

Galactica

Astronomy and Space Science Magazine



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

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ABOUT SPACE



Legacy of 24 years



Pioneer Organization



1000+ 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



**Mr. Shivam Gupta,
MD, SPACE**

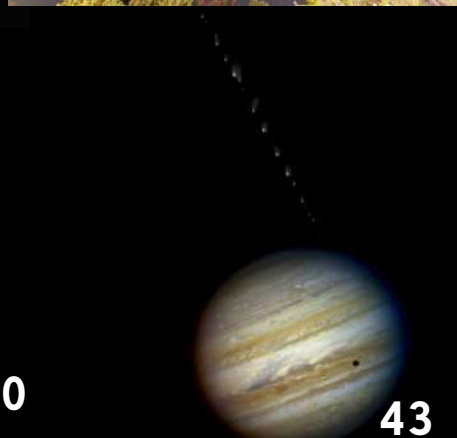
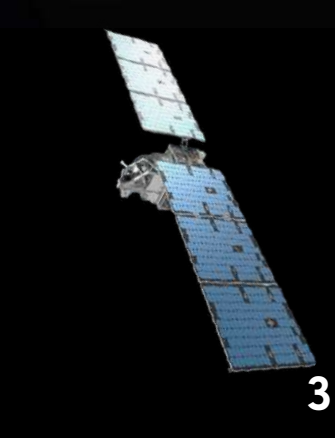
Education is integral to humankind growth and it strongly contributes towards innovation and developments. Space is transforming India to provide better learning opportunities through Experiential and Hands-on learning in the very niche field of Astronomy and Space Science. Our mission to build from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

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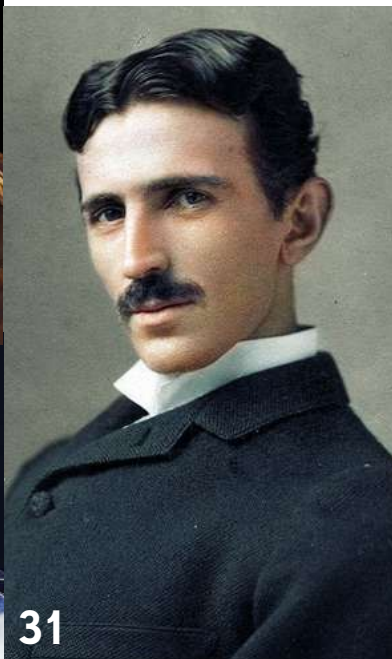
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SPACE INSIGHTS

ASTRO CARNIVAL, MUMBAI

Space India organized an exciting Astro Carnival on the 30th of June (Asteroid Day, 116th anniversary of Tunguska event) aimed at promoting astronomy and educating the public about the wonders of the universe. The event was in collaboration with Dr Bhau Daji Lad Museum to spread awareness about Asteroids and celebrate Asteroid day 2024. This location likely offers high foot traffic, allowing Space India to reach a large and diverse audience. This approach provided an opportunity for meaningful interactions and discussions with the public.

Space India's vision for its scientific outreach program is to ignite a passion for exploration and discovery, empowering individuals to delve into the depths of the cosmos. Our goal is to not only impact the scientific community but also inspire the next generation of astronomers and space enthusiasts. By fostering curiosity and providing engaging experiences in astronomy and science education, we aim to add a touch of excitement and wonder to the journey of understanding and resolving the mysteries of the universe.



Mr. Arvind Paranjpye, the Director of Nehru Planetarium, Mumbai, and Ms. Swati Kalwar, the former CEO of the Energy Swaraj Foundation, graced the event as distinguished dignitaries. The event commenced at 11 am with the arrival of guests. Mr. Paranjpye delivered an engaging address to the students, setting the stage for an interactive session where the educator informed them about asteroids and their potential impact on Earth. The session concluded with a stimulating quiz competition, allowing students to test their newfound knowledge in a fun and competitive manner. The event featured a diverse range of engaging activities designed to captivate attendees of all ages and backgrounds.

Arvind Paranjpye commented: "I am delighted to be at SPACE India's Astro Carnival. This is a commendable initiative. The team has travelled all the way from Delhi to Mumbai. I extend my best wishes to Dr. Sachin Bahmba, Founder of SPACE Group, and Ms. Shalini Bahmba, Co-Founder of SPACE Group. Their outreach programs have made a significant impact."

One of the highlights of these events was the comet-making activity, where participants had the opportunity to learn how comets are formed. This hands-on experience allowed audience to create their own miniature comets, gaining insight into the composition and characteristics of these celestial objects. The activity not only provided a fun and interactive way to understand comets but also sparked curiosity about the science behind them.



Another fascinating activity was the AR VR (Augmented Reality Virtual Reality), where the public had access to VR headsets enabling experiences that range from realistic simulations to entirely fantastical realms. This experience allowed participants to float in space. They observed International Space Station, Sun, Satellites, Stars and Milky way in a simulation. They were awestruck while describing their experiences and thought the idea of inculcating astronomy with such technology is wonderful.



Additionally, there was an activity of Solar system hunt. Attendees could experience firsthand the differences in sizes of the planets, while hunting them down in the museum's area. This interactive treasure hunt not only educated the public about the varying sizes and features on different planets but also made the learning process engaging.

The event attracted a diverse crowd, over 1000 people of all ages showing keen interest and asking numerous questions about space and astronomy. Several Mumbai schools, including Ideal English School, Thane; Ryan International School, Panvel West, St. Joseph's High School, Panvel West and St. Joseph's High School, Khanda Colony New Panvel (W), were present at the event. It was a tremendous success, with a large turnout of enthusiastic attendees. Parents praised our efforts in educating young minds and spreading awareness about space and astronomy.



MONTHLY TELESCOPIC OBSERVATION

SPACE ARCADE team conducted 2024's 6th Monthly Telescopic Experience session on the 15th of June 2024 in Delhi.

People from various places joined the observation with their telescopes, binoculars, and other astronomical equipment. They learned and experienced the breathtaking view of the Moon and planet Beehive Cluster. They also learned about different types of telescopes and cleared all their queries on the Alignment of various telescopes then did basic Astrophotography.

Everyone had their hands-on telescopic experience and enjoyed the view of the moon and its craters through the 8" Dobsonian telescope, 130EQ mount telescope and Schmidt-Cassegrain telescope set up by the SPACE team.



Visit: www.spacearcade.in

TELESCOPE SE MOON DEKHA KYA?



Astronomy Ka Asli Mazaa, Telescope Se He Aata Hai - Ad Film Featuring:
Sanjana Sanghi (Actor & UNDP Youth Champion).

Watch the beautiful moment between siblings and how the right equipment can spark curiosity and fascinate you and your loved ones. Every time you are at your balcony or while traveling to your favorite destinations, whether in the middle of the woods or next to the ocean, just point your Telescope to the sky & explore the universe.

We are also thrilled to announce the launch of our new website. Check out our website's fresh look and seamless user experience and enjoy the stunning visuals of the cosmos while browsing our website. Explore now at www.spacearcade.in and purchase Telescope, Binoculars and Accessories at best prices with great customer service.

#SeeBeyondTheWorldWeLiveIn

Purchase now and use Coupon Code on our website: **'SANJANA500'**
& get an Instant Discount of ₹500 on minimum purchase of ₹10,000/-.



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UNVEILING THE BEAUTY OF

LADAKH WITH ASTROPORT

Nestled in the heart of the Himalayas, Ladakh is renowned for its stark landscapes, towering mountains, and serene monasteries. However, beyond its breathtaking terrestrial beauty, Ladakh offers a celestial spectacle that is equally mesmerizing because the Ladakh is based above the clouds which are the main reason of the light pollution. Astroports are the first concept-based unique tourism destinations in India focusing on experiential learning. The strategically designed serene sites are located in nature's lap far away from the polluted cities with a heavy twinkling sky above. With Astroport, visitors can now delve into the cosmic wonders of Ladakh like never before.

Astroport's stargazing experience in Ladakh is unparalleled. The region's high altitude and minimal light pollution create the perfect conditions for clear, star-studded skies. Astroport capitalizes on this natural advantage, providing state-of-the-art telescopes and expert guidance to unveil the secrets of the universe. Whether you are an avid astronomer or a curious traveler, Astroport's well-curated sessions cater to all levels of interest and expertise in three of the prime locations i.e. Leh, Nubra and Pangong. Astroport in Ladakh is more than just an astronomical adventure; it is an invitation to reconnect with the cosmos. Embrace the magic of Ladakh's night sky and let Astroport guide you through a celestial odyssey that will leave you starry-eyed and inspired.

Astroports are built to provide not only the comforts and facilities of a 'conventional' tourist destination but also lead to exploring and learning through well researched and well-presented programs/activities. Imagine reclining under the vast, inky sky, watching as constellations, planets, and distant galaxies reveal themselves with serene beauty of Nubra valley and Pangong Lake. Astroport's knowledgeable guides enrich the experience with engaging narratives, turning each stargazing session into a journey through space and time. From spotting the rings of Saturn to tracing the Milky Way, every moment is a blend of education and awe. Astroport's dedicated efforts with Kailash Expeditions have transformed Ladakh into a premier destination for astronomical tourism, merging the wonders of the universe with the region's serene beauty.



UNISTELLAR

THE NEW FRONTIER OF ASTRONOMY

Now with Smart Telescopes introducing a new addition to our state of the art facilities for stargazing in India "UNISTELLAR EVSCOPE 2"



RING NEBULA (EVSCOPE 2)

Now explore space without limits at Astroport - India's most loved stargazing destinations.

Unistellar 2, the latest innovation in astronomical technology, revolutionizing the way we explore the night sky. Building on the success of its predecessor, Unistellar 2 offers enhanced

features that make stargazing accessible and engaging for both amateur astronomers and seasoned stargazers. Equipped with cutting-edge optics and advanced image processing, Unistellar 2 delivers crystal-clear views of celestial objects featuring a digital eyepiece designed in collaboration with NIKON, the EVSCOPE 2 is the most advanced, most immersive smart telescope on the market. Its user-friendly interface and automated tracking system simplify the process of locating and observing stars, planets, and galaxies.

One of Unistellar 2's standout features is its ability to filter out light pollution, providing crisp, detailed views even in urban environments.



RING NEBULA (MEADE LX (90))

The telescope's smart technology connects seamlessly to smartphones, allowing users to capture stunning images and share their discoveries in real-time. Premium high-precision optics coupled with a highly sensitive digital sensor and the live image-processing capability of an onboard computer. This innovation ensures that everyone, regardless of location, can experience the wonders of the universe. Unistellar EVSCOPE 2 is not just a telescope; it's a gateway to the stars, inspiring curiosity and expanding our understanding of the cosmos. Embrace the future of stargazing with Unistellar EVSCOPE 2 and embark on a journey through the universe like never before with Astroport at Namah Resort.

Guest Feedback - Observing Deep Sky objects with such clarity was simply astounding.

PROJECT PARIDHI JULY 2024: A FLAGSHIP PROJECT OF SPACE



On June 19th, 2024, the Edtech team of SPACE India conducted Project Paridhi for our young and enthusiastic iAstronomers. This immersive learning experience aimed to provide practical astronomy training, specifically exploring how to determine the circumference of the Earth with simple backyard tools. The session began with an explanation of the history and fundamentals of the Project Paridhi, including celestial measurements and calculations. iAstronomers were introduced to tools like the gnomon stick, drawing board and pins, pencil, ruler, white sheet, and calculator, all essential for measuring shadows accurately and precisely. The goal was to find the shortest shadow cast at local noon during the summer solstice, which is a crucial part of the experiment.

The Edtech team guided the iAstronomers step by step to set up their experiments. On June 21st, iAstronomers aligned the gnomon rod to cast its shadow precisely at noon, recorded the shortest shadow length, and noted the exact time. They gathered essential data and performed calculations using mathematical formulas.

Using the acquired data, iAstronomers applied the ancient formula derived by Eratosthenes, which relates the angle of the sun's rays at different locations on Earth to determine its circumference. This mathematical exercise reinforced their understanding of the formula and geometry while highlighting the practical applications of astronomy in everyday life.

Project Paridhi concluded with iAstronomers eagerly discussing their findings and insights. The project significantly highlighted the importance of hands-on learning in fostering scientific curiosity and critical thinking among future astronomers.

As participants departed, inspired and empowered, they carried with them newfound knowledge and a deeper appreciation for the wonders of astronomy and the scientific method. They also felt a sense of responsibility to share their learnings with the community, create a meaningful impact, value scientific exploration and discovery, and contribute to a more informed and scientifically aware society.



MOONLIT MARVELS

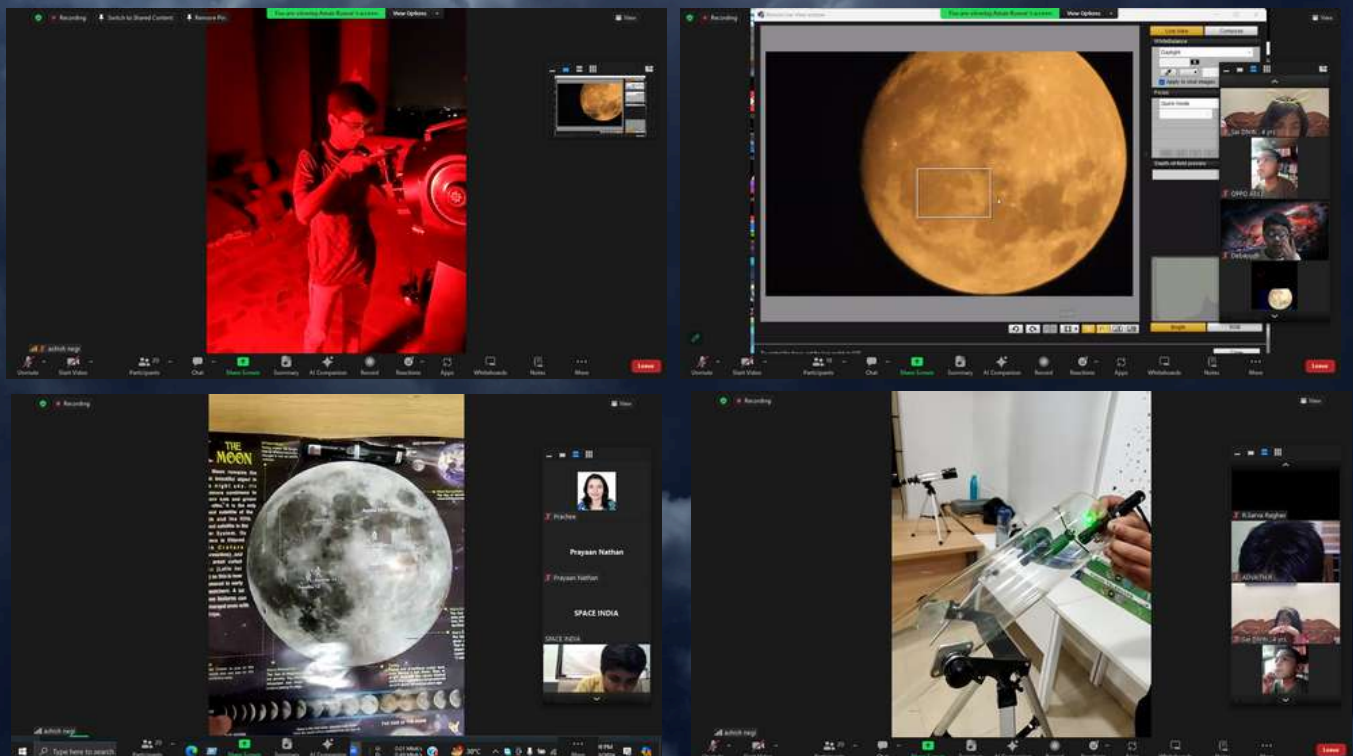
iASTRONOMER

On the evening of June 20th, 2024, the iAstronomer Club organized a highly anticipated physical meet, bringing together astronomy enthusiasts for an engaging Moon observation session complemented by various astronomical activities. Held from 7:00 PM to 8:30 PM, the event was a perfect blend of hands-on telescope experience and interactive educational activities.

