SPACE™
EMPOWERING LIFE

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Galactica

Astronomy and Space Science Magazine

What's Inside?

www.space-global.com

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.

Team

ABOUT SPACE

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

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

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

CMD's Message

Dr. Sachin Bahmba, CMD, SPACE

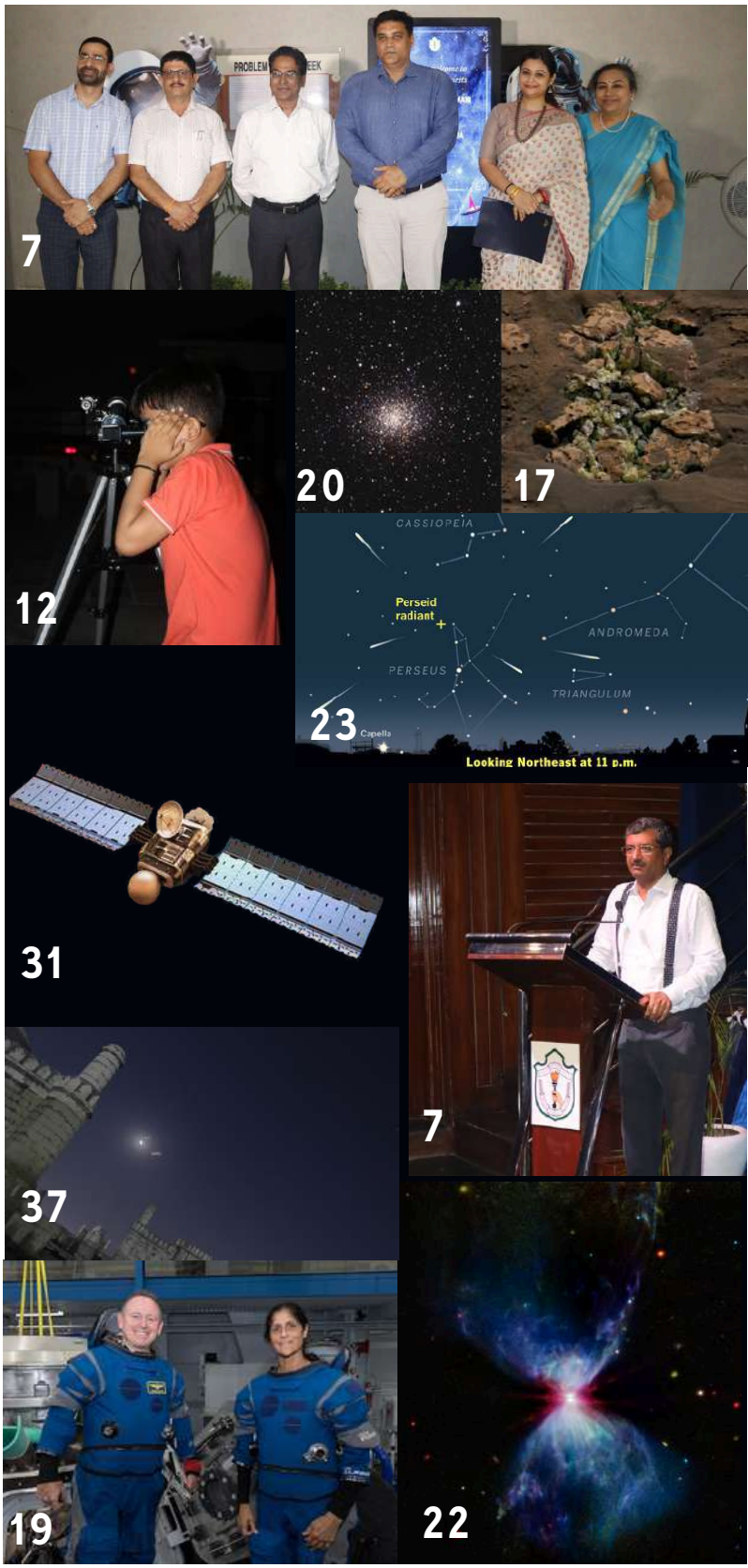
Space and Astronomy are the future for the young generation of our country. This is a great means to inculcate scientific temperament among the masses. Such astronomy sessions will provide a hands-on learning platform for students wherein they explore the real world of science, I wish for young students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

MD's Message

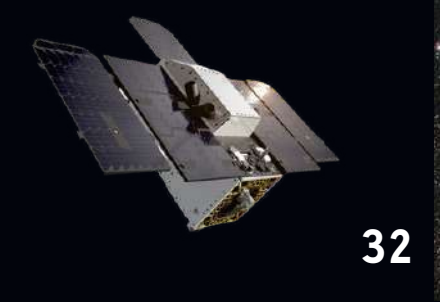
Mr. Shivam Gupta, MD, SPACE

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

LIST OF



CONTENTS



23 August

NATIONAL SPACE DAY

Touching lives while touching the Moon: India's Space Saga

Chandrayaan-3 mission accomplished safe and soft-landing of Vikram Lander on the lunar surface on August 23, 2023. With this, India became the fourth country to land on the moon and first to land near the southern polar region of the moon. The soft-landing was followed by successful deployment of Pragyan Rover. The landing site was named as 'Shiv Shakti' point (Statio Shiv Shakti) and August 23 was declared as the "National Space Day". India will celebrate its maiden National Space Day on August 23, 2024.

Chandrayaan-3 Mission: A Leap Forward for India's Lunar Exploration

On August 23, 2023 India celebrated a landmark achievement in its space exploration history with the successful landing of the Chandrayaan-3 mission's Vikram lander on the lunar surface. This monumental success has prompted Prime Minister Narendra Modi to declare August 23 as "National Space Day," commemorating the nation's strides in space technology and exploration.

SPACE India is celebrating National Space Day, tribute to the tireless efforts of scientists, engineers, and researchers who have propelled India's space program to global recognition. By celebrating this day, SPACE India aims to inspire future generations to pursue careers in STEM fields, foster interest in space science, and showcase the benefits of space technology in improving lives.

