory in September 2024 to avoid a potential collision with South Korea's Danuri spacecraft, officially known as the Korea Pathfinder Lunar Orbiter (KPLO). The Indian Space Research Organisation (ISRO) reported that the maneuver, conducted on September 19, was necessary to prevent a close approach projected to occur two weeks later if no changes were made.



India's Chandrayaan 2 moon orbiter (CH2O) maneuvered in September to avoid a close approach with Korea's Danuri spacecraft, ISRO said. (Image credit: ISRO)

Chandrayaan-2 performed another orbital adjustment on October 1, 2024, to maintain a safe distance from other orbiters, including NASA's Lunar Reconnaissance Orbiter (LRO). These maneuvers reflect the increasing complexity of lunar operations as multiple spacecraft share the Moon's orbital environment.

Lunar orbiters like Chandrayaan-2, Danuri, and LRO operate in near-polar orbits, especially over the Moon's poles, where their paths frequently intersect. This shared trajectory raises the risk of potential collisions. Over the past 18 months, the Korea Aerospace Research Institute (KARI), which operates Danuri, has issued over 40 "red alarms" for potential close approaches involving Chandrayaan-2, Danuri, and LRO.

Collision-avoidance maneuvers are becoming increasingly common. For instance, in 2021, Chandrayaan-2 avoided a potential close pass with LRO by shifting its orbit. The two spacecraft would have come within just 1.8 miles (3 kilometers) of each other without the adjustment. Similarly, Danuri has performed at least three orbital changes since entering lunar orbit in December 2022, including avoiding Japan's Smart Lander for Investigating Moon (SLIM).

Despite the growing risks, there is currently no globally coordinated protocol for managing collision avoidance around the Moon. Space agencies rely on direct communication, sharing position data via email and teleconferences. However, challenges such as network security barriers and limited contact information complicate coordination efforts.

NASA's Jet Propulsion Laboratory provides a tool called the Multimission Automated Deep-Space Conjunction Assessment Process (MADCAP) to assess collision risks. However, experts, including Soyoung Chung of KARI, emphasize the need for an international framework to ensure safe operations as lunar activities intensify.

With more nations venturing into lunar exploration, establishing such protocols will be vital for ensuring the sustainability of missions around the Moon.

Space Scales: How Astronauts Measure Their Mass Without Gravity

NASA astronaut Tom Marshburn uses the Body Mass Measurement Device in the Zvezda service module aboard the International Space Station on Dec. 23, 2012. (Image credit: NASA)

Microgravity in low Earth orbit is a demanding environment for the human body, and astronauts must ensure they stay in peak fitness while on the International Space Station (ISS). On Earth, our fitness routines are often designed around our weight. But how can astronauts measure their weight when they are effectively weightless in space?

Two devices on board the ISS, NASA's Space Linear Acceleration Mass Measurement Device (SLAMMD) and Russia's Body Mass Measurement Device (BMMD), can measure astronauts' body mass rather than weight. SLAMMD uses Isaac Newton's second law of motion, which is that a force's strength is equal to the mass that the force is pushing multiplied by the acceleration of that mass when it is pushed by that force.

SLAMMD is part of the Human Research Facility Rack, which is part of the European-built Columbus laboratory. It uses springs to push the guide arm against the astronaut, causing them to be pushed back.

The force exerted by the springs is known, and the astronaut's acceleration is calculated by dividing the change in velocity over that distance by the time taken. A laptop attached to SLAMMD can perform the calculation F = ma to determine the astronaut's body mass to within an accuracy of half a pound. The Russian method uses the BMMD, which is found in the space station's Zvezda module. It uses springs, but instead of using a one-time push, an astronaut crouches onto it and sets it moving like a pogo stick, moving up and down. Timing the period provides a good estimate of the astronaut's body mass.

An astronaut loses 1% of their bone density each month, on average, while in space. Muscles also atrophy and the heart weakens because it doesn't need to work as hard to pump blood around an astronaut's body.

To counteract the effect of microgravity, astronauts on the ISS exercise for two hours each day in the space station's onboard gym to maintain muscle mass, bone density and cardiovascular health. Measuring their body mass plays a vital part in checking that they remain fit and healthy.

European Space Agency astronaut André Kuipers uses SLAMMD to measure his body mass. (Image credit: NASA/ESA)

GW170817 - The aftermath

On 17th August 2017, telescopes around the world turned towards the merger of two neutron stars that occurred approximately 130 million light-years away in NGC 4993. GW170817, or AT2017gfo, was the first time the merger of neutron stars, a kilonova, was detected.

Neutron stars are remnants of massive stars, which collapsed under their gravity after running out of star fuel. They are one of the densest objects in the universe. When two neutron stars merge, a kilonova explosion occurs. The energy from this explosion is enough to tear atoms apart into a plasma consisting of free electrons and atomic nuclei. An environment that is similar to the early universe after the Big Bang.

Recently, researchers from the Niels Bohr Institute published a paper in the journal Astronomy and Astrophysics, in which they went over the aftermath of the GW170817. To carry out the investigation, they had to utilize data collected over several days from several observatories and the Hubble Space Telescope due to the transient nature of a kilonova.

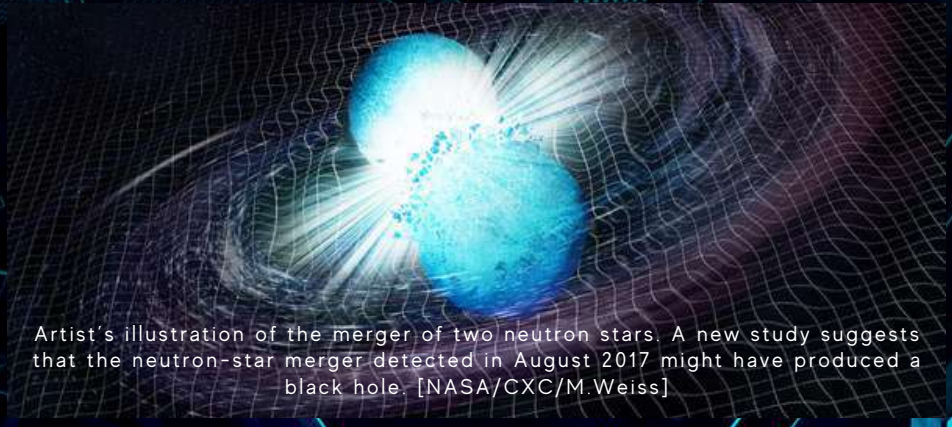
With the help of the instruments, the Cosmic DAWN Center team were able to capture a snapshot of the powerful and violent collision, which, potentially, resulted in the birth of the smallest black hole to be observed to date and the synthesis of precious metals.

Information from this research is vital as it will help us understand cosmic nucleosynthesis. There are three types of nucleosynthesis: slow neutron capture (s-process), proton process (p-process), and rapid neutron capture (r-process). In a kilonova, atoms are formed through the r-process, and through observing GW170817, astronomers, for the first time, observed atoms being formed when the plasma cooled after the kilonova.

Analysis of the data revealed that the kilonova had a shell of gas that was expanding around it. Additionally, researchers were able to learn about the velocity, density, temperature, ionization and direction of flow of the gas. All while identifying the synthesis of several elements heavier than Iron such as Tellurium, Lanthanum, Cesium, and Yttrium.

Kilonova are complex mini-laboratories where scientists can study extreme nuclear physics. They are also important contributors to heavy elements in the Universe and researchers are keen to understand how elements form in such an environmnet.

GW170817 produced about 16,000 Earth masses of heavy elements. This includes 10 Earth masses of the elements gold and platinum.



Artist's illustration of the merger of two neutron stars. A new study suggests that the neutron-star merger detected in August 2017 might have produced a black hole. [NASA/CXC/M.Weiss]

Solving the mystery of the Corona

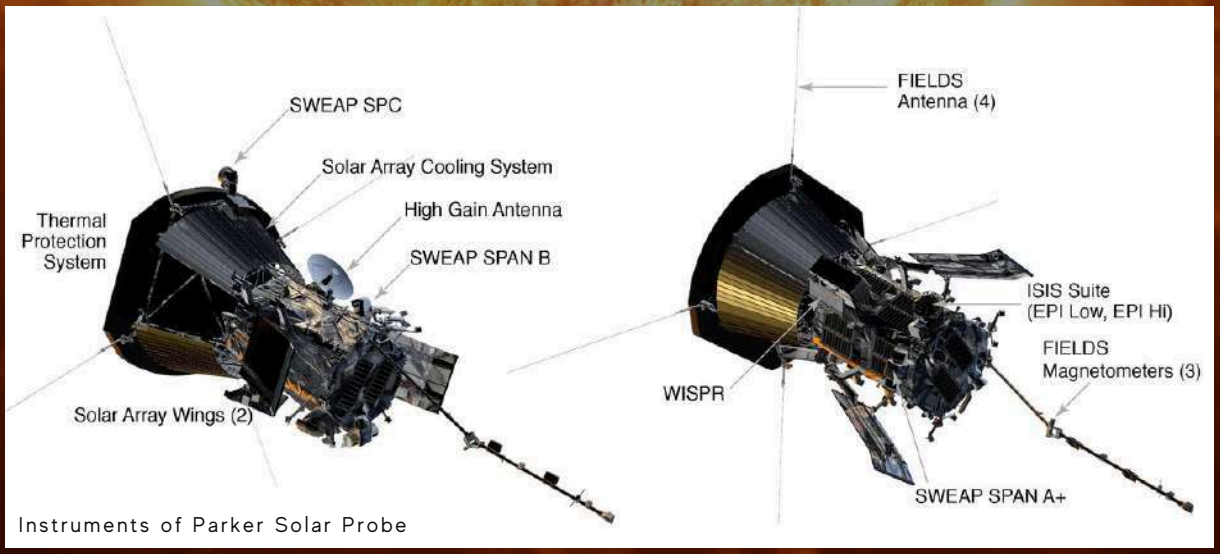
Since its launch in 2018, the Parker Solar Probe has been observing the sun, allowing us to learn more about our home star. Travelling at 0.06% of light speed, it is currently the fastest object designed by man.

