

Galactica

Astronomy and Space Science Magazine

What's Inside?

SPACE Insights

Highlights From October 2024

Moon Phases And Planet Visibility

What's Awaiting in November 2024

Cultural Astronomy & Celestial Tales

Student's Corner

Historical Events Happened In November

November Born Legends

Train Your Brain

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

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ABOUT SPACE



Legacy of
24 years



Pioneer
Organization



10000+
Activities
Developed



1000+
Schools
Associated



1.5M+
Students
Engaged



10K+
Outreach
Events



10+
Cities
Presence

SPACE is the pioneer organization working towards the development of science and astronomy in India. It aims to create a scientifically aware society and contribute to the technological and social development of the country. **SPACE** organization belongs to an astronomical league, diligently working towards development in astronomy and space science through astronomical tutorials, modules, and curriculum for education requirements of schools & students in India. We constantly engage in offering introductory astronomy, science about space, astrophysics, telescopes, and internet astronomy to the masses.

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

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

CMD's Message



Dr. Sachin Bahmba,
CMD, SPACE

Space and Astronomy are the future for the young generation of our country. This is a great means to inculcate scientific temperament among the masses. Such astronomy sessions will provide

a hands-on learning platform for students wherein they explore the real world of science, I wish for young students to let their ambitions soar and think big as they are the future of our country.

MD's Message

Education is integral to humankind growth and it strongly contributes towards innovation and developments. Space is transforming India to provide better learning opportunities through



Mr. Shivam Gupta,
MD, SPACE

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

Page no.

Topics

1 SPACE Insights

Highlights of September 2024

- 7 BepiColombo's Celestial Waltz: Unlocking Mercury's Magnetic Mysteries
- 8 Chopsticks catch: SpaceX's starship booster lands in style on flight 5
- 9 Cosmic Kaleidoscope: Solar storm unleashes auroras
- 10 India inaugurates world's highest imaging Cherenkov MACE telescope in Ladakh
- 11 Isro Chief S Somnath receives prestigious IAF World Space Award
- 12 Axiom Space, Prada Unveil Spacesuit Design for Moon Return
- 13 China Launches 3 Astronauts To Tiangong Space Station In "Dream" Mission
- 14 Arecibo Observatory's Collapse
- 15 **From the eyes of the WEBB - October 2024**
- 18 **What's up in the Sky**
- Astronomical Events- October 2024**
- 19 Final Supermoon of the year: The Beaver Moon
- 20 Leonids Meteor Shower
- 21 Conjunctions for the month
- 22 Uranus At Opposition
- 23 Mercury at Greatest Eastern Elongation



CONTENTS



Cultural Astronomy

- 24 Following the Stars
- 25 Asteroids: Celestial Forces in Ancient Myths and Modern Imagination
- 27 **Rocket launches - November 2024**
- 29 **SpaceX launches in November 2024**
- 31 **Students corner**
- 35 **November born legends**
- 37 **Astrophotographs from Space Associated Astronomers and Space Team**
- Historical Events in November**
- 38 Beginning of a New Era
- 39 From the Streets to the Stars: Laika's Role in the Space Race
- 40 Philae Lands on Comet 67P
- 41 Artemis 1: The Test Flight That Will Shape the Future of Lunar Exploration
- 42 Mariner 9 and the Dawn of Interplanetary Exploration
- 43 **Life at SPACE**
- 45 **Train your brain**



SPACE INSIGHTS

IGNITING CURIOSITY: A HANDS-ON ASTRONOMY WORKSHOP ON SAFE SOLAR OBSERVATION

On October 15, 2024, an astronomy workshop took place at the Space Office in Dwarka, organized by Space India in collaboration with the American Center. Participants from schools like Imperial Heritage School, Gurugram, and Genesis Global School, Noida, learned essential solar observation techniques. Guests were welcomed warmly by the Space team, setting an excited tone for a day of learning. The workshop began with an engaging presentation by an expert, explaining the Sun's features and safe viewing practices. Participants and teachers explored solar observation methods, marveling at sunspots through specialized equipment.

The workshop emphasized safe solar viewing, highlighting the dangers of direct sunlight to the eyes and introducing safe tools for exploring our Sun.

The workshop included a highly interactive session where participants received hands-on training in aligning telescopes and projecting solar images. Using methods like solar filters, pinhole projectors, and solar telescopes, attendees observed fascinating solar features, particularly sunspots, gaining valuable, practical experience in solar observation.

One standout activity demonstrated how to safely project the Sun's image using a telescope equipped with a front-mounted solar filter. Participants also experimented with UV-sensitive beads, which highlighted the presence of ultraviolet light and enhanced their appreciation for the Sun's characteristics. These interactive elements provided an enjoyable, memorable learning experience.

Safety was prioritized throughout, as participants were guided on safe and unsafe solar observation techniques. They learned to use certified solar filters and proper equipment, ensuring they could explore solar phenomena without risking eye damage. The workshop introduced specialized tools like mirror projectors and solar viewing goggles, giving attendees a well-rounded understanding of safe solar observation.

The workshop's overarching goal was to spark curiosity and appreciation for astronomy, fostering a safe approach to exploring the Sun. The collaboration between Space India and the American Center successfully combined theoretical and hands-on learning, leaving participants with the knowledge, tools, and excitement to explore the cosmos safely. The shared enthusiasm and awe among attendees marked the success of this impactful educational initiative.



Mesmerizing Saturn-Moon Occultation Captured at SOAR Centre, Faridabad

On the 15th of October 2024, a spectacular Saturn-Moon occultation was captured from the SOAR Centre at DPS, Sector-19, Faridabad. The rare celestial event began at 12:30 AM IST when the Moon, in its orbit, slowly moved in front of Saturn, gradually obscuring the planet and its iconic rings from view. At 1:31 AM IST, Saturn majestically reappeared from the Moon's bright limb, offering a stunning sight as it emerged back into the night sky.

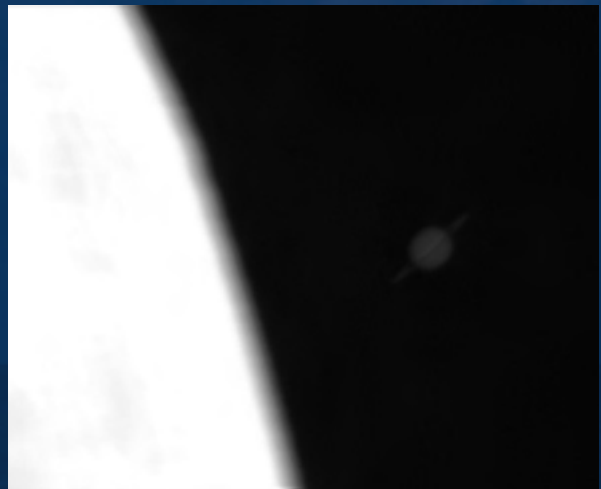
The occultation unfolded in a graceful sequence, with Saturn's luminous disk and rings slowly disappearing behind the darker edge of the Moon, creating the mesmerizing illusion that the planet was being swallowed by the lunar surface. This celestial dance offered a rare and breathtaking glimpse of planetary alignment in real-time, showcasing the dynamic nature of the cosmos. The contrast between Saturn's brilliant rings and the Moon's dark limb heightened the beauty of this cosmic ballet.



Saturn disappearing behind the Moon captured through SOAR's telescope.

The event was meticulously documented using a Celestron Edge HD 14-inch telescope, known for its exceptional optical clarity, along with the ZWO ASI 385 MC planetary camera, which specializes in capturing detailed planetary images. The efforts to photograph this spectacle were led by Mr. Vikrant Narang, Mr. Deepanshu Rai, and observatory education officer Mr. Javed Alam.

This occultation not only highlighted the marvel of astronomical alignments but also demonstrated the SOAR Centre's commitment to inspiring students and astronomy enthusiasts by bringing the wonders of the universe to their doorstep.



Saturn reappearance captured through SOAR's telescope.

World Space Week 2024: Empowering Through Education

World Space Week 2024, celebrated from October 4th to October 10th, became an extraordinary opportunity to inspire young minds and ignite a passion for space exploration across schools affiliated with SPACE India's Universe in the School (UITS) program. The theme, "Space and Climate Change," provided the perfect backdrop for students to delve into the role of space science in addressing one of the most pressing global challenges. This year, the celebrations were marked by an impressive array of interactive activities that aimed to cultivate curiosity, foster creativity, and deepen understanding of our universe among students of various age groups.

Throughout the week, students were immersed in the marvels of the cosmos through hands-on workshops, astronomy sessions, creative competitions, and engaging exhibits that brought space closer to home. The events offered a blend of education and excitement, allowing students to develop their scientific inquiry while nurturing their imaginations. Such efforts to cultivate early interest in space science can have lasting impacts, potentially guiding these young learners toward future careers in the field—a key objective for both the schools and SPACE India. This collective mission aligns with the broader goals of India's space agency, ISRO, which continues to inspire the nation with its groundbreaking achievements and vision of a prosperous space-faring future.

One of the most impactful celebrations took place at K. R. Mangalam World School, Vaishali, where SPACE India organized a Cosmic Night on October 17th to coincide with the Super Full Moon. The event drew students and their families into a night of celestial observations and engaging space-themed activities such as stomp rocketry, hydro rocketry, and creative competitions such as the Stellar Dress-Up contest, where students embodied celestial bodies, astronauts, and scientists in a fun, interactive display.

Similarly, the spirit of exploration was palpable at DPS Greater Faridabad, where a three-day Planetarium Show from October 7th to October 9th captivated 993 students from grades I to IX. The event offered a virtual tour of the night sky, immersing students in the beauty of celestial objects and constellations. Divided into age-appropriate sessions, younger students marveled at shows like Puppy on the Moon, while older students explored the depths of space with Back to Moon and Deep Sky presentations.

At St. Martin Diocesan School, Delhi Cantt, the Cosmic Mind Forum on October 15th took a different route, focusing on career aspirations in space science. Retd. Wing Commander Satyam Kushwaha, a decorated fighter pilot and space expert, addressed over 400 students, sharing his experiences in military aviation and space exploration. His message resonated deeply, encouraging students to dream big and think critically about pursuing careers in space.



The Next Generation of Space Explorers and Innovation

Across the city, at K. R. Mangalam School, Vikaspuri, students celebrated the week with creative, hands-on activities that encouraged students to express their knowledge of space through art and crafts. Galaxy Making, Astro Art, Constellation Crafting, and Astro-Doodling were just a few of the activities that saw participation from students in grades I to VIII. Students explored the beauty of the cosmos in a tactile and imaginative way, translating their knowledge into colorful and innovative creations. Older students engaged with the theme of "Space and Climate Change" through astro-quizzes and video podcasts.

One of the most memorable celebrations took place at G.D. Goenka Public School, Model Town, where students from classes 2 to 5 participated in week-long space-themed activities. The school's event lineup combined art, science, and hands-on exploration, allowing students to dive into topics such as planetary systems, stars, and constellations, creating a holistic space-learning experience that ignited their imaginations.

At Bal Bharati Public School, Pitampura, the celebrations took a thought-provoking turn with the Space and Climate Change Debate, where students from grades VI to VIII presented their ideas on the intersection of space science and environmental stewardship. This was complemented by a Space-Themed Art Competition and documentary screenings, including a film about Dr. Vikram Sarabhai, inspiring students to learn more about the pioneering spirit behind India's space endeavors.

Meanwhile, Sri Venkateshwar International School, Dwarka, brought younger students into the fold with creative drawing activities that allowed them to imagine themselves as astronauts, aliens, and space explorers. The students' joyful participation underscored the power of imagination in shaping young minds, sparking enthusiasm for space science even at an early age.

These events across Delhi's schools illustrate the extraordinary impact of World Space Week 2024 and SPACE India's commitment to promoting space science education. Students learned about the wonders of the universe while gaining an understanding of how space science can address critical challenges, such as climate change. As India looks toward the future of space exploration, nurturing the curiosity and ambitions of today's students will contribute to the next generation of space scientists, engineers, and innovators. The collaborative efforts of schools, educators, and SPACE India are crucial in this mission, helping to elevate India's position in global space research while inspiring the future leaders of our space program.



From Theory to Telescope: DPS Faridabad's 'Universe for All' Inspires Future Astronomers



On 23rd October 2024, Delhi Public School, Sector-19, Faridabad, hosted an exciting evening observation session for Group 3-5 beginner and elementary-level students as part of the "Universe for All" program. The event, held from 6:00 PM to 8:00 PM, offered students an enriching opportunity to explore fascinating celestial phenomena such as occultations, eclipses, transits, and conjunctions.

A PowerPoint presentation in the school auditorium provided a detailed overview of two recent astronomical events—the Saturn-Moon occultation on 15th October and the Pleiades-Moon occultation on 20th October. Students learned valuable insights from the Saturn-Moon occultation and Pleiades-Moon occultation, including the precise timing and interaction of celestial orbits, and the dynamic movement of these bodies. They gained an understanding of relative sizes, distances, and three-dimensional space, while also exploring planetary atmospheres, refining orbital data, and developing practical telescope and observation skills.

After the presentation, students were taken to the SOAR Centre (Space Observatory and Research) for practical telescope observations. Beginner-level students excitedly observed Venus and Saturn, while the elementary-level group marveled at the magnificent view of Saturn and the distant Andromeda Galaxy.