Participants had the opportunity to observe the Moon through a variety of telescopes, including a Celestron 6SE (6-inch Schmidt-Cassegrain), Meade LX200 (10-inch Schmidt-Cassegrain), an 8-inch Newtonian Dobsonian, and a 50 mm refractor. These telescopes provided stunning views of the lunar surface, showcasing craters, maria, and other features with remarkable clarity. The iAstronomers enjoyed watching the Moon through these different telescopes, each offering a unique perspective and adding to the overall excitement of the event.

In addition to the telescope observations, the event featured several engaging activities designed to enhance participants' understanding of astronomy. Attendees used moon maps to identify and mark lunar features, learned to determine their latitude using simple tools, and practiced using a planisphere to identify stars and constellations. A session on smartphone astrophotography taught participants how to capture celestial objects using their smartphones, adding a modern twist to the traditional observation methods.

The iAstronomer Club's physical meet was a resounding success, offering a rich and varied experience that deepened attendees' appreciation and understanding of the Moon and astronomy. The event was successful as it was attended by more than 20 iAstronomers. The club looks forward to organizing more such events in the future, fostering a community of passionate and knowledgeable astronomers.



iAstronomers clicked photograph of Moon with the help of Phone camera and learnt about the working of the Reflector Telescope, features of the Moon and were briefed on the different aspects of Moon

ASTERIODS & INSIGHTS : A STELLAR EVENING WITH ARUSHI NATH



On June 29, the iAstronomer club held an engaging 'Ask an Astronomer' event to celebrate Asteroid Day, aiming to raise public awareness about the potential danger posed by asteroids, or 'near-Earth objects.' The special event featured Arushi Nath, the 2023 Young Astronomers Award Winner of the Royal Astronomical Society of Canada. The session was moderated by iAstronomer's very own Myraa Khattar, who expertly guided the discussion.

The event began with an introduction to Asteroid Day and its significance, highlighting the global effort to educate the public on asteroid threats. Arushi Nath shared her journey as an astronomer, delving into her passion for studying asteroids and her notable achievements, including her award-winning discoveries.

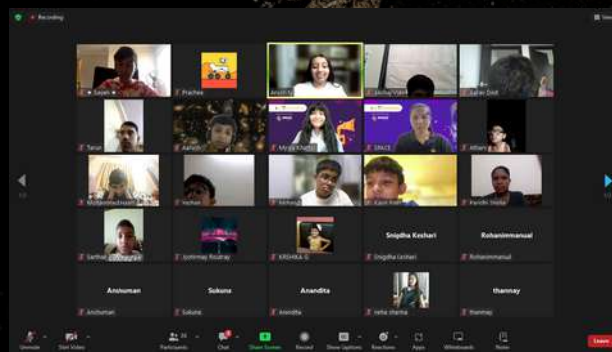
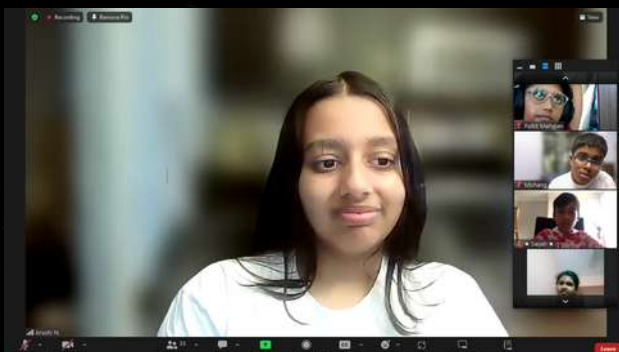
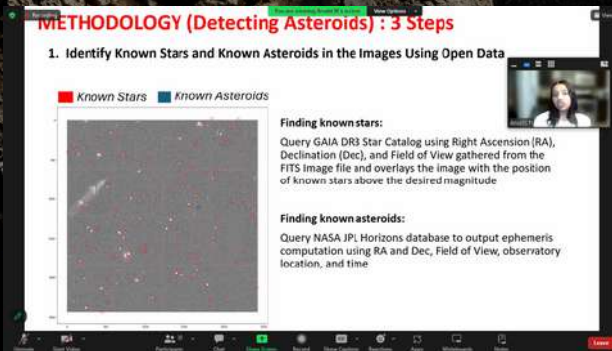
The discussion covered a variety of topics, starting with the asteroid belt, the region between Mars and Jupiter where most asteroids are found. Arushi explained the different types of asteroids, their composition, and how they are categorized based on their proximity to Earth. She also addressed the potential threats these celestial bodies pose and the measures being taken to monitor and mitigate these risks.

One of the most captivating parts of the event was when Arushi shared her personal experiences in discovering asteroids. She described the meticulous process of identifying and tracking these objects, emphasizing the importance of collaboration and technological advancements in her work. Her insights provided a fascinating glimpse into the life of a young astronomer making significant contributions to the field.

The Q&A round was a highlight, allowing participants to interact directly with Arushi. iAstronomers asked a range of questions, from technical details about asteroid tracking to personal inquiries about her journey and future aspirations. Arushi's thoughtful and enthusiastic responses made the session both informative and inspiring.

The event was a resounding success, attended by over 40 participants. The interactive format and Arushi Nath's engaging presence made it a memorable experience for all. iAstronomers left the event with a deeper understanding of asteroids and a renewed passion for astronomy.

In conclusion, the iAstronomer club's 'Ask an Astronomer' event with Arushi Nath was a testament to the power of knowledge-sharing and community engagement. It not only celebrated Asteroid Day but also inspired budding astronomers to pursue their curiosity about the cosmos.



ASTEROID DAY 2024: CELEBRATING CELESTIAL WONDERS

i**AS**TRONOMER

Asteroid Day, observed annually on June 30, took on a particularly vibrant hue in 2024 with a series of engaging and educational events hosted by Space India. This global event, dedicated to raising awareness about asteroids and the potential hazards they pose, saw active participation from enthusiasts of all ages, fostering a spirit of curiosity and learning.

Space India orchestrated a suite of online competitions that captured the imaginations of the young generation. For seniors, the "Celestial Sculpt Off-Crafting Asteroid Worlds" challenged participants to create detailed models of asteroids, showcasing their understanding of these celestial bodies' composition and structure. The entries ranged from scientifically accurate depictions to imaginative interpretations, all reflecting a deep engagement with the subject matter and a keen eye for detail. Moreover, juniors participated in the "Asteroid Prep Talk Showdown," where they shared their videos and demonstrated their knowledge and communication skills by presenting compelling talks on asteroids. This competition not only highlighted the importance of awareness but also encouraged the development of public speaking and critical thinking skills among young participants. Their speeches underscored the need for innovative solutions and global cooperation in addressing potential asteroid threats.

The youngest enthusiasts enjoyed the "Artistic Adventure with Asteroids" competition. This event invited kids to express their fascination with asteroids through doodle art. The resulting pieces, bursting with creativity and curiosity, were a testament to the boundless enthusiasm that space exploration can inspire. From impressive doodles to intricate crafts, the children's works showcased a delightful blend of imagination and scientific intrigue.

The competitions saw participation from iAstronomers and other space enthusiasts who brought their passion and expertise to the forefront. The competition attracted iAstronomers and space enthusiasts, who showcased their passion and skills. By joining these events, they unlocked new opportunities for learning and discovery. Participants engaged in exciting challenges, gained valuable insights, and broadened their knowledge about space. These competitions fostered a community of curious minds eager to explore the universe.

Asteroid Day 2024, with its blend of science, creativity, and community engagement, was a stellar success. The event fostered a deeper understanding of asteroids and their significance, while also inspiring the next generation of space explorers. By combining education with creativity, Space India managed to create an event that was both informative and entertaining, further cementing Asteroid Day's role in educating and inspiring minds across the globe.



HIGHLIGHTS OF JULY 2024

CHINA LANDS CHANG'E 6 SAMPLE-RETURN PROBE ON FAR SIDE OF THE MOON



A depiction of China's Chang'e 6 moon lander on the far side of the moon after landing on June 2, 2024. (Images source: CNSA)



The drilled surface of the moon seen in a photo released by China's lunar mission.

According to Chinese space officials, the robotic Chang'e 6 mission landed inside Apollo Crater, in the massive South Pole-Aitken basin, at 6:23 a.m. Beijing Time on Sunday (June 2). The landing took place at 6:23 p.m. EDT (2223 GMT) on June 1. The probe "successfully landed in the pre-selected area," China's space agency announced.

The China National Space Administration (CNSA) now has two far-side landings under its belt: this one and Chang'e 4, which landed a lander-rover combination on the grey dirt in January 2019. No other country has done it once.

On Tuesday, the Chang'e-6 lunar probe departed from the moon's far side, bringing the country one step closer to completing an ambitious mission that highlights its growth as a space superpower. In a momentous moment before takeoff, China reportedly became the first country to put its national flag on the moon's far side, which is perpetually facing away from Earth.

The mission, carrying the first lunar rocks ever recovered from the moon's far side, blasted off and entered lunar orbit early Tuesday Beijing time, following successful sample collection over the previous two days, according to a China National Space Administration (CNSA) release.

Its return to Earth is projected to take roughly three weeks, with a landing in China's Inner Mongolia region around June 25. The successful return of the samples would offer China an early advantage in capitalizing on the geopolitical and scientific benefits of expanding lunar exploration - an increasingly competitive field that has contributed to what NASA chief Bill Nelson refers to as a new "space race."

This is China's second lunar sample collection, following the return of rocks from the near side by the Chang'e-5 in 2020. The Chang'e-6 probe passed "the test of high temperatures" and collected samples by drilling into the moon's surface and picking up soil and rocks with a mechanical arm. After gathering the specimens, Chang'e-6 raised the Chinese flag using a robotic arm.

Engineer Zhou Changyi stated that the granite was crushed, melted, and pulled into filaments roughly one-third the diameter of a human hair, which were then spun into thread and stitched into cloth.

Voyager 1 is back online! NASA's most distant spacecraft returns data from all 4 instruments

NASA's Voyager 1 spacecraft has resumed normal science operations for the first time since a technical glitch developed in November 2023. More specifically, it began broadcasting nonsensical data to Earth rather than the usual binary code of 0s and 1s. Of course, Voyager 1 is 46 years old, which is ancient for a spaceship, so it's not surprising that its health may be deteriorating.

The crew partially rectified the issue in April when they instructed the spacecraft to begin providing engineering data, which included information about the spacecraft's health and state. On May 19, the mission team completed the second phase in the repair process, sending a command to the spacecraft to begin returning science data. Two of the four science instruments resumed their normal operations immediately. Two more instruments required extra work, but all four are now producing valid scientific data.

The four instruments investigate plasma waves, magnetic fields, and particles. The only spacecraft to directly sample interstellar space are Voyager 1 and Voyager 2, which are located outside the heliosphere, the Sun's protective bubble of magnetic fields and solar wind.

While Voyager 1 is returning to doing science, more minor work is required to mitigate the effects of the problem. Engineers will, among other things, resynchronize timekeeping software on the spacecraft's three onboard computers so that commands can be executed at the appropriate time.

The team will also undertake maintenance on the digital tape recorder, which stores data for the plasma wave experiment, which is relayed to Earth twice a year. (The majority of the Voyagers' scientific data is sent immediately to Earth and not recorded.)

Voyager 1 is more than 15 billion miles (24 billion kilometers) from Earth, whereas Voyager 2 is more than 12 billion miles (20 billion kilometers) away. The probes will celebrate 47 years of operation later this year. They are NASA's longest-running and farthest-reaching spacecraft. Both spacecraft passed Jupiter and Saturn, with Voyager 2 also passing Uranus and Neptune.

Even if Voyager 1 had gone black permanently, the mission would still have been a huge success. After its launch in 1977, its primary purpose was to research Jupiter and Saturn, which was completed by 1980. (The twin spacecraft, Voyager 2, went on to investigate Uranus and Neptune.) But Voyager 1 is on an unstoppable trajectory. Continuing its voyage away from Earth, the spacecraft entered interstellar space in 2012, returning vital information about this enigmatic domain.

Three Craters discovered on Mars by scientists of Physical Research Laboratory

A Scientists from the Physical Research Laboratory (PRL) in Ahmedabad, a subsidiary of India's Department of Space, have discovered three new craters on Mars. The International Astronomical Union (IAU) Working Group for Planetary System Nomenclature has formally designated these craters, which are located at 21.0°S, 209°W in the Tharsis volcanic region. The craters are named for a former PRL Director and two small Indian towns.

The craters are named as follows:

Lal Crater: This approximately 65-kilometer-wide crater is situated at -20.98° and 209.34° . It is named for Prof. Devendra Lal, a well-known Indian geophysicist and former director of PRL, who held the position from 1972 to 1983.

Mursan Crater is located on the eastern edge of the Lal Crater's rim and measures around 10 km in width. It is named after Mursan, a town in Uttar Pradesh, India.

Hilsa Crater, located on the western side of the Lal Crater's rim, is similar in size to the Mursan Crater and around 10 km wide. It was called after the town of Hilsa in Bihar, India.



Three craters of Mars named "Lal," "Mursan," and "Hilsa"(Photo- :X/@PRLAhmedabad)

Sedimentary deposit identified in the crater's subsurface using SHARAD/MRO. This discovery provides solid evidence of considerable water activity on Mars, implying that water carried enormous amounts of sediment into what is now known as the Lal Crater. The entire Lal Crater in the Tharsis volcanic region is covered with lava. Geophysical data supports the presence of materials other than lava, with a 45-meter-thick

This discovery proves that Mars was previously wet, with water flowing across its surface. The two smaller superimposed craters, Mursan and Hilsa, on either side of Lal Crater provide a date for the Lal Crater's infilling process.

This discovery proves that Mars was previously wet, with water flowing across its surface. The two smaller superimposed craters, Mursan and Hilsa, on either side of Lal Crater provide a date for the Lal Crater's infilling process. The evidence implies that this infilling was episodic, which sheds light on the planet's geological past.