SPACE India planned the following Events as a part of National Space Day celebration:

- **Webinar** – To the moon and beyond on occasion of the national space day, a discussion on Careers in space and the future of space exploration and many more things with distinguished panel of renowned Space Scientist and Industry experts. Link to register for the virtual discussion: For Schools - https://forms.gle/6i4DYsuUWKCaDgMS9 and For General public - https://forms.gle/P7z5CPrD839ShK629
- **Cosmic Mind Forum** – An interactive offline session and a one-on-one interaction with a renowned Scientific professional.
- **Celebration in SPACE Associated Schools** – With different activities and competitions on National Space Day. Link to register: https://forms.gle/hy4hWsLEhiiy9qPr9
- **Wall of Stellar Messages** – Share a message for ISRO and Chandrayaan team to us and we'll send it to ISRO. Link to register: https://forms.gle/ntqvgkz8zSptu8UP8
- **Astronomy Showcase in Pan India Schools** – An amazing and engaging celebration for students with many hands-on activities related to astronomy.

Register your school for National Space Day Celebration

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MERCHANDISE PARTNER

SPACE ARCADE

23 August

NATIONAL SPACE DAY

Touching lives while touching the Moon: India's Space Saga

Celebrating 1st Anniversary of

CHANDRAYAAN-3 LANDING

Explore

SOUVENIR COLLECTION of

ISRO MERCHANDISE

by

SPACE ARCADE

Be a part of India's History

National Space Day

National Space Day (NSpD), is an annual celebration in India. Celebrated on August 23rd, honors the triumph of Chandrayaan-3's Vikram lander. This day seeks to promote space science and astronomy nationwide. The first celebration on August 23, 2024, will highlight the theme **"Touching lives while touching the moon: India's Space Saga."**

Space Arcade is thrilled to launch an exquisite collection of exclusive ISRO merchandise. From stylish T-shirts and chic tote bags to premium pens, and much more, there's something to delight every space enthusiast.

As the official **ISRO merchandise partner,** Space Arcade invites you to commemorate this historic day with their unparalleled collection. **Scan the QR code** below & explore our range of apparel and accessories.

Picture captured by Space team during Chandrayaan 3 launch

Chandrayaan-3
Black Round Neck T-Shirt

National Space Day Cap

Explore more NSpD Merchandise, by scanning the QR Code

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GALACTICA

Astrophotography in Himalayas: Capturing the MILKY WAY IN LADAKH

Astrophotography, where Stargazing experts through Astroport venture into the darkest corners of the night to capture the mesmerizing beauty of the Milky Way. Astrophotography is more than just taking pictures; it's a magical blend of science, art, and patience. Imagine standing under a canopy of stars in remote, untouched landscapes, with only the sound of the wind and the faint glow of distant galaxies. This is where the Milky Way reveals itself in all its splendor, weaving a tapestry of light across the velvet sky. Every photograph of the Milky Way is a testament to the vastness and beauty of our universe. Let's embark on this cosmic adventure together, where every click of the shutter captures a moment of wonder and inspiration. Welcome to the world of astrophotography – where science meets art, and the universe becomes our playground.

Details : Camera: Canon 1500D Focal: 16mm Aperture: ƒ/2.8 ISO: 3200 Shutter Speed: 20.0s

Ladakh is Located at an average altitude of 3500 meters (11,500 feet) above sea level, Ladakh offers astrophotographers the advantage of thinner atmosphere, which reduces atmospheric interference and enhances visibility of stars and celestial objects. Ladakh, with its sparse population and minimal artificial lighting, provides exceptionally dark skies, perfect for capturing the Milky Way in all its glory. Ladakh is known for its clear skies, especially during the summer months (May to September), when the weather is most favorable for astrophotography. Popular spots for astrophotography in Ladakh include Pangong Tso Lake, Nubra Valley and the high-altitude plains around Leh. Ladakh, amidst the towering peaks of the Himalayas, is not just a haven for trekkers and adventurers but also a paradise for astrophotographers seeking to capture the mesmerizing beauty of the Milky Way.

You can use a DSLR camera with manual settings capability. These cameras allow you to manually adjust shutter speed, aperture, and ISO, which is crucial for astrophotography. A sturdy tripod is essential to keep your camera steady during long exposures. This prevents blur caused by camera shake, especially in low light conditions. A remote shutter release helps minimize camera shake when triggering the shutter, especially for long exposures. A red headlamp or flashlight with a red filter is useful for adjusting camera settings and navigating in the dark without affecting your night vision. Astrophotography requires patience and persistence. Be prepared to spend several hours shooting during the night to capture the Milky Way under optimal conditions. When capturing the Milky Way, remember your dew heater—essential for preventing condensation on optics during long exposure sessions. This device helps maintain the temperature of your camera lens slightly above the ambient temperature. In cool and humid conditions, such as those often found at night, dew can quickly form on these surfaces, leading to blurred images or complete obstruction of your view.

Set your camera to Manual (M) mode to have full control over settings. Use the widest aperture your lens allows (e.g., f/2.8 or lower) to gather as much light as possible. This helps in capturing faint stars and details of the Milky Way. Start with a moderate ISO setting (e.g., ISO 1600 to 3200) and adjust based on your specific conditions. Higher ISO values increase sensitivity to light but can introduce noise (graininess) in the image. The shutter speed determines how long your camera's sensor is exposed to light. Start with a shutter speed of around 20-25 seconds to avoid star trails (the apparent movement of stars due to the Earth's rotation). Adjust this based on the focal length of your lens and the desired effect. use the live view mode on your camera to zoom in on a bright star or distant light source and manually adjust focus until the stars appear sharp. Incorporate interesting foreground elements such as mountains, lakes, tree or traditional Ladakhi architecture to add depth and context to your Milky Way shots. Use your remote shutter release to trigger the exposure to minimize camera shake.

spend 3 to 4 hours to Capture multiple images and select some best images for post-processing. Post-processing is a common technique in astrophotography, especially for capturing the Milky Way. Transfer the RAW or JPEG images from your camera to a folder on your computer Launch the StarStaX software on your computer. Once your images are in StarStaX, stack them to improve details and reduce noise in your Milky Way shot. After stacking, adjust the levels and curves to make the contrast and brightness pop. Fine-tune colors and saturation to bring out the natural colors of the Milky Way. Use selective sharpening to highlight the details in the Milky Way structure.