The students were enthralled by the experience, expressing immense enthusiasm as they saw these celestial wonders with their own eyes. The seamless blend of theoretical knowledge and hands-on learning made the session highly engaging and educational. Many students shared their excitement about the newfound understanding of how celestial bodies move and align in space.

This event not only strengthened the students' grasp of astronomy but also ignited their curiosity for future stargazing activities, leaving them eager for more such astronomical adventures. It was a memorable session, underscoring the school's dedication to providing interactive, educational experiences through the "Universe for All" program.



MONTHLY TELESCOPIC OBSERVATION BY SPACE ARCADE

SPACE ARCADE held its Monthly Telescopic Observation event on October 14, 2024, in Delhi, gathering astronomy enthusiasts from different regions. Attendees brought along telescopes, binoculars, and other gear to explore the night sky together.

During the session, participants enjoyed stunning views of the Moon, Venus, and Saturn, with close-up glimpses of lunar craters, Venus in its various phases, and Saturn's iconic rings. The SPACE ARCADE team demonstrated telescope setup and alignment, guiding participants through the use of different models and answering questions. They also provided an introduction to basic astrophotography, encouraging attendees to capture their observations.

Telescopes available at the event included the Space Voyage 8" F/6 Dobsonian, NexStar 4SE Computerized GoTo Telescope, Space Launcher 114 AZ, and Celestron Astromaster 70AZ, each offering unique perspectives of the celestial objects on view.

The event inspired curiosity and hands-on learning, making it a memorable experience for everyone involved. SPACE ARCADE aims to continue these monthly sessions, inviting more people to explore the wonders of the universe.

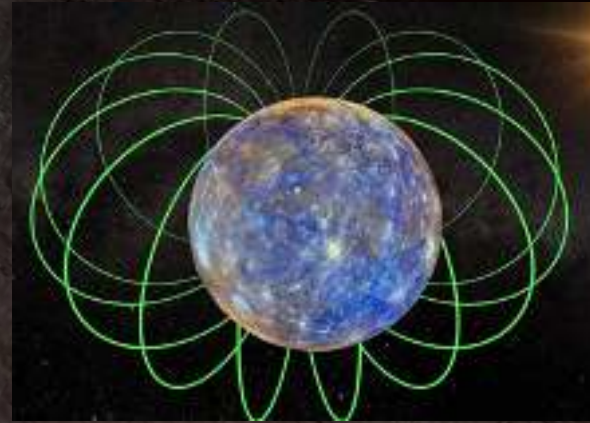


HIGHLIGHTS OF OCTOBER 2024

BEPICOLOMBO'S CELESTIAL WALTZ: UNLOCKING MERCURY'S MAGNETIC MYSTERIES

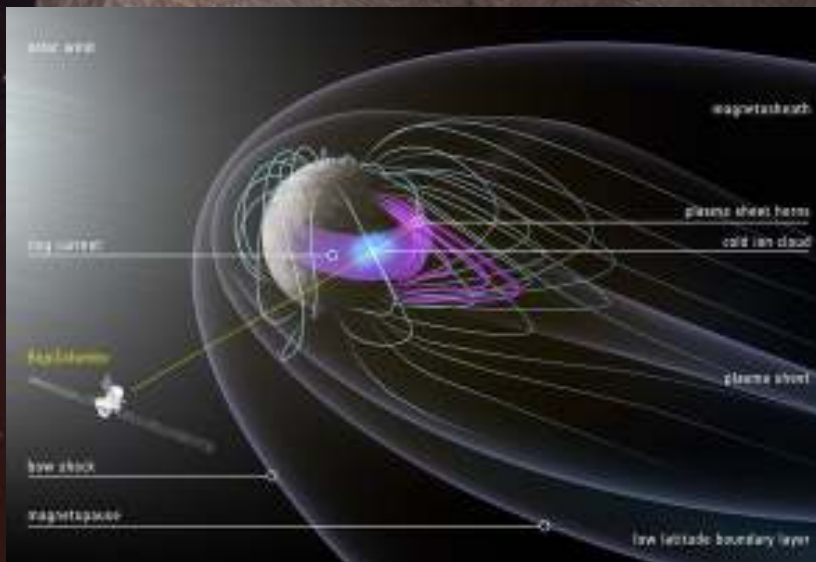
The BepiColombo spacecraft, a joint mission between the European Space Agency (ESA) and Japan Aerospace Agency (JAXA), is making rapid flybys of Mercury, the solar system's smallest planet. These flybys are helping scientists understand the planet's magnetic field, which forms a protective magnetic bubble around it and guards against charged particles in the solar wind. However, scientists are curious about why this tiny inner planet's magnetic field is much weaker than ours. Because Mercury is closer to the sun than Earth, its magnetic bubble experiences a far more intense pummeling from the solar wind.

One of BepiColombo's main tasks is to investigate this interaction and the properties of Mercury's magnetic field.



An illustration of magnetic fields surrounding Mercury the closest planet to the sun.
(Image credit: Robert Lea/NASA)

The spacecraft will build a dynamic dual-picture of the space environment around Mercury by separating into different units: the ESA-controlled Mercury Planetary Orbiter (MPO) and the JAXA-led Mercury Magnetospheric Orbiter (MMO). The six planned flybys have given operators tantalizing hints at the sort of science the mission will deliver when truly in place. The fast flybys of Mercury have also provided glimpses of Mercury that wouldn't be possible from orbit. The team crossed Mercury's magnetosphere in about 30 minutes, moving from dusk to dawn and at the closest approach of just 146 miles (235 km) above the planet's surface.



Mercury's magnetic field as observed by BepiColombo with various features labeled. (Image credit: ESA/JAXA)

They conducted their research with the aid of BepiColombo's Mercury Plasma Particle Experiment (MPPE) suite of instruments, which were active during the June 2023 flyby. They combined data was collected by MPPE with computer modeling, revealing the origins of interacting particles and features of Mercury's magnetic bubble.

The expected structures like the 'shock' boundary between the free-flowing solar wind and the magnetosphere, as well as passing through the 'horns' flanking the plasma sheet were seen.

The team also studied the direct interaction between charged particles in the solar wind and plasma around Mercury and BepiColombo itself. This process is complicated by the fact that when the spacecraft is facing the sun, it is heated and cooled, and heavier charged particles called ions can't be detected because BepiColombo becomes electrically charged and repels them. However, when BepiColombo slips into the shadow of Mercury, cool ions in a sea of plasma become detectable, allowing BepiColombo to see ions of the elements oxygen, sodium, and potassium around Mercury.

CHOPSTICKS CATCH: SPACEX'S STARSHIP BOOSTER LANDS IN STYLE ON FLIGHT 5

The biggest and most powerful rocket ever built took to the skies again. And this time, it came back. SpaceX has successfully launched its 400-foot-tall Starship vehicle for the fifth time ever, sending it aloft from its Starbase site in South Texas.

The mission aimed to break new ground for Starship and spaceflight in general by returning Starship's huge first-stage booster, known as Super Heavy, directly to its launch mount, catching it with the "chopstick" arms of the launch tower in a bold and unprecedented maneuver. About seven minutes after liftoff, SpaceX's Super Heavy executed what appeared to be a bull's-eye landing, hovering near the Mechazilla launch tower as the tower captured it with its metal arms.

SpaceX also aimed to send Starship's 165-foot-tall upper stage, known as Starship or simply Ship, to space and bring it back to Earth with a splashdown in the Indian Ocean. That occurred about 65 minutes after liftoff, with the Ship firing three of its six engines to hover over the ocean before tipping over and exploding. SpaceX's founder and CEO, Elon Musk, agreed that a big step towards making life multiplanetary was made that day.

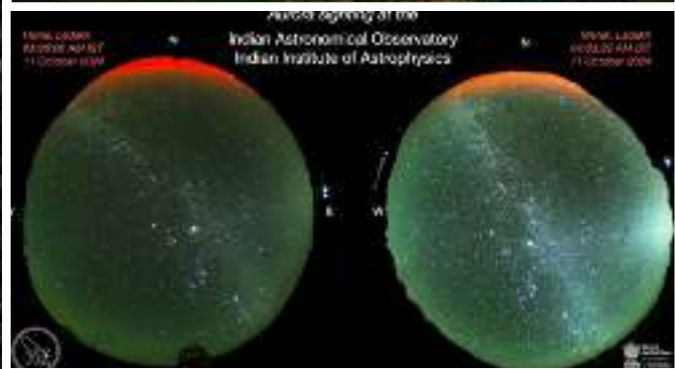
The vehicle was designed to be fully and rapidly reusable, which combined with Starship's unprecedented power could revolutionize spaceflight. NASA is a believer in the vehicle, selecting it to be the first crewed lander for its Artemis program of moon exploration. If all goes to plan, Starship will land NASA astronauts on Earth's nearest neighbor for the first time through Artemis 3 mission, which is targeted to launch in September 2026.

Flight 5 Starship featured some significant modifications compared to its predecessors. One of the key upgrades on Starship ahead of flight was a complete rework of its heat shield, with SpaceX technicians spending more than 12,000 hours replacing the entire thermal protection system with newer-generation tiles, a backup ablative layer, and additional protections between the flap structures.

In the end, the late-November estimate for Flight 5 proved pessimistic. It is safe to assume that SpaceX wants to launch another Starship mission relatively soon. Last month, SpaceX conducted a static fire with the Flight 6 Ship vehicle.

COSMIC KALEIDOSCOPE: SOLAR STORM UNLEASHES AURORAS

One of the rarest kinds of celestial lights-the brightest red auroras- had been seen in Leh in Ladakh, resulting from an intense solar storm prompted by increased solar activity," said ISRO officials.



Red aurora captured from Stakna, outside Leh. (Photo Credit: Indian Institute of Astrophysics and Bhabha Atomic Research Center)

"Auroral activity is normally found above the polar regions; therefore, its visibility so south (Ladakh) means that it has caused unusually severe geomagnetic storms there, prompted by a set of CMEs by the Sun."

Indian Institute of Astrophysics (IIA) scientists along with Bhabha Atomic Research Center (BARC) scientists recorded such auroras on the night of 10-11 October, 2024. They were captured on all-sky cameras while observers saw them naked. The occurrence was the fourth such incident in the solar cycle going on.

Recently, flare on sun enabled those lights to become visible from locations of even lower latitudes, stated IIA professor Annapurni Subramaniam. Earth's geomagnetic scale for storm categorized the storm a G4; this basically causes interference on Earth's magnetic field lines, meaning an upsurge of more pronounced and intense light display that characterized the northern aurora as well.

The particles come into the atmospheric components where it excites those atoms responsible for the emission of red light through which that solar wind is shown to observers through the lights in question under aurora.

ISRO's Dr. S Somanath has stated that Indian satellites are safe and not affected by the storm. BARC warned that such solar storms may cause interference in high frequency radio communications and can lead to radiation risks to satellites, so it is a must to monitor space weather phenomena for potential impacts on critical infrastructure and global communication systems.

INDIA INAUGURATES WORLD'S HIGHEST IMAGING CHERENKOV MACE TELESCOPE IN LADAKH



Secretary DAE & Chairman AEC inaugurates the MACE observatory at Hanle, Ladakh. (Source: BARC)

On October 4, 2024, Dr. Ajit Kumar Mohanty, Secretary of the Department of Atomic Energy (DAE), officially opened the Major Atmospheric Cherenkov Experiment (MACE) Observatory at Hanle, Ladakh. Built in-house by BARC with assistance from ECIL and other Indian industrial partners, MACE is the tallest imaging Cherenkov telescope in the world located at an altitude of ~4,300 m and the largest in Asia. Commemorative plaques were unveiled during the inauguration, which was a component of the DAE's Platinum Jubilee festivities.

During his speech, Dr. Mohanty commended the teamwork that went into MACE, emphasizing its importance for studying cosmic rays and its potential to improve our knowledge of high-energy gamma rays. He hoped that MACE will inspire future generations and urged youngsters to seek jobs in astronomy.

Other speakers were Dr. Annapurni Subramaniam, who highlighted the fruitful partnership between DAE and the Indian Institute of Astrophysics, and Shri Ajay Ramesh Sule, who stressed the harmony between scientific study and tourism at the Hanle Dark Sky Reserve.

The event included a guided tour of the observatory, a special film highlighting the progress of the MACE project, and a picture compilation of the project's voyage. By improving India's astrophysics and cosmic-ray research capacities, the MACE telescope hopes to further knowledge of phenomena like black holes and supernovae worldwide. Additionally, it aims to promote international cooperation, establishing India as a major force in the world scientific community and motivating upcoming researchers in the area.

ISRO CHIEF S SOMNATH RECEIVES PRESTIGIOUS IAF WORLD SPACE AWARD

On 14th October 2024, ISRO received the International Astronautical Federation (IAF) World Space Award for its remarkable Chandrayaan 3 mission. ISRO's chairman S. Somanath accepted the award on the organizations behalf during the 75th International Astronautical Congress in Baku, Azerbaijan.

The IAF World Space Award is one of the highest recognitions in the field of space exploration. It celebrates individuals or organizations that have made outstanding contributions to space science and innovation. And Chandrayaan 3 was the perfect candidate for the award. Its successful landing near the Lunar South Pole made India the first country to reach the previously untouched region. This achievement solidified India's place as a key player in space exploration.