ISRO'S REUSABLE LAUNCH VEHICLE COMPLETES THIRD LANDING TEST

On June 23, 2024, the Indian Space Research Organisation (ISRO) happily completed its third consecutive successful Reusable Launch Vehicle (RLV) Landing Experiment (LEX). The third and final test in the LEX (03) series took place at 07:10 IST at the Aeronautical Test Range (ATR) in Chitradurga, Karnataka. RLV LEX-03 proved the RLV's autonomous landing capability under harsher release conditions (cross range of 500 m vs. 150 m for LEX-02) and more severe wind conditions. At a height of 4.5 kilometers, the winged vehicle, called 'Pushpak', was released from an Indian Air Force Chinook helicopter.

Pushpak autonomously executed cross-range correction manoeuvres from a release point 4.5 km from the runway, approached the runway, and executed a precise horizontal landing at the runway centerline. Because of the vehicle's low lift-to-drag ratio aerodynamic configuration, the landing velocity exceeded 320 kmph, which is faster than 260 kmph for a commercial aircraft and 280 kmph for a typical fighter aircraft.

Following touchdown, the vehicle's velocity was reduced to nearly 100 kmph using its brake parachute, after which the landing gear brakes were utilized for deceleration and runway stop. This mission validated ISRO's competence in obtaining the most important technologies needed for the development of a Reusable Launch Vehicle (RLV) by simulating the approach and landing interface as well as high-speed landing conditions for a vehicle returning from space.



This mission has proven the enhanced guidance algorithm that handles error corrections in the longitudinal and lateral planes, which is crucial for the next Orbital Re-entry Mission. Using sensors like as inertial sensors, radar altimeters, flush air data systems, pseudosatellite systems, and NavIC, the RLV-LEX employs multisensor fusion.

Notably, the RLV-LEX-03 mission demonstrated the resilience of ISRO's design capacity to reuse flight systems for many missions by using the winged body and flight systems as such from the LEX-02 mission without any modifications.

This mission aims to replicate the high-speed landing conditions and approach and landing interface of a spacecraft return, hence confirming ISRO's proficiency in obtaining the essential technologies needed for the creation of a Reusable Launch Vehicle (RLV).

The Director of VSSC, Dr. S Unnikrishnan Nair, emphasized that ISRO's confidence in the vital technologies necessary for upcoming orbital re-entry missions is increased by this continuous success. For this mission to be successful, Shri. B Karthik is the vehicle director and Shri. J Muthupandian is the mission director.



ISS 'Superbug' discovery raises 'Health Concerns' for astronauts with Sunita Williams aboard

Researchers from the Indian Institute of Technology-Madras and NASA's Jet Propulsion Laboratory (JPL) are working together to research a 'superbug', a multidrug-resistant virus identified aboard the International Space Station (ISS). This discovery has raised 'health worries' among astronauts, including Sunita Williams, who is currently on board the ISS. The study of this disease could possibly have important applications on Earth.

Enterobacter bugandensis, a prevalent nosocomial pathogen, was found on ISS surfaces. Indian-origin Sunita Williams, 58, and Wilmore, 61, departed for their third space journey on Thursday, June 6. This momentous event marked the first flight to the International Space Station (ISS) with Boeing's Starliner spacecraft. Williams pilots the flight test, while Wilmore is the mission commander. "The current study emphasises the critical need to investigate the pathogenic potential of microorganisms in space environments to safeguard astronaut health and mitigate the risks associated with opportunistic pathogens," the news agency PTI reported an IIT-M announcement as saying.

Researchers undertook a comprehensive study to investigate the genetic, functional, and metabolic enhancements of multidrug-resistant bacteria, with a focus on *Enterobacter bugandensis*. The study emphasizes the critical necessity to investigate the pathogenic potential of microorganisms in space environments in order to preserve astronaut health and reduce risks from opportunistic diseases.

The study's results have interesting implications in controlled Earth environments, such as hospital intensive care units, where multidrug-resistant infections pose considerable issues. Understanding the genetic adaptations of multidrug-resistant *E. bugandensis* can help design tailored antimicrobial therapies. The study found that understanding the persistence and succession patterns of *E. bugandensis* in space can help guide strategies for managing microbial contamination in closed environments such as spaceships and hospitals.

Another study quoted by NASA on *E. bugandensis* emphasized the International Space Station (ISS) as a symbol of human progress in space exploration. Despite the space station's controlled environment, which includes microgravity, elevated carbon dioxide levels, and enhanced solar radiation, microorganisms flourish in a unique niche. These microbes have a significant impact on the health and well-being of astronauts on board. *Enterobacter bugandensis*, which is widely detected in clinical samples such as the human gastrointestinal tract, has been reported to have pathogenic properties, potentially causing a variety of diseases.



This screengrab from NASA shows astronaut Sunita Williams (seated L) and Butch Wilmore (seated R) posing with the crew of the International Space Station (ISS) after the docking of the Boeing Starliner on June 6, 2024. (AFP)



NASA Selects International Space Station US Deorbit Vehicle

NASA said that SpaceX has been chosen to design and construct the U.S. Deorbit Vehicle, which will enable the space station to be deorbited while guaranteeing that no risk to populated regions is encountered. When station operations come to an end, NASA and its foreign partners will be better able to ensure a safe and orderly transfer in low Earth orbit by choosing a U.S. Deorbit Vehicle for the station.

This ruling permits the continuous use of space close to Earth and supports NASA's ambitions for future commercial destinations. "The orbital laboratory continues to serve as a model for space research, collaboration, and science for the good of all." The business will design the deorbit spacecraft, but NASA will acquire ownership and manage it for the duration of its mission. As part of the re-entry process, it is anticipated to destructively break apart together with the space station.

The International Space Station has been operated by five space agencies since 1998: the Canadian Space Agency (CSA), the European Space Agency (ESA), the Japan Aerospace Exploration Agency (JAXA), the National Aeronautics and Space Administration (NASA), and State Space Corporation Roscosmos. Each agency is in charge of overseeing and managing the hardware provided by the other agencies. The station was intended to be mutually reliant and depends on contributions from both parties in order to operate.

Operating the station through 2030 is a commitment made by the United States, Japan, Canada, and the participating nations of ESA. Russia has promised to keep running the station until at least 2028. All five space organizations are in charge of ensuring the International Space Station is kept safely in orbit.

The potential value of the single-award contract is \$843 million in total. A future purchase will be made for the U.S. Deorbit Vehicle's launch service. Thousands of researchers on the ground have carried out over 3,300 microgravity experiments with the crews living on board the station. Lessons learnt aboard the International Space Station are helping to transfer the torch to future commercial stations. The International

Space Station is the cornerstone of space commerce, from commercial crew and cargo collaborations to commercial research and national lab research.

THE SPEED OF SOUND ON MARS IS CONSTANTLY CHANGING, STUDY FINDS

The intricacies of how sound behaves on Mars at different times and locations have been uncovered by researchers, and the findings differ greatly from those of Earth. Multiple microphones are carried by NASA's Perseverance rover on Mars. These instruments have detected a variety of extra sounds, including the unsettling spluttering of Martian dust devils, as they investigate the characteristics of materials on the Red Planet. Sound on Mars already exhibits unusual behavior, according to recordings.

For example, sounds below 240 hertz, or the middle C on a piano, move at a speed of around 30 feet per second (10 meters per second) more slowly than sounds at a higher pitch. This is due to the fact that 95% of Mars' atmosphere is made up of carbon dioxide molecules, which absorb some of the energy of sound at low frequencies. If left unaccounted for, such strange features can jeopardize communications on upcoming Mars missions, especially crewed ones.

The researchers started by compiling data from the Mars Climate Database on a variety of characteristics, such as temperature, chemical composition, and atmospheric pressure, at different locations on the Red Planet. The sound speed and attenuation were measured at various times of the planet's year, or around 687 Earth days, and in diverse locations throughout the Martian terrain, such as valleys and mountain tops.

Because the underlying causes sound fluctuate greatly over time and space, this technique was required. The largest distinction from Earth, however, is the massive daily variations in temperature and, to a lesser extent, carbon dioxide concentration. For example, during the day, the temperature in the region where the Perseverance rover currently resides varies by around 90 degrees Fahrenheit (50 degrees Celsius).

This results in sound traveling at speeds of up to 100 feet per second (30 meters per second) and dissipating three times more quickly during hotter hours than during colder ones. The researchers told Live Science that the findings enable them to "predict the sound speed and attenuation for any location at the Martian surface at any time of year and any time of day." Additionally, the model can help scientists better grasp the true sounds of Mars' sound-producing objects.



Sound on Mars may be the most Earth-like on mountaintops, like the purple mountain seen in this Mars Reconnaissance Orbiter image, according to new research. Elsewhere, the speed of sound varies greatly by location, time of day, and temperature. (Image credit: NASA/JPL-Caltech/Univ. of Arizona)

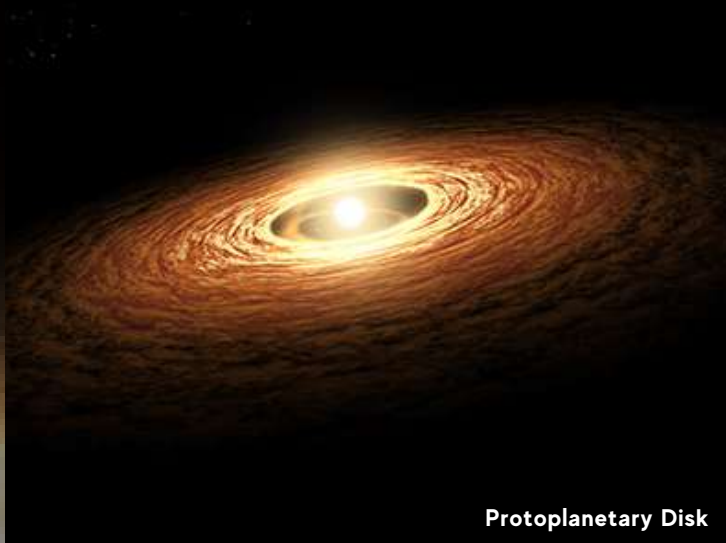
FROM THE EYES OF WEBB – JUNE 2024

Webb Finds Plethora of Carbon Molecules Around Young Star

Planets form in disks of gas and dust orbiting young stars. Observations indicate that rocky planets are more likely than gas giants to form around stars much more lightweight than our Sun. However, depending on conditions within the disk, the planets that form there could be very different from Earth.

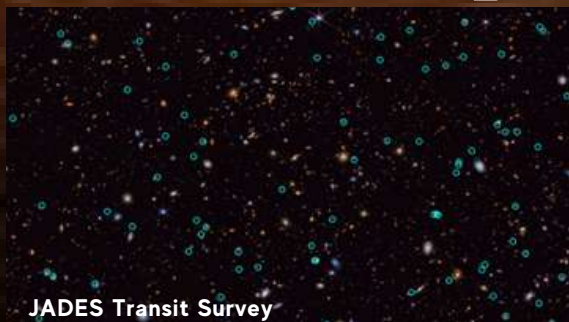
In a new study, astronomers used NASA's James Webb Space Telescope to study a red dwarf star weighing just one-tenth as much as our Sun. No known planets have formed around this young star yet, which is just one to two million years old.

The team found that the gas in the planet-forming region of the star is rich in carbon-bearing molecules. Paradoxically, this means that any rocky planets that form there could be carbon-poor.



Protoplanetary Disk

NASA's Webb Opens New Window on Supernova Science



JADES Transit Survey

A team of astronomers studying JADES data identified about 80 objects (circled in green) that changed in brightness over time. Most of these objects, known as transients, are the result of exploding stars or supernovae. Prior to this survey, only a handful of supernovae had been found above a redshift of 2, which corresponds to when the universe was only 3.3 billion years old – just 25% of its current age. The JADES sample contains many supernovae that exploded even further in the past, when the universe was less than 2 billion years old. It includes the farthest one ever spectroscopically confirmed, at a redshift of 3.6. Its progenitor star exploded when the universe was only 1.8 billion years old.

NASA's James Webb Space Telescope has unveiled 10 times more early universe supernovae than previously known, offering new insights into the cosmos. These findings, presented by Christa DeCoursey at the American Astronomical Society meeting, highlight the detection of supernovae from when the universe was very young. Utilizing the JWST Advanced Deep Extragalactic Survey (JADES) program, the team identified supernovae by analyzing imaging data and noting changes over time. They found about 80 supernovae, including the most distant core-collapse and Type Ia supernovae, crucial for measuring cosmic expansion. The discoveries reveal the nature of early supernovae, aiding the understanding of star formation and explosion mechanisms in the universe's infancy. Webb's sensitivity promises further significant findings in transient science, potentially revolutionizing our knowledge of the early universe.

Investigating the Origins of the Crab Nebula With NASA's Webb



Crab Nebula

A team of scientists utilized NASA's James Webb Space Telescope to analyze the Crab Nebula, a supernova remnant located 6,500 light-years away. Using the MIRI and NIRCams instruments, they gathered data to clarify its history. The Crab Nebula, resulting from a core-collapse supernova in 1054 CE, shows an expanding shell of gas and dust driven by a pulsar. Previously attributed to an electron-capture supernova, the new Webb data suggest its composition could also be from a weak iron core-collapse supernova.

Webb's spectroscopic capabilities provided new measurements of nickel and iron ratios, offering a more accurate understanding of the nebula's origins. The team's findings indicate both electron-capture and weak iron core-collapse scenarios are possible. Further studies are needed to distinguish between these possibilities. Additionally, Webb's observations allowed the team to map the Crab Nebula's dust distribution, revealing it differs from other supernova remnants, with warmer dust in the outer filaments.

First-of-Its-Kind Detection Made in Striking New Webb Image



Serpens Nebula

NASA's James Webb Space Telescope has captured a groundbreaking image of protostellar outflows in the Serpens Nebula using its Near-Infrared Camera (NIRCam). This discovery features jets of gas from newborn stars aligned in the same direction, contrary to previous observations. These jets, appearing as red streaks due to molecular hydrogen and carbon monoxide, offer a direct view of the star formation process.

The Serpens Nebula, 1,300 light-years away, is home to a dense cluster of young stars. Future studies with Webb's NIRSpect will analyze the chemical makeup of these clouds, shedding light on the conditions of star and planet formation.