The main goal of NASA's Parker Solar Probe was to investigate the mysterious spike in temperature that occurs in the solar atmosphere. For decades it has been known that the Solar atmosphere is hotter than the solar surface, but scientists couldn't explain why. To get a complete picture, the Parker Solar Probe has FIELDS, WISPR, IS-O-IS and SWEAP onboard to work together as they study the corona, the solar wind, and the photosphere.

Currently, one of the accepted reasons for the temperature spike is because of fully ionized Helium. Fully ionized He is very good at trapping heat, and the efficiency of the process doesn't matter. This is because a small amount of energy is needed to heat the corona to ridiculously high temperatures. Parker has recently discovered that strange waves of magnetic-field energy, known as switchback, also play a vital part in heating the corona.

Switchback forms in the photosphere. In the photosphere, regions of intense magnetic energy form, and many magnetic field lines tangle up with each other. The magnetic field lines are not identical. Some are straight, pointing away from the sun, while others are horseshoe-shaped, looping back to the surface. When the two kinds of magnetic fields bump against each other, the lines can disconnect and reconnect, forming a giant kink, the switchback, in the field lines. The switchback then travels away from the surface and into the corona where it dissolves, transferring its energy. Thus far, it is believed to be one of the most important – if not the most important – ways the sun heats its corona.

Knowing the influence of the magnetic field on the corona is important as the magnetic field also controls space weather. Space weather has a huge impact on satellites, human spaceflight and even our power grids. Understanding the role magnetic fields play in the sun will help us to be better at predicting and planning for all types of Solar storms.



Instruments of Parker Solar Probe

FROM THE EYES OF WEBB – NOVEMBER 2024

Eyes on the Universe: JWST soars into Space

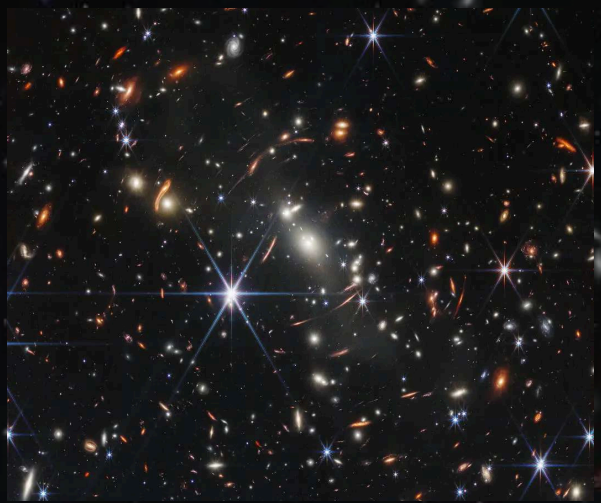
Webb was launched on December 25, 2021, aboard an Ariane 5 rocket from the Ariane Space ELA-3 launch complex at Europe's Spaceport, near Kourou in French Guiana. It was shipped there via the Panama Canal from Northrup's factory in California, where it underwent final integration and testing.

The European Space Agency's contribution to the project included the launch vehicle and launch location. The Ariane 5 is one of the world's most reliable launch vehicles, and it was chosen for both its dependability (it was the only launch vehicle that matched NASA's standards for launching a mission like Webb) and the value it provided through our multinational cooperation. Read about why the Ariane 5 was chosen.

It is advantageous for launch sites to be near the equator, as the Earth's spin can provide additional thrust. At the equator, the Earth's surface moves at a speed of 1670 kilometers per hour.

Arianespace's Ariane 5 rocket with NASA's James Webb Space Telescope onboard, Thursday, Dec. 23, 2021, at Europe's Spaceport. (Image Credit: Chris Gunn)

The Launch Segment comprises three main components: **Launch Vehicle:** An Ariane 5 with a cryogenic upper stage in a single launch configuration, with a large payload fairing with a maximum static diameter of 4.57 meters and a useful length of 16.19 meters. **Payload Adapter:** made up of the Cone 3936 and the ACU 2624 lower cylinder and clamp-band, served as the mechanical and electrical contact between the Webb Observatory and the Launch Vehicle. **Launch campaign preparation and launch campaign.** The launch campaign preparation and launch campaign were the mutual responsibility of NASA, ESA, Northrop Grumman and ArianeSpace.

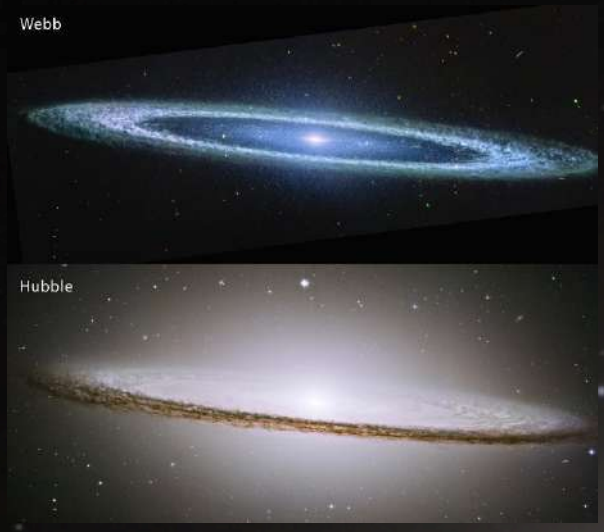


During a White House event on Monday, July 11, President Joe Biden presented this image of the galaxy cluster SMACS 0723, also referred to as Webb's First Deep Field.

A slice of sky about the size of a grain of sand held at arm's length by a person on the ground is covered by Webb's image, which shows hundreds of galaxies in a very small portion of the vast cosmos.

Webb provided the most precise glimpse of the early cosmos to date thanks to his keen near-infrared vision, which highlighted weak structures in very far-off galaxies.

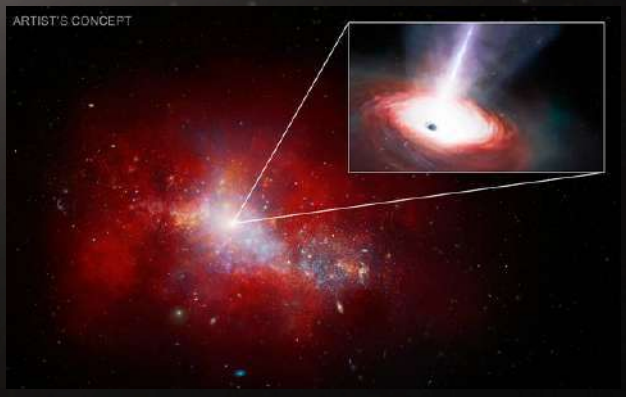
Sombrero Galaxy Dazzles in New Image Clicked by JWST



NASA's James Webb Space Telescope has captured a new image of the Sombrero galaxy, also known as Messier 104, in the mid-infrared. The image shows a smooth inner disk instead of the glowing core seen in visible-light images, and the galaxy's outer ring shows intricate clumps in the infrared. The clumpy nature of the dust, detected by the MIRI instrument, could indicate the presence of young star-forming regions.

However, unlike other galaxies studied, the Sombrero galaxy is not a hotbed of star formation, producing less than one solar mass of stars per year. The galaxy also contains 2000 globular clusters, providing a pseudo laboratory for astronomers to study stars. The rings of the Sombrero galaxy produce less than one solar mass of stars per year, in comparison to the Milky Way's roughly two solar masses a year. In the MIRI image, galaxies of varying shapes and colors litter the background of space. The different colors of these background galaxies can tell astronomers about their properties, including how far away they are. The Sombrero galaxy is around 30 million light-years from Earth in the constellation Virgo.

Astronomers Find Early Fast-Feeding Black Hole Using NASA Telescopes



A low-mass supermassive black hole at the center of a dwarf galaxy in the early universe has been discovered by astronomers using data from NASA's James Webb Space Telescope and Chandra X-ray Observatory. The black hole is pulling in matter at a phenomenal rate, over 40 times the theoretical limit. This discovery could help explain how supermassive black holes grew so quickly in the early universe. The black hole, called LID-568, was hidden among thousands of objects in the Chandra X-ray Observatory's COSMOS legacy survey. The speed and size of these outflows led the team to infer that a substantial fraction of the mass growth of LID-568 may have occurred in a single episode of rapid accretion.

The black hole appears to be feeding on matter at a rate 40 times its Eddington limit, which relates to the maximum amount of light that material surrounding a black hole can emit and how fast it can absorb matter. This new discovery provides new insights into the formation of supermassive black holes from smaller black hole "seeds," which current theories suggest arise from the death of the universe's first stars or the direct collapse of gas clouds.