Held in Milan, Italy, the award ceremony honors India's groundbreaking achievements to lunar exploration and the increasing leadership it is assuming in the international space community. Despite the difficulties faced by its predecessor, Chandrayaan-2, Dr. Somanath guided this project to its eventual success. The scientific payloads, for instance, produced invaluable information about sulfur and other elements found in the lunar soil.



Many scientists and engineers around India have been motivated by Chandrayaan-3, which has increased the nation's youth interest in STEM subjects and space exploration. As a result, chances for global cooperation have increased, and India is unquestionably in a position to influence how its space exploration develops in the future.



ISRO chief S. Somanath receives the IAF World Space Award for Chan(drayaan-3 mission success during a ceremony, in Milan, Italy. (Photo Credit: ISRO)

Axiom Space, Prada Unveil Spacesuit Design for Moon Return

Axiom Space and Prada have unveiled the flight design of the Axiom Extravehicular Mobility Unit (AxEMU) spacesuit for NASA's Artemis III mission at the International Astronautical Congress in Milan, Italy. The outer-layer design and materials work were jointly developed by the two industry leaders, blending creativity and engineering to enhance the next-generation spacesuit design. Axiom Space used a dark cover layer for display purposes to conceal the suit's proprietary technology, while the spacesuit worn on the lunar surface will be made from a white material that reflects heat and protects astronauts from extreme high temperatures and lunar dust.

Prada's in-depth knowledge and experience on materials and production processes supported innovative work in addition to the spacesuit cover layer. Prada's design and product development team worked alongside Axiom Space engineers on customized material recommendations and features to protect astronauts against the unique challenges of the lunar environment and visually inspire future space exploration. The AxEMU program exemplifies how the commercial space industry is enabling non-traditional partnerships to enhance space exploration capabilities.

The Exploration Extravehicular Mobility Unit (xEMU) spacesuit, which NASA is developing, provides enhanced performance, safety, and flexibility. The suit can tolerate the high temperatures of the lunar south pole and fits a variety of crew members. It has robust cooling technologies, regenerable carbon dioxide scrubbing, an onboard diagnostic system, and several redundant systems.

Life support systems, pressure garments, avionics, and other cutting-edge technology are all part of the spacesuit architecture. Axiom Space, SpaceX, and NASA facilities have conducted significant testing and simulations of the AxEMU. With crewed underwater experiments and a pressurized simulation, the suit is almost finished with development.

ARTEMIS EVA Spacesuit Technology and Design

AXIOM
SPACE

The Axiom Extravehicular Mobility Unit (AxEMU) spacesuit will be used for NASA's Artemis III mission, worn by the next humans to walk on the surface of the moon. The suit includes advanced technologies and provides unmatched flexibility, mobility, and safety for spacewalks on the lunar surface.

- Lights and HD Camera
- Helmet & Mic
- Advanced 4G/LTE Communication
- Endurance Athlete Based In-suit Nutrition

- Suit Control Interface
- Biometric Monitoring

- Advanced Textiles
- Accommodates Wide Range of Crewmembers (Anthropomorphic sized)
- Enhanced Flexibility, Mobility, Safety



- Variable Suit Pressure
- Critical System Redundancy
- Regenerable CO2 Scrubbing System
- Maintained Orientation On-mission
- Modular, Evolvable Design
- Cellular Communication
- Portable Life Support System Backpack to Keep Astronauts Safe for Up to 8 Hrs.
- Spacesuit Outer Layer Engineered/Designed by Axiom Space & Prada

- Custom-made Gloves

- Boots Engineered to Withstand Lunar Temperatures & Rough Terrain

China Launches 3 Astronauts To Tiangong Space Station In "Dream" Mission



Astronauts Cai Xuzhe (right), Song Lingdong (centre) and Wang Haoze waving to the crowd during a departure ceremony ahead of the launch. (PHOTO: AFP)

Three Chinese astronauts have embarked on a "dream" mission to the Tiangong space station, which includes the nation's only female spaceflight engineer. In order to meet the space program's lofty target of landing humans on the moon by 2030 and eventually building a lunar outpost, the new team will carry out experiments. Wang Haoze, 34, became the third Chinese woman to take part in a crewed mission when the Shenzhou-19 mission launched from the Jiuquan Satellite Launch Center in northwest China.

In late April or early May of next year, the Shenzhou-19 crew, led by Cai Xuzhe, will make their way back to Earth. Cai, a 48-year-old veteran of the air force, contributes expertise from his time spent aboard Tiangong during the 2022 Shenzhou-14 trip. The crew is now "fully prepared mentally, technically, physically, and psychologically" for the mission ahead.

With its space program becoming the third to place humans in orbit and having successfully landed robotic rovers on Mars and the Moon, China is accelerating its efforts to realize its "space dream" under President Xi Jinping. The centerpiece of the program is the Tiangong space station, which is expected to launch a crewed expedition to the Moon by 2030 with the goal of establishing a base there.

During their stay aboard Tiangong, the Shenzhou-19 crew will conduct a number of experiments, some of which will use "bricks" composed of materials that mimic lunar dirt. Tests will be conducted on these goods to determine their performance under various situations, including severe radiation, gravity, and temperature. Because materials transportation into space is expensive, Chinese scientists hope to be able to use lunar soil for the construction of the future base.

The Shenzhou-19 mission is primarily about "accumulating additional experience," according to Jonathan McDowell, an astronomer at the Harvard-Smithsonian Center for Astrophysics in the United States. China has invested billions of dollars into developing an advanced space programme on par with the United States and Europe, with its Chang'e-4 probe landing on the far side of the moon in 2019 and a small robot on Mars in 2021.

Arecibo Observatory's Collapse: The Untold Story of Cable Failure and Zinc Decay

On 1st December 2020, radio astronomy took a hit when the support cables holding up Arecibo's instrument platform gave way, causing the platform to crash onto the observatory's iconic and massive reflector dish. This was a cultural, historic, and academic loss, and four years later, we learned the probable cause of the structural failure.

Arecibo Observatory, also known as the National Astronomy and Ionosphere Center (NAIC), was an observatory in Barrio Esperanza, Arecibo, Puerto Rico. Completed in 1963, Arecibo was known for its approximately 305 m inverted spherical dome reflector dish that took advantage of a natural sinkhole, with its receiver and radar transmitters held by cables 150 m above the dish. For 53 years it was the world's largest single-aperture telescope until China's Five-hundred-meter Aperture Spherical Telescope (FAST) claimed the title in 2016.

Arecibo has played a crucial role in radar and radio astronomy and was utilised by NASA for its Near-Earth Object Program. It also played a part in the Search for Extraterrestrial Intelligence (SETI) program. Throughout its lifetime, Arecibo made many scientific discoveries that changed our understanding of the universe.

Arecibo's demise was a short time coming. In August 2020 one of the cables holding up the instrument platform snapped and damaged the reflector dish. A similar incident took place in November 2020, threatening the structural integrity of the support structure. After engineers inspected the site, Arecibo's owners announced for safety reasons, the telescope would be decommissioned through a controlled demolition. Unfortunately, before the demolition date, one of the world's most powerful telescopes gave way.

Shortly after the loss a committee was put together to investigate the cause of the structural failure. 4 years on, they have released a report that detailed the probable causes. The committee identified that the failure sequence started 39 months earlier when Hurricane Maria visited the island in September 2017. The committee identified hidden failures that should have been caught during the post-hurricane inspection were missed. These failures were fractures in the cable and socket from zinc decay. While the committee isn't sure about the cause of the zinc decay, they believe that Arecibo's powerful electromagnetic radiation environment caused an accelerated rate of metal decay. This is the first documented case of zinc decay causing a structural failure.

Arecibo may never collect radio data again. However, the site has transitioned into an education centre and will continue its legacy as the epicentre of astronomical discovery.



Arecibo Observatory before collapse
(Image credit: NASA)



Arecibo Observatory after collapse
(Image credit: Noticel)

FROM THE EYES OF WEBB – OCTOBER 2024

'Blood-Soaked' Eyes: NASA's Webb & Hubble Examine Galaxy Pair



Astronomers have captured the highest-resolution image yet of the interacting spiral galaxies IC 2163 and NGC 2207, thanks to the combined efforts of the James Webb Space Telescope and the Hubble Space Telescope. This stunning image, which merges mid-infrared light from Webb with visible and ultraviolet light from Hubble, reveals intricate details of the galaxies' interaction.

The smaller galaxy, IC 2163, appears to be creeping behind the larger NGC 2207, though the two have only grazed each other so far. The image shows shock fronts and tidal distortions in the galaxies' arms, where their material may have collided, producing bright, vein-like structures. These "eyelids" and other red-highlighted features indicate the galaxies' evolving shapes due to their gravitational encounter.

Both galaxies are undergoing rapid star formation, producing around 24 new stars the size of the Sun each year—significantly more than our Milky Way. Several supernovae have also occurred in these galaxies, contributing to the reshaping of gas and dust and promoting the birth of new stars.

In the future, as these galaxies continue to interact, they may eventually merge, reshaping their cores and arms while creating new stellar formations. However, over time, star formation will slow as the galaxies' gas supplies deplete, leading to a more stable configuration. For now, the image offers a vivid snapshot of a dramatic cosmic encounter.

James Webb Space Telescope deciphers the origins of Pluto's icy moon Charon



Using the James Webb Space Telescope (JWST), astronomers have detected carbon dioxide and hydrogen peroxide on Pluto's largest moon, Charon. This breakthrough sheds light on the moon's composition and history. Although scientists had previously found water ice, ammonia-bearing species, and organic compounds on Charon, these new findings are significant because carbon dioxide and hydrogen peroxide had eluded earlier observations.

Led by Silvia Protopapa from the Southwest Research Institute, the team used JWST's Near-Infrared Spectrograph (NIRSpec) to fill gaps in our understanding of Charon's surface. The detection of these molecules not only add

to the known composition of Charon but also hints at the moon's formation and the irradiation processes that have shaped its surface. These findings help scientists better understand icy bodies in the distant regions of our solar system, offering clues about their evolution and the processes they've undergone over time.

James Webb Space Telescope studies dusty 'pancakes' feeding baby stars and birthing planets

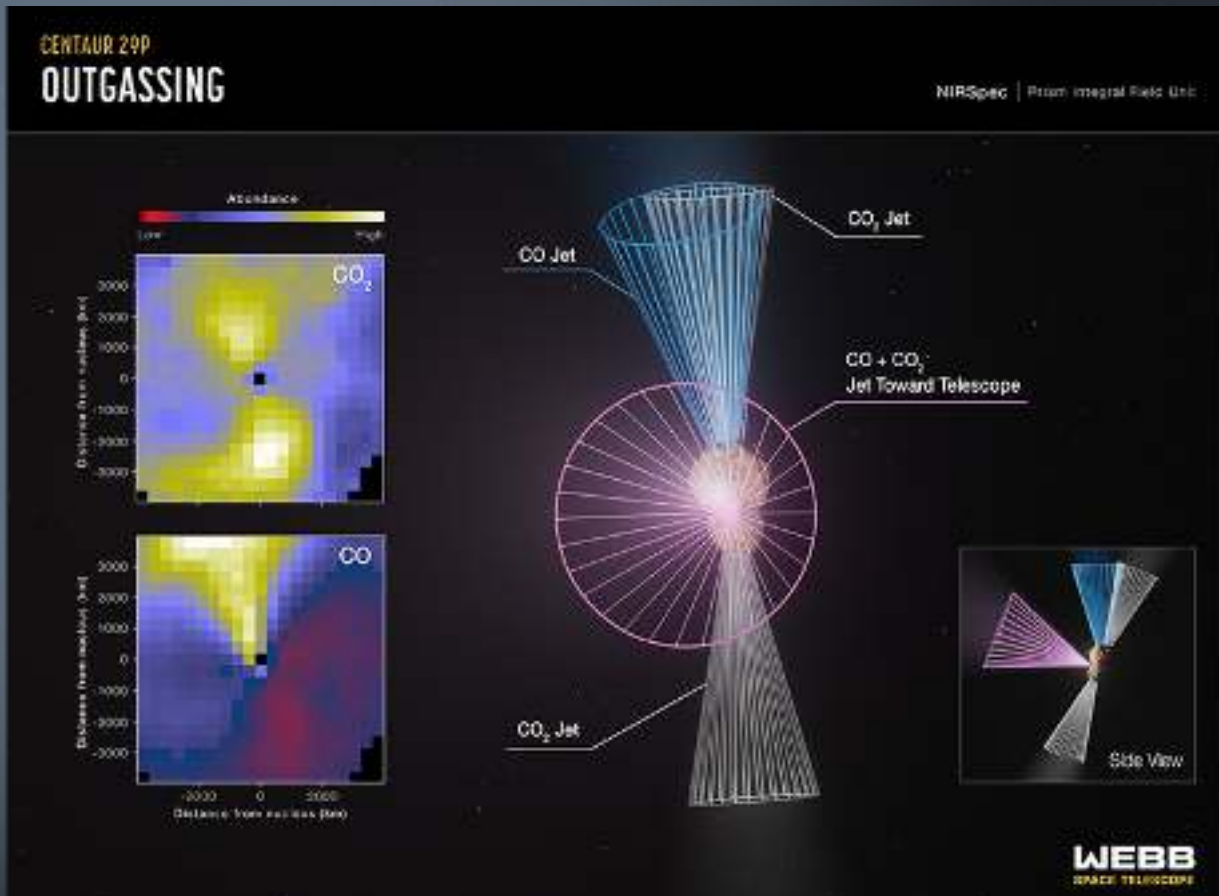


Using JWST, astronomers have captured a clearer view of the gas and dust "pancakes" surrounding young stars, crucial for their growth and planet formation. These protoplanetary disks, rich in material, feed the stars while shaping their future planetary systems.