Pillars of Creation Star in New Visualization from NASA's Hubble and Webb Telescopes

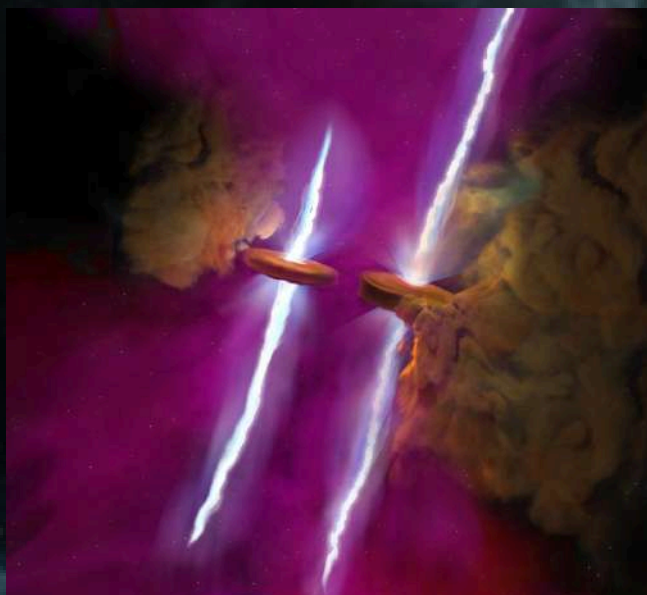


Pillars of Creation(Eagle Nebula)

The Pillars of Creation, a stunning feature within the Eagle Nebula, gained fame through NASA's Hubble Space Telescope in 1995. Recently, NASA released a groundbreaking 3D visualization using data from both the Hubble and James Webb space telescopes. This detailed visualization showcases the pillars in both visible and infrared light, revealing their complex structures and star-forming regions. Led by Frank Summers and based on research by Anna McLeod, the project provides an immersive experience, illustrating the complementary capabilities of Hubble and Webb.

The visualization, part of NASA's Universe of Learning initiative, is designed to engage audiences of all ages, offering insights into star formation and nebular science. It also includes a 3D printable model, further enhancing the educational experience. The Hubble Space Telescope, a joint NASA and ESA project, continues to contribute to our understanding of the universe after more than three decades of operation.

NASA's Webb Reveals Long-Studied Star Is Actually Twins



NASA's James Webb Space Telescope revealed a surprising discovery in the WL 20 star group, previously studied since the 1970s. Using the Mid-Infrared Instrument (MIRI), researchers found that what was believed to be one star, WL 20S, is actually a pair of stars formed 2-4 million years ago. The discovery, presented at the 244th American Astronomical Society meeting, also showed matching jets of gas from the stars' poles. Additional observations by the Atacama Large Millimeter/submillimeter Array (ALMA) revealed disks of dust and gas around both stars, indicating potential planet formation.

The findings offer new insights into the stars' transition from youth to adulthood. The combined power of Webb and ALMA highlights the critical stages in star formation and the life cycle of stars, providing unprecedented data and exciting prospects for future discoveries.

SATURN IN MYTHOLOGICAL TRADITIONS AROUND THE WORLD

Saturn, the Roman god of agriculture, time, and wealth, has parallels in various mythological traditions across the globe. The following explores the stories related to Saturn in ten different cultures, highlighting the common themes and unique interpretations each culture brings to this mythological figure.

Roman Mythology

Saturn

In Roman mythology, Saturn is revered as the god of agriculture, time, and wealth. He is most famously associated with the Golden Age, a mythical period of peace and prosperity where humanity lived in harmony with nature. A dark aspect of Saturn's myth is his act of devouring his children to prevent them from overthrowing him, mirroring the Greek myth of Cronus. This narrative underscores the themes of power and the cyclical nature of time.

Greek Mythology

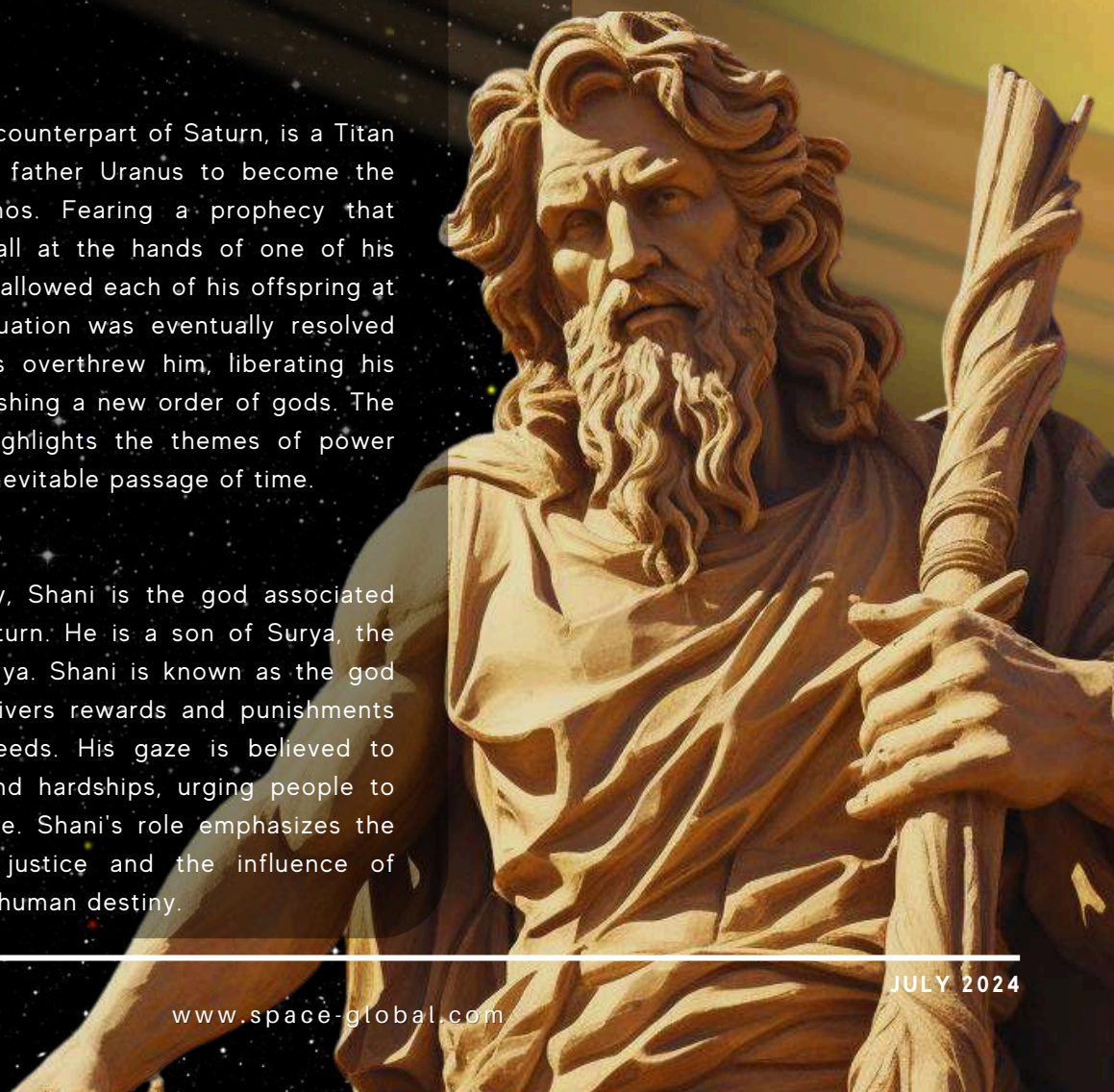
Cronus

Cronus, the Greek counterpart of Saturn, is a Titan who overthrew his father Uranus to become the ruler of the cosmos. Fearing a prophecy that foretold his downfall at the hands of one of his children, Cronus swallowed each of his offspring at birth. This dire situation was eventually resolved when his son Zeus overthrew him, liberating his siblings and establishing a new order of gods. The story of Cronus highlights the themes of power struggles and the inevitable passage of time.

Hindu Mythology

Shani

In Hindu mythology, Shani is the god associated with the planet Saturn. He is a son of Surya, the Sun god, and Chhaya. Shani is known as the god of justice, who delivers rewards and punishments based on one's deeds. His gaze is believed to bring challenges and hardships, urging people to lead a righteous life. Shani's role emphasizes the moral aspects of justice and the influence of celestial bodies on human destiny.



Mesopotamian Mythology

Ninurta

Ninurta, a god of war, hunting, and agriculture in Mesopotamian mythology, is associated with Saturn. Worshipped in the Sumerian, Akkadian, and Babylonian traditions, Ninurta is known for slaying the demon Asag and using his victories to bring order and fertility to the land. This narrative connects Saturn's attributes with themes of agricultural prosperity and the maintenance of cosmic order.

Egyptian Mythology

Horus

In Egyptian mythology, while not directly associated with Saturn, Horus the Elder, a sky god, is linked to time and seasons, aligning with some attributes of Saturn. Additionally, the Egyptians identified Saturn with Horus the Bull (Horus the Elder). This association reflects the Egyptian emphasis on celestial cycles and their influence on agricultural and temporal rhythms.

Chinese Mythology

Zhen Xing

In Chinese mythology, Saturn is associated with the star Zhen Xing and is part of the Five Planets (Wu Xing), each connected to an element and direction. Zhen Xing corresponds to the earth element and is linked to stability and authority. This connection underscores the importance of Saturn in maintaining cosmic balance and order in Chinese cosmology.

Japanese Mythology

Dosei

In Japanese mythology, Saturn is known as Dosei. While there isn't a rich mythological narrative comparable to other cultures, Dosei is associated with the element of earth and is part of traditional Japanese cosmology influenced by Chinese astrology. This highlights the cultural integration of astrological knowledge and its significance in understanding the natural world.

Aztec Mythology

Tlaloc, the Aztec god of rain and fertility, shares attributes with Saturn in terms of agricultural influence. The Aztecs observed planetary movements, including Saturn, to guide their agricultural practices and religious ceremonies. This connection underscores the importance of celestial bodies in ensuring agricultural prosperity and sustaining life.



The Stories in the Stars

Stories are a series of connected events told through various forms of media. Anything can be a story, and it can occur during any period. They add value to human culture overall and allow us to understand our world better while helping us navigate the complexities of life. Stories entertain, inspire and teach us. It is also the oldest form of escapism and the most important part of life.

Storytelling comes alive at night. During the day, practical matters took over, but at nighttime, when there was limited light and little entertainment, storytelling ruled. Thus, it is not a surprise that the bright beacons of light that shone down on us got interwoven with our stories.

The stars have been revered as gods while being used to track seasons and navigate the world. Ever since humans walked the Earth, we have given the celestial objects in the sky a lot of power. Cultures have, throughout history, given names and mythical stories to its brightest objects.

Pleiades are one such object.

Pleiades is an open star cluster, of which we can see 6 individual stars. Yet, many cultures consider the cluster to have 7 stars, while utilising stories to explain why we can see only 6 visible stars. It's believed that once we could observe 7 individual stars in the Pleiades cluster until one of the stars 'disappeared'. To explain this disappearance, we created a story to explain what happened.

Stories about the stars could also help us track human migration.

The asterism Big Dipper is seen as a bear in many cultures across Eurasia. In particular, the traditional stories of the Serbians in Eastern Russia have the Big Dipper as a Bear being chased by 3 hunters and a bird. Across the straits, throughout the North American continent, the indigenous population have similar stories for the Great Dipper. Given that there is existing evidence that humans crossed over the ancient land bridge in the sea between modern-day Russia and Alaska, it will not be far-fetched that one of the items carried through was the stories of the stars.

WHAT'S UP IN THE SKY - JULY 2024

LUNAR CALENDAR

MOON CALENDAR JULY 2024

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.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5 NEW	6
7	8	9	10	11	12	13 FIRST
14	15	16	17	18	19	20
21 FULL	22	23	24	25	26	27
28 LAST	29	30	31			

PLANETS VISIBILITY

Mercury
Evening planet, not optimally placed. Best visible at mid of the month.



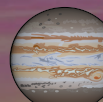
Venus
Evening planet, not easily visible for this month.



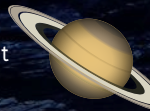
Mars
Morning planet near Jupiter. In close conjunction with Uranus on 15 July.



Jupiter
Improving morning planet. Impressive scenes towards end of July with Jupiter close to Mars and crescent Moon, against the stars of Taurus.



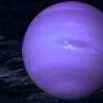
Saturn
Morning planet, best visibility occurs at the end of the month.



Uranus
Morning planet in conjunction with Mars on 15 July.



Neptune
Improving morning planet, best seen at the end of July.



BRIGHT DEEP SKY OBJECTS

M4 located in the constellation Scorpius, is a huge, spherical collection of stars known as a globular cluster. Just 5,500 light-years away, it is the closest globular cluster to Earth. Because of its apparent magnitude of 5.9 and proximity to Antares, one of the brightest stars in the night sky, M4 is relatively easy to find with a small telescope.



Lagoon Nebula (M8) was discovered in 1654 by the Italian astronomer Giovanni, sought to catalog nebulous objects in the night sky so they would not be mistaken for comets. 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.

Discovered in 1702 by the German astronomer Gottfried Kirch, M5 is one of the oldest globular clusters in the Milky Way galaxy. With an apparent magnitude of 6.7 and a location 25,000 light-years away in the constellation Serpens, M5 appears as a patch of light with a pair of binoculars and is best viewed during July.



Messier 83 also known as the Southern Pinwheel Galaxy is a barred spiral galaxy approximately 15 million light-years away in the constellation borders of Hydra and Centaurus. It is one of the closest and brightest barred spiral galaxies in the sky. With a magnitude of 7.5 and is one of the brightest spiral galaxies in the night sky.

ASTRONOMICAL EVENTS - JULY 2024

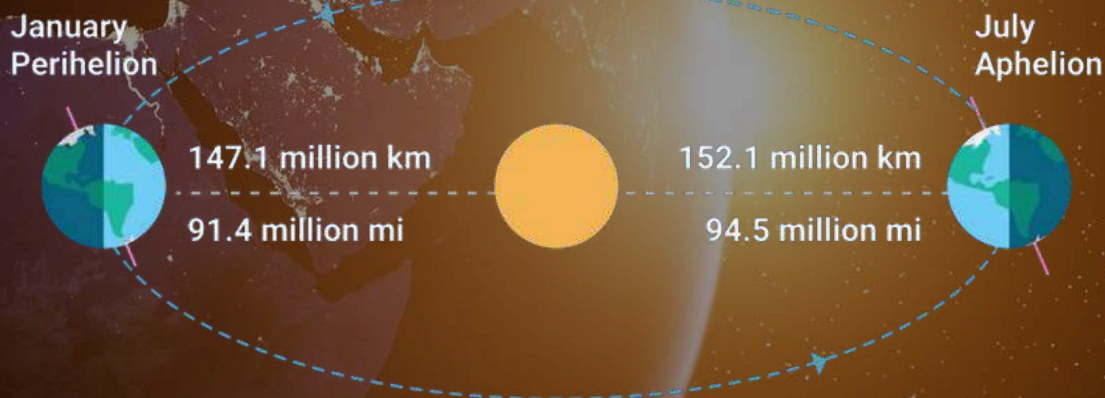
Earth at Aphelion

Earth's journey around the Sun follows an elliptical, or slightly oval, path, causing our distance from the Sun to change over the years. The point where Earth is farthest from the Sun is known as aphelion, which will occur on July 5, 2024.

The term "aphelion" is derived from the Greek words "apo," meaning away or apart, and "helios," referring to the sun god. In contrast, perihelion, the point where Earth is closest to the Sun, happens about two weeks after the December solstice. Aphelion occurs around two weeks after the June solstice.