After processing, review your image critically to ensure it meets your artistic vision. Save the final image in a high-quality format suitable for sharing or printing, such as TIFF or JPEG. Deep SkyStacker is also one of the best software among astrophotographers for aligning and stacking multiple images to reduce noise and improve detail.

Capturing the Milky Way is a blend of technical skill and artistic vision. With the right equipment, camera settings, and methodical approach. In Ladakh, where the Himalayas kiss the heavens and the night sky unfolds in all its splendor, astrophotography is a gateway to a realm of awe and discovery. Each moment spent under these pristine skies offers a chance to witness the Milky Way's grandeur like never before. Join us in this cosmic adventure where science and art converge, where every photograph not only captures light but also tells the timeless story of our place in the universe. Welcome to Ladakh, where the universe unfolds its secrets, and where each photograph is a doorway to galaxies beyond imagination.

SOAR: A YOUNG STAR LAUNCH

An astronomy Showcase aptly named "SOAR: A Young Star Launch" was placed in Delhi Public School, Faridabad, on 21st August 2024, between 5:00 PM and 8:00 PM. Students enrolled in the esteemed "Universe for All" program had the remarkable opportunity to showcase their astronomical knowledge and skills. This grand event was meticulously planned with 52 activities such as Twinkling stars, Common Directions, Identify the planets, Gatway to Cosmos, Our star the Sun, Jewels of the night sky Nebulas, Jewels of the night sky Galaxies, Observation deck , Soar Operations, Types of telescope, Astrophotography, Safe Solar Observation through telescope, solar view goggles, pinhole projector and many more activities tailored for different classes, primarily designed to captivate the interest of parents and distinguished chief guests. Parents enthusiastically participated in the activities, and the students eloquently explained the intricacies of their projects, displaying a profound understanding of the subject matter.

Under the guidance and support of their dedicated teachers, the students poured their hearts into preparing their activities. Each student was assigned a task that required them to create informative chart papers, Planet's headbands, intricate models, and conduct thorough research on their given topics. Their hard work and creativity shone brightly during the event.

On this auspicious occasion, the school was honored to welcome Mr. Kumar Vyonkesh Mani, a distinguished Scientist at DRDO, and Dr. Sachin Bhamba, the esteemed CMD of Space, as the chief guests. They were accompanied by the honorable principal, Mr. Anil Kumar, and the vice principal, Dr. Sandeepan Rishi. Together, they visited each stall, where the students, brimming with confidence, passionately explained the scientific principles behind their activities. The chief guests were visibly impressed by the students' depth of knowledge and their articulate presentations.

In addition to the stalls, the chief guests had the pleasure of visiting the school's state-of-the-art SOAR (Space Observatory and Astronomy Research) center. Here, the students elucidated the significance of the observatory in the school and provided detailed explanations about the sophisticated equipment housed within. Their presentations highlighted the importance of hands-on learning and the pivotal role of the observatory in fostering a deeper understanding of space science.

Following the tour, everyone assembled in the school auditorium for the award ceremony. The students were filled with pride and excitement as they received beginner-level certificates from the esteemed chief guests. This recognition served as a testament to their hard work, dedication, and the knowledge they had acquired through the program.

In the closing moments of the event, both Mr. Kumar Vyonkesh Mani and Dr. Sachin Bhamba addressed the students, showering them with praise for their hard work and perseverance. They emphasized the importance of curiosity, continuous learning, and the pursuit of scientific knowledge. The principal also took the opportunity to address the students, expressing heartfelt appreciation for their dedication and the effort they had put into preparing for the astronomy showcase. He commended their commitment to learning and their ability to inspire others through their enthusiasm and passion for astronomy.

The astronomy showcase at Delhi Public School, Faridabad, was not only a testament to the students' abilities but also a celebration of their unyielding spirit of inquiry and their remarkable achievements in the field of space science. The event left a lasting impression on all attendees, reinforcing the value of education, exploration, and the boundless possibilities that lie within the cosmos.

TERRAIN EXPLORERS: SPACE INDIA & AMERICAN CENTER'S 3RD WORKSHOP

In an inspiring blend of education and innovation, SPACE India conducted the third session of their engaging workshop series in collaboration with the American Center on 22nd July. This exciting workshop titled "Terrain explorers" delved into the fascinating ways we map and understand the terrains of distant celestial worlds and the intricate details of Earth's landscapes through cutting-edge technology.

The workshop was held at the American center, which was vibrantly decorated for America's National Day, adding a festive atmosphere to the occasion. The center's space-themed decorations, including standees and exhibits highlighting the collaborative efforts between NASA and ISRO for instance the NISAR mission, captivated the attendees including students, parents and teachers.

Enthusiastic students from diverse schools such as Mount St. Mary's, Gaurs International, GD Goenka, Delhi Public School and numerous other schools participated in the event. For these young minds, the workshop offered a rare and valuable opportunity to explore space science and technology. The day was not just a celebration of space exploration but also a unique exposure for participants who were all visibly overwhelmed by the experience.

The session was led by an avid astronomer of Space India who introduced the students to essential technologies like SAR (Synthetic Aperture Radar), InSAR (Interferometric Synthetic Aperture Radar), RADAR, and laser systems. These advanced tools are crucial for understanding surface features, such as elevation and depth. Further, the presentationoffered a thorough understanding of how these technologies enable satellites to create highly accurate topographical maps, which are vital for both Earth observation and space exploration.

A highlight of the workshop was the hands-on activity where students engaged directly with satellite systems. They explored how transmitters, receivers, and antennas work together to collect and transmit data. This practical experience allowed the students to gain a tangible understanding of the technology and appreciate its real-world applications.

Mr. Darryl Woolfolk, the Public Diplomacy Officer at the American Embassy, shared his insights on the workshop's impact. He remarked, "I think the impact is just that we had hoped that young people interested in science and space science specifically, will get to try out things, empower their minds and hands in scientific discoveries. It will generate interest in some of them to further pursue studies in space science which is what we are after."

When asked about his vision for the future, he emphasized the potential of this generation to witness and even contribute to humanity's presence on other planets like Mars. "This generation could be the first to see the beginning of our presence on other planets like Mars" he noted.