The JWST provided new insights into the gas flows, or "winds of change," that sculpt these disks. In a groundbreaking discovery, the telescope detected evidence for a long-theorized process through which young stars gather material from their surrounding disks.

A team of astronomers from the University of Arizona, led by Ilaria Pascucci, studied four edge-on protoplanetary disk systems. Their observations offer a glimpse into what our solar system and the sun looked like 4.6 billion years ago, before Earth and other planets formed. These findings provide the most comprehensive view yet of the forces shaping star and planetary system formation, solving a key mystery in astrophysics.

NASA's Webb Reveals Unusual Jets of Volatile Gas from Icy Centaur 29P



NASA's James Webb Space Telescope has offered groundbreaking insights into Centaur 29P/Schwassmann-Wachmann 1 (29P), an icy object orbiting between Jupiter and Neptune. Originally from the Kuiper Belt, centaurs like 29P are in a transitional stage between primordial icy bodies and comets, showing signs of active outgassing. Webb's Near-Infrared Spectrograph (NIRSpec) detected carbon monoxide (CO) and carbon dioxide (CO₂) jets on 29P, revealing a complex composition. The CO₂ jets emerged from the centaur's north and south poles, while a CO jet pointed northward, making this the first definitive detection of CO₂ on a centaur.

This variability in CO and CO₂ abundances across 29P's surface suggests that its nucleus may be an aggregate of distinct materials, possibly formed from the fusion of separate primordial objects, challenging prior assumptions about Kuiper Belt object composition. Scientists are especially interested in understanding the mechanism behind 29P's outgassing since its distance from the Sun means that sublimation, which typically drives comet activity, is unlikely to be water-based.

The research team aims to conduct extended observations of 29P to learn if the jets change over time, potentially uncovering further insights into the processes driving its periodic outbursts. Expanding knowledge about centaurs like 29P could also enhance our understanding of the solar system's formation and evolution.

WHAT'S UP IN THE SKY - NOVEMBER 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.

Monthly Lunar Calendar
November 2024



PLANETS VISIBILITY

Mercury

Evening planet, reaches greatest eastern elongation on 15 November. Not ideally placed.



Venus

Improving evening planet, setting nearly three hours after the Sun at the end of November.



Mars

Well-placed red planet. Located 2° from M44 end of month.



Jupiter

Approaching opposition and well presented in Taurus. Visible mid to late evening all month.



Saturn

Well-presented evening planet in Aquarius. It will remain visible throughout the month.



Uranus

Opposition on 17 November and beautifully presented all month long.



Neptune

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



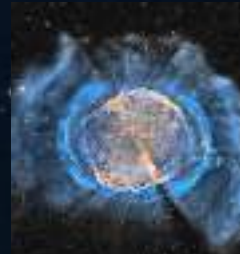
BRIGHT DEEP SKY OBJECTS

M29 (Cooling Tower) is an open cluster that's situated in the Cygnus constellation and can be seen with binocular and telescope. The cluster is certainly worth a look due to its location and unusual shape. It appears like a squashed dipper that loosely resembles the main stars of Ursa Major.



Lagoon Nebula (M8) was discovered in by the Italian astronomer Giovanni Hodierna. This star-forming cloud of interstellar gas is located in the constellation Sagittarius and its apparent magnitude of 6 makes it faintly visible to the naked eye in dark skies.

M27 (Dumbbell Nebula) was the first planetary nebula discovered. This nebula results from an old star that has shed its outer layers in a glowing display of color. M27 can be found in Vulpecula constellation, and has an apparent magnitude of 7.5.



The Andromeda Galaxy is a barred spiral galaxy and is the nearest major galaxy to the Milky Way. Originally named Andromeda Nebula, for several centuries, with a magnitude of 3.4 is visible through naked eye. Andromeda Galaxy is approximately 2.5 million light-years from Earth and is heading our way.

ASTRONOMICAL EVENTS - NOVEMBER 2024

Final Supermoon of the year: The Beaver Moon

On November 15, the night sky will light up with the Beaver Moon, marking 2024's last supermoon. This full moon, set to reach peak illumination at 3 a.m., has its origins in Native American, Colonial American, and European folklore. Named for the season when beavers prepare their lodges for winter, the Beaver Moon is a reminder of nature's cycle as animals prepare for colder months.

A supermoon occurs when the moon reaches its full phase while at its closest point to Earth, an event that can make it appear up to 14% larger and 30% brighter. This November, skywatchers can enjoy the fourth and final supermoon of the year, a celestial phenomenon that has graced the skies since August's Blue Moon. NASA explains that because the moon's orbit around Earth is elliptical, its distance from Earth changes, which is why supermoons appear slightly larger and brighter than typical full moons.

Adding to the spectacle, the Beaver Moon will appear near the Pleiades star cluster—often called the "Seven Sisters"—in the constellation Taurus. For those in the Northern Hemisphere, the moon's appearance alongside this famous cluster adds a visual treat for the night. Meanwhile, Mercury will also make a brief appearance in the evening sky the following day as it reaches its greatest elongation east of the Sun, a short-lived opportunity to see the elusive planet.

This full moon has many names reflecting cultural traditions around the world. The Cree and Assiniboine call it the Frost Moon, while the Anishinaabe know it as the Freezing Moon, marking the arrival of frost and the shift toward winter. The Tlingit refer to it as the Digging Moon, signaling animals' preparations for the cold, and the Dakota and Lakota people call it the Deer Rutting Moon, a reference to deer mating season. Whether called the Beaver Moon or the Frost Moon, November's full moon reminds us of nature's rhythm. As it shines brightly in the night sky, it brings a sense of awe and connection to traditions that have long marked the arrival of winter.

Leonids Meteor Shower

Each November, as Earth passes through the debris trail of Comet 55P/Tempel-Tuttle, the annual Leonid meteor shower lights up the sky. This small comet, with a nucleus 2.24 miles wide, completes its orbit every 33 years. Having last come close to the Sun in 1998, Tempel-Tuttle will return in 2031. Named after its co-discoverers, Ernst Tempel and Horace Tuttle, Tempel-Tuttle is classified as a periodic comet, as noted by the "P" in its name, which designates comets with orbits under 200 years. These comets continually refresh their trails of debris each time they loop around the Sun.

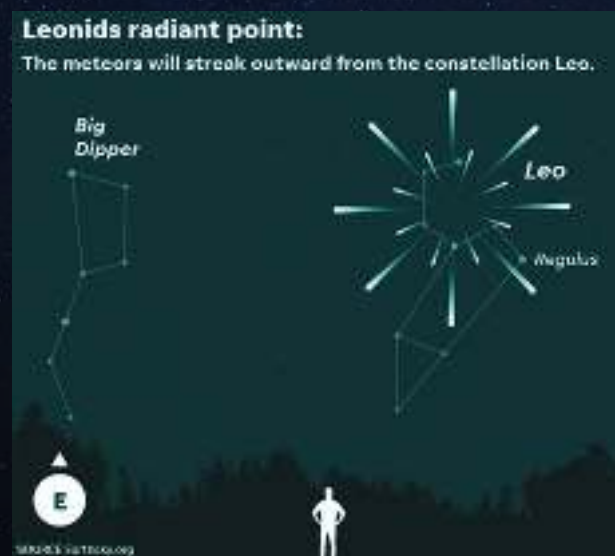
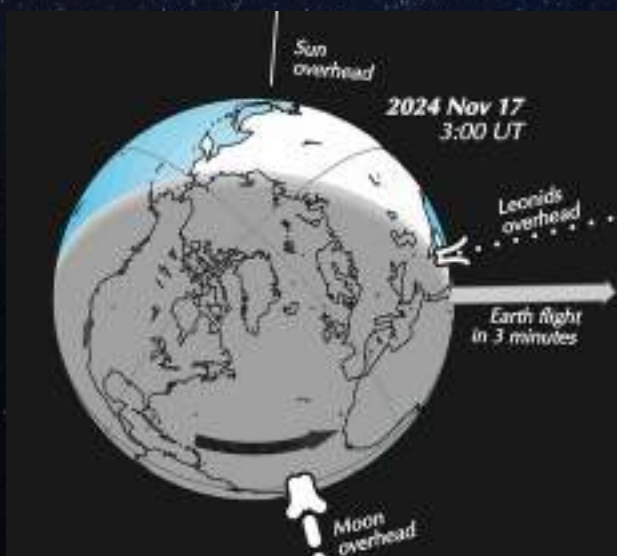
Approximately every 33 years, the Leonids have the potential to surge into a meteor "storm," delivering more than 1,000 meteors per hour. The most legendary of these storms took place in 1966, when thousands of meteors per minute fell across the sky, appearing like a brief, spectacular "rain." The last storm-level event occurred in 2002, though the Leonids generally appear as a more modest annual shower.

Viewing the 2024 Leonids:

From November 6 to 30, meteor enthusiasts can look skyward for the Leonids, peaking around November 17. This year, however, the nearly full moon may obstruct some of the fainter meteors, though the brighter fireballs and fast-moving streaks could still be visible. The Leonids are some of the fastest meteors, hurtling through the sky at 44 miles (71 kilometers) per second, sometimes producing colorful, long-lived trails.

In New Delhi, the shower becomes visible around 11:48 p.m. when the Leonids' radiant point, located in the constellation Leo, rises in the eastern sky, continuing until dawn at around 6:17 a.m. The shower's best display may occur before dawn, as the radiant reaches its highest point around 7:00 a.m. This optimal positioning brings meteors directly into Earth's view, creating more visible, short trails near the radiant. At other times, the meteors will appear to enter at an angle, producing longer, dramatic streaks that traverse more of the sky.

With the peak predicted at 6:00 p.m. on November 17, viewers may experience the best shows after the radiant rises later that night. For stargazers, it's a perfect opportunity to witness an event that, while not storm-level this year, continues to capture the imagination with the Leonids' promise of cosmic wonder.



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.

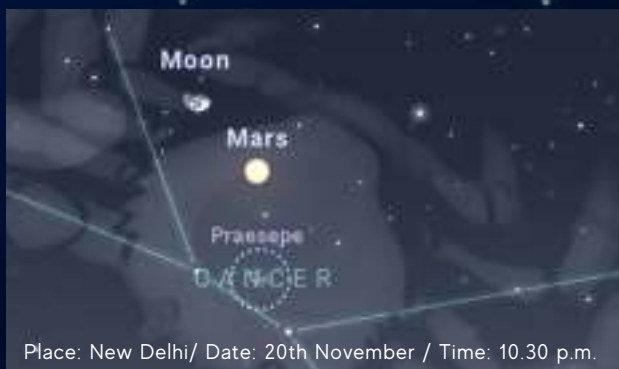


Conjunction of Moon and Saturn

On November 11th, the Ringed planet Saturn and the Moon will have the closest approach in the night sky & reaching an altitude of 48° above the south-eastern horizon. The Moon will be at magnitude -12.46, and Saturn at magnitude 0.88. And it will be visible around 05.02 p.m. at noon till 09:14 p.m.

Conjunction of Moon and Jupiter

On November 17th, 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 -12.69, the planets Jupiter is at a magnitude of -2.62. The Moon, Mars and Jupiter, together will be seen in the evening sky around 07.55 p.m.



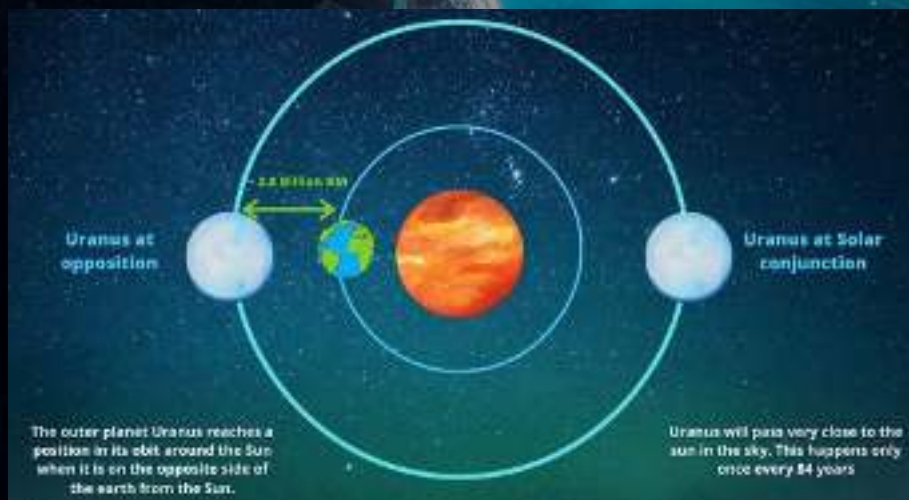
Conjunction of Moon and Mars

On November 20th, 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 -12.28, and Mars at magnitude -0.27. And it will be visible around 10.30 p.m., before midnight.