Revealing Vega: A Cosmic Disk Unlike Any Other

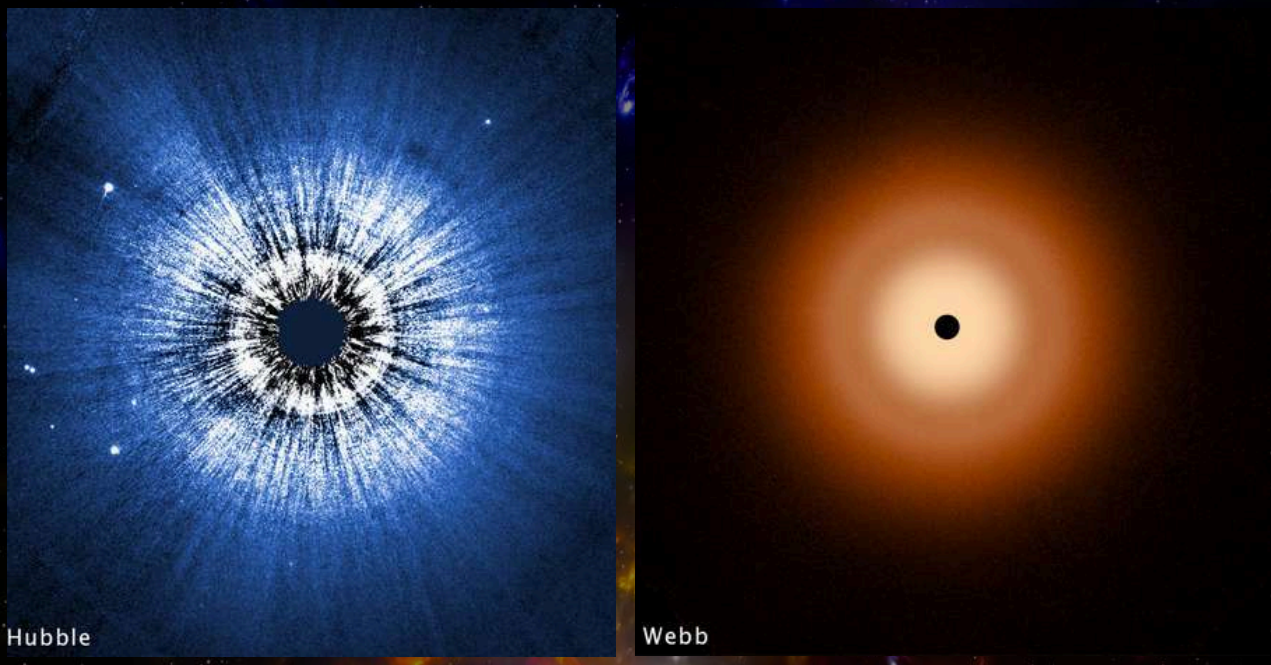


IMAGE CREDIT: NASA, ESA, CSA, STSCI, S. WOLFF (UNIVERSITY OF ARIZONA), K. SU (UNIVERSITY OF ARIZONA), A. GÁSPÁR (UNIVERSITY OF ARIZONA)

The Hubble Space Telescope has discovered a disk of dust and gas around a star called Vega, which is 40 times brighter than our Sun. The disk's distribution of dust is layered due to the pressure of starlight pushing out smaller grains faster than larger grains. The researchers believe that different types of physics will locate different-sized particles at different locations, helping them understand the underlying dynamics in circumstellar disks.

The Vega disk has a subtle gap around 60 AU from the star, but otherwise is very smooth all the way in until it is lost in the glare of the star. This shows that there are no planets down to Neptune-mass circulating in large orbits, as in our solar system. The researchers are seeing in detail how much variety there is among circumstellar disks and how that variety is tied into the underlying planetary systems.

Newly forming stars accrete material from a disk of dust and gas that is the flattened remnant of the cloud from which they are forming. In the mid-1990s, Hubble found disks around many newly forming stars, likely sites of planet formation, migration, and sometimes destruction. Fully matured stars like Vega have dusty disks enriched by ongoing "bumper car" collisions among orbiting asteroids and debris from evaporating comets. Dust within our solar system is replenished by minor bodies ejecting dust at a rate of about 10 tons per second, which is shoved around by planets.

Vega continues to be unusual, with its architecture markedly different from our own solar system where giant planets like Jupiter and Saturn keep the dust from spreading. Fomalhaut, a nearby star, has three nested debris belts and is suggested to have formed planets, but no planets have been positively identified yet.

WHAT'S UP IN THE SKY - DECEMBER 2024

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.

PLANETS VISIBILITY

Mercury
Evening planet, reaches greatest elongation west on 23 December. Spot after mid month

Venus
Reasonably well placed in the evening sky. Sets 4 hours 15 mins after sunset.

Mars
Mars Retrograde on 6 December, Shines at -1.2 magnitude, and approaching opposition.

Jupiter
Opposition on 7 December, magnificently place planet. Visible throughout the month.

Saturn
Well placed in the southern sky among the stars of Aquarius constellation at 28° altitude.

Uranus
Evening planet reaches highest point in the sky under darkness all month.

Neptune
Well-positioned evening planet that reaches peak altitude of 35° in darkness all month.

BRIGHT DEEP SKY OBJECTS

M42 (Orion Nebula) or NGC 1976 is located in Northern hemisphere (Orion constellation) and can be seen with Naked eye as fuzzy patch of light. Its apparent magnitude is 4.0. It can be found in the middle sword asterism near Orion's belt. Most well known and brightest nebula in the night sky.

Pleiades also known as seven sisters or (M45) is located in Taurus constellation with apparent magnitude of 1.2. With naked eyes it looks like hazy 6 stars group and resembles a tiny dipper. Binocular or small telescope can reveal more stars in the cluster.

M1 (Crab Nebula) is located in Taurus constellation with an apparent magnitude of 8.4. It is a remnant of supernova explosion first observed by Chinese astronomer in 1054 AD. The nebula is bright enough to be observed by binocular and small telescope.

M35 also known as Shoe Buckle or NGC 2168 is an open star cluster relatively close to us – it is located 2,800 light years away from the Earth. With an apparent magnitude of 5.1 it can even be spotted with naked eyes in Gemini constellation. A telescope will help you in spotting individual stars in cluster.

ASTRONOMICAL EVENTS - DECEMBER 2024

JUPITER IN OPPOSITION: THE GIANT PLANET SHINES BRIGHTEST

Get ready to witness one of the most spectacular celestial events of the year—**Jupiter's opposition** on **December 14, 2024.** Opposition occurs when Earth passes directly between the Sun and a planet, placing the planet opposite the Sun in the sky. For Jupiter, this means it will be as close as possible to Earth, making it appear larger and brighter than ever before.

When Jupiter reaches opposition, it rises as the Sun sets, making it visible for much of the night. For stargazers and astrophotographers, it's an ideal time to catch a glimpse of the gas giant, as it will be at its most prominent. Jupiter will rise around **6:00 pm** local time, reaching its highest point in the sky at **12:12 am, positioned 83°** above the **southern** horizon. It will set around **6:23 am.**

During opposition, Jupiter will be in the constellation **Taurus** and will be positioned about **4.09 AU** away from Earth. Its disk will measure **47.1 arcseconds** in diameter and shine at an impressive magnitude **-2.8.** While it may appear as a bright star to the naked eye, a pair of binoculars will reveal its disk and possibly even some of its moons.

In addition to being at opposition, Jupiter will also be at **perigee**, its closest point to Earth, further enhancing its brightness and size. These alignments happen because the Earth, Sun, and Jupiter line up with Earth placed directly between the Sun and the planet.

Jupiter's opposition happens once every year, but this is the perfect time to catch a stunning view of the planet, especially for those in India, where it will be visible from **6:00 pm to 6:23 am.** Be sure to mark your calendar—this is an event you won't want to miss!

Geminids 2024: A Cosmic Celebration of Winter Skies

The **Geminid meteor shower**, active from **December 4 to December 17**, is caused by **asteroid 3200 Phaethon**, which is unique because most meteor showers are linked to comets. Discovered in **1983** by **Simon Green** and **John Davies**, Phaethon is the first known asteroid associated with a meteor shower. The asteroid orbits between Mercury and Mars, and its debris intersects Earth's orbit, leading to the Geminid meteors.

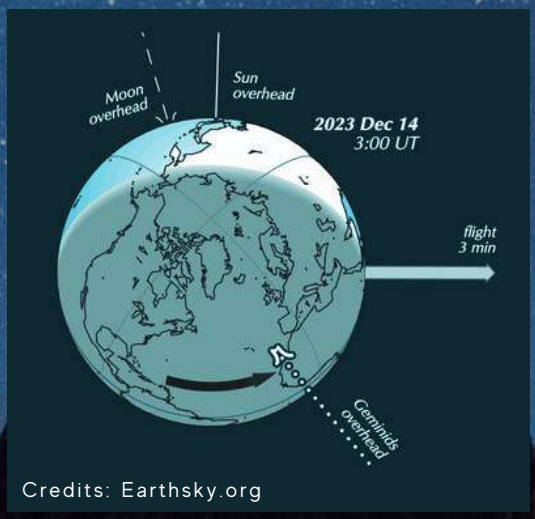
This year's peak will occur around **December 14, 2024**, when up to **120 meteors per hour** could be visible, depending on the viewing conditions. From India, the shower becomes visible after **6:50 pm**, when the radiant point in Gemini rises above the **eastern horizon**, and remains active until dawn.