The "Terrain Explorers" workshop was more than just an educational event; it was a memorable journey into the world of space exploration and technology. The enthusiasm and curiosity sparked by the workshop were evident in the students' active participation and engagement. As SPACE India and the American center continue their collaboration on such educational initiatives, they play a crucial role in nurturing the next generation of scientists and explorers, ensuring that the spirit of discovery and innovation remains vibrant and ever-growing.

ASTRONOMY SHOWCASE

An **"Astronomy Showcase"** was set up in K.R. Mangalam World School Vikaspuri and Gurgaon on PTM. It was organized with the joint efforts of the Astronomy educators and students of the middle wing on July 20th, 2024.

In this showcase, many fun-filled Astronomy-based activities were conducted which were thoroughly enjoyed by people of all age groups- from students to parents. Apart from being a stress buster for the children; this was an interactive, informative, and fun zone in the school that caught everyone's attention.

Students also volunteered for the showcase and explained the activities to the guests. There was a plethora of fun-filled Astronomy activities like Ring the Planet, weighing yourself on different planets, Pop Rocket, Crater making, Stomp rocket, Save the Earth Hydro Rocketry, lung capacity test, creating a sky map, Can you be an Astronaut, Students Corner, Shoot the Alien and Solar observation using solar filters, solar view goggles, and telescope.

Students and parents both participated in the activities with full zeal and thoroughly enjoyed them. People were amazed to see the students' scientific temperament and logical thinking. In all, it was a "hands-on learning" day and was thoroughly enjoyed by everyone. The showcase was appreciated by everyone in the school and received great feedback from students and parents.

Selfie With Full Moon

The full moon is a celestial event that occurs approximately every 29.5 days when the moon is directly opposite the sun from the Earth's perspective. Students of K.R. Mangalam, DPS participated and clicked Selfie with the Full Moon on 21st August 2024

MONTHLY TELESCOPIC OBSERVATION

SPACE ARCADE team conducted 2024's 7th Monthly Telescopic Experience session on the 20th of July 2024 in Delhi.

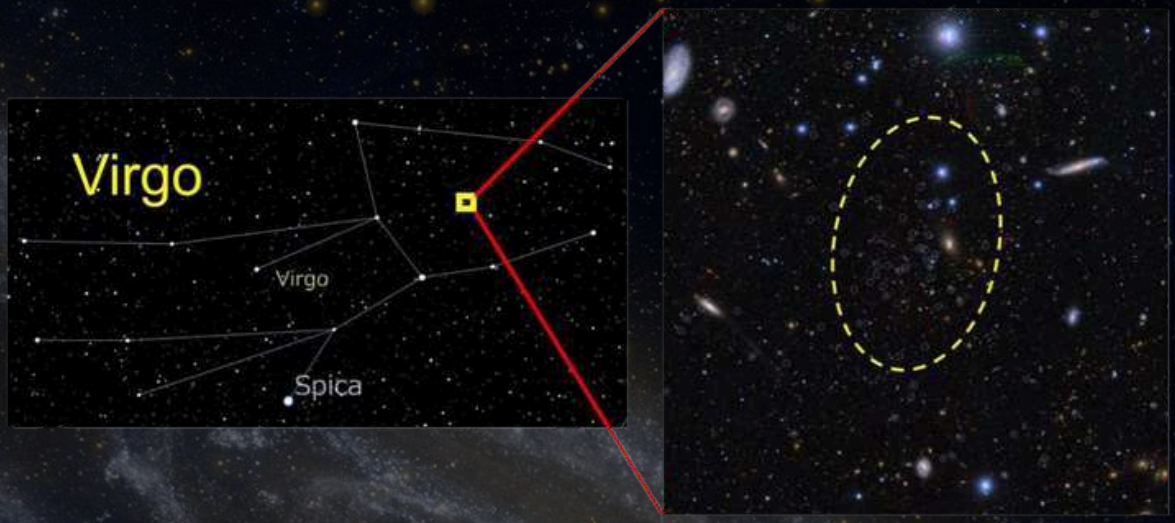
People from various places joined the observation with their telescopes, binoculars, and other astronomical equipment. They learned and experienced the breathtaking view of the Moon and planet Beehive Cluster. They also learned about different types of telescopes and cleared all their queries on the 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 and Schmidt-Cassegrain telescope set up by the SPACE team.

Visit: www.spacearcade.in

HIGHLIGHTS OF JULY 2024

SCIENTISTS FINALLY FOUND 2 OF THE MILKY WAY'S MISSING SATELLITE GALAXIES.



The position of the newly found dwarf galaxy Virgo III and its member stars. (Image credit: NAOJ/Tohoku University)

Two new Milky Way satellite galaxies have been found by astronomers, and these discoveries may contribute to our understanding of dark matter, the enigmatic substance that makes up around 85% of the universe's matter yet is essentially invisible to us.

The findings also bring cosmologists one step closer to resolving a persistent issue with the "lambda cold matter model," or "ΛCDM," which is the mainstream model of cosmology. In this model, the term "cold" implies that dark matter is made up of particles that travel slower than light.

The recently discovered compact star clusters are known as Virgo III and Sextans II. At maximum distances of 1.4 million light-years, they join the approximately 60 known dwarf galaxies that swarm around our much larger home spiral galaxy. Among these Milky Way dwarf galaxy satellites, the Large Magellanic Cloud (LMC) and the Small Magellanic Cloud (SMC) are the most well-known and substantial.

Because they are far away and dim, many tiny dwarf galaxy satellites of the Milky Way are yet unidentified, but Chiba and colleagues were eager to start looking for these elusive objects. So they looked at the telescope made by Subaru which is particularly suited for searching dwarf galaxies.

About 220 dwarf galaxies should orbit the Milky Way, according to certain simulations based on the standard model of cosmology, but scientists are unable to determine their exact locations. In order to restore that balance, Sextans II and Virgo III have been discovered. However, the ramifications of these discoveries may provide the opposite challenge to cosmologists than the one they faced previously.