URANUS AT OPPOSITION

On November 17, Uranus reaches opposition, positioning itself directly opposite the Sun from Earth's perspective, making it ideally visible throughout the night. Under dark skies and with good eyesight, Uranus can be spotted without any visual aid, but binoculars or a small telescope will make it much easier to see this distant planet clearly.

What Is Opposition: "Opposition occurs when the Sun, Earth, and planet lie along a straight line with the Earth in the middle," thus putting the Sun and planet on opposite sides of the Earth, hence the term 'Opposition'. This means that the planet is as close to the Earth as possible and will appear as big and as bright as it can ever get. This is a great time to see and observe planets in the night sky occur when they are at opposition. During opposition, the planet appears at its most prominent and brightest, and it is above the horizon for much of the night. For stargazers and astrophotographers, it is an ideal time to view and photograph the superior planets. Planetary oppositions for Jupiter, Saturn, Uranus, and Neptune occur almost every year, as Earth's much faster orbit passes between these planets and the Sun.



Viewing Details:

Location in the Sky: Uranus will lie in the constellation Taurus.

Best Times: It will be visible from around 7:05 p.m. to 5:08 a.m.

Viewing in New Delhi: In New Delhi, Uranus will rise in the eastern sky around 7 p.m. at an altitude of 21°, reaching its highest point of 80° above the southern horizon at around midnight (12 a.m.). It will set below 21° in the western horizon by 5:08 a.m.

Appearance:

Through Binoculars or a Telescope: Uranus will appear as a small, greenish disk. In favorable conditions, up to four of its moons might also be visible.

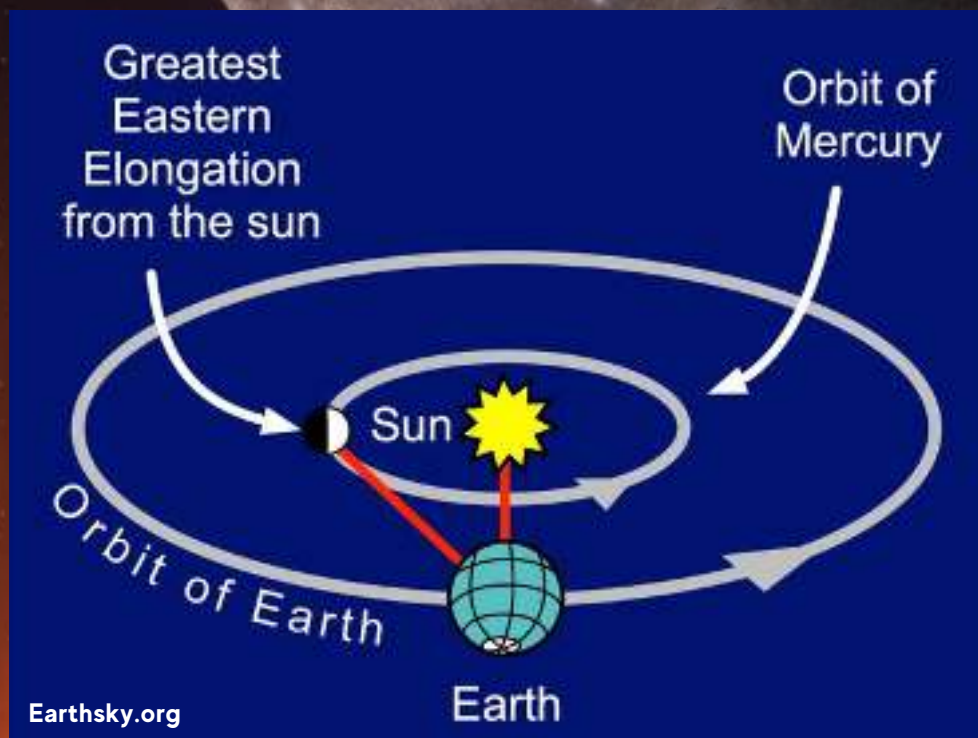
Brightness at Opposition: Its brightness will reach a magnitude of 5.67, making it faint but observable in dark-sky conditions.

This is an excellent opportunity for enthusiasts to catch a rare, detailed glimpse of the seventh planet in our solar system.

Mercury at Greatest Eastern Elongation

Mercury, the innermost planet in our solar system, orbits closer to the Sun than Earth and remains near the Sun in our sky, often hidden by its glare. It becomes visible only during brief periods when it reaches its greatest elongation—its furthest separation from the Sun—an event occurring every 3–4 months, alternately in the morning and evening skies, depending on Mercury's position east or west of the Sun. When it lies to the east, it becomes visible in early evening twilight, setting shortly after the Sun. When it's to the west, it rises just before sunrise, visible in the morning twilight.

Mercury's position is always near the ecliptic, the Sun's apparent yearly path across the sky, which represents the plane of Earth's orbit and traces through the zodiacal constellations. Because all planets orbit within roughly the same plane, Mercury's path aligns closely with this line. However, as the ecliptic intersects the horizon at different angles throughout the year, Mercury appears at varying heights above the horizon during each apparition, despite a similar distance from the Sun. Its separation ranges from 18 to 28 degrees.



In the current apparition (October–December 2024), Mercury can be seen low in the western sky at sunset, peaking in brightness at magnitude -0.3 and reaching its greatest elongation on November 16.

For observers in New Delhi, this apparition will be challenging, with Mercury only rising to about 13° above the horizon at sunset on November 20.

FOLLOWING THE STARS

Tawantinsuyu, or the Realm of the Four Parts, was the largest empire in pre-Columbian America. Commonly known as the Inca Empire, it lasted from 1438 till 1533, covering modern-day Peru, western Ecuador, western and south Bolivia, Northwest Argentina, the Southwestern tip of Columbia and a large portion of Chile. The Incan Empire is fascinating as it lacked several features (such as the wheel, the use and knowledge of irons and steel, a writing system, money and markets) we associate with civilizations. Yet at the same time, they constructed monumental stonework architecture, an extensive road network that reached the corners of the empire, had finely woven textiles, could communicate and maintain records through knotted strings and maintained agriculture with innovations in a difficult climate, among other feats.



Map of the Incan Empire shortly before it fell

Despite lasting for only a century, the Incans developed advanced forms of religion, social structure, construction, and astronomy by assimilating knowledge and cultures available before the empire with the tribes conquered throughout the expansion. This knowledge they utilized in their daily lives.

The Incan civilization placed great importance on astronomy and had an intrinsic belief that everything in and around the world was connected. They were the only culture in the world to define constellations of both light and darkness and assigned every star and constellation identified with a purpose.

They were also a horizon-based culture, building carefully placed pillars so that when the sun rose or set between the pillars, they knew it was time to plant at various altitudes.

Even Machu Picchu, the famous Incan site is connected to the stars. It is believed to be a sacred ceremonial site, which doubled as an agricultural experimental centre and an astrometrical observatory.

The end of the Incas came about when the Spanish conquistadors arrived on their shores. After subduing the Inca empire, the Spaniards began a campaign against the indigenous religion. This included a systematic eradication of their structures and gathered knowledge. Yet, within the ruins, the astronomical knowledge remains, as do the stars above.

Asteroids: Celestial Forces in Ancient Myths and Modern Imagination



Asteroids have inspired a variety of myths, legends, and fictional tales, often rooted in their enigmatic presence in the cosmos and their potential for both destruction and creation. Although asteroids themselves aren't a central theme in ancient mythology (as they were not well understood), some mythological stories involve meteors, comets, or other cosmic objects. Here are a few mythical or fictional interpretations that can be related to asteroids:

Phaethon and the Greek Myth of Cosmic Fire: In Greek mythology, Phaethon, the son of Helios (the sun god), takes control of his father's sun chariot, causing chaos as he fails to control the horses. As he loses control, the chariot veers too close to the Earth, scorching the land. Eventually, Zeus strikes Phaethon down with a thunderbolt, and his body crashes to the ground. In some interpretations, this crash could be linked to a meteorite or asteroid impact, symbolizing fiery destruction from the heavens.

Chicxulub Impact and the Mayan Apocalypse Myth: The asteroid impact that is believed to have caused the extinction of the dinosaurs 66 million years ago left a crater at Chicxulub, Mexico. In modern interpretations of ancient Mayan mythology, this event has been linked to the Mayan apocalypse myth. While the Mayans didn't specifically reference an asteroid, the belief in cosmic forces of destruction aligns with the imagery of celestial bodies causing apocalyptic events.

Tiamat and Babylonian Creation Myth: In Babylonian mythology, Tiamat was a primordial sea goddess associated with chaos. According to the Enuma Elish, the Babylonian creation myth, the god Marduk split Tiamat in two to create the Earth and the heavens. Some modern speculative fiction writers associate this story with the concept of a planet or large asteroid being shattered, possibly symbolizing asteroid impacts or the destruction of a celestial body.

The Tunguska Event as Modern Myth: In 1908, a massive explosion occurred over the Tunguska region of Siberia, believed to have been caused by an asteroid or comet fragment exploding in the atmosphere. While this event is historically recent, it has inspired many modern myths and legends, particularly in Russian folklore.

Some tales describe the explosion as the wrath of a god, while others associate it with alien technology or supernatural occurrences.

Asteroids in Modern Fiction: *Lucifer's Hammer* (1977) by Larry Niven and Jerry Pournelle: A science fiction novel that describes the effects of a comet's impact on Earth. The story blends the science of asteroid impacts with the mythic concept of world-ending events, playing on humanity's fear of celestial catastrophes.

Armageddon (1998): The Hollywood blockbuster imagines a large asteroid on a collision course with Earth, threatening all life. The idea of a cosmic object wiping out civilization is steeped in modern myth-making, where asteroids become agents of destruction.



Ancient Egyptian Astronomical Beliefs: The Egyptians believed in divine order (Maat) and viewed celestial bodies as part of that order. A cosmic disruption, like a meteorite or asteroid strike, could be interpreted as a sign of disorder or chaos. Though no specific myth refers directly to asteroids, the cosmic events in Egyptian lore sometimes involve celestial bodies causing disruptions in the earthly realm.

The Myth of Typhon: In Greek mythology, the monstrous Typhon was a giant who challenged Zeus for supremacy over the cosmos. Some versions of the myth describe Typhon hurling fiery stones or thunderbolts at the gods. Although not explicitly an asteroid, Typhon's connection with falling celestial objects could symbolize a destructive cosmic force similar to an asteroid impact.



Asteroids, while often feared for their destructive potential, are also seen in modern tales as harbingers of change, transformation, or renewal, echoing themes from ancient myths about celestial bodies.

ROCKET LAUNCHES IN NOVEMBER 2024

PROBA-3

Date: November 29, 2024

Rocket: PSLV-XL

Agency: Indian Space Research Organization (ISRO)

Launch Site: First Launch Pad, Satish Dhawan Space Centre, India

The Proba-3 mission is a pioneering project by the European Space Agency (ESA) focusing on precision formation flying. This mission involves two independent spacecraft that will fly 150 meters apart, accurately maintaining this formation to simulate an "artificial solar eclipse." This unique setup will allow for detailed observations of the solar corona, the outermost part of the Sun's atmosphere, without interference from the solar disk's brightness. The mission will spend six hours in formation during each orbit, enabling extended scientific observations.

The spacecraft will operate in a highly elliptical orbit, with formation flying taking place around apogee, the farthest point from Earth in their orbit, to perform payload operations. During other parts of the orbit, the spacecraft will engage in free flight. Proba-3's success could lead to future formation-flying missions for space science and astronomical studies.

This mission, launched aboard ISRO's Polar Satellite Launch Vehicle (PSLV-XL), showcases the collaborative efforts of ESA and ISRO in advancing space science and technology.

The Proba-3 mission (Image credit: ESA)



IONOSFERA-M 1 & 2



Date: November 5, 2024.

Rocket: Soyuz 2.1b Fregat-M.

Agency: Roscosmos.

Launch Site: Site 1S, Vostochny Cosmodrome, Russia.

The Ionosfera-M 1 & 2 mission is the first step in a constellation designed for space weather monitoring as part of the Ionozond project. These two satellites, developed by JSC VNIEM Corporation for Roscosmos, will help gather data on Earth's ionosphere and magnetosphere, studying natural and human-made phenomena that affect these regions.

Operating in sun-synchronous orbits at around 800 km altitude, they will carry instruments such as spectrometers for plasma and radiation, and devices for ionospheric plasma energy analysis. This mission is critical to understanding the dynamics of the ionosphere, with applications ranging from radio communications to satellite operations.

MAIDEN FLIGHT

Date: November 2024.

Rocket: New Glen.

Agency: Blue Origin.

Country: USA.

Launch Site: Launch Complex 36, Cape Canaveral Space Force Station, FL, USA.

The Maiden Flight of Blue Origin's New Glenn marks a significant step for the company, debuting their heavy-lift rocket designed to support a variety of missions, including satellite deployment and contributions to NASA's Artemis lunar exploration program. Standing over 320 feet tall, New Glenn features a massive seven-meter payload fairing and is powered by seven BE-4 engines using liquid oxygen and liquefied natural gas (LNG).

This rocket aims to carry large payloads, with its reusable first stage capable of landing on a sea platform for future missions. The flight is the culmination of years of development, aiming for future missions that include collaborations with NASA and commercial customers. The success of this flight will play a vital role in Blue Origin's competitiveness in the space launch industry.