The best time to view the Geminids is around **2:00 am**, when the radiant point is highest in the sky. This allows for short, vertical meteor trails. However, outside this window, meteors will appear at an angle and may travel across a larger area of the sky.
At peak activity on **December 14**, the radiant point will reach an altitude of **85°** above the horizon from New Delhi, and observers may see up to **119 meteors per hour** if skies are dark and unobstructed. The **near-full Moon** will interfere with visibility, as it will be just one day away from full phase in **Taurus**.

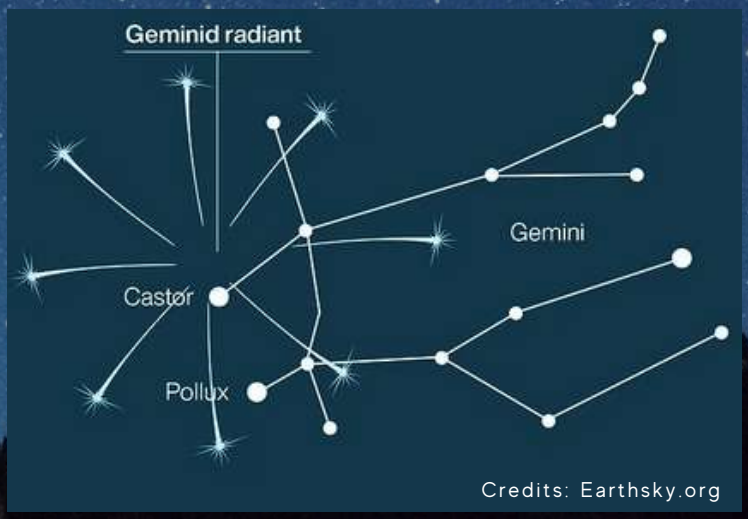
Meteor showers occur when Earth passes through streams of debris left by comets or asteroids. The Geminids are unique because their parent body is an asteroid, not a comet. The debris from 3200 Phaethon creates the meteoroid stream that Earth intersects each December.

Meteors from this shower radiate from a common point in the sky, known as the radiant. For the Geminids, the radiant is located at right ascension **07h20m**, declination **33°N** in **Gemini**.

To see the most meteors, look 30–40° away from the radiant in dark, clear skies. Although the radiant is where meteors appear to originate, meteors can be seen throughout the sky.



Credits: Earthsky.org



Credits: Earthsky.org

Mercury Elongation: Catch the Planet at Its Best

Mercury, the closest planet to the Sun, is often hidden in its glare, making it challenging to observe. However, every few months, Mercury reaches **greatest elongation**, the point when it appears at its farthest distance from the Sun, allowing it to be visible. The December 2024 **apparition** presents a great chance to catch this elusive planet.

Greatest elongation occurs when Mercury is either in the morning or evening sky, visible for a short time before slipping back into the Sun's glare. These apparitions happen every 3–4 months, alternating between morning and evening views.

When Mercury is **east of the Sun**, it appears in the **evening sky,** just after sunset.

When it lies **west of the Sun**, it rises just before the Sun, making it visible in the **morning sky**.

The greatest elongation of Mercury in late 2024 occurs on **December 25, 2024, at 12:40 pm**, when it will shine brightly at **magnitude -0.4**. From India, Mercury will peak at 19° above the horizon on December 24 just before sunrise. The best time to spot it is about **40 minutes** before sunrise, starting in mid-December.

Mercury stays near the **ecliptic**, the Sun's apparent path across the sky. Its height above the horizon changes depending on the angle of the ecliptic, which shifts with the seasons.

During autumn and spring, when the ecliptic meets the horizon at a steep angle, Mercury appears higher in the sky.

In summer and winter, when the ecliptic meets the horizon at a shallow angle, Mercury needs to be farther from the Sun to be visible at a decent altitude.

This seasonal shift explains why some apparitions are better for viewing than others.

Viewing Tips

Where to Look: Focus on the eastern horizon just before dawn, as the sky brightens. With clear skies and a low horizon, Mercury will be visible even to the naked eye.

Best Viewing Time: Mercury will be at its brightest around December 25. After this, it will gradually slip into the Sun's glare, fading from view by January 2025.

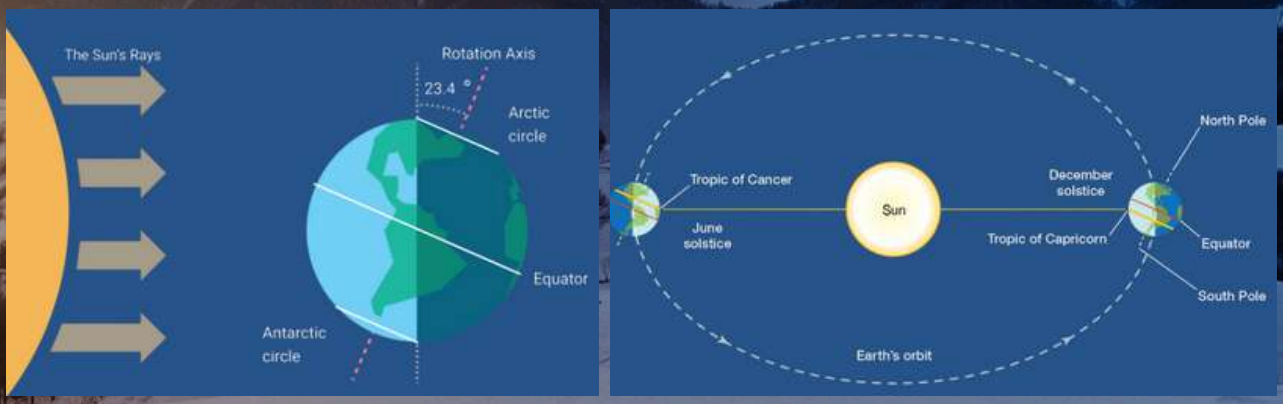
Don't miss this rare chance to witness Mercury at its greatest elongation! Mark your calendars for December 25 and enjoy the view of this elusive planet.

THE WINTER SOLSTICE: EARTH'S TILT AND THE CHANGING SEASONS

Mark your calendars for December 21, 2024, when the Winter Solstice occurs in the Northern Hemisphere, marking the shortest day and longest night of the year. This also signals the official start of winter, as the Sun reaches its southernmost position in the sky, with a declination of 23.5° S in the constellation Capricornus. On this day, the Sun will appear directly overhead at noon along the Tropic of Capricorn.

Meanwhile, in the Southern Hemisphere, December 21 brings the Summer Solstice, the longest day of the year, and the beginning of summer.

These solstices occur due to Earth's 23.5° axial tilt, which causes the poles to alternately lean toward or away from the Sun during its orbit. This tilt creates the cycles of light and shadow that give rise to the changing seasons. Without this tilt, the Sun would always shine directly above the Equator, resulting in constant daylight and no seasonal variations.



Credits: Timeanddate.com

The Winter Solstice happens twice annually, once in each hemisphere. In the Northern Hemisphere, it falls around December 21 or 22, bringing the shortest day. In the Southern Hemisphere, it occurs around June 20 or 21, bringing the longest day. On these dates, the Sun's rays shine directly on either the Tropic of Capricorn or Tropic of Cancer.

Astronomically, the Winter Solstice marks the beginning of winter, which lasts until the spring equinox in March (Northern Hemisphere) or September (Southern Hemisphere). Culturally, the increasing length of days after the solstice symbolizes renewal and rebirth.

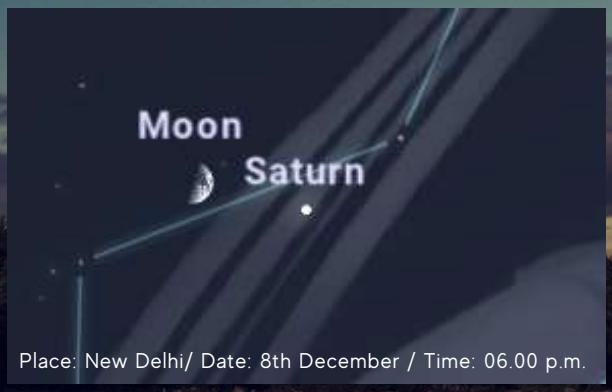
The Summer Solstice, on the other hand, occurs when Earth's tilt maximizes exposure to the Sun, resulting in the longest day of the year. Though astronomically defining the seasons, meteorologists base the seasons on temperature patterns.

The Winter Solstice is a reminder of the delicate balance between Earth's tilt and orbit, which creates the dynamic patterns of sunlight and seasons that make Earth so extraordinary.

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: New Delhi/ Date: 8th December / Time: 06.00 p.m.

Conjunction of Moon and Saturn

On December 8th, the Ringed planet Saturn and the Moon will have the closest approach in the night sky & reaching an altitude of 52° above the south-eastern horizon. The Moon will be at magnitude -11.95, and Saturn at magnitude 1.01. And it will be visible around 12.30 p.m. at noon till 11.55 p.m.

Conjunction of Moon and Jupiter

On December 14th, the Moon, and the Giant planet Jupiter will appear very close to each other in the night. They will be in the North-eastern direction. Moon is at a magnitude of -12.75, the planets Jupiter is at a magnitude of -2.65. The Moon, Mars and Jupiter, together will be seen in the evening sky around 06.00 p.m.

Place: New Delhi / Date: 14th December / Time: 07.30 p.m.

Place: New Delhi/ Date: 18th December / Time: 09.00 p.m.