By combining Subaru's night-sky "footprint" with the distribution of dwarf galaxies it has observed, they were able to determine the approximate number of satellites that should actually round our galaxy. As a result, it was calculated that 500 galaxies surround the Milky Way, which is more than twice as many as what was expected by simulations using the ΛCDM.

The group that made these discoveries on Milky Way dwarf galaxies now plans to use a second ground telescope to look into the precise number of satellite galaxies that encircle our galaxy.

Earth has 7 strange Quasi-Moons

Things in space are typically referred to by two names. One is fun while the other is formal. It is logical. In addition to maintaining consistency, communicability, and clarity in their exoplanet catalogs and black hole references, researchers must also foster positive energy as they are sentient beings. For example, the galaxy cluster known as "ACT-CL J0102-4915" is so massive that it is literally referred to as "The Fat One," or El Gordo.

The public is being invited to submit suggestions for a name for one of Earth's quasi-moons to the International Astronomical Union, which is in charge of naming policies for celestial objects and phenomena. The object is currently known as asteroid 164207, or 2004 GU9, however it is called a "moon" since it seems to be connected to the gravitational tides of our planet like to Our Moon.

Nevertheless, 2004 GU9 is a "quasi" satellite as the sun's force truly determines its orbit; Earth's orbit around the sun simply coincides with its path. The orbit of GU9 in 2004 is also erratic. Actually, it's unlikely that this odd item will linger in our solar system forever. Approximately after the year 2600, it is anticipated to disappear.

According to Nasser, three of Earth's seven semi-neighbors have sufficient scientific evidence to qualify as "official" quasi-moons. "We picked the weirdest one," he continued, out of the three. It's a grayish rock that resembles the scale of the Eiffel Tower and is most likely shaped like an irregular blob with jagged edges.

The naming competition is being held in association with the podcast Radiolab, which is presented by Lulu Miller and Latif Nasser. This is because Nasser was able to name a quasi-moon of Venus of his own not too long ago by accident. According to Nasser, Zoozve (the name for moon) was only accepted because the IAU was enthralled with the "cuteness" of the product's backstory.

Regretfully, or luckily, depending on your point of view, the IAU is probably going to be more stringent when it comes to the new quasi-moon naming project. Though Nasser stated, "If there are names that are sort of extraordinary and are not mythological, we'll try to pitch it to them," the IAU prefers mythological names.

We lean more toward the lighthearted idea that 'Maybe it should be Mooney McMoonface!' They seem more inclined to say, in my opinion, "This is not a silly, whimsical gag." This will be up there permanently." So if you have any fun name in your mind and you can back up the name with your unique or mythological go on to this website to enter the contest. (https://radiolab.org/moon-official-rules/).

SOLAR MAXIMUM IS IN SIGHT BUT WHEN WILL IT ARRIVE

The sun experiences an 11-year cycle of rising and falling activity. Swiss astronomer Johann Rudolf Wolf created the solar cycle numbering and naming scheme in 1852, and designated the historic 1755–1766 solar cycle as "Solar Cycle 1" in his new system of solar cycle numbering. The sun was already in Solar Cycle 9 when he got to work. We are now in Solar Cycle 25 as of December 2019.

At solar minimum, when the sun is almost completely devoid of sunspots, a particular solar cycle begins. Coronal mass ejections (CMEs) and solar flares cannot occur during this timeframe for months at a time. After a few years of solar minimum, solar activity progressively increases to a solar maximum phase. Large solar flares and CMEs are most common during solar maximum.

The solar maximum, as defined by science, is the highest point on the sunspot number curve after 13 months of smoothing. What does this signify? Although counting the sunspots on the surface is a simple method, sunspot numbers are determined every day. Because solar maximum is defined by the peak of the 13-month smoothed curve, it may not occur in the month with the most sunspots.

Take Solar Cycle 24 as an example: the highest monthly sunspot number was reported in February 2014, although the official solar maximum occurred in June 2014. Meanwhile, in the current Solar Cycle 25, May and June 2024 saw the greatest monthly sunspot counts since September 2022. It is probable that these are the highest monthly sunspot numbers we will see, even if the 13-month averaged figure (which defines solar max) continues to grow for a few months. Alternatively, the future months may witness higher sunspot levels than May and June.

When will we know?

It is impossible to know if you are at the height of the solar cycle in any given month. This is due to the fact that it is always uncertain if sunspot activity will be higher in the following month than it is in the one you are now in. We are unable to predict whether sunspot numbers will increase again, even months after the likely solar maximum. An excellent illustration of this may be seen in our current solar cycle, which peaked in June 2023 and then declined for several months before increasing again in April and May of 2024.

Historical solar cycle data frequently shows this double peak in sunspot numbers, although it is never certain. To declare with confidence that the peak has gone, it may occasionally take a year or two of consistently dropping sunspot numbers. We also need to take into account the 6-month lag before we even obtain the data point for a specific month because this trend analysis employs the 13-month smoothed sunspot values.

We might not be able to pinpoint the exact date of solar maximum until the end of 2025 or 2026, given that it is predicted to occur between July 2024 and January 2025.

SIGNS OF LIFE COULD SURVIVE ON SOLAR SYSTEM MOONS ENCELADUS AND EUROPA

If life is present on the frozen ocean moons of Europa and Enceladus, it may exist in measurable trace amounts just beneath their frozen exteriors.

For a considerable amount of time, scientists have postulated that Enceladus, one of Saturn's 146 known moons, and Europa, one of Jupiter's 95 moons, could both have enormous oceans of liquid water that support life. Should this be the case, then complex organic molecules–the building blocks of life as we know it–such as nucleic acids and amino acids could function as "biosignatures" of life on other worlds.

The issue is that intense solar radiation strikes both Europa and Enceladus, possibly destroying intricate biological molecules on their surfaces. On the other hand, recent findings provide some optimism, indicating that those biosignatures might actually persist provided they are kept intact in the moons' icy shells. In the event that this is accurate, these molecules might be situated so near the surface that they could be liberated by upcoming robotic landers.

It's possible that biosignature chemicals can persist in the shallower ice on Enceladus, negating the need for more excavation compared to Europa. These moons are not only nearly atmosphere-free and extremely cold, but they are also surrounded by solar radiation, energetic particles, and cosmic rays from massive events like supernovas that occur outside of our solar system. Yet, it is thought that beneath the thick, ice surfaces of Europa and Enceladus, there lay oceans of liquid water.