SPACEX LAUNCHES IN NOVEMBER 2024

SpaceX-Starlink Group: SpaceX is scheduled to launch a batch of Starlink satellites in November 2024, contributing to the ongoing expansion of its satellite internet constellation. The specific launch window is expected to be between November 1 and November 10, although exact dates can change due to various factors, including weather and technical readiness as already achieved significant milestones, including launching the 7,000th Starlink satellite earlier this year. The upcoming mission aims to continue building on the existing network to enhance global internet coverage, especially in underserved areas

425 PROJECT FLIGHT 3

Date: November 2024.

Rocket: Falcon 9 Block 5.

Launch Site: Cape Canaveral Space Force Station, FL, USA.

The 425 Project Flight 3 is part of a series of reconnaissance satellite launches for South Korea's Defense Acquisition Program Administration (DAPA). This third mission will deploy one of the five planned synthetic aperture radar (SAR) satellites designed to provide detailed imagery for military reconnaissance purposes. The satellites will be launched into low Earth orbit (600-700 km altitude), providing South Korea's military with high-resolution (30-50 cm) imagery to monitor key facilities, especially in nearby regions. This mission is expected to strengthen South Korea's national defense capabilities by allowing consistent observation of strategic locations every two hours



4X ASTRANIS MICROGEO

Date: November 2024.

Rocket: Falcon 9 Block 5.

Launch Site: Cape Canaveral Space Force Station, FL, USA.

The mission will launch four Astranis MicroGEO satellites to geostationary orbit. These satellites, developed by Astranis, are part of the company's effort to provide affordable internet connectivity by utilizing small, low-cost geostationary satellites.

Unlike traditional large GEO satellites, these MicroGEO satellites are significantly smaller and offer more targeted coverage for specific regions, improving broadband access for underserved areas. The November launch will be a crucial step in expanding Astranis' constellation, enhancing global connectivity solutions for commercial and governmental users.



GSAT-20

Date: November 2024.

Rocket: Falcon 9 Block 5.

Launch Site: Cape Canaveral, Florida, USA.

The GSAT-20 mission is a critical part of India's satellite communications development, aiming to enhance internet connectivity across the country, particularly in rural and remote areas. GSAT-20 will be a high-throughput communication satellite, utilizing advanced technologies like electric propulsion for orbit-raising and station-keeping. This satellite is designed to provide high-speed internet services by offering substantial bandwidth and supporting multiple frequency bands.

This launch marks a significant step for ISRO in improving India's digital infrastructure and is part of the government's broader plan to boost communication capabilities in underserved regions.



THURAYA 4-NGS

Date: November 2024.

Rocket: Falcon 9.

Country: USA.

Launch Site: Cape Canaveral Space Force Station, FL, USA.

The Thuraya 4-NGS mission, operated by Yahsat, aims to expand satellite communication services across Europe, the Middle East, Central Asia, and Africa. This next-generation satellite will leverage advanced technologies to enhance capacity and flexibility in delivering integrated communication solutions, which are crucial for various customer segments, including defense and government sectors. The Falcon 9 rocket was chosen for its reliability and proven track record, with SpaceX having successfully completed over 128 launches to date. Yahsat's CEO emphasized the importance of this collaboration with SpaceX to develop a robust satellite infrastructure, marking a significant step in their growth strategy.



TRANSPORTER 12

Date: November 2024.

Rocket: Falcon 9 Block 5.

Country: USA.

Launch Site: Launch Complex 4E, Vandenberg Space Force Base, CA, USA.

The Transporter 12 mission is a dedicated rideshare flight designed to deploy dozens of small microsatellites and nanosatellites into a sun-synchronous orbit (SSO). This mission is part of SpaceX's SmallSat Rideshare Program, which offers satellite operators a cost-effective way to launch small payloads, typically for a starting price of around \$300,000 per mission, including up to 50 kg of payload mass. The Falcon 9 Block 5 rocket will be utilized for this launch, which aims to support both commercial and government customers looking to place their satellites in orbit. Transporter 12 underscores SpaceX's commitment to facilitating access to space for smaller payloads and enhancing global satellite capabilities.



WORLDVIEW LEGION 5 & 6

Date: November 2024.

Rocket: Falcon 9 Block 5.

Country: USA.

Launch Site: Launch Complex 4E, Vandenberg Space Force Base, CA, USA.

The WorldView Legion 5 & 6 mission is set to launch a pair of advanced Earth observation satellites as part of Maxar Technologies' WorldView Legion constellation. This launch, scheduled for mid-November 2024, marks a significant step in enhancing global imaging capabilities. The WorldView Legion satellites will provide high-resolution imagery and data, supporting a variety of applications including agriculture, urban planning, and disaster response. These satellites are designed to improve upon the capabilities of previous generations, offering more frequent revisits and expanded coverage of the Earth.



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

STUDENT'S CORNER

Mission Terra Jalavaayu - To save our planet

Vandagal Tulasi, Astronomer

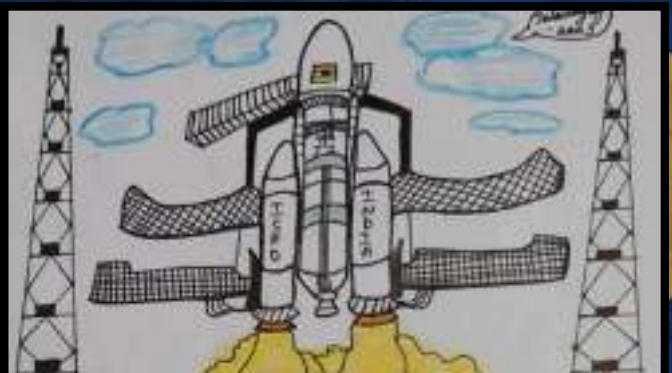
Fictional Space mission that can help towards environment sustainability of our planet Earth. Let's begin our space journey with photo story

On Earth, Year 2023, Climate change threatens our future.

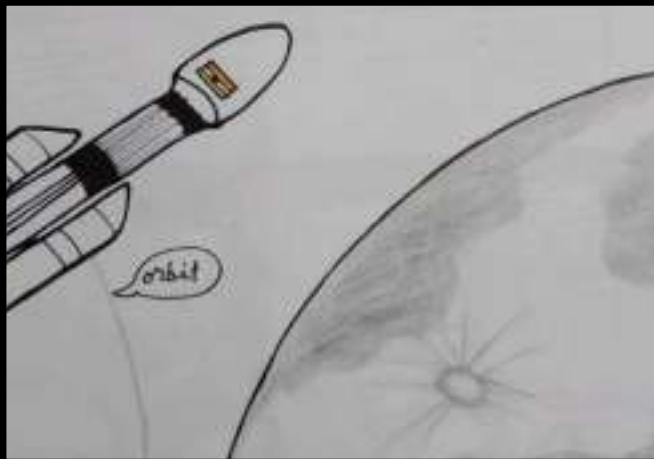
Earth from space



Earth 2023 Climate change threatens our future



ISRO' officials discussing the mission named Terra Jalavaayu and aims to save our planet. Jalavaayugaan 1 shoerlty blasts off to study the Earth's climate.



Space craft when reached in orbit started deploying Solar panels. Jalavaayan 1 solar panels power, and climate monitoring starts. After a while data from the mission reveals the impact of climate change



ISRO's scientist race against time to find the solution and come up with carbon capture satellite which reduces the emission.



Mission Terra Jalavaayu succeeds and Earth's future is secured.

It was a victory for humanity and Our planet's future looks brighter thanks to the ISRO team.

Charting the Cosmos

Aryan Gupta, Astronomy Club Student

ISRO's Ambitious Roadmap for Future Space Missions

The Indian Space Research Organisation (ISRO) stands at the brink of a new era, poised to undertake ambitious missions that push the boundaries of space exploration and technological innovation. As India's premier space agency, ISRO's upcoming projects are designed not only to enhance the nation's scientific capabilities but also to position India as a global leader in space exploration.

1. Gaganyaan: India's First Manned Spaceflight:

One of the most anticipated missions is Gaganyaan, India's maiden human spaceflight program. Planned for launch by 2025, Gaganyaan aims to send a three-member crew into low-Earth orbit for a duration of 5-7 days. This mission will be a historic achievement, making India the fourth country to independently send humans into space. It will serve as a cornerstone for future crewed missions, including potential collaborations for manned lunar expeditions.

2. Chandrayaan-4 and Beyond:

Following the success of Chandrayaan-3, ISRO has set its sights on further lunar exploration with Chandrayaan-4. This mission will focus on studying the moon's south pole in greater detail, potentially laying the groundwork for human habitation and resource extraction. With advancements in rover and lander technology, ISRO's vision extends to joint lunar missions with other space agencies, further contributing to global lunar exploration efforts.

4. Mars and Venus Missions:

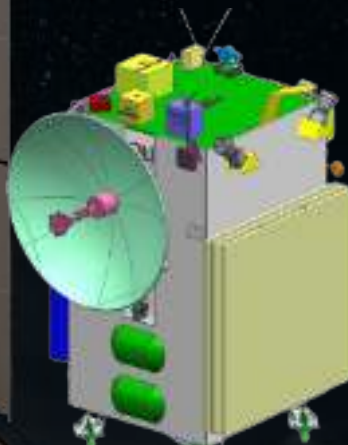
Following the success of Mangalyaan, ISRO is preparing for its Mars Orbiter Mission 2 (MOM-2) to further explore the Red Planet. Additionally, Shukrayaan-1, ISRO's first mission to Venus, aims to study the planet's atmosphere and surface characteristics, expanding India's planetary exploration program. With these pioneering missions, ISRO continues to exemplify innovation, scientific exploration, and the pursuit of knowledge. The future holds exciting prospects as the agency spearheads India's journey into deeper space, fostering international collaborations and inspiring a new generation of explorers.



(Image credit: ISRO)



(Image credit: ISRO)



(Image credit: ISRO)

Impacts From Asteroid

Sourajit Mandal, Astronomy Club Student

Imagine you being a dinosaur millions of years ago, enjoying your newly found meal slowly after a long day in the spring and then.... Something happened... a big flash... KABOOM... and well... your entire species disappears forever. The thing that caused your extinction was an asteroid now known as the Chicxulub asteroid. This asteroid was 10-15 km diameter which hit the Earth at seafloor off the coast of Mexico.

Not only did this cause the extinction of 75% of all the species on the planet, but it also left a lasting impact crater of diameter 150 kilometers! And well... you know how we know all of this? Well... you guessed it right! The Crater was the key solution to knowing about all of this ancient disaster! Craters are an important source of information in the study of the past of celestial objects and bodies. of big bangs, crashes and impacts, did you know there's an even bigger crater in South Africa?

In South Africa, we can find the largest verified impact crater on the entire planet with a diameter of about 300 kilometers. Known as the Vredefort Crater, it was formed 2 billion years ago telling us about our planet's extremely violent past. But this is old... very old... don't we have something new? Yes, we do! We do have the Barringer Crater, quite far away from the last destination. This crater in USA, also known as Meteor Crater is a 1.2-kilometer-wide crater in Arizona formed around 50000 years ago by a nickel-iron meteorite. This basically means that we have a newly made specimen to study from! This asteroid crater is incredibly well-preserved, and offers valuable insights into the impact process.

But till now we are still on Earth. We need to look farther away... so let's see the moon. So first, we have the Tycho Crater on the Moon. This 86-kilometer-diameter "young lunar crater" at about 108 million years old is easily recognizable by its bright rays extending across the Moon's surface.

Now you would be thinking... even THAT is close right? Yes, you are right. Let's get farther out. Let's go to Mars! Not just any crater, Hellas Basin in Mars is absolutely Gargantuan! This crater has a massive impact basin over 2300 kilometres in diameter. It is among the largest known impact structure in the Solar System.

Huh... you want to go even further away from Earth? Ok... let's see what about Saturn? No, I don't mean a crater on Saturn itself but on its moon Mimas. The Herschel Crater dominates this moon's surface, giving it a striking resemblance to the Death Star from Star Wars. The crater is about 130 kilometers wide, nearly a third of Mimas's diameter.

YOU WANT EVEN FURTHER OUT IN THE SOLAR SYSTEM! Ok... lets go to the farthest crater that we know well about. Let us go to the moon of Pluto- Charon. On Charon, Pluto's largest moon, we find some fascinating craters, but one stands out for its cool factor-Skywalker Crater. Located on a distant moon in the Kuiper Belt, this crater's name alone makes it exciting, but there's more to it than just that. Skywalker Crater and other craters on Charon reveal a lot about the moon's icy surface and its history of impacts. Unlike craters on rocky planets, the craters here are shaped by the collision of frozen material, giving scientists clues about what's beneath the ice.

What's even cooler is that Charon itself is covered in canyons, valleys, and craters, making it a dynamic place to study the outer reaches of the Solar System. It might be far away from Earth, but these distant craters give us a peek into how the Solar System formed and evolved.

So, there you have it! From the impact that wiped out the dinosaurs to the frozen craters on distant moons, craters aren't just holes in the ground-they're time capsules, revealing stories from billions of years ago and even from the edges of our Solar System.