Conjunction of Moon and Mars

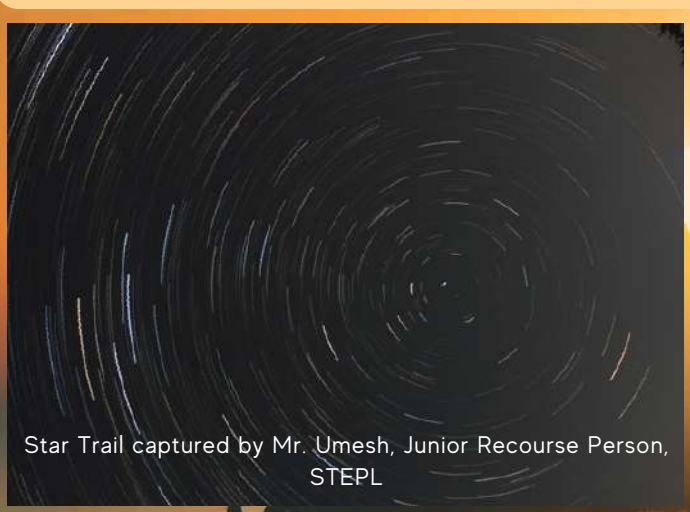
On December 18th, the Red planet Mars and the Moon will have the closest approach in the night sky & reaching an altitude of 11° above the eastern horizon. The Moon will be at magnitude -12.48, and Mars at magnitude -0.90. And it will be visible around 08.30 p.m. in the night sky.

ASTROPHOTOGRAPHS FROM SPACE ASSOCIATED ASTRONOMERS

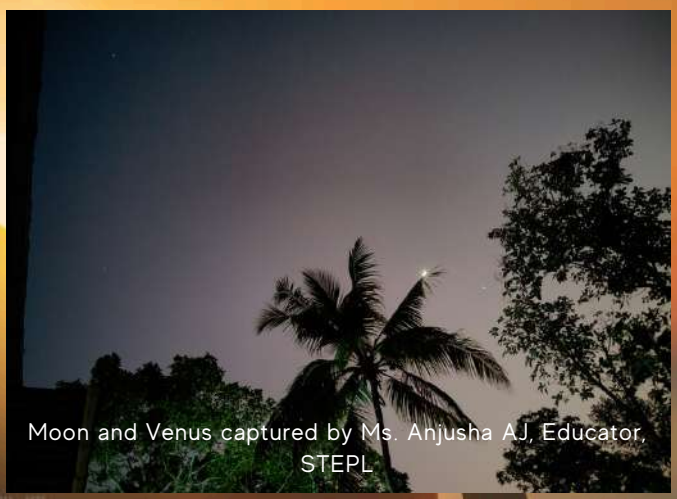
Night Sky Captured by Muhammad Talal.

Full Moon Captured by Aashman Asthana.

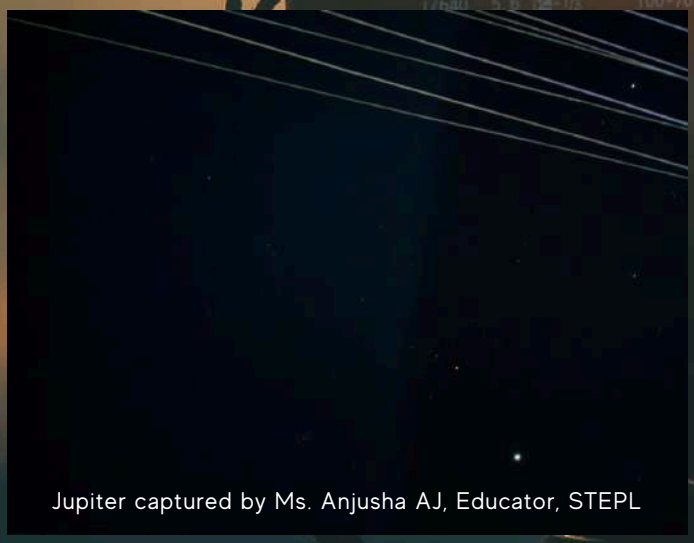
ASTROPHOTOGRAPHS FROM SPACE TEAM



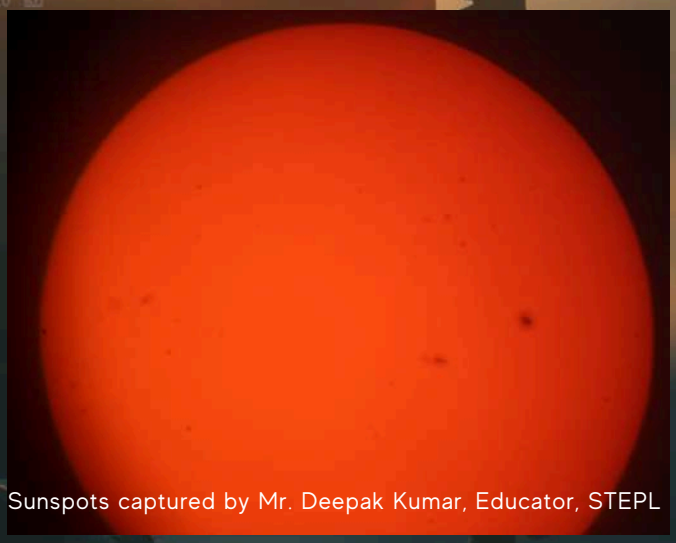
Star Trail captured by Mr. Umesh, Junior Recourse Person, STEPL



Moon and Venus captured by Ms. Anjusha AJ, Educator, STEPL



Jupiter captured by Ms. Anjusha AJ, Educator, STEPL



Sunspots captured by Mr. Deepak Kumar, Educator, STEPL

Legends in the Stars: Mythical Stories Behind Constellations Across Cultures"

Many cultures have created mythical stories to explain the constellations, tying their celestial observations to their beliefs, traditions, and values. Here are some fascinating examples:

1. Greek Mythology: The Story of Orion
Constellation: Orion
Myth: Orion was a mighty hunter who boasted of his skill. In one version, he threatened to kill all the animals on Earth, angering Gaia, the Earth goddess, who sent a giant scorpion to kill him. Both Orion and the scorpion were placed in the sky as constellations, forever facing opposite directions to symbolize their conflict.
Significance: The myth reflects themes of hubris, nature's balance, and the inevitability of fate.

2. Chinese Mythology: The Weaver Girl and the Cowherd
Constellation: Vega (Weaver Girl) and Altair (Cowherd)
Myth: The Weaver Girl, a goddess, fell in love with a mortal cowherd. Angered by their union, the goddess's father separated them with the Silver River (the Milky Way). Once a year, on the seventh day of the seventh lunar month, magpies form a bridge, allowing them to reunite.
Significance: This romantic tale explains the positions of Vega and Altair and is celebrated during the Qixi Festival in China.

3. Aboriginal Australian Mythology: The Emu in the Sky
Constellation: The dark spaces in the Milky Way
Myth: Many Aboriginal Australian cultures see the dark patches of the Milky Way as a giant emu. In one story, the emu's position in the sky determines the time for harvesting emu eggs.
Significance: The myth demonstrates the deep connection between Aboriginal people and their environment, using the stars as a natural calendar.

4. Hindu Mythology: The Seven Sages (Saptarishi)
Constellation: Ursa Major (Big Dipper)
Myth: The Saptarishi (Seven Sages) were wise men who served as advisors to the gods. They are immortalized in the sky to oversee the world and guide humanity.
Significance: This story ties the stars to wisdom, divine guidance, and the cyclical nature of time.

5. Native American Mythology: The Great Bear
Constellation: Ursa Major
Myth: In many Native American traditions, the stars of the Big Dipper form a great bear being chased by three hunters. As the bear runs, its blood colors the leaves red in autumn.
Significance: This story connects the stars to seasonal changes, reflecting an understanding of nature's cycles.

6. Polynesian Mythology: Māui and the Fishhook
Constellation: Scorpius
Myth: Māui, a legendary hero, used his magical fishhook to pull islands from the sea. The curve of the Scorpius constellation is said to represent Māui's fishhook.
Significance: This myth symbolizes creation, navigation, and the relationship between humanity and the ocean.

7. Egyptian Mythology: The Goddess Nut
Constellation: The Milky Way
Myth: Nut, the sky goddess, arches over the Earth, her body forming the Milky Way. Each night, she swallows the sun, and each morning, she gives birth to it anew.
Significance: The story ties the movement of celestial bodies to the cycles of life and death.

8. Inuit Mythology: The Hunter and the Polar Bear
Constellation: Orion and Ursa Major
Myth: Orion represents a hunter, while Ursa Major represents a polar bear. The hunter chases the bear across the sky, reflecting the relationship between humans and animals in Inuit culture.
Significance: This tale connects celestial movements to survival and the balance between hunter and prey.

9. Norse Mythology: Fenrir and the Chains
Constellation: Lupus (The Wolf)
Myth: Lupus is sometimes linked to Fenrir, the great wolf bound by the gods to prevent him from wreaking havoc. His presence in the stars is a reminder of the tension between chaos and order.
Significance: This story exemplifies Norse themes of conflict and the cyclical nature of time.
These myths reflect how ancient cultures used the stars to explain the universe, connect to their environment, and pass down values and stories through generations.

Concluding Cultural Astronomy

Astronomy is one of the oldest scientific fields. It has accompanied many generations of parents and children, evolving along. Shaping civilization and evolving to fit their understanding. Our ancestors have looked to the stars and sought guidance from them.