Johannes Kepler clarified the concepts of aphelion and perihelion in the early 17th century through his laws of planetary motion, fundamentally changing our understanding of orbits. This elliptical orbit causes Earth's distance from the Sun to vary by about 3%, a change so subtle it is almost unnoticeable. At aphelion in 2024, the Sun will be over 94 million miles (152.1 million kilometers) away from us, more than 3 million miles farther than during perihelion. Although this distance shifts slightly each year, it does not significantly impact our seasons.

Our seasonal weather patterns are driven mainly by the 23.5-degree tilt of Earth's axis, not by our varying distance from the Sun. So, while aphelion marks the point when we are farthest from our star, the axial tilt plays the starring role in shaping our seasons. Because Earth's orbit is elliptical, our planet travels at different speeds during its journey around the Sun. We move faster when we are closer to the Sun at perihelion and slower when we are farther away at aphelion.



Despite being farther from the Sun during aphelion, the difference in distance is not enough to noticeably affect the amount of solar energy Earth receives. This is why summer in the Northern Hemisphere still feels hot despite being at the farthest point from the Sun. During aphelion, the Sun appears slightly smaller in the sky compared to when Earth is at perihelion, but this difference is so minor that it's hard to notice without precise instruments.

Although Earth is farthest from the Sun during aphelion, temperatures can still be quite hot, especially in the Northern Hemisphere where it's summer. This dispels the myth that distance from the Sun directly dictates seasonal temperatures. Aphelion occurs at roughly the same time every year, around early July, due to the stable nature of Earth's orbit. Earth's orbital speed is at its slowest during aphelion, moving at about 29.29 kilometers per second (18.21 miles per second), whereas at perihelion, Earth speeds up to around 30.29 kilometers per second (18.82 miles per second).

The amount of solar energy Earth receives at aphelion is about 7% less than at perihelion, but this slight difference doesn't significantly affect global temperatures due to the thermal inertia of Earth's atmosphere and oceans. The axial tilt of Earth has a far greater impact on seasons than the slight difference in distance caused by aphelion and perihelion. This tilt ensures that one hemisphere is tilted toward the Sun during summer and away during winter, driving seasonal changes.

Aphelion is also a great time for amateur astronomers to observe the Sun, as it is a bit safer and easier to view using proper solar filters due to its slightly smaller size and lower intensity.

CELESTIAL ALIGNMENT OF MOON, MARS, JUPITER AND PLEIADES



Place: New Delhi/ Date: 29th July / Time: Around 02.00 a.m.

On July 29, 2024, a spectacular celestial alignment will grace the night sky, featuring the waning crescent Moon positioned near the glimmering Pleiades star cluster. Alongside, the reddish planet Mars will lie nearby, aligning with the largest planet in our solar system, Jupiter. This event promises a visual treat for both amateur and seasoned astronomers alike.

The Moon's brightness will serve as a guide to this alignment, showcasing Jupiter's prominent presence, easily visible even in areas with moderate light pollution. Mars, notable by its distinctive reddish hue, will stand out among the stars, adding to the

visual spectacle. The Pleiades, also known as the Seven Sisters, a striking open star cluster in the constellation Taurus, will be a highlight of this alignment. Even though it can also be seen with the naked eye, it is best viewed with binoculars or a small telescope under dark skies, and will also offer one to see Uranus near Pleiades which is otherwise not visible to the naked eye.

This event provides an excellent opportunity for astrophotography enthusiasts to capture the beauty of these celestial bodies in one frame. Such alignments occur because all planets, including the Moon, generally follow the ecliptic plane—the apparent path of the Sun across the sky—allowing for these rare but awe-inspiring configurations. Throughout history, celestial alignments have held cultural significance, often marking important events or seen as omens.

This July 29, 2024 alignment of the Moon, Jupiter, Mars, and the Pleiades offers a unique chance to marvel at the dynamic and ever-changing nature of our night sky, making it a must-see event for astronomy enthusiasts and casual stargazers alike.

LUNAR OCCULTATION OF ANTARES

On **July 18**, 2024, lunar occultation will occur in the night sky, where the moon occults the star, Antares. The term "occultation" originates from the Latin "occultare," meaning "to hide." It refers to the complete obscuration of light from one astronomical body, such as a star, by another, like a planet or satellite. For instance, a total solar eclipse occurs when the Moon occults the Sun. Astronomers utilize occultations to measure the angular diameters of stars and identify binary star systems by analyzing their light intensity as they pass behind the Moon. These events also enable precise measurements of planet sizes, asteroid shapes, and the temperatures of planetary atmospheres. Antares, a red, semiregular variable star with an apparent visual magnitude of approximately 1.1, stands as the brightest star in the zodiacal constellation Scorpius and is among the largest known stars. The lunar occultation will be visible from Sub-Saharan Africa, the Moon will pass in front of Antares (Alpha Scorpii). Although this event won't be observable from India, a close conjunction between the Moon and Antares will still be visible.



Place: Sub-Saharan Africa/ Date: 18th July/ Time: 1.45 a.m.

Lunar occultations are geographically limited, visible only from specific locations due to the Moon's proximity to Earth causing significant parallax. These occurrences provide astronomers with crucial insights into celestial objects, enhancing our comprehension of the universe's dynamics and diversity.

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 Uranus and Mars

On July 16th, the red Planet Mars will meet the seventh planet Uranus in the North east direction. The pair will be visible in the sky at around 01.40 a.m. but the close to each other at around 02.30 a.m. Mars will be at a magnitude of 0.95 & Uranus will have a magnitude of 5.97.



Place: New Delhi/ Date: 16th July / Time:02.30 a.m.

Conjunction of Moon and Saturn

On July 25th, the ringed planet Saturn and the Moon will have the closest approach in the night sky & reaching an altitude of 47° above the south-eastern horizon. The Moon will be at magnitude -12.60, and Saturn at mag 0.9. And it will be visible around 1.45 am in the night. For South India, it will be the occultation of Saturn and Moon.



Place: New Delhi/ Date: 25th July / Time: 01.45 a.m.

Conjunction of Moon and Jupiter

On July 31, the Moon and the planet Jupiter will appear very close to each other in the early morning. They will be in the eastern direction. Moon is at a magnitude of -10.97, and the planet Jupiter is at a magnitude of -1.97. The Moon and Jupiter will be seen in the night sky around 02.00 a.m., in the north-east direction.



Place: New Delhi / Date: 31st July / Time: 02.00 a.m.

Rocket launches in July 2024

Gaganyaan-1 (Uncrewed)

India's ambitious Gaganyaan-1 mission, the first uncrewed test flight under the Gaganyaan programme, is poised for launch in July 2024. This landmark event will take place at the Satish Dhawan Space Centre (SDSC) in Sriharikota, Andhra Pradesh. While the exact date and time of the launch are still to be finalized, preparations are in their final stages, signaling a significant advancement in India's space exploration efforts.

The name "Gaganyaan" is derived from the Sanskrit words "gagana," meaning celestial, and "yāna," meaning craft or vehicle. This aptly describes the mission's purpose: to explore and reach the celestial realms. The Gaganyaan-1 mission is designed to validate key technologies and systems that will be crucial for future crewed space missions.

The primary objective of this mission is to test the performance and reliability of the launch vehicle, spacecraft systems, life support systems, and emergency escape provisions. A critical component of this mission is the use of a humanoid robot, which will simulate human physiological functions. This robot will provide essential data on the environmental conditions inside the spacecraft, helping scientists and engineers refine the design and systems for subsequent manned missions.

The success of Gaganyaan-1 will be a major step towards India's first human spaceflight, which is planned for 2025. The data collected during this uncrewed mission will be invaluable for ensuring the safety and success of future astronauts. This mission underscores India's growing capabilities in space technology and its commitment to becoming a significant player in human space exploration.

With the Gaganyaan-1 mission, India aims to join an elite group of nations capable of sending humans into space. This endeavour not only highlights the advancements in India's space technology but also serves as an inspiration for future generations of scientists, engineers, and space enthusiasts. As the countdown to July 2024 begins, the world watches with anticipation as India takes its first giant leap towards human spaceflight.



Electro-L N5

Date: Expected In July, 2024 **Rocket:** Proton-M / DM-03 **Agency:** Roscosmos **Country:** Russia
Launch Site: Baikonur, Kazakhstan

Purpose: Electro-L N5 is the fifth unit of Russian electro-L geostationary satellites series. Electro-L satellites are designed primarily for meteorological and climate monitoring purposes. They provide high-resolution images of Earth's atmosphere, weather patterns, and climate dynamics. These satellites are equipped with advanced imaging instruments, typically including multi-spectral cameras capable of capturing images in visible and infrared wavelengths. This allows for detailed observations of cloud cover, precipitation, temperature gradients, and other meteorological phenomena.



KuiperSat

Date: Expected in July, 2024 **Rocket:** Atlas V 551
Agency: United Launch Alliance + Amazon **Country:** USA
Launch Site: Cape Canaveral SLC-41, USA

Purpose: Project Kuiper is a mega constellation of satellites in Low Earth Orbit that will offer broadband internet access, this constellation will be managed by Kuiper Systems LLC, a subsidiary of Amazon. This constellation is planned to be composed of 3,276 satellites. The satellites are projected to be placed in 98 orbital planes in three orbital layers, one at 590 km, 610 km and 630 km altitude.



Ariane 62

Date: June 30, 2024 **Rocket:** Ariane 6
Agency: ESA **Country:** Europe **Launch site:** Guiana Space Centre, French Guiana

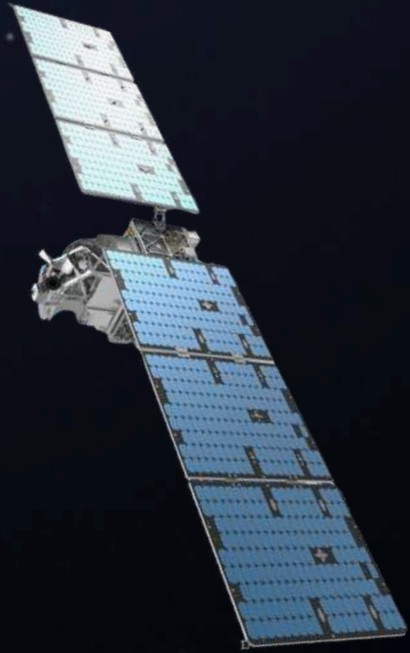
Purpose: In 2014, ESA selected a design for the next generation Ariane rocket, the Ariane-6, which becomes operational in the 2020s. Contrary to the earlier dual-launch Ariane-4 and Ariane-5 rockets, the new Ariane-62 is designed to be 40-50% cheaper. It is capable of launching a wide range of payloads, from small satellites to large spacecraft. It can launch up to 4,500 kg (9,900 lb) into geosynchronous transfer orbit (GTO) and 10,350 kg (22,820 lb) into low Earth orbit (LEO). It is primarily intended for government and scientific missions. This is because it is more cost-effective than Ariane 64 and is still capable of launching a wide range of payloads.



Arctic Weather Satellite

Date: Early July **Rocket:** Falcon 9 **Agency:** ESA **Country:** Europe **Launch Site:** Vandenberg SLC-4E, California, USA

Purpose: The European Space Agency has built the Arctic Weather Satellite in just 36 months which is a microsatellite. This is a meteorological satellite which will observe the weather conditions specifically at the Arctic region. There is a huge weather data collected for different parts of the world. However, the monitoring of the Arctic remains insufficient, as geostationary satellites have no visibility of this northerly region. This is the first satellite of the EPS Sterna mission which is a constellation of six micro satellites. This mission will provide constant data of temperature and humidity for every location on Earth.

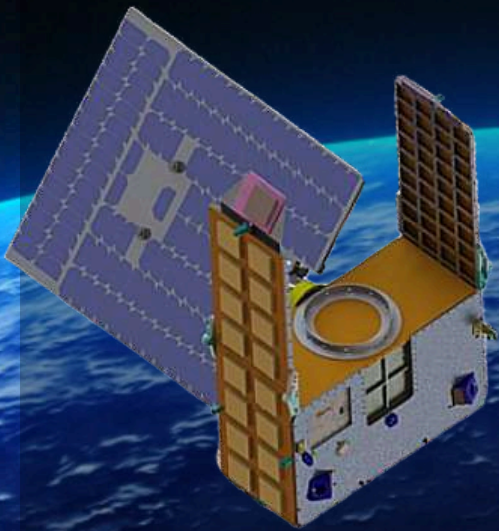


GNOMES-5

Date: June 25, 2024 **Rocket:** Falcon Heavy **Agency:** PlanetIQ **Country:** USA **Launch Site:** Vandenberg SLC-4E, California, USA

Purpose: PlanetIQ's GNOMES (GNSS Navigation and Occultation Measurement Satellites) is a planned constellation of 20 small satellites to provide radio occultation data for weather forecasting, climate research, and space weather monitoring, with the first satellites launched in 2016. The overall objective is to introduce innovation to satellite weather observations.

For this reason, PlanetIQ's satellites will carry the fourth-generation "Pyxis" radio occultation (RO) sensor. Pyxis builds on the heritage of the gold standard for RO sensors. This state-of-the-art, next-generation RO sensor is smaller, lighter, and consumes less power than prior versions, but has nearly 3x the data collection capability since it will receive signals from all four major GNSS constellations (GPS, GLONASS, Galileo and Beidou).



STARLINK GROUP

StarLink Group 7-22/23/24/27/28/29/30

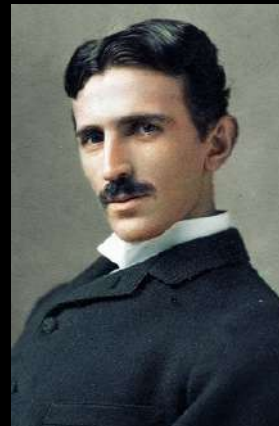
Starlink is a satellite internet constellation project developed by SpaceX, with the goal of providing high-speed internet access to underserved and remote areas globally. Satellite Deployment: SpaceX regularly launches batches of Starlink satellites into orbit aboard its Falcon 9 rockets. Each batch typically contains dozens to hundreds of satellites.

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

Happy Birthday

Nikola Tesla

Nikola Tesla Serbian Cyrillic (10 July 1856 – 7 January 1943) was a Serbian-American inventor, electrical engineer, mechanical engineer, and futurist. He is known for his contributions to the design of the modern alternating current (AC) electricity supply system. In 1899, Tesla recorded first cosmic radio waves. Alone in his Colorado Springs, Colorado Lab one night, Tesla heard strange rhythmic sounds. The sounds were in such a regular pattern that Tesla concluded it could only be an effort to communicate with Earth by alien beings. The signals were indeed extraterrestrial: radio waves from distant celestial sources – planets, comets, stars, or galaxies.



Hans Albrecht Bethe

Hans Albrecht Bethe (July 2, 1906 – March 6, 2005) was a German-American theoretical physicist who made major contributions to nuclear physics, astrophysics, quantum electrodynamics, and solid-state physics, and who won the 1967 Nobel Prize in Physics for his work on the theory of stellar nucleosynthesis. For most of his career, Bethe was a professor at Cornell University. During World War II, he was head of the Theoretical Division at the secret Los Alamos that developed the first atomic bombs. There he played a key role in calculating the critical mass of the weapons and developing the theory behind the implosion method.