Happy Birthday



November 15, 1738

William Herschel

Frederick William Herschel (November 15, 1738 – August 25, 1822) was a German-British astronomer and composer renowned for his contributions to astronomy. He discovered the planet Uranus and hypothesized that nebulae are composed of stars, developed a theory of stellar evolution. He was one of the first 'professional' astronomers and discovered infrared radiation in 1800 by experimenting with sunlight. He constructed his first large telescope in 1774 and spent nine years surveying the sky. Herschel's legacy continues to influence astronomers and enthusiasts, reminding us of the importance of observation and inquiry in understanding the universe.

Alan Shepard

Alan Shepard (November 18, 1923 – July 21, 1998) was a pioneering American astronaut and naval aviator, renowned for being the first American in space. Selected as one of NASA's original seven astronauts, he flew the Mercury-Redstone 3 mission, known as Freedom 7, on May 5, 1961, reaching an altitude of 116.5 miles (187.5 km) during a 15-minute flight. Later, he commanded Apollo 14, launched on January 31, 1971, where he explored the Moon and famously hit two golf balls on its surface. Shepard received numerous honors, including the Congressional Space Medal of Honor and the Presidential Medal of Freedom, inspiring future generations in space exploration.



November 18, 1923



November 20, 1889

Edwin Powell Hubble

Edwin Powell Hubble (November 20, 1889 – September 28, 1953) was an influential American astronomer who transformed our understanding of the universe. He is best known for formulating Hubble's Law, which established that the universe is expanding, a groundbreaking discovery for cosmology. He also developed a galaxy classification system, the Hubble sequence, categorizing galaxies into spirals, ellipticals, and irregulars. His contributions are commemorated by the Hubble Space Telescope, launched in 1990, which has provided stunning images and vital data, confirming many of his theories. His work laid the foundation for modern cosmology and continues to inspire research in astrophysics and our comprehension of the cosmos.

Happy Birthday

Edmond Halley

Edmond Halley (6 November 1656 – 25 January 1742) was an influential English astronomer, mathematician, and geophysicist, renowned for predicting the return of Halley's Comet, which he linked to comets observed in 1531, 1607, and 1682. His calculation of the comet's return for 1758 was confirmed. Halley also measured the distance to stars, notably Sirius, and studied the transit of Mercury in 1661. He contributed to terrestrial magnetism and created detailed maps of the Southern Hemisphere skies. Halley's work significantly advanced astronomy, bridging classical and modern astrophysics, with Halley's Comet continuing to symbolize his lasting impact on the field.



November 6, 1656

C. V. Raman

C.V. Raman (7 November 1888 – 21 November 1970) was a notable Indian physicist, regarded as the "Father of Physics". He received the Nobel Prize in Physics in 1930 for discovering Raman scattering, demonstrating that light changes wavelength when passing through transparent materials. This achievement made him the first Asian and non-White Nobel laureate in any scientific discipline. Raman also made important contributions to acoustics, studying sound waves and musical instruments. Honored with the Bharat Ratna in 1954, he is celebrated as a pioneering figure in Indian science, with a lasting legacy through the Raman Effect and the institutions he helped establish.



November 7, 1888

Carl Edward Sagan

Carl Sagan (November 9, 1934 – December 20, 1996) was an influential American astronomer, planetary scientist, and science communicator. He is renowned for creating the Pioneer plaque and Voyager Golden Record to communicate with potential extraterrestrial intelligence. Sagan became a prominent spokesperson for astronomy, often appearing on shows like The Tonight Show Starring Johnny Carson. He authored significant books, including The Demon-Haunted World, Pale Blue Dot, and Contact, promoting critical thinking and scientific literacy. Celebrated for making science accessible, his vision of a universe filled with possibilities continues to inspire curiosity and exploration.



November 9, 1934

ASTROPHOTOGRAPHS FROM SPACE ASSOCIATED ASTRONOMERS

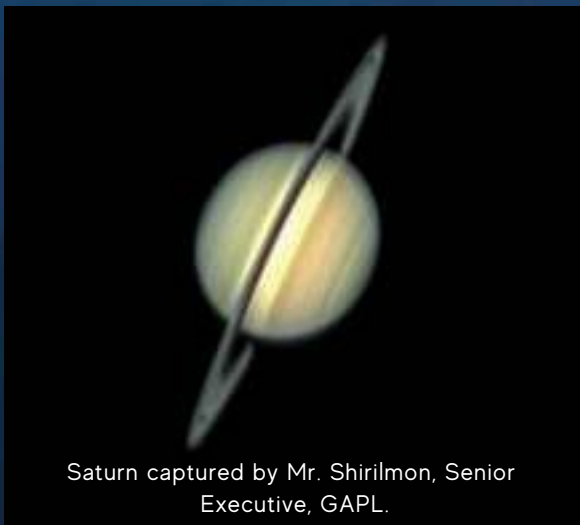


The Great Hercules Globular Cluster Captured by
Devika Baitule.



Moon Captured by Alankrit Gupta.

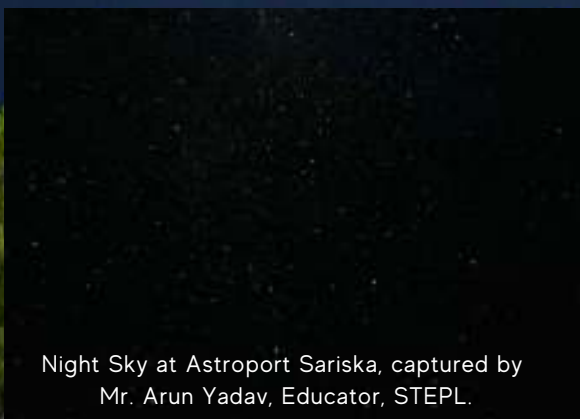
ASTROPHOTOGRAPHS FROM SPACE TEAM



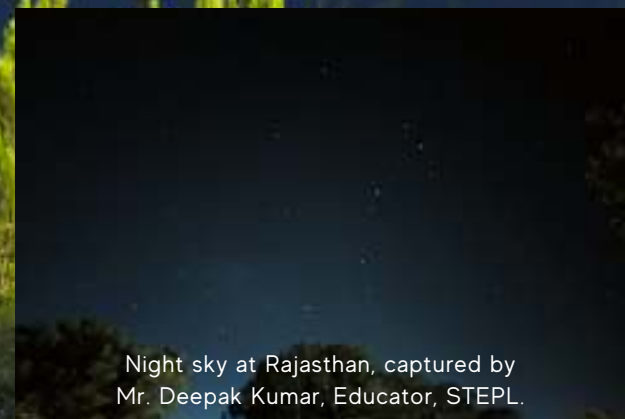
Saturn captured by Mr. Shirilmon, Senior
Executive, GAPL.



Moon and Venus captured by Mr. Ashish Pchouri,
Educator, STEPL.



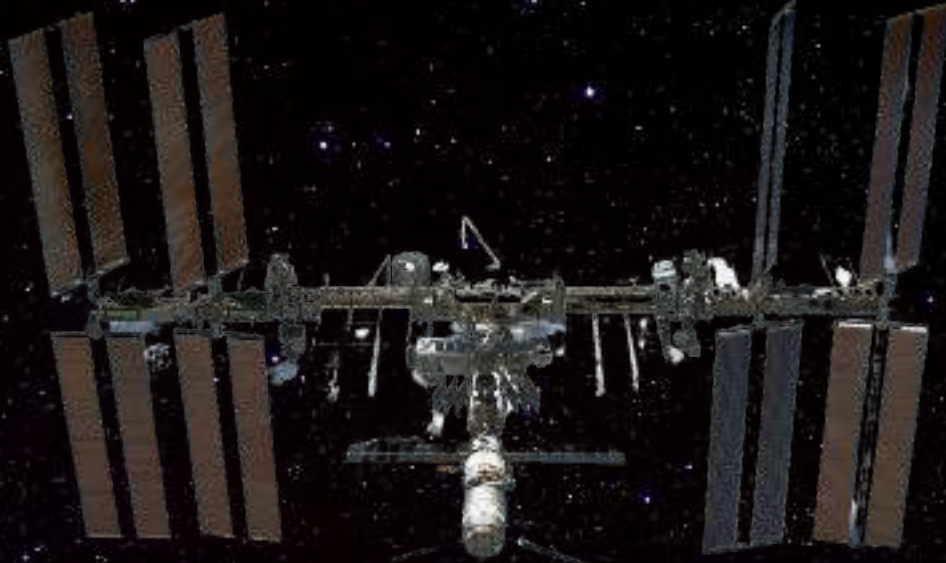
Night Sky at Astroport Sariska, captured by
Mr. Arun Yadav, Educator, STEPL.



Night sky at Rajasthan, captured by
Mr. Deepak Kumar, Educator, STEPL.

HISTORICAL EVENTS HAPPENED IN NOVEMBER

BEGINNING OF A NEW ERA



On 20th November 1998, aboard a Russian Proton rocket, Zarya, 'dawn' in Russian, launched from the Baikonur Cosmodrome, Kazakhstan. Funded by NASA, the module was built by the Russian Space Agency, Roscosmos, reflecting the cooperative spirit that underpins the International Space Station (ISS). This was the crucial first step to realize the vision of a permanent human outpost in space. Zarya's initial role was to provide power, propulsion, and communications during the early stages of the ISS's assembly.

A month later, Zarya was joined by the American Unity module. When the two modules docked, it was a symbolic moment and a technical achievement. As the first integration of US and Russian hardware in orbit, it was a testament to the post-Cold War cooperation between the two nations. Over the years, modules like Japan's Kibo laboratory and Europe's Columbus module were added, transforming the ISS into a sprawling research hub. This cooperative effort exemplifies how nations can work together to achieve extraordinary technological advancements in space exploration. The ISS is a unique international endeavour involving multiple countries, including the U.S., Russia, Japan, Canada, and members of the European Space Agency (ESA). These nations contributed resources, technology, and expertise to create a space station that reflects a shared vision for humanity's future in space. The ISS became a platform for collaboration, moving beyond the competition of the Space Race and fostering partnerships that spanned continents.

After the first crew docked two years later, in November 2000, space has been inhabited by humans for 24 straight years as of November 2024.

Currently, the ISS serves as a floating laboratory where groundbreaking research takes place. The microgravity environment aboard the station has enabled scientists to conduct experiments in fields like biology, physics, and materials science that would be impossible on Earth. Research on the ISS has led to advancements in medicine, such as insights into muscle atrophy and bone loss, which are essential for future long-duration space missions.

The ISS also plays a crucial role in Earth observation, providing valuable data on climate change, environmental degradation, and natural disasters. This information has enhanced our understanding of Earth and contributed to global efforts to address environmental challenges.

The ISS, which is to date the largest structure ever assembled in space, also stands as a symbol of what can be achieved when nations work together.

FROM THE STREETS TO THE STARS: LAIKA'S ROLE IN THE SPACE RACE



Laika, a stray husky-spitz mix, was the first living creature to orbit Earth. With a pounding heart and rapid breath, Laika rode a rocket into Earth orbit, 2,000 miles above Moscow streets she knew.

Soviet engineers planned Sputnik 2 hastily after Premier Nikita Khrushchev requested a flight to coincide with November 7, 1957, the 40th anniversary of Russia's Bolshevik Revolution. They worked without blueprints, drawing from the knowledge they acquired from the unmanned and undogged Sputnik 1. The Russian stray dogs were selected as they were assumed to be much harder as they had to fend for themselves on the city's streets.

In preparation, scientists ran several tests on the dogs, mimicking space conditions. Eventually they chose Kudryavka (Little Curly and Laika's Russian name) as Sputnik 2's dog cosmonaut and Albina (White) as the backup. Doctors performed surgery on both dogs, embedding medical devices in their bodies to monitor heart impulses, breathing rates, blood pressure, and physical movement.

When Laika was chosen, it was with the knowledge that her trip to space is a one way trip. However, the scientists were not heartless. One of her keepers, Vladimir Yazdovsky, took 3-year-old Laika to his home shortly before the flight because he wanted to do something nice for the dog.

Three days before the scheduled liftoff, Laika entered her constricted travel space, newly cleaned, armed with sensors, and fitted with a sanitation device.

When the Sputnik 2 took to the skies, the noises and pressures of flight terrified Laika. Her heartbeat rocketed to triple the normal rate and her breathing rate quadrupled. She reached orbit alive, and circled Earth for approximately 103 minutes. Unfortunately, Sputnik 2 lost its heatshield and without the protection, the temperature in the capsule rose until it took a toll on Laika. According to Russian medical doctor and space dog trainer, Oleg Gazenko, she died "soon after launch."

Not everyone supported the Sputnik 2's launch. Some protested the deliberate decision to let Laika die because the Soviet Union lacked the technology to return her safely to Earth. In Great Britain, the Royal Society for the Prevention of Cruelty to Animals and the British Society for Happy Dogs opposed the launch. Later on, the humane use of animal testing spaceflight was essential to preparation for manned spaceflight, and Laika's death offered proof that space was livable.

PHILAE LANDS ON COMET 67P

Landing on a comet is no small feat. This is mostly due to its weak gravitational field, where even a light jump could cause an object to escape its pull. Yet, on 12th November 2014, Rosetta's lander Philae landed on Comet 67P. Philae aimed to land on the landing site named Agilkia, on the comet's "head" – part of its unusual, dual-lobed shape. Philae's landing system failed to deploy on initial contact which caused the lander to bounce twice before finally settling in a shaded area, limiting its ability to recharge through solar power.