Throughout the year, we have seen the various ways the celestial bodies that occupy the sky have influenced ancient cultures and shaped their view of the world. Those bodies have aided our ancestors in identifying the ideal time for planting, taught them how to track time, and allowed them to navigate through the largest ocean on the planet. Additionally, ancient cultures have also kept a detailed record of the night sky, giving us the opportunity to travel through time to see how the sky looked thousands of years ago.

Despite knowing that for thousands of years, we have looked to the stars and sought guidance, we do not know when we started deriving meaning from them. That knowledge has been lost to the sands of time. Yet, we know how the journey has changed. No longer do we only learn about stars that we can see with our eyes to learn about deep time.

The stars have shaped our history. Guiding our ancestors as they expanded their horizons and learned about new places. They kept us company during the cold nights and filled us with hope when there were none.

Huge structures have been built to commemorate them. Structures with hidden uses that we are only learning about. In an indirect way, the stars remind us that our ancestors were as human as we adapted to live in a world that is foreign to us.

Today, our relationship is very different with the stars. Yet, the night sky that once inspired our ancestors still inspires us today and will continue to do so as we push the edge of our knowledge and learn more.

Rocket launches in December 2024

Proba-3: Crafting an Artificial Eclipse

On December 4th , 2024, two spacecraft–Coronagraph and Occulter–will launch aboard ISRO's reliable PSLV-XL rocket from Sriharikota, India. Their mission, Proba-3, is an awe-inspiring collaboration between ESA and ISRO, set to revolutionize our understanding of the Sun.

Once in orbit, the two spacecraft will perform a cosmic ballet, maintaining an extraordinary 144-meter separation to create an artificial solar eclipse. By blocking the Sun's dazzling surface, they will unveil the faint corona–the Sun's mysterious outer atmosphere–for detailed observation. This region is key to understanding solar wind and space weather, which impact Earth's satellites, power grids, and technology.

Months of preparation have gone into this moment. The spacecraft traveled from Europe to India, underwent rigorous testing, and were meticulously integrated with the PSLV rocket. Engineers ensured every detail was flawless, from the secure mating of the Coronagraph to the precise placement of the Occulter atop it.

Proba-3 represents the pinnacle of international collaboration and innovation. By unlocking the secrets of the Sun's corona, it promises to advance solar science while showcasing humanity's ability to work together to push the boundaries of exploration. The countdown to this celestial journey has begun.

The Proba-3 mission (Image credit: ESA)

SPADEX's Docking Experiment

On December 20th 2024, ISRO will embark on a groundbreaking mission with the launch of the Space Docking Experiment (SPADEX) aboard the reliable PSLV-C60 rocket. This ambitious project involves two spacecraft, aptly named Chaser and Target, designed to perform a complex orbital rendezvous and docking maneuver. This feat, achieved at an altitude of 700 kilometers, will simulate autonomous docking, a critical capability for the future of India's space program.

The two spacecraft will use advanced sensors, navigation systems, and robotic technologies to approach, align, and securely dock at speeds of over 8 km/s. This mission will not only validate these technologies but will also mark India's entry into the exclusive club of nations—alongside the U.S., Russia, and China—that have mastered autonomous docking.

The SPADEX mission lays the foundation for India's larger space ambitions. These include assembling modular components for the planned Indian Space Station by 2028 and supporting interplanetary missions like Chandrayaan-4, which will rely on docking for spacecraft assembly and sample returns. The robotic docking system also holds promise for satellite servicing, including refueling, repairs, and tackling space debris—a growing concern in modern space exploration.

Furthermore, SPADEX represents a collaboration between ISRO and private players, reflecting the recent reforms in India's space sector. These reforms aim to foster innovation and efficiency, making SPADEX not only a technological milestone but also a symbol of India's expanding space ecosystem. This mission is set to demonstrate how India is charting a sustainable and innovative path in space exploration.

The SPADEX mission (Image credit: isro.gov.in)

NZSA Venus Mission

On December 30th 2024, the Venus Life Finder mission will embark on a daring voyage to explore Venus's mysterious atmosphere. Designed to detect signs of organic compounds that could indicate the potential for life, this uncrewed spacecraft, developed by Rocket Lab in collaboration with MIT, will be the first private mission to another planet. Originally set for May 2023, the mission has now been rescheduled to launch no earlier than December 30, 2024, with the spacecraft expected to reach Venus by May 13, 2025.

The spacecraft consists of two key components: the Photon Explorer cruise stage and a small atmospheric probe. The Photon Explorer, developed for NASA's CAPSTONE mission, will carry the probe to Venus, performing maneuvers including a lunar gravity assist to adjust its trajectory. Upon arrival, the probe will detach from the Explorer, enduring a peak g-force of 60 Gs during its descent through Venus's atmosphere, a journey that will take just five minutes.

At an altitude between 45 km and 65 km, the probe will use an auto fluorescing nephelometer, which projects a laser into the atmosphere. This instrument will analyze cloud particles for potential organic compounds, scattering and fluorescence that could hint at life's presence. The data will be transmitted directly to Earth, though limited bandwidth will restrict the transmission of only critical findings before the probe impacts the surface.

With an estimated cost of less than 10 million US dollars, this mission not only aims to advance planetary science but also demonstrate that smaller, cost-effective space missions can achieve groundbreaking results in deep space exploration. This is just the first step in what Rocket Lab hopes will become a series of small missions to further explore Venus. The Venus Life Finder could unlock clues to the mysteries of our neighboring planet and, perhaps, the possibility of life beyond Earth.

The NZSA mission (Image credit: Rocket Lab)

****Note: Launch dates of the missions are scheduled to be launched in December 2024 but may subject to change.**

STUDENT'S CORNER

SmallSats - The Future Of Satellites?

Sourajit Mandal, Astronomy Club Student

Imagine your personal swarm of satellites floating in space collecting weather data or providing high-speed internet, or even aiding in climate monitoring. Sounds like a movie scene from a sci-fi movie, right? But for SmallSats, that is not fiction anymore. These small satellites are revolutionizing the space journey, resulting in cheaper, faster, and ultimately more accessible access to space. Not a tool only for governments and large corporations anymore, research organizations, universities, and even startups are starting to take part in launching their space missions.

There is a wide range of SmallSats in form and size with varied aims. Among the popular is the CubeSat whose shape is like a cube, 10x10x10cm big in size and weighing a few kilograms. One of the neat aspects of CubeSats is that they're modular-that is, you can stack multiple units together for more complex missions. Now we also have PocketQubes, which are smaller and often used for low-budget, educational projects. Microsatellites and nanosatellites are comparatively much larger, typically weighing maximum one hundred kilograms, and have been used for tasks such as Earth observation or global communication networks.

An amazing example of SmallSat innovation is the KickSat project. KickSat aimed to show how space exploration can become even more accessible by launching hundreds of tiny satellites known as Sprite chips. These Sprites were the size of a large postage-stamp! They could be best described as miniature spacecrafts with basic sensors, radios, and solar panels. Although the first attempt in 2014 met with several obstacles, the project sparked a wave of thinking about how we might further miniaturize the technology and launch swarms of these chips to gather scientific data or experiment with communications.

What makes SmallSats revolutionary is that they are so simple. They weigh less and are smaller than conventional satellites, which means they can be launched and built at much lower cost. Instead of requiring a dedicated rocket, they can be fitted alongside on a larger mission to save even more money. But don't be fooled by their size- they can be a real deal! They can assist farmers with crop monitoring, they can map the Earth in high-resolution, or even place internet access in the farthest reaches of the globe. These satellites are mission flexible.

Innovation is also accelerating with the rise of SmallSats. While massive satellites require years to design and launch into space, SmallSats can be constructed and launched into orbit in a matter of months or even in weeks. This fast turnaround allows technology to be tested and updated quickly, so that the modern requirements are met at least in relation to the pace of needs. Moreover, since the private companies such as SpaceX and Rocket Lab offer routine launching opportunities, going into space is no longer an event in a lifetime.

The future of SmallSats is bright and full of possibilities: imagine satellites that can repair each other in orbit, adapt to new tasks mid-mission, or work together like birds in a flock to accomplish greater things. The sky, or rather the space, is no longer the limit. SmallSats are opening up new horizons and are just at the beginning of this great journey.

Lost In The Light: The Importance Of Preserving Natural Darkness

Aryan Gupta, Astronomy Club Student

The night sky, with its breathtaking tapestry of stars and celestial wonders, has been a source of awe and inspiration for humanity for centuries. Words like "heavenly," "stellar," and "cosmic" are testament to its beauty and magnificence. Beyond its visual splendor, the night sky has served as a cultural keystone, shaping the hallmarks of civilization such as art, literature, mathematics, science, religion, language, poetry, and our very concepts of time.

However, the advent of artificial illumination, while significantly enriching the quality of life by creating luminous environments during the nighttime, has also given rise to a pressing environmental issue: light pollution. With the emergence of new lighting technologies, the negative impacts of improper illumination have become increasingly evident, affecting both urban and rural areas.

Light pollution, the excessive or misdirected artificial light produced by human activities, has detrimental effects on astronomical research and the ecological balance. It disrupts the natural rhythms of wildlife, leading to long-term damage to ecosystems. The International Dark Sky Association (IDA) has recognized light pollution as a significant environmental concern, affecting not only humans but also wildlife and the climate.