Giuseppe Piazzi

Giuseppe Piazzi, (born July 16, 1746, Ponte di Valtellina, Lombardy [Italy], Habsburg crown land–died July 22, 1826, Naples), He was Catholic priest of the Theatine order, mathematician, and astronomer. He established an observatory at Palermo, He is the one who discovered (January 1, 1801) and named the first asteroid, or "minor planet," Ceres. He supervised the compilation of the Palermo Catalogue of stars, containing 7,646 star entries with unprecedented precision, including the star names "Garnet Star" from Herschel, and the original Rotanev and Sualocin.



Happy Birthday



Vera Florence Cooper Rubin

Vera Florence Cooper Rubin (July 23, 1928 – December 25, 2016) was an American astronomer who pioneered work on galaxy rotation rates. She uncovered the discrepancy between the predicted and observed angular motion of galaxies by studying galactic rotation curves. By identifying the galaxy rotation problem, her work provided evidence for the existence of dark matter. These results were later confirmed over subsequent decades. The Vera C. Rubin Observatory in Chile is named in her honor.

Friedrich Wilhelm Bessel

Friedrich Wilhelm Bessel (22 July 1784 – 17 March 1846) was a German astronomer, mathematician, physicist, and geodesist. He was the first astronomer who determined reliable values for the distance from the sun to another star by the method of parallax. Certain important mathematical functions were named Bessel functions after Bessel's death, though they had originally been discovered by Daniel Bernoulli before being generalised by Bessel.



Chushiro Hayashi

Chushiro Hayashi (25, 1920 – February 28, 2010) was a Japanese astrophysicist. Hayashi tracks on the Hertzsprung–Russell diagram are named after him. Hayashi was born in Kyoto and enrolled at the Imperial University of Tokyo in 1940, earning his BSc in Physics after 2½ years, in 1942. He was conscripted into the navy and, after the war ended, joined the group of Hideki Yukawa at Kyoto University. He made additions to the Big Bang nucleosynthesis model that built upon the work of the classic Alpher–Bethe–Gamow paper.

Black Holes: The most Mysterious object in the universe

Kavin Pranaav K, iAstronomer

Black holes are points in space that are so dense that they create deep gravity sinks. Black holes are so-called because the gravity in the center is so strong.

Anatomy of a Black Hole

Event Horizon - This is what makes a black hole black

Accretion Disk - The main light source from a black hole is a structure

Event Horizon Shadow - The event horizon captures any light passing through it.

Photon Sphere - From every viewing angle, thin rings of light appear at the edge of the black hole shadow.

Doppler Beaming - Viewed from most angles, one side of the accretion disk appears brighter than the other.

Corona - It has been called one of the most extreme physical environments in the universe.

Particle Jets - A small amount of material heading toward the black hole.

Singularity - It is the final destination for anything falling into the event horizon.

Types of Black Holes

Stellar: This type of black hole is formed by the gravitational collapse of a star.

Intermediate: The size should range from around one hundred to hundreds of thousands of times the Sun's mass.

Supermassive: Almost every large galaxy, including our Milky Way galaxy, has a supermassive black hole at its center.

Primordial: Scientists theorize that primordial black holes are formed in the first second after the universe's birth.

Interesting Facts about black holes

- The lightest known black hole is only 3.8 times the sun's mass.
- The one who discovered the black hole is Christian Wolf.
- Anything that goes too close will be stretched and compressed like putty, called spaghettification.
- The most massive black hole observed, TON 618 tips the scales at 66 billion times than the sun's mass
- One time a black hole is born when massive stars run out of fuel and explode in supernovae.

Conclusion

Black holes are the most mysterious cosmic objects, much studied but not fully understood. They are huge concentrations of matter packed into very tiny spaces. A black hole is so dense that gravity just beneath its surface, is strong enough that nothing not even light can escape.

REMEMBER THE AURORA PARTY OF 1859? WHAT HAPPENS IF THE SUN DOES IT AGAIN?

Sourajit Mandal, Astronomy Camp

On May 11, 2024 people around the world saw something strange in the sky. Something they had never seen before. At least, not for the people born after 1859. Though at a smaller scale than the 1859 event, people living even in the relatively lower latitudes such as that of Ladakh in India saw bright auroras!

It was the first of September, 1859. The Carrington Event, the most powerful geomagnetic storm in recorded history, was taking place. Strong auroras were seen even in low-latitude locations like Mexico, Cuba, and Hawaii. According to reports from around the world, the storm generated sparks and even fires in telegraph stations.

The 1859 geomagnetic storm was most likely caused by a coronal mass ejection from the Sun impacting with Earth's magnetosphere. Whereas the recent event was due to a solar flare.

But that was the case 166 years ago. What will happen if something like that happens now? Can the sun's radiation be the cause of massive problems?

Today, our dependence on technology has grown dramatically. In 1859, the main form of long-distance communication was the telegraph. Now, we rely on a vast network of satellites, power grids, and global communication systems. A geomagnetic storm of similar magnitude to the Carrington Event could have catastrophic effects on our modern infrastructure.

Satellites orbiting the Earth are particularly in danger. A powerful geomagnetic storm could damage or destroy these satellites, leading to a loss of critical services such as GPS navigation, weather forecasting, and global communications. This would not only disrupt daily life but could also have severe implications for global security and emergency response.

Our power grids will also be at risk. A massive solar storm could induce electric currents in the Earth's crust, potentially leading to widespread transformer damage and power outages. The resulting blackouts could last for days, weeks, or even longer, depending on the severity of the damage. This would affect everything from heating and cooling systems to water supply and healthcare services.

Modern communication systems, including the internet and mobile networks, could face significant disruptions. The loss of satellites would be a major blow, but even ground-based systems could be affected by the induced electric currents and magnetic fluctuations. This would damage our ability to communicate, coordinate, and manage the crisis effectively.

Solar storms occur due to disturbances on the Sun's surface, often involving sunspots and solar flares. These disturbances can result in the release of vast amounts of energy and plasma into space in the form of coronal mass ejections.

When these ejections are directed toward Earth, they interact with our planet's magnetosphere, causing geomagnetic storms. The intensity of these storms can vary, but the most powerful ones have the potential to cause significant disruptions to our technological systems.

The heliosphere, a vast bubble-like region of space dominated by the solar wind and the Sun's magnetic field, plays a crucial role in protecting our solar system from interstellar radiation. This magnetic field acts as a shield, deflecting harmful cosmic rays and preventing them from reaching the inner planets, including Earth. Without the Sun's magnetic field, our planet would be exposed to a lot higher levels of radiation from space, which could have serious consequences for life on Earth. Thus, while solar storms can pose a threat to our technology, the Sun's magnetic field is also a vital protector of our planet from the dangers of interstellar space.

TYPE IA SUPERNOVA: THE STANDARD CANDLE TO FLRW

Souryadeepta Majumdar, iAstronomer

There have been discussions on the Universe being homogeneous as per the Modern Cosmological model renowned as the CDM model and a metric known as the Friedmann-Lemaître-Robertson-Walker metric, using which, one can find the expansion rate of the universe. However, there is one interesting fact that the Modern Cosmological Model supports the establishment of the model of a flat universe and can be mathematically interpreted by using Euclidean geometry. However, if we consider the computations of the expansion rate at the present day, it is done with respect to a specific star known as the Type Ia Supernova (spelt as 'type one-a supernova'). The further discussion will elaborate about Supernovae and this specific type of Supernova, further showing how the expansion rate is measured using this as a referral object.

Before explaining the Type Ia Supernova, a brief on what is a supernova. Supernova (plural: Supernovae), comprises of two terms "Super" and "nova" where super implies the superlative or massive version of an event and nova is the Latin term for "new". In simple words, a Supernova is the event of explosion of a star. Whenever a star reaches the death phase, provided it is at least 8 times or more heavier than the Sun, their explosion is termed as supernova. If we compare a star, its functioning requires fuel, basically energy sources to continue the system.

A major contribution of this fuel is through nuclear reactions which are fission and fusion reaction. The stability of a star is an equilibrium state between the gravitational pulls of the particles towards the centre and the outward pressure that is generated due to such a nuclear pull. During the death phase the equilibrium breaks and all the particles start approaching the centre of mass of the system, ultimately leading to a drastic rise in temperatures in order of billion degrees. This change leads to a massive explosion that produces shock waves that acts as fuel to the exploding particles to create new elements and slowly gives rise to black hole, neutron star or a nebula depending on physical parameters.

Based on physical types, Supernovae are of two categories: Type Ia and Type II. The former (Type Ia) is a result of collapsing binary (two) star systems in which a white dwarf of carbon-oxygen composition is accumulating matter from a companion. This means one of the stars in the binary system is a carbon-oxygen white dwarf (a star with compressed volume and radius of about 4000km and average density 106 g cm^{-3}). The latter, however, is due to the end of a massive star's lifetime due to weak nuclear reactions. Now, knowing what a Supernova is and what are the types, we arrive in this crucial point, tracing to the FLRW metric. The FLRW metric helps in determining the expansion rate of the universe.

The computations of the expansion rate of the Universe are achieved by measuring the distance between a referred object and the time taken by light to travel the distance. In these cases, the Type Ia Supernova is used widely and is also referred to as the Standard Candle or the Standard Bulb. This means that this Supernova has enough light source (parameter known as 'luminosity') to create the foundations of the Cosmic ladder, which is used to compute distances for distant celestial objects like galaxies. However, addressing to a point that Type Ia Supernova is only considered as a Standard Candle and that's because, unlike Type II, Type Ia occurs when the stars explode approximately at same masses which is almost 1.4 solar mass for a standard White dwarf. Besides, the explosion is almost the same for all the Type Ia explosions and hence is referred to a Standard Candle.

Hence, using these Supernovae to compute distances and speed, computation of the expansion rate of the Universe using the FLRW has been conducted and are currently used for considerations of studying Modern Cosmology, Stellar Entropy and Galaxies. Hence, the Type Ia Supernova along with its fellow existing types is a vital consideration in the Cosmos to study the universe.

A Chance of Life !!

Sourajit Mandal, Astronomy Camp

Huh! Imagine relaxing on your spaceship one day and suddenly the bell rings. A friend of yours has come at the door to play video games with you. A friend who is not a human but something else. A friend who is an alien. This though a sci-fi, at present may be a possibility in the future. This is because we might just have found aliens! This may be the first scientific proof of life outside of our planet! But first let's dive deeper into the topic.

A few days ago it appeared in the news headlines that a planet named K2-18b had a chance of being habitable and may even support life as per the data provided by JWST. Dr Nikku Madhusudhan of Cambridge university while examining the data provided by the JWST last year found carbon bearing molecules like CO₂ and methane which are signatures of life. Moreover this means it's likely to have an ocean beneath the atmosphere, making it a Hycean world.

But that is not the exciting news. The exciting news is that there is a chance that a molecule named DMS is in the planet's atmosphere. Why is that so interesting?

DMS or Dimethyl sulphide or methylthiomethane is an organic molecule that is produced mainly by phytoplankton living in the ocean. Remarkably it accounts for 80% of biogenic sulphur emissions and 50% of the global sulphur emissions into the atmosphere. It reflects back the sun's rays into space, cooling the Earth by 4 degrees. It is often considered as a biomarker for extraterrestrial life. The presence of DMS on K2-18b, although requiring further confirmation, is exciting because it suggests the possibility of biological processes similar to those on Earth.

This discovery opens a new chapter in the search for life beyond our planet. If future observations solidify the presence of DMS, it would be a significant leap forward in our quest to find alien life. Imagine a future where we don't just hypothesise about alien friends, but can actually play video games with them!

However, there are still some things to consider. Even if life exists on K2-18b, it's likely to be very different from life on Earth. The planet is much larger and has a different composition, so any organisms there would have likely adapted to those specific conditions.

Regardless, the discovery of DMS on K2-18b is a thrilling development and brings us closer to answering the age-old question: Are we alone in the universe?

VIPER- DISCOVERING WONDERS ON THE MOON

Navya Kiran, |Astronomer

I am sure we all are aware about our very own natural satellite, the moon. The effulgent shining body causes tides on Earth and illuminates our whole planet at night. But ever seemed to wonder how its state was when it was first made and what mysteries it may still hold that we can't catch a glimpse of. Well, here is a remarkable piece made by the National Aeronautics and Space Administration, which will be breaking the barriers between us and the lunar's one-of-a-kind game-changing resources. Welcome VIPER, bound to represent a significant milestone in lunar exploration.

VIPER, or Volatile Investigating Polar Exploration Rover by NASA, has been designed with a purpose to find game-changing resources on the moon which could be amazing news for mankind. This rover has been designed to find resources needed for life on the moon, which would totally transform the future of space exploration and would be a testament for life-term presence on the moon and would also open boundaries for life on Mars and beyond. Said to be launched in November 2024, scientists say that with the help of VIPER, our future technology and living will be like never before. It is said to be the first robotic rover of NASA to be going on the moon, ready to odyssey far and beyond on the surface of the South Pole of the moon.

VIPER has been set several goals and milestones to effectuate:

1. Characterize the distribution and physical state of lunar polar water and other volatiles in lunar cold traps and regolith to understand their origin.
2. Provide the data necessary for NASA to evaluate the potential return of in-situ resource utilization from the lunar polar regions.
3. Provide the data and the information about the ice sheets of the Southern Polar Cap Region of the moon and provide insights on whether life could be created or not.

VIPER has several instruments for deep researching and providing data back on Earth:

NSS (Neutron Spectrometer System)- As the rover drives across the lunar surface, it will detect the presence of water on the lunar ice caps by seeing if there is hydrogen present or not as hydrogen is one of the elements present in water. It will see the presence of atoms and neutrons.

TRIDENT (The Regolith and Ice Drill for Exploring New Terrains-These 3 feet drill will drill into the surface below 3 feet, exploring the soil and other features of it to find water deep within. With its sharp cuttings, it would provide major information about the properties and characteristics of the soil.

NIRVSS (Near-Infrared Volatiles Spectrometer System)- After the TRIDENT has done its job, NIRVSS will detect the type and properties of hydrogen detected earlier by NSS, whether it is a water molecule or simply a hydrogen atom. It would be very useful to us to know about the nature of the region and whether life could be attained there.

VIPER, to conclude, will be a major game-changer for the future of living. Nobody until now, was able to believe life could exist on the moon. The VIPER mission would do wonders and would completely evolve the future of space exploration.

DISCOVERING EXOPLANETS: HOW SCIENTISTS FIND PLANETS AROUND OTHER STARS

Aayan Kumar Chauhan, Astronomy Camp

Introduction

Exoplanets, or planets outside our solar system, have fascinated scientists and the public alike. But how do astronomers find these distant worlds? This article explores the innovative methods used to discover exoplanets, helping us understand more about the universe and the potential for life beyond Earth.