Because of the gravitational pull that these moons' parent planets and their sister moons have on them, their oceans would be shielded from such particles and warmed by geothermal heat produced by that pull. This would imply that life may exist on these subterranean waters provided they have the proper chemistry and an energy supply.

After taking samples of amino acids and sealing them in airless vials, the researchers cooled the substances to a temperature of about minus 321 degrees Fahrenheit, or negative 196 degrees Celsius. To test the molecules' ability to survive, the researchers next subjected the amino acids to several intensities of high-energy light known as "gamma rays." Additionally, the researchers investigated the impact of amino acid mixing with meteorite material on the survivability of dead bacteria sealed in the ice of Europa and Enceladus.

When combined with silicas, which are comparable to those found in meteorite dust, the team discovered that amino acids broke down more quickly. Nevertheless, deceased micro bacteria's amino acids broke down more slowly than usual. This might be the case because the cell walls of bacteria protect amino acids from radiation-induced reactive chemicals that would otherwise hasten their breakdown.

NASA's Curiosity Rover Discovers a Surprise in a Martian Rock

On May 30, a rock that NASA's Curiosity Mars rover had driven over burst open, shocking scientists with the sight of yellow sulfur crystals—something they had never seen on the Red Planet before. The rover has been investigating a region of Mars rich in sulfates—a type of salt that contains sulfur and is formed when water evaporates—since October 2023.

However, the rock Curiosity recently ripped apart is composed of elemental, or pure, sulfur, as opposed to previous detections of sulfur-based minerals, which are composed of a mixture of sulfur and other elements. What connection, if any, elemental sulfur has to other sulfur-based minerals in the vicinity is unknown.

During off-roading in the Gediz Vallis channel, which winds down a portion of the 3-mile-tall (5-kilometer-tall) Mount Sharp, which the rover has been climbing since 2014, Curiosity has found a number of findings. A distinct era of Martian history is represented by each layer of the mountain. If and when microbial life ever developed on Mars, Curiosity's objective is to investigate where and when the planet's ancient terrain might have supplied the nutrients required.

Credit: NASA/JPL-Caltech/MSSs

Experts believe that rivers of liquid water and debris sculpted the canal, leaving behind a ridge of rocks and silt that stretches two kilometers down the mountainside underneath it. Gaining further insight into the processes that altered this landscape billions of years ago has been the aim.

The most recent hints from Curiosity indicate that both may have been involved: some piles seem to have been caused by smaller localized landslides, while others were probably left by more powerful flows of water and debris.

Based on rocks discovered in the debris mounds, those conclusions are made: Some of the debris mounds are filled with more angular rocks that may have been deposited by dry avalanches, in contrast to the rounded stones that are carried by water flows and form river rocks.

At last, the sediment that had fallen here was saturated with water. Some of the rocks have white "halo" designs etched into them by chemical reactions brought on by the water. Over time, erosion caused by wind and sand has exposed these halo forms.

Curiosity's seven-foot (2-meter) robotic arm was used to drill its 41st hole, and afterward, the six-wheeled scientist dripped the powdered rock into devices inside its belly for more research. This will allow scientists to ascertain the composition of the rock.

Budget allocated for Space Sectors

Two realities were represented in the Union budget in a few words and statistics. One, how essential to the goal of Viksit Bharat are India's state-run space and atomic energy sectors. Secondly, how the notion of making them accessible to the private sector is thought to be essential to their development. The space sector would receive Rs 13,042.75 crore from Finance Minister Nirmala Sitharaman, an increase from the Rs 12,543.91 crore allotted in 2023–2024.

She also said that a venture capital fund valued at Rs 1,000 crore would be established to advance space technology development. More than 180 government-recognized start-ups operating in the space sector are expected to benefit from the money, which Sitharaman predicted will increase the space economy by five times over the next ten years.

Regarding the atomic energy industry, the minister of finance declared that the Center will collaborate with private entities to create small modular reactors (SMRs), assisting India in increasing its production of nuclear energy. According to Sitharaman, "Nuclear energy is expected to form a significant part of the energy mix for Viksit Bharat."

Up until now, the private sector's engagement in the sensitive field of atomic energy has been restricted to building reactor vessels and carrying out other particular jobs as turnkey projects for government organizations. India is currently working with commercial entities to shift to cleaner fuels in order to meet its goal of having net-zero carbon emissions by 2070.

In the meantime, the current budget's research boost for the space sector follows India's recent successes in space exploration, which included the successful Chandrayaan-3 and Aditya L1 missions, both completed last year.

Based on official estimates, India's 8,180 MW installed nuclear capacity is expected to grow to 22,480 MW by 2031–2032. The nation's space economy is predicted to increase from its current $8.4 billion to $44 billion by 2033, or roughly the same amount of time. It is thought that this initiative to incorporate more private parties in the journey will hasten the transition.

Sunita Williams and Butch Wilmore Stranded in Space: Technical Glitches Delay Their Returns

Indian-origin astronaut Sunita Williams and her fellow astronaut Butch Wilmore are facing an unexpected and prolonged stay in space, now extending to 52 days due to technical malfunctions with their spacecraft. Originally slated for a brief 10-day mission, their return has been indefinitely postponed following a series of issues with the Boeing Starliner spacecraft they used for their journey.

The duo launched on June 5 aboard the Starliner, which was making its maiden flight. However, the mission quickly encountered problems. Critical failures include five of the spacecraft's 28 maneuvering thrusters ceasing to function, a malfunctioning propellant valve, and five reported helium leaks. These technical glitches have severely disrupted their planned schedule, leaving their return date uncertain.

NASA and Boeing engineers are actively addressing these issues. The propulsion system failures and valve problems are particularly concerning as they directly impact the spacecraft's ability to maneuver and ensure a safe re-entry. While engineers are working around the clock to develop and implement solutions, a fix has yet to be fully realized, prolonging the astronauts' stay.

Sunita Williams and Butch Wilmore (Photo: Nasa)

The situation highlights the complex nature of space travel and the unforeseen challenges that can arise. Despite these setbacks, Williams and Wilmore continue their work on the ISS, contributing valuable research and performing essential maintenance.