From left to right: Rosetta Spacecraft, Philae Lander, Comet 67P (Image Credit: ESA/Rosetta/NavCam)

The Rosetta mission, launched by the European Space Agency (ESA) on 2nd March 2004, was a historic milestone in space exploration. It was the first spacecraft to orbit and land on a comet. Accompanied by Philae, its lander module, Rosetta journeyed an extraordinary 6.4 billion kilometers over ten years to reach Comet 67P/Churyumov-Gerasimenko (67P). This historic mission provided unprecedented insights into the early solar system and offered humanity its first close-up look at a comet's surface.

After a decade long journey, on August 6, 2014, Rosetta began an in-depth study of the comet, capturing detailed images and data that revealed its complex, rugged terrain with towering cliffs, boulders and active jets of gas and dust. The mission's goal was ambitious: to study the comet up close and deploy a lander, Philae, onto its surface.

Despite its precarious landing and limited sunlight for its solar panels, Philae successfully collected and transmitted valuable data for 57 hours before its battery drained. Its instruments performed experiments on the comet's surface composition, magnetic field, and more, revealing information about the presence of complex organic molecules and other building blocks of life. Rosetta's data reshaped our understanding of comets.

This is the first spacecraft ever to land on the surface of a speeding comet – a huge landmark in the history of space exploration. Because comets are remnants from the formation of the solar system it is hoped that it will unlock further clues about the development of life on Earth.

The daring approach and groundbreaking discoveries of Rosetta and Philae continue to inspire future missions aimed at exploring small celestial bodies, deepening our understanding of the solar system and potentially uncovering the origins of life on Earth. It demonstrated that humanity could land on, study, and even interact with objects traveling millions of kms away at incredible speeds. This remains a monumental achievement in space exploration, setting a new standard for our study of small solar system bodies and deepening our understanding of the early solar system and the possible origins of life on Earth.

ARTEMIS 1: THE TEST FLIGHT THAT WILL SHAPE THE FUTURE OF LUNAR EXPLORATION

In a bold step toward returning humans to the Moon, NASA launched Artemis 1, the first mission in its Artemis program, marking a historic return to lunar exploration. Artemis 1, an uncrewed test flight, serves as a foundation for future manned missions, aiming to establish a sustainable presence on the Moon and eventually explore beyond. This mission brought cutting-edge technology, ambitious objectives, and renewed humanity's curiosity about our closest celestial neighbor.

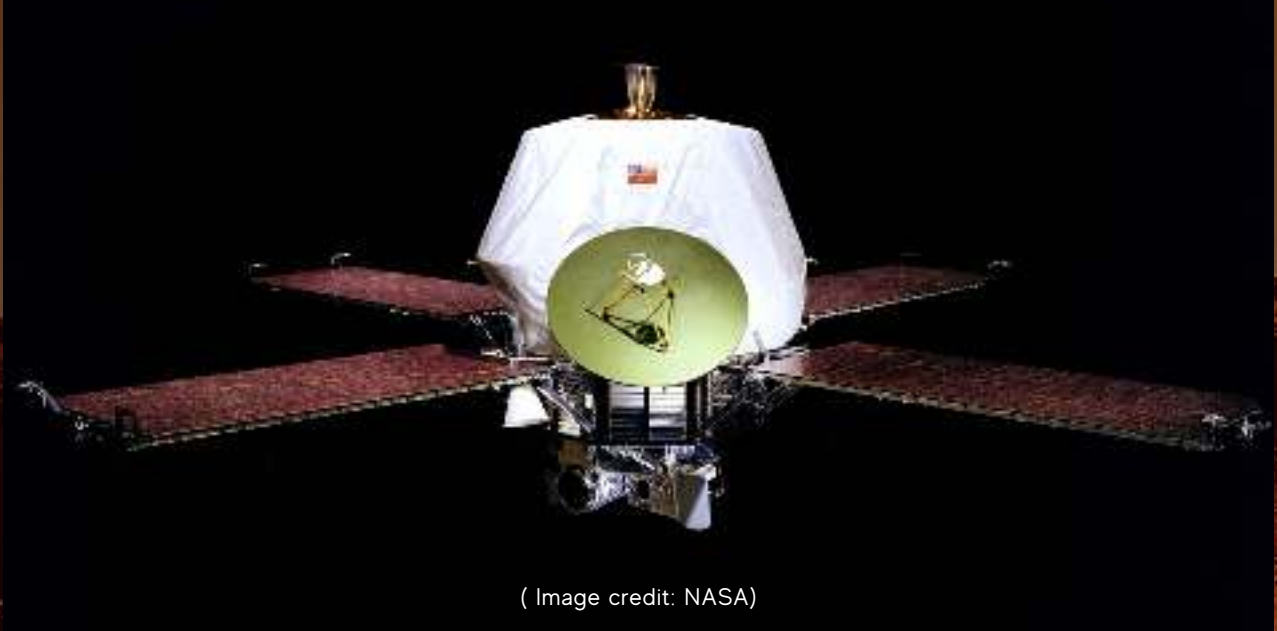
The Artemis 1 mission launched on November 16, 2022, from Kennedy Space Center in Florida. NASA's powerful Space Launch System (SLS), the most powerful rocket built to date, carried the Orion spacecraft into deep space, generating 8.8 million pounds of thrust and reaching speeds up to 22,600 mph. The SLS is designed to transport heavy payloads, and Orion is NASA's latest spacecraft intended for extended, crewed missions in deep space. Orion's structure and systems ensure safety for long-duration missions, making it ideal for the future lunar exploration NASA envisions.

After launch, Orion embarked on a 25-day mission, during which it performed several crucial maneuvers near the Moon. One of its closest lunar flybys brought it within 80 miles of the lunar surface, allowing Orion to capture stunning images of Earth alongside the Moon. Orion then traveled to a record-breaking 40,000 miles beyond the Moon, farther than any spacecraft designed for humans has ever gone, exposing its systems to the extreme conditions of deep space.

The mission's conclusion was just as critical. Orion re-entered Earth's atmosphere, testing its advanced heat shield—NASA's largest ever built—designed to withstand the 5,000°F temperatures encountered during re-entry. Orion used a skip re-entry technique, "skipping" along Earth's atmosphere to reduce speed and heat before splashing down in the Pacific Ocean on December 11, 2022. This demonstrated that Orion and the SLS can reliably and safely return astronauts from lunar missions.

The success of Artemis 1 has set the stage for Artemis 2, a crewed mission around the Moon, and Artemis 3, which will land astronauts on the lunar surface. Artemis 1 marks the dawn of a new era, with the Moon now a critical step in humankind's journey to Mars and beyond, inspiring generations with the promise of further discovery in space.

MARINER 9 AND THE DAWN OF INTERPLANETARY EXPLORATION



(Image credit: NASA)

On November 14, 1971, NASA's Mariner 9 successfully entered Mars' orbit, making history in the process. Mariner 9 became the first spacecraft to orbit another planet. Launched aboard an Atlas-Centaur rocket from Cape Canaveral, Mariner 9 was designed to unlock the mysteries of the Red Planet by capturing detailed images of its surface. After outlasting an unexpected global dust storm, the spacecraft's instruments began mapping Mars from above, ushering in a new era of planetary exploration.

In the months following its arrival, Mariner 9 provided humanity's first close-up views of Mars, revealing previously unseen features like massive volcanoes, vast canyon systems, and channels that hinted at ancient water flow. These images marked a pivotal scientific achievement, transforming our understanding of Mars and fueling new questions about the planet's potential for past or present life. Mariner 9's success laid the groundwork for a host of future missions, setting a precedent for interplanetary exploration that endures to this day.

The mission's accomplishments established Mars as a primary target for scientific study, inspiring cooperation and technological innovation. Since Mariner 9, numerous missions from NASA, ESA, and other space agencies have ventured to Mars, each building on the discoveries initiated by this historic orbiter. Today, the collective knowledge gained has expanded significantly, with orbiters, landers, and rovers working in unison to decode Mars' complex history.

As of 2024, Mariner 9's legacy continues through ongoing missions that build on its foundation, including efforts to investigate Mars' geology, climate, and potential for sustaining life. The Mariner 9 mission remains a landmark achievement, symbolizing humanity's drive to explore beyond Earth and uncover the secrets of our neighboring planets.

LIFE AT SPACE

Celebrating Diwali 'The festival of Lights'

On October 26th, we came together to celebrate one of India's most cherished festivals—Diwali. Known as the festival of lights, Diwali isn't only a time for family gatherings but also a valuable opportunity for teams to connect, celebrate, and strengthen bonds. In today's diverse and inclusive workplaces, celebrating Diwali in the office promotes cultural awareness, boosts employee morale, and fills the atmosphere with festive joy.

Our entire office was beautifully adorned with marigold garlands, torans, bandhanwars, and paper lanterns. The celebrations began with virtual games to include our remote team members, ensuring everyone felt part of the festivities. These fun-filled games, hosted by HR team, were enjoyed by all.



Following this, we held a Rangoli and departmental room decoration competition. Each department put in impressive effort, showcasing creative decorations and vibrant rangolis. Afterward, our management team visited each department to select the winners, adding excitement to the day.



The main event kicked off with a mesmerizing ramp walk and dance performance by Vikas Mishra from the Operations team, which captivated everyone. A delicious lunch followed, featuring a blend of traditional Indian Flavors and festive dishes, adding to the day's charm. The fun continued with a spirited game of musical chairs, complete

with a unique twist. We divided into two teams of nine, creating a lively atmosphere that brought back childhood memories and strengthened team bonds. The most anticipated moment of the day was the announcement of the winners. The Educators team took home the prize for the Rangoli competition, the Outreach team won for best decoration, Muskan from the Admin Department was awarded Best Dress-Up (Female), and Neeraj Rohila from Operations team received Best Dress- Up (Male).



To keep the festive spirit high, we set up a dance floor where traditional Diwali tunes blended with contemporary beats, creating an uplifting environment that encouraged team bonding and celebrated cultural vibrancy.

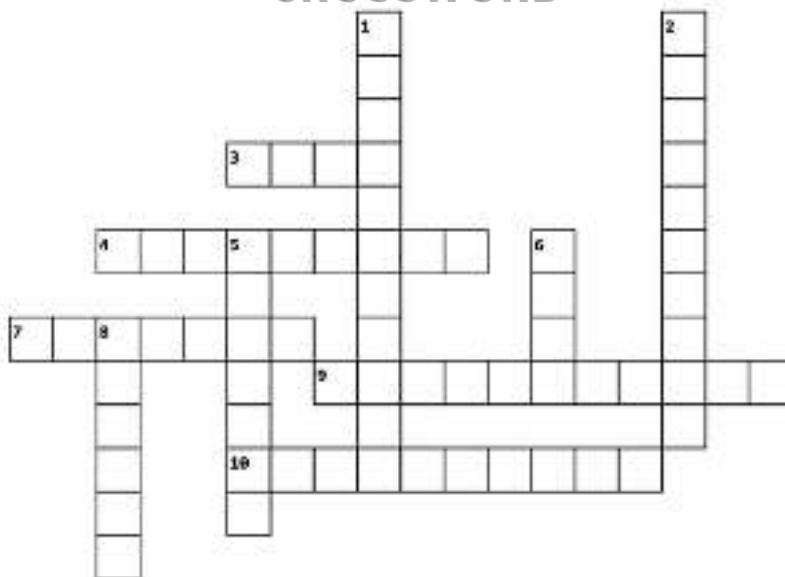


The event concluded with a snack party and gift distribution, closing the day on a high note. These celebrations reminded us that such occasions go beyond festivities; they are essential for building a positive, collaborative work environment.

As we wrapped up Diwali, we carry forward the spirit of positivity, teamwork, and growth for the months to come.

TRAIN YOUR BRAIN

CROSSWORD



Across

3. What moon is speculated to have rings?
4. What gas, discovered in 2020, could be a potential biomarker in Venus's atmosphere?
7. In Ancient China, which mythological creatures were comets compared with?
9. What type of rocket is used for the Europa Clipper mission?
10. What is the official term for the spider-like terrain on Mars?

Down

1. What is the name of the first commercial spacewalk mission?
2. What is the name of India's first Venus mission?
5. What ancient timekeeping device can the wheels of the Konark Sun Temple be used as?
6. Which spacecraft of NASA studied the dwarf planet Ceres?
8. In which crater did Chang'e 6 collect lunar samples?

Astronomy Word Puzzle

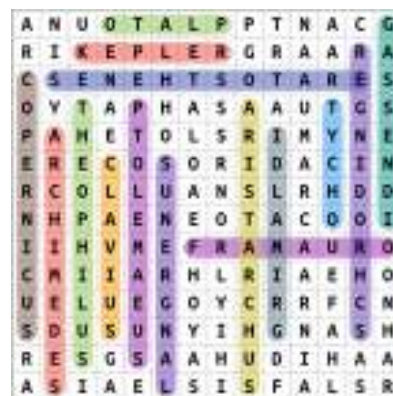
Find the Craters from the mixed letters and mark them.

Nebulae



NORTH AMERICA
HELIX
COCCON
CALIFORNIA
ROSETTE
DUMBBELL
BUBBLE
EAGLE
CRAB
LAGOON
ORION
CARINA
HORSEHEAD
FLAME
TARANTULA

Answers for last month puzzles.



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

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