1. Transit Method

The transit method is one of the most successful techniques for discovering exoplanets. It involves observing the light from a star and looking for periodic dips in brightness. These dips occur when a planet passes in front of the star, blocking some of its light.

- **How It Works:** When a planet transits, or crosses in front of its star, it causes a slight dimming that can be detected with sensitive instruments.
- **Tools Used:** Space telescopes like Kepler and TESS (Transiting Exoplanet Survey Satellite) are designed specifically for detecting these tiny changes in brightness.
- **Significant Discoveries:** The Kepler mission alone has discovered thousands of exoplanets using this method, revealing the diversity of planetary systems in our galaxy.

2. Radial Velocity Method

Also known as the Doppler method, this technique measures the changes in a star's velocity as it moves towards or away from us due to the gravitational pull of an orbiting planet.

- **How It Works:** A planet's gravity causes its star to wobble slightly as they orbit their common center of mass. This wobble changes the star's light spectrum, shifting it towards blue when the star moves closer (blue shift) and towards red when it moves away (red shift).
- **Tools Used:** Ground-based observatories with precise spectrometers, like the HARPS (High Accuracy Radial velocity Planet Searcher) instrument, are crucial for detecting these shifts.
- **Significant Discoveries:** This method was used to discover the first exoplanet around a sun-like star, 51 Pegasi b, in 1995.

3. Direct Imaging

Direct imaging involves capturing actual images of exoplanets by blocking out the star's light to see the dim planets orbiting around it.

- **How It Works:** Specialized instruments and techniques, such as coronagraphs and adaptive optics, are used to block the star's light and enhance the visibility of the planets.
- **Tools Used:** Large telescopes like the Very Large Telescope (VLT) and upcoming space telescopes like the James Webb Space Telescope (JWST) are equipped with these advanced instruments.
- **Significant Discoveries:** Direct imaging has been used to discover and study young, massive exoplanets located far from their stars, such as those in the HR 8799 system.

4. Gravitational Microlensing

Gravitational microlensing occurs when a massive object, like a star, passes in front of another star and acts as a lens, magnifying the background star's light. If a planet is orbiting the foreground star, it can further magnify the light.

- **How It Works:** When a foreground star with an orbiting planet aligns with a distant star, the gravity of the foreground star and planet bends and magnifies the light from the background star.
- **Tools Used:** Observatories like the Optical Gravitational Lensing Experiment (OGLE) and collaborations like the Microlensing Observations in Astrophysics (MOA) project.
- **Significant Discoveries:** This method is effective for finding planets at great distances from Earth, including those in other galaxies.

5. Astrometry

Astrometry measures the precise movements of stars in the sky to detect wobbles caused by orbiting planets.

- **How It Works:** By observing the star's position over time, astronomers can detect minute changes in its movement, indicating the presence of a planet.
- **Tools Used:** Space missions like Gaia, which is mapping the positions of stars with unprecedented precision.
- **Significant Discoveries:** While astrometry has been challenging to use for exoplanet discovery, it holds great potential for finding Earth-like planets in the future.

Conclusion

The discovery of exoplanets has revolutionized our understanding of the universe and our place in it. Each method offers unique insights and challenges, contributing to a fuller picture of the myriad planetary systems that exist beyond our own. As technology advances, we can expect to find even more fascinating worlds, potentially answering the age-old question of whether we are alone in the universe.

NUCLEAR FISSION: HARNESSING THE POWER OF THE ATOM

Nikhilesh.B.iAstronomer

Atomic parting could be an instrument that was found within the late 1930s that discharges a vast amount of energy by parting a heavy nuclear core into two lighter cores. This process has significant impacts on energy generation, therapeutic investigation, and national security. It is vital for atomic reactors and nuclear weapons. The components of atomic parting, as well as its applications, points of interest, challenges, and potential for future energy era, are all inspected in this article.

When a heavy core, like uranium-235 or plutonium-239, gets a neutron, it gets to be unstable and splits into two lighter cores, a process known as atomic parting happens. As a result of mass being changed over into energy according to Einstein's condition $E=mc^2$, this process discharges free neutrons and a critical amount of energy. A self-sustaining chain reaction can be made by new parting occasions activated by free neutrons. Atomic bombs detonate as a result of an uncontrolled response, while atomic reactors are fueled by this directed response.

Atomic control plants are where atomic parting is most obviously utilized, creating energy through a controlled chain reaction. Energy from this source changes water into steam, which powers turbines that are connected to generators to provide energy. 10% of the world's energy is created by atomic energy, a noteworthy low-carbon energy source.

Therapeutic isotopes utilized in cancer treatment and diagnostic imaging are delivered through atomic parting. One common parting item utilized in therapeutic imaging is technetium-99m. Atomic parting is additionally in favor of atomic weapons, and the unstable drive of atomic bombs is delivered by the energy discharged by an uncontrolled response, which includes a critical impact on geopolitics and universal security.

In spite of its great title, nuclear fission has noteworthy downsides. Since parting creates amazingly radioactive waste that has to be carefully put away for an extended period of time, overseeing radioactive waste is vital. Creating secure waste alternatives is fundamental to the industry's long-term sustainability.

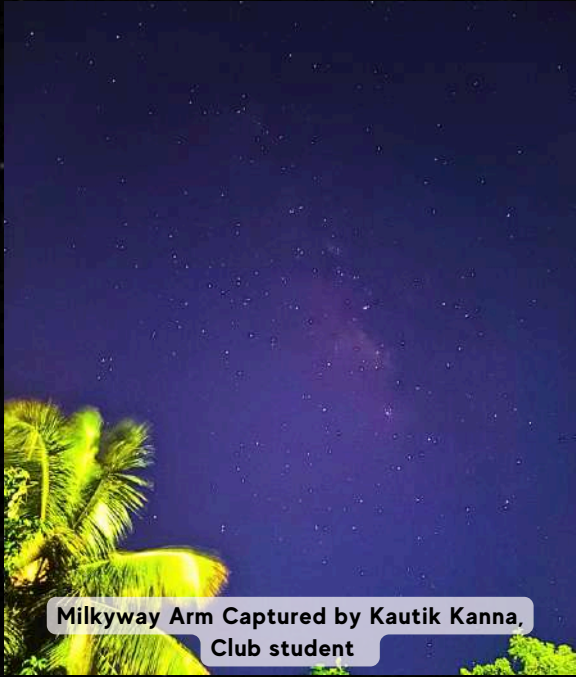
Another critical deterrent is the potential for atomic incidents. Occasions at Three Mile Island, Fukushima, and Chernobyl have brought consideration to the possible risks related with atomic control. Indeed with all of the safety instruments that modern reactors have, there's continuously a chance of a disastrous disappointment.

Another issue related to atomic parting is the expansion of atomic weapons. Nuclear weapons may be created utilizing the same materials and innovations as are utilized in reactors. Strong universal collaboration and control are fundamental to halt the expansion of atomic weapons and to progress the peaceful utilize of atomic energy.

Atomic fission's future depends on tending to its drawbacks and optimizing its advantages. Unused innovations in reactor technology, such as Generation IV reactors and Small Modular Reactors (SMRs), hold out hope for expanding atomic power's sustainability, efficiency, and security. These unused forms are outlined to utilize resources more successfully, cut down on waste, and reduce the chance of mishaps. The objective of research into waste management methods and substitute fuel cycles is to relieve the issues related to radioactive waste. Curiousities like transmutation, which abbreviates the half-lives of long-lived radioactive isotopes, give promising waste transfer choices.

Atomic fission's future depends on tending to its downsides and optimizing its focal points. Unused innovations in reactor technology, such as Generation IV reactors and Small Secluded Reactors (SMRs), hold out hope for expanding atomic power's maintainability, effectiveness, and security. These unused adaptations are planned to utilize resources more effectively, cut down on waste, and reduce the chance of mishaps. The objective of inquiry about waste management strategies and interchange fuel cycles is to moderate the issues related to radioactive waste.

VISUAL ARTS FROM SPACE ASSOCIATED ASTRONOMERS



Milkyway Arm Captured by Kautik Kanna,
Club student



Partial Eclipse Captured by Srivainavi, iAstronomer



Moon Trail, Captured by Kautik Kanna, Club student



Moon captured by Aryan Gupta, iAstronomer

Saturn Through The Years



2021



2022



2023

Saturn captured by Aryan Gupta, iAstronomer

VISUAL ARTS FROM SPACE ASSOCIATED ASTRONOMERS



Diya Avicot John, IAstronomer



.Prisha Gulati,IAstronomer



Rajita Singh, IAstronomer



Vincy Bansal, IAstronomer

Vincy Bansal



Kavya Dwivedi, IAstronomer

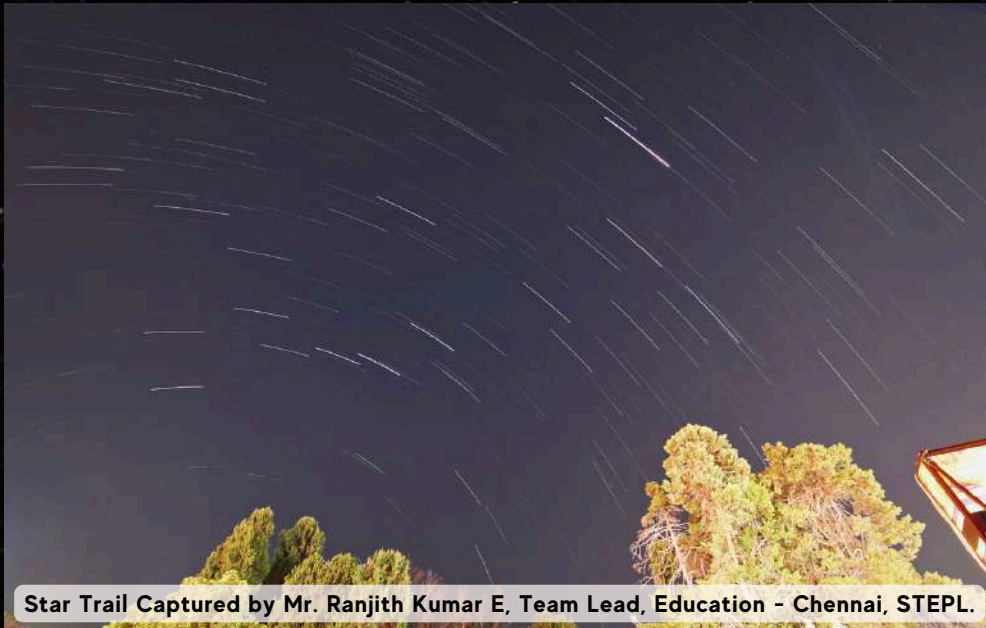
Black hole,
It is a shadow.....
But It does not see my bland Eyes.
Sometime It's a ghost of soul.
It's a Supernova of a world...
oh! It's challenge.
It Emit Radiations moves.....
That Journey not end..
But I can never surprised
A wonderfull challenge in Astro..

Poem By Deepa k , IAstronomer

ASTROPHOTOGRAPHS BY SPACE TEAM



Celestial alignment of Moon, Saturn and Mars captured by Mr. Arun Yadav, Educator - Delhi, STEPL.



Star Trail Captured by Mr. Ranjith Kumar E, Team Lead, Education - Chennai, STEPL.



Celestial alignment of Moon, Saturn and Mars captured by Ms. Sanjana Nayak Educator - Delhi, STEPL.

HISTORICAL EVENTS HAPPENED IN JULY

PLUNGING INTO THE JUPITER

On March 1993, when husband and wife duo Eugene M. and Carolyn Shoemaker, along with their colleague and frequent collaborator, David Levy, discovered the comet that would bear their names, Shoemaker-Levy 9 (SL9), the comet was already in its twilight years.

In July 1992, the SL9, captured by Jupiter's gravity decades earlier, had experienced the power of the gas giant's tidal force when it passed within the planet's Roche's limit, resulting in the comet getting broken up into more than 20 pieces. SL9 was the first time an active comet orbiting a planet was observed.

More than a year after its discovery, SL9's fragments met their inevitable end between the 16th and 22nd of July 1994. All the pieces of the comet plunged into Jupiter's hemisphere at dizzying speeds of 216,000 km/h and with a force of 300,000,000 atomic bombs. In its descent, the fragments created plumes as high as 3,000 km and heated the atmosphere to 40,000 degrees Celsius. SL9 left dark, ringed scars that were easier to spot than the Great Red Spot. It was one of the most spectacular ends that humans ever witnessed.



The scars left by SL9

SL9's original size, before July 1992, was calculated to be between 1.5 and 2 kilometres wide. If an object of similar size hits our home planet, it would be devastating. For Jupiter, the collision allowed us to learn more about Jupiter while highlighting the role Jupiter plays in reducing space debris in the inner solar system and giving us new insights into cosmic collisions. Through SL9's impact, we learned more about the high-altitude winds in Jupiter. We also got to study the relationship between the magnetosphere and the atmosphere. Even today, the changes brought about by the comet's impact are recognizable.

Another legacy of SL9 was planetary defence. As it was one of the first direct observations of an extraterrestrial collision of a solar system object, popular media covered it a lot. This led to NASA, in 1998, getting the authority to seek more Near Earth Objects. In 2013, the dangers of Near Earth objects to Earth reared their ugly head with the arrival of a small asteroid that broke up over Chelyabinsk, Russia. In 2016, NASA established the Planetary Defense Coordination Office (PDCO) which manages the agency's mission of finding, tracing and understanding asteroids and comets that could be a hazard to Earth. Today, over 90% of asteroids larger than 1km have been identified. At least 33% of asteroids between 140 and 1000 meters have been identified.



Comet Shoemaker-Levy 9
Approaching Jupiter in 1994

CASSINI'S VISIT

After a long, seven-year journey, Cassini has finally reached its destination, the Saturnian system. It had taken the scenic route to the ringed planet, passing Venus (twice), Earth, 2685 Masursky and Jupiter before, on 1st July 2004, getting inserted into Saturn's orbit.

Cassini - Huygens, the spacecraft's full name, was named after two 17th-century astronomers: Giovanni Cassini and Christiaan Huygens. The mission was a collaboration between NASA, ASI, and ESA. ESA provided Huygens, a space probe designed to study the atmosphere of Titan, Saturn's largest moon. Huygens could land on the satellite's surface, the first time such an event occurred in the outer solar system.



A backlit image of Saturn from Cassini

Cassini's work was daunting. The spacecraft was to study Saturn, its rings, Titan, other icy satellites and the planet's magnetosphere. It had to collect data on the composition, structure and interaction of the aforementioned parts of the Saturnian system along with other data.

The spacecraft, on a Titan IVB/Centaur, lifted off into space on 15th October 1997. It was the fourth spacecraft to visit Saturn but the first to orbit it, collecting information on the planet, rings, and moons. For over 13 years, Cassini orbited Saturn. That is until April 2017, when mission control set Cassini on an impact course that lasted five months. This was Cassini's Grand Finale. The final part of Cassini's mission gave us observations of the planet and its rings we have never received before.