NASA has yet to provide a revised timeline for their return, but they emphasize that the priority remains the safety of the crew. The space community and the public are closely following the developments, eagerly awaiting news on when the astronauts will finally return to Earth.

WHAT'S UP IN THE SKY - AUGUST 2024

LUNAR CALENDAR

IMPORTANCE OF MOON PHASES FOR STARGAZERS

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

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

PLANETS VISIBILITY

Mercury
Inferior conjunction 19 August, best in morning sky at end of month.

Venus
Evening planet, setting only 40 mins after Sun all month

Mars
Improving morning planet, forming interesting patterns with Aldebaran and Jupiter.

Jupiter
Improving morning planet in Taurus. Reaching good altitude of nearly 40° under dark skies at end of month.

Saturn
Improving morning planet, occulted by the Moon on 21 August.

Uranus
Improving morning planet, currently near the Pleiades.

Neptune
Morning planet able to reach peak altitude, due south, in darkness from mid-August.

BRIGHT DEEP SKY OBJECTS

Messier 6 also known as The Butterfly Cluster or NGC 6405 is an open cluster of stars in the constellation of Scorpius. Its name derives from the vague resemblance of its shape to a butterfly. Estimates of the Butterfly Cluster's distance have varied over the years, with a mean value of around 1,600 light years, giving it a spatial dimension of some 12 light years.

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.

Messier 10 is a globular cluster of stars in the constellation of Ophiuchus. The object was discovered by the Charles Messier on 1764 and described it as a "Nebula without stars". It is roughly 15,000 light-years from Earth and has an apparent magnitude of 6.4. This cluster can be easily observed during early August.

Messier 19 is a globular cluster in the constellation Ophiuchus. It was discovered by Charles Messier on 1764 and added to his catalogue of comet like objects that same year. It was resolved into individual stars by William Herschel in 1784. The cluster is located 28,500 light-years from Earth and It has an apparent magnitude of 7.7

FROM THE EYES OF WEBB - JULY 2024

NASA's Webb Images Cold Exoplanet 12 Light-Years Away

An international team using NASA's James Webb Space Telescope has directly imaged the exoplanet Epsilon Indi Ab, located 12 light-years from Earth. This planet, orbiting the K-type star Epsilon Indi A, is one of the coldest observed exoplanets and has several times the mass of Jupiter. Using Webb's Mid-Infrared Instrument (MIRI), the team achieved direct imaging, a rare feat accomplished for only a few dozen exoplanets. Epsilon Indi Ab, slightly warmer and more massive than Jupiter, offers a unique opportunity to study a true solar system analog due to its cold temperature of 35°F (2°C). The planet's atmospheric properties suggest significant methane, carbon monoxide, and carbon dioxide presence. The team plans further photometric and spectroscopic observations with Webb to understand this and similar planets better.

Exoplanet Epsilon Indi Ab

NASA's Webb Investigates Eternal Sunrises, Sunsets on Distant World

Exoplanet WASP-39

Using the James Webb Space Telescope, astronomers have analyzed the atmospheric differences between the morning and evening of the tidally locked exoplanet WASP-39 b, located 700 light-years from Earth. WASP-39 b has a constant dayside and nightside due to its locked rotation. By examining the 2- to 5-micron transmission spectrum, they discovered a temperature difference of about 200°C (300°F) between the two regions, with the evening side being hotter. This difference is attributed to gas circulation patterns, where winds transfer cooler air from the nightside to the morning and hotter air from the dayside to the evening. The study provides new insights into the structure and dynamics of exoplanetary atmospheres, showcasing the advanced capabilities of the Webb telescope.

NASA's Webb Captures Celestial Fireworks Around Forming Star

Dark molecular cloud L1527

NASA's James Webb Space Telescope captured a mid-infrared image of a protostar within the dark molecular cloud L1527. This vibrant image reveals the protostar's behavior and the surrounding gas and dust concentrations. The protostar, about 100,000 years old, is at the center of an hourglass-shaped structure formed by outflows carving through the molecular cloud. The bright red region indicates the protostar and its accretion disk, while blue areas highlight carbon-rich molecules. Webb's MIRI instrument shows the effects of these outflows on the thick dust and gases, providing insights into the protostar's energetic activity and its influence on its environment. As the protostar matures, it will consume and disperse the surrounding cloud, making the star more visible. This observation aids in understanding star formation in the Taurus region, where L1527 is located.

Vivid Portrait of Interacting Galaxies Marks Webb's Second Anniversary

Penguin and the Egg Arp 142

To mark the second anniversary of NASA's James Webb Space Telescope, an image of two interacting galaxies, Arp 142, has been released. This telescope, capturing infrared light, reveals intricate details of the galaxies, known as the Penguin and the Egg. Their interaction began 25-75 million years ago and will eventually merge them into a single galaxy. The Penguin, a spiral galaxy rich in gas and dust, shows star formation due to gravitational interactions, while the Egg, an elliptical galaxy, remains mostly unchanged. The telescope's capabilities continue to provide remarkable insights into the universe, inspiring future scientific exploration.

ASTRONOMICAL EVENTS - AUGUST 2024

Perseids Meteor Shower

The Perseids is one of the best meteor showers to observe, producing up to 80 meteors per hour at its peak.

Comet Swift-Tuttle

The Perseid meteor shower, known for its numerous bright meteors, is caused by tiny fragments from Comet Swift-Tuttle, which was first discovered in 1862. The name "Perseids" comes from the constellation Perseus, as the meteors seem to originate from this part of the sky. This meteor shower is a favorite among astronomers and stargazers, as it can produce 60 to 100 meteors per hour during its peak, particularly when viewed from a dark location. The Perseids occur annually from July 17 to August 24, with the peak this year happening on the night of August 12 and into the early morning of August 13.

How and When to see the Perseids Meteor Shower in 2024:

The best time to observe the Perseid meteor shower in 2024 will be from midnight until dawn, as this is when the sky is darkest and the radiant point is highest. The peak will coincide with a 1st quarter moon, which will be 50% illuminated. The shower builds up gradually, with the best viewing often occurring just before dawn.