For astronomers, light pollution is a significant challenge. The glare from artificial lights washes out the faint glow of stars and other celestial objects, making it difficult to conduct observations and diminishing the night sky's splendor. The loss of our connection to the night sky is a profound cultural and scientific setback. As Vincent van Gogh, the legendary painter of 'The Starry Night' once wrote in a letter to his brother Theo, "I know nothing with any certainty, but the sight of the stars makes me dream." His generation enjoyed a night sky unmarred by artificial lights, a privilege that is becoming increasingly rare for us today.

Practical steps to reduce light pollution:

While excessive outdoor light pollution may appear uncontrollable for an individual, overlighting in the home can be easily reduced. Here are some practical steps to mitigate light pollution: Opting for amber or warm white lights with fewer short wavelengths, or using red light at night, which has zero short wavelengths; Using sensors, timers, or simply turning off unnecessary lights in the evening, particularly on balconies, in gardens, and on façades.

Public awareness and policy changes are crucial in addressing light pollution. Maps based on nighttime satellite data can be used in communication campaigns to highlight the extent and effects of light pollution. Citizen science projects like Globe at Night encourage individuals to measure and submit observations of night sky brightness, contributing to a global database that supports research and advocacy efforts.

Call to Action:

The night sky is an incredibly magnificent and deeply threatened natural asset. Its importance extends beyond its beauty and grandeur; it is integral to our cultural heritage and has a profound impact on our mental well-being. Some researchers suggest that reconnecting with the night sky can have positive effects on mental health, offering a sense of peace and inspiration. In conclusion, while space telescopes provide astronomers with the ability to observe celestial phenomena from beyond Earth's light-polluted atmosphere, we must also strive to preserve the beauty of the night sky for future generations. By taking action to reduce light pollution and raising awareness through outreach and citizen science, we can ensure that the awe-inspiring sight of the stars remains a source of dreams and wonder for all.

Happy

December 7, 1905

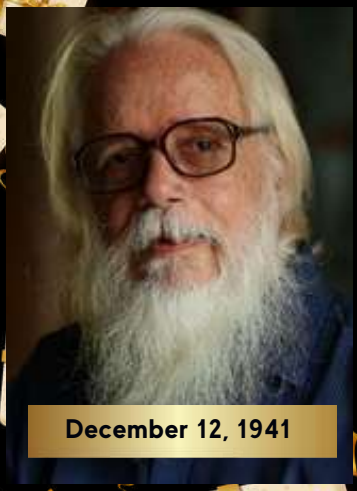
Gerard Kuiper

Gerard Peter Kuiper (December 7, 1905 – December 23, 1973) was a Dutch-American astronomer and regarded as the father of modern planetary science. His research on the solar system's formation laid the groundwork for discovering the Kuiper Belt, a region beyond Neptune with icy bodies, dwarf planets like Pluto. Kuiper discovered Uranus's moon, Miranda and Neptune's moon, Nereid and identified carbon dioxide on Mars and methane in Titan's and Uranus's atmospheres. NASA honoured him with the Kuiper Airborne Observatory, an aircraft-mounted infrared telescope. His legacy endures in the Kuiper Prize, lunar and Martian craters, and continued exploration of the outer solar system.

Annie Cannon

Annie Jump Cannon (December 11, 1863 – April 13, 1941), known as the "Census Taker of the Sky," was an American astronomer whose work revolutionized stellar classification. She discovered 300 variable stars, five novae, and published extensive star catalogues. Alongside Edward C. Pickering, she co-developed the Harvard Classification Scheme, the first system to classify stars by temperature and spectral type. Her achievements earned her numerous awards, including the Henry Draper Medal from the National Academy of Sciences. The Annie Jump Cannon Award was established in her honor to recognize outstanding contributions by women in astronomy.

December 11, 1863



December 12, 1941

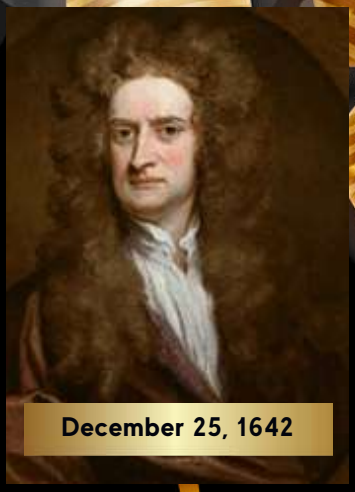
Nambi Narayanan

Nambi Narayanan (born December 12, 1941) is an Indian aerospace scientist who played a key role in advancing India's space program. As a senior ISRO scientist, he introduced liquid propulsion technology, vital for launching heavier payloads. His work on the Vikas engine was crucial to the success of India's PSLV and GSLV launch vehicles, significantly enhancing satellite launch capabilities. Despite facing false espionage charges, later proven baseless, Narayanan persevered and remained committed to India's space ambitions. In 2019, he was honoured with the Padma Bhushan, celebrating his resilience and pioneering contributions to India's space exploration efforts.

Birthday

Sir Isaac Newton

Sir Issac Newton (25 December 1642 – 20 March 1726) was an English mathematician, physicist, and astronomer, a key figure in the Scientific Revolution. He formulated the laws of motion and universal gravitation, explaining that every particle attracts every other particle with a force proportional to their masses and inversely proportional to the distance between them. Newton also made significant contributions to optics, demonstrating that white light is composed of different colors. His work Mathematical Principles of Natural Philosophy (1687) unified the laws of motion and gravity, shaping modern physics and paving the way for future advancements in science and mathematics.



December 25, 1642

December 27, 1571

Johannes Kepler

Johannes Kepler (December 27, 1571 – November 15, 1630) was a German astronomer, mathematician. His work helped lay the foundation for modern astronomy and physics. Kepler is best known for his laws of planetary motion, which revolutionized our understanding of the solar system. He was the first to explain the process of vision, stating that the eye's lens focuses light onto the retina. Kepler's work fundamentally changed our understanding of the universe and contributed to the scientific and mathematical foundations of modern astronomy and physics. His laws are still used today to describe the orbits of planets and spacecraft.

Arthur Eddington

Arthur Eddington (28 December 1882 – 22 November 1944) was an English astronomer, physicist, and mathematician known for his contributions to stellar structure, relativity, and cosmology. He is famous for leading the 1919 solar eclipse experiment that confirmed Einstein's theory of general relativity by observing the deflection of light by the Sun. Eddington developed a model explaining how stars generate energy through nuclear fusion. His work on stellar dynamics and relativity was foundational to 20th-century astrophysics. Additionally, Eddington played a key role in popularizing modern physics and making complex scientific concepts accessible to the public.

December 28, 1882

HISTORICAL EVENTS HAPPENED IN DECEMBER

APOLLO 8: LUNAR ODESSY

On December 21, 1968, a historic journey began that would change the course of space exploration forever. Aboard the mighty Saturn V rocket, the Apollo 8 mission blasted off from Kennedy Space Center, carrying three brave astronauts—Frank Borman, Jim Lovell, and William Anders—on a journey to the Moon. Their mission was simple yet extraordinary: to orbit the Moon, test the spacecraft's systems, and lay the groundwork for the first Moon landing. What began as a mission to ensure the success of future lunar landings would become a defining moment in human history.

As the spacecraft hurdled into space, the crew ventured beyond Earth's familiar orbit, reaching the Moon's vicinity for the very first time. On Christmas Eve, as they circled the Moon, the astronauts captured a breathtaking image of Earth rising above the Moon's desolate surface—one of the most iconic photos ever taken, known as Earthrise. It symbolized the fragility of our planet and the vastness of the universe, sparking a profound sense of connection across the globe. The astronauts were witnessing a reality no human had ever imagined, one that would inspire countless individuals to look up and wonder about their place in the universe.

But Apollo 8 wasn't just a mission about exploration; it was a mission of inspiration. The crew's Christmas Eve broadcast, where they read from the Book of Genesis, brought the wonder of space into homes around the world. It reminded humanity that we were all part of something greater, united by the infinite mysteries of the cosmos. People across the world sat glued to their screens, feeling the weight of this monumental achievement and its message of unity, peace, and potential.

With their successful orbit and safe return, Apollo 8 proved that the U.S. was ready to send astronauts to the Moon. This groundbreaking mission paved the way for Apollo 11, just months away from achieving the first Moon landing. The Apollo 8 mission wasn't just a triumph of technology—it was a triumph of human courage, collaboration, and the spirit of exploration, setting the stage for future generations to dream even bigger.

Astronauts William A. Anders, James A. Lovell Jr., and Frank Borman, (left to right) during water egress training in the Gulf of Mexico. (Image credit; NASA)

SPACEX'S GROUNDBREAKING SUCCESS: REDEFINING THE FUTURE OF ROCKETRY

In the realm of space exploration, where technology and human ingenuity collide to push the boundaries of possibility, few innovations have had as much impact as the idea of reusing rockets. The concept itself had been explored in various forms, but it was SpaceX's bold vision that would redefine the future of space travel. Led by Elon Musk, SpaceX set out with one fundamental goal: to reduce the exorbitant costs of space missions by making rockets reusable, starting with the Falcon 9's first-stage booster.

In a moment that would go down in history, on December 21, 2015, Falcon 9's first stage booster was successfully recovered after delivering a payload to orbit. As the rocket's booster descended back toward Earth, it landed gently on a landing pad at Cape Canaveral, completing the first-ever recovery of a rocket's first stage in the history of spaceflight. This achievement was far more than just a technical success–it was a game changer. The notion of reusing rockets could now move from the realm of science fiction to that of reality.