Finally, on 17 September 2017, after almost 2 decades travelling in space, Cassini plunged into Saturn's atmosphere. It sends data back to Earth as long as possible before disintegrating in the atmosphere like a meteor. This was to preserve Saturn's moons, in particular Enceladus and Titan, and prevent contamination from the spacecraft.

The Cassini-Huygens data revealed a lot about the Saturnian system. Through the mission, we understood that Enceladus possesses a global ocean of liquid water with high potential hydrothermal activity on the seafloor. We also learned that Saturn's rings are active and dynamic and could be a laboratory for how planets or moons form. Meanwhile, Titan was revealed to have rivers, lakes and seas that are blanketed in thick atmosphere, among others.

Cassini has collected enough information about the system that its data, will continue to yield discoveries for decades, despite the spacecraft no longer being with us.

NEW HORIZONS

A lone spacecraft, in the vastness of space, wakes from its slumber. Except for brief annual checkups, it has spent most of the previous eight years under hibernation. Now, New Horizons is prepared to approach its primary mission goal. In six months, it will be flying by Pluto.

The National Academy of Sciences ranked the exploration of the Kuiper Belt, especially Pluto and Charon, its moon, as a top priority for the 2000s. In response, as a part of its New Frontier program, NASA produced New Horizons, a spacecraft designed to make history. History started from day one, on 19th January 2006, when, atop an Atlas V rocket, New Horizons travelled to space, reaching 58,500 km/h, the fastest human-made object ever launched from Earth. New Horizons also became the select few spacecraft to achieve the velocity required to leave the solar system.

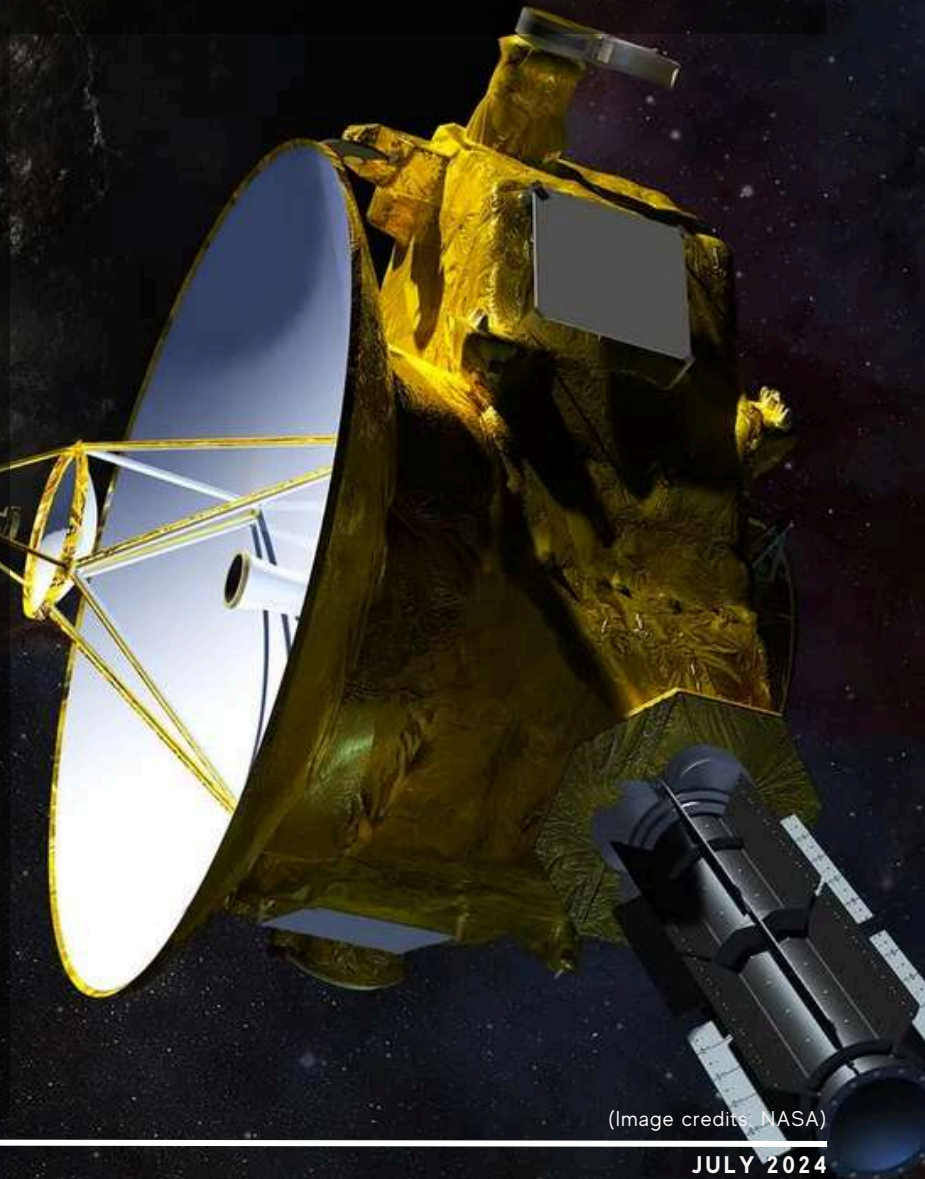
New Horizons' flyby of the dwarf planet wraps up the five-decade-long period of observation that began in the early '60s with Venus and Mars before continuing in the '70s and '80s when Mercury, Jupiter, Mars, Uranus and Neptune were studied. Now, it was time for Pluto's secrets to be unveiled.

While studying Pluto and its system was New Horizons' primary mission, the spacecraft was also to study one or more Kuiper Belt Object (KBO) with a flyby of the object. New Horizons was the first mission to study the planet and explore the region with specialised instruments to gain a better understanding of comets, dwarf planets, and the solar system, as the region has well-preserved material from the planet formation era.

On 14th July 2015, New Horizons flew 12,500 km above Pluto's surface when Pluto was 34 AU from the Sun. Through the flyby, we learned that Pluto is a diverse world, with towering water-ice mountains and wide plains of exotic nitrogen ice in the shape of a heart.

After collecting data on Pluto, New Horizons continued on its way. In 2018, at the edge of the solar system, New Horizons confirmed the existence of the 'Hydrogen wall' that was first detected by the twin Voyager spacecraft. Earlier this year, in 2024, New Horizons raised the possibility that the Kuiper Belt stretches out further than previously thought. How this knowledge affects our perception of the Solar system is yet to be seen.

New Horizons has enough power and propellant to operate through the 2040s. By this time, it will be beyond 100AU from the Sun and in the interstellar medium, joining the twin Voyagers spacecraft. Scientists are interested in what its instruments will record as the spacecraft transits from the Sun's dominant region into the interstellar region.



(Image credits, NASA)

SAVITSKAYA SPACEWALKS

On 17th July 1984, aboard Soyuz T-12, alongside Commander Vladimir Dzhanibekov and Research Cosmonaut Igor Volk, Flight Engineer Svetlana Yevgenyevna Savitskaya launched into space. Shortly after launch, Soyuz T-12 docked to the space station Salyut 7.

Soyuz T-12 was not Savitskaya's first trip to space. Two years earlier, aboard Soyuz T-7, she followed Valentina Tereshkova's footsteps, becoming the second woman to visit space. With her second mission, Savitskaya became the first woman to visit space twice.

A few days later, on 25th July 1984, when Savitskaya exited the Salyut 7 to conduct some welding experiments, she became the first woman to spacewalk, scoring another milestone.

Spacewalk, formally known as extra-vehicular activity (EVA), occurs whenever the astronaut leaves the space vehicle. The first spacewalk occurred in 1965, and it lasted 10 minutes long.

In contrast, Savitskaya's spacewalk lasted over 210 minutes as she conducted welding experiments. Spacewalks are incredibly dangerous and, thus, are rarely utilised.

Savitskaya was selected as she had the flight experience and the physical ability required to perform the necessary operations for multiple hours in a heavy, bulky space suit. Her excellent performance in space also silenced those who didn't believe that women had the capabilities to perform well in space missions. Initially, in 1986, Savitskaya was supposed to return to Salyut 7, commanding an all-female crew for International Women's Day. The mission got cancelled as the ageing space station was suffering technical problems. Savitskaya did not return to space after her second mission.

According to Roscosmos, Russia's space agency, Savitskaya received the highest honour of her homeland, Hero of the Soviet Union, on two separate occasions. She also received two Orders of Lenin and the Order of the Badge of Honor. A main-belt asteroid, Asteroid 4118 Sveta, was named after her too.



Cosmonaut S. Savitskaya performs a deposition of coatings in space, overboard the orbital station "Salyut-7" Image credits: researchgate.

NEWSLETTER

As the days grow longer and the sun shines brighter, there is no better way to bring a burst of energy into our Spaceship than with a Summer Carnival-themed employee engagement event. This was the perfect occasion to infuse our office with the vibrant spirit of summer.

The program started with a warm welcome by Ms. Stuti Bhatia, Executive – Public Relations, who introduced the theme and introduced an icebreaker session where team members shared their fondest summer holiday memories. This followed by a few childhood summer memories of our MDs, Mr. Mitul Jain and Mr. Shivam Gupta of SPACE Group, after which they have shared one important topic of global warming while spreading awareness amongst our team.

The program then continued with birthday celebrations, work anniversaries, and sparkled with new joiners. But the epitome of the occasion was the announcement of Spacian of the Month. Huge applause for Mr. Ash Mohammad, Graphic Designer – Marketing & Communication, for his level of consistency and dedication. His contributions to our success are enormous, more so in the form of developing various content materials for nearly all departments at Space. Ash's commitment and discipline are greatly admired.



A cake-cutting ceremony, followed by a delicious lunch and refreshments, was held to mark the program. The event got further exciting by classic musical chairs game and dancing. Furthermore, we rolled in an ice cream cart into the office just about when summer was brewing. The colourful display of ice cream flavours and toppings presented an atmosphere of festivity and fun.

Finally, we added to the fun with a photobooth that came with props and backgrounds, where Spacians took their time in group photo and selfie captures.

Intern Spotlight:

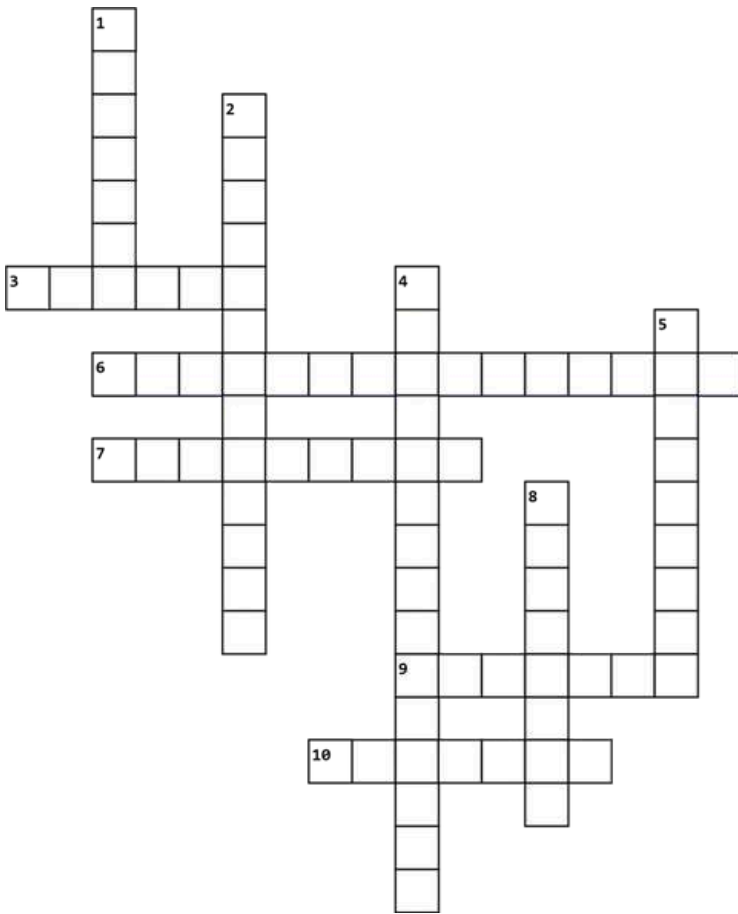
"As a marketing intern at Space, I got an opportunity to work under the guidance of Vinayak sir. This internship really made a difference in giving me practical experience in marketing within the astronomy education industry. I got hands-on experience in many marketing-related tasks and projects. From my experience, the internship under the leadership of Vinayak sir was an eye-opener, which has prepared me for success in my marketing career." – Saumya Garg

Summer Carnival event was vibrant and energizing. There was fun, awareness, and celebration—everything fused into one. We look forward to many more events that bring us together, inspire creativity, and foster a sense of unity within our Space family.



TRAIN YOUR BRAIN

CROSSWORD



Across

- 3. What is the main component of the Sun's atmosphere that can be seen during a solar eclipse?
- 6. Who discovered planet Neptune?
- 7. What is the term for the distance light travels in one year?
- 9. What is the colorful displays of lights in the Earth's polar regions called as?
- 10. Who is the owner of The Blue Origin Space company?

Down

- 1. What is the name of the first human-made object to leave the Solar System?
- 2. Who was the First Indian Origin women to travel Space?
- 4. Name the astronomer who discovered the four moons of Saturn and also defined the rotation period of Saturn?
- 5. Which Catalogue gives description of 110 celestial objects, serving as a comprehensive guide for astronomers?
- 8. What is the primary component of the Sun?

ASTRONOMY WORD PUZZLE

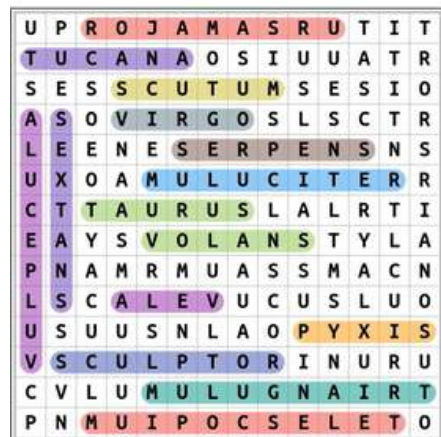
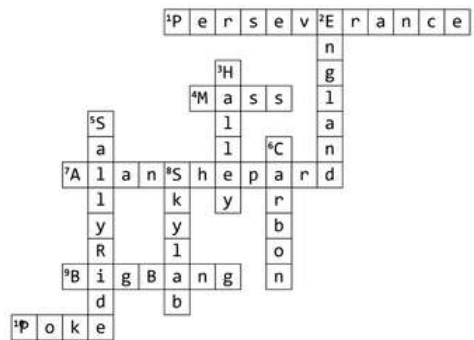
Find the galaxies from the mixed letters and mark them.

GALAXIES

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

- ANDROMEDA
- PINWHEEL
- CARTWHEEL
- FIREWORKS
- ANTENNEE
- BODE
- COMET
- BUTTERFLY
- CONDOR
- CIGAR
- MELIN
- MILKWAY
- NEEDLE
- MICE
- CIRCINUS

Answers for last month puzzles.



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

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