(Image credit: Sky and telescope.com)


An image of the comet Swift-Tuttle
(Image Credits - Planetary.org)

Tips for Watching the Perseid Meteor Shower:

Observing the Perseid meteor shower requires no special equipment. For the best experience, find a dark location away from artificial lights. Here are some tips:

Avoid Light Pollution: Stay away from city lights for a clearer view.

F**ind the Darkest Spot:** Look at the darkest part of the sky to see more meteors.

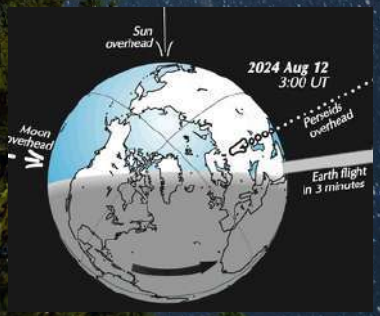
Let Your Eyes Adjust: It takes about 15 minutes for your eyes to adapt to the darkness.

Stay Comfortable: Use a reclining chair to avoid neck strain.

Don't miss this spectacular meteor shower!

Myths, legends and associations with the Perseid meteor shower:

The Perseid meteor shower is linked to various cultural myths and legends. In Greek mythology, it's named after Perseus, who beheaded Medusa and married Andromeda. The name "Perseids" refers to their descendants. In Catholic tradition, the meteors are called "the tears of St. Lawrence," as the shower peaks around the date of his martyrdom. The Romans associated the shower with the god Priapus, believing it symbolized fertility and agricultural abundance.



The 2024 Perseid meteor shower, seen in earth mode
(Image Credits: earthsky.org)

FIRST SUPERMOON OF THE YEAR!

The Full Moon in August 2024 promises to be an astronomical delight, being both the year's first Supermoon and a seasonal Blue Moon. Known as the Sturgeon Moon, this Full Moon is named after North America's largest freshwater fish.
On August 19, 2024, at precisely 18:26 GMT (11.56 p.m. IST), the Moon will reach its full phase, shining in the constellation Aquarius. Although the Full Moon is a fleeting moment, its glowing presence will grace the sky for several days around this date.

What is a Supermoon?
The Moon's average distance from Earth is 384,400 km (238,855 miles), but this can vary. When the Moon comes closer to our planet, it appears larger and brighter—a phenomenon known as a Supermoon. Specifically, a Supermoon is when the Full or New Moon is within 90% of its closest point to Earth, making these events about 7% bigger and 16% brighter than usual.

Why the Sturgeon Moon? The August Full Moon, or Sturgeon Moon, is named after one of the oldest and most primitive fish species, some astrologers believe it spiritually signifies strength and resilience and it also gets its name from Native American tribes around the Great Lakes, who found August to be the prime season for catching sturgeon. These ancient, large fish, sometimes called "living fossils," have hardly changed since prehistoric times. They can grow over 2-3.5 meters long, weigh around 90 kilos, and some female sturgeons live up to 150 years.

Super moon captured by Mr. Ranjith Kumar E, Team Lead, Chennai, using a 250mm focal length Camera.

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 Jupiter and Mars

On August 15th, the red Planet Mars will meet the Giant planet Jupiter in the East direction. The pair will be visible in the sky at around 01.00 a.m. but the close to each other at around 03.30 a.m. Mars will be at a magnitude of 0.83 & Jupiter will have a magnitude of -2.04.

Place: New Delhi/ Date: 15th August / Time:03.30 a.m.

Place: New Delhi/ Date: 20th August / Time: 07.30 p.m.

Conjunction of Moon and Saturn

On August 20th, the Ringed planet Saturn and the Moon will have the closest approach in the night sky & reaching an altitude of 28° above the south-western horizon. The Moon will be at magnitude -12.78, and Saturn at mag 0.7. And it will be visible around 07.30 p.m. in the night.

Conjunction of Moon, Mars and Jupiter

On August 28, the Moon, the planets Mars and Jupiter will appear very close to each other in the past midnight. They will be in the North-eastern direction. Moon is at a magnitude of -11.48, the planets Jupiter is at a magnitude of -2.11 and Mars at a magnitude of 0.76. The Moon and Jupiter will be seen in the night sky around 1.30 a.m.

Place: New Delhi / Date: 28th August / Time: 01.30 a.m.

Maps in the Sky, Home on the Ocean

The Pacific Ocean is the world's largest and deepest ocean. It covers approximately 32% of the world's surface, equivalent to the total land area. Traversing the featureless ocean without navigational instruments is akin to a death sentence. Yet for several thousands of years, while other cultures were sailing close to their coastlines, the Polynesians successfully travelled the massive ocean, trading with far-off islands and discovering lands untouched by man.

Wayfinding is the process of orienting and travelling from place to place. It is how humans have found their way for most of history and what helped ancient humans to travel across featureless lands. Even in modern technology, humans are wayfinding without knowing. A simple example of wayfinding is looking at the street or town name to know where we are. Another form of wayfinding is looking for the North Star in the night sky or tracking the motion of the sun to know the cardinal directions. Navigating is a specific form of wayfinding, which includes knowing the current position and the position of the final destination before plotting a route to connect the two points and determining the transport.

Polynesian wayfinding is on another level. Perfected nearly 3000 years ago, it was used to enable long voyages across the Pacific Ocean. With Polynesian Wayfinding, ancient Polynesians made contact with almost every island within the Polynesian Triangle (found between New Zealand, Hawaii and Easter Island) while settling on more than 1000 islands in the region. Ancient Polynesians were migrating people, and the ocean and its islands were their home.

The Polynesians had a highly developed navigation system, which included observing the stars as they rose and passed through the night sky and memorizing sky charts. The knowledge was not easily available. It was fiercely guarded and passed from masters to apprentices, often in the form of a song.

The Navigators would not only rely on the stars to travel through the vast ocean. During the day or when it was cloudy, they would feel the movement of the ocean by paying attention to the ocean swells. Swells which were short and steep indicated the presence of land nearby while far from land, swells were felt as slow undulations. Additionally, they relied on visual aids such as wave crests and cloud formations to orient themselves.

Through the stars and the techniques they developed, ancient Polynesians were