Another iconic moment, came about 4 months later, in April 2016, when SpaceX achieved the first successful landing of a Falcon 9 booster on a drone ship in the Atlantic Ocean. This was a technical feat that had never been accomplished before. With its pinpoint accuracy, the booster landed on the drone ship with grace, proving that rockets could not only return to Earth but could do so with such precision that they could land on a small platform in the middle of the ocean. This was the first of many such landings, and with each one, SpaceX's dream of reusability was becoming a reality.

By 2017, SpaceX had successfully landed boosters both on land and on drone ships multiple times. These landings were not just symbolic; they represented a major shift in how space travel would operate in the future. In an industry where rockets were previously single-use, the ability to reuse components would lead to dramatic cost savings. The reusability of the Falcon 9's first stage was a turning point. It marked the beginning of a new era in space exploration, one that would see rapid advancements in space travel.

In 2020, SpaceX made history again by becoming the first private company to launch astronauts to the International Space Station (ISS) aboard its Crew Dragon spacecraft, a mission that relied on the same reusable Falcon 9 booster technology that had been perfected over the years. As the years have passed, SpaceX's successes have continued to build on the foundation of those early Falcon 9 first-stage landing tests. With every successful launch, the company has proven that rockets can be reused, and that space exploration is no longer limited by the financial and technical constraints that once defined it. Reusability, once a distant dream, is now an integral part of the space industry.

Today, SpaceX is not only a leader in rocket reusability but also a key player in commercial spaceflight, with its sights set on even greater goals, including sending humans to Mars. The success of Falcon 9's first-stage landing tests is a testament to the power of perseverance, innovation, and vision. What began as an ambitious idea–making rockets reusable–has now become a central part of the future of space exploration. Each landing is a small victory, not just for SpaceX, but for humanity's journey into the stars. SpaceX's ability to recover and reuse rockets will undoubtedly pave the way for even more daring missions in the years to come.

CHARTING THE PATH TO THE STARS: HERMANN OBERTH'S REVOLUTIONARY IDEAS

Hermann Oberth (front) with officials of the Army Ballistic Missile Agency.Image Credits: flickr.com

Hermann Oberth, often referred to as the German father of rocketry, was a pioneering physicist whose groundbreaking work transformed space exploration from a fantastical dream into a scientific pursuit. Inspired by the imaginative stories of Jules Verne, Oberth built his first model rocket at age 14 and dedicated his life to the concept of space travel.

Oberth, a Romanian-born physicist, was one of the pioneers of modern astronautics alongside Konstantin Tsiolkovsky and Robert Goddard. From an early age, Oberth was fascinated by space travel, inspired by the works of Jules Verne. His doctoral dissertation, Die Rakete zu den Planetenräumen, explored theoretical concepts that would become the foundation of modern rocketry, including liquid propellants like liquid oxygen and hydrogen, multi-stage rockets, and space navigation.

The work proposed that rockets could escape Earth's gravitational pull and travel into space, an idea that had never been seriously considered before. Oberth also introduced the concept of "space mirrors," which would focus sunlight onto specific regions of Earth or redirect it into space. These forward-thinking concepts sparked interest in space travel and laid the groundwork for future technological developments.

Although Die Rakete zu den Planetenräumen was initially rejected by academic authorities, it had a lasting impact. In 1927, Oberth's work inspired the formation of the Verein für Raumschiffahrt (Society for Space Flight), where Oberth became a mentor to early rocket engineers. His ideas influenced a new generation of scientists and engineers, many of whom played key roles in developing the technology for space exploration. Later on in life, Oberth worked with his former student, Werhner von Braun, to develop the Saturn V rockets that took astronauts to the moon.

Oberth's contributions to space travel were foundational, and his legacy lives on through institutions like the Hermann Oberth Space Travel Museum and the Hermann Oberth Society, which continue to honor his groundbreaking work. His vision and theoretical breakthroughs were crucial in advancing the study and pursuit of space exploration. Today, Die Rakete zu den Planetenräumen remains a cornerstone of rocketry and astronautics, showcasing Oberth's foresight and influence on the future of space travel.

Hermann Oberth's legacy is a mixed one. Despite his lasting contribution to space travel, he also developed the V-2 rockets for Nazi Germany. The same technology that was used to target civillans during World War 2. Even in his later life, he was a member of National Democratic Party of Germany and he was honored by Stille Hilfe, a known Nazi support organization.

JUPITER'S FIRST SNAPSHOT

In December 1973, NASA's Pioneer 10 spacecraft made history as the first probe to capture and send back images of an outer planet–Jupiter. Launched on March 2, 1972, Pioneer 10 embarked on an unprecedented journey with the goal of exploring Jupiter and its dynamic environment. Managed by NASA's Ames Research Center, Pioneer 10 was the first spacecraft specifically designed to travel beyond Mars' orbit and conduct a flyby of the gas giant, while also providing valuable scientific data about Jupiter's atmosphere, radiation belts, magnetic field, and moons.

One of the key challenges Pioneer 10 faced was crossing the Asteroid Belt, a perilous region between Mars and Jupiter filled with millions of rocky objects. Despite concerns about the spacecraft's safety, Pioneer 10 successfully navigated this belt, marking another first for space exploration. On November 6, 1973, while still 16 million miles from Jupiter, Pioneer 10 began transmitting images of the planet using its photopolarimeter. The spacecraft's imaging system continued to improve as it approached Jupiter, and by December 1, 1973, it sent back images that exceeded even the best Earth-based photographs of the gas giant, capturing Jupiter's iconic cloud bands, immense storms, and the Great Red Spot in stunning detail.

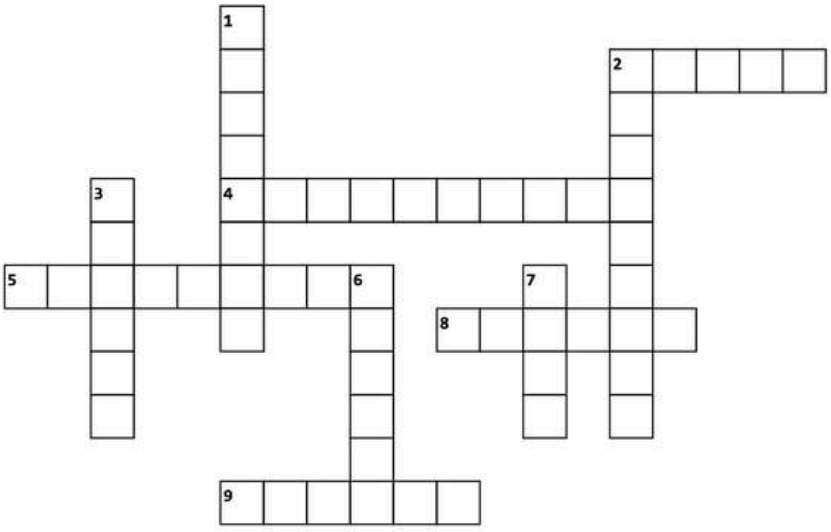
On December 3, 1973, Pioneer 10 made its closest approach to Jupiter, passing within 81,000 miles (130,000 kilometers) of the planet's cloud tops at a speed of 78,000 miles per hour. During this flyby, Pioneer 10 collected crucial data on Jupiter's atmosphere, magnetosphere, and radiation belts, while also imaging its moons, including Europa and Ganymede. These discoveries provided scientists with unprecedented insights into the outer solar system and laid the foundation for future missions, such as Voyager and Galileo.

Initially designed for a 21-month mission, Pioneer 10 far surpassed expectations, continuing to send valuable data until January 2003, when it was 7.6 billion miles (12.23 billion kilometers) from Earth. Pioneer 10 became the first spacecraft to leave the solar system and enter interstellar space, earning the title of humanity's first interstellar emissary.

Image Credits: NASA

TRAIN YOUR BRAIN

CROSSWORD



Across

2. What type of rays is the MACE telescope designed to study?
4. What is the name of the tower used by SpaceX to catch the Starship booster?
5. What is the name of the asteroid that caused the extinction of the dinosaurs?
8. What type of galaxies are IC 2163 and NGC 2207?
9. Which moon of Pluto has the Skywalker Crater?

Down

1. What is the name of the European module added to the ISS?
2. What is ISRO's first manned spaceflight program called?
3. What was the name of the lander that touched down on Comet 67P?
6. What is the name of the final supermoon of 2024?
7. Which international space station module was built by Japan?

Astronomy Word Puzzle

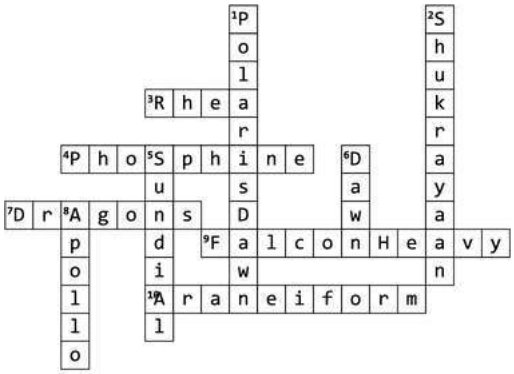
Find the Craters from the mixed letters and mark them.

Space Missions

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

CHANDRAYAAN
KEPLER
VOYAGER
PERSEVERANCE
JUNO
ROSETTA
PARKER
EXOMARS
INSIGHT
NEW HORIZONS
SPITZER
APOLLO
MARS ODYSSEY
HUBBLE
CURIOSITY

Answers for last month puzzles.



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

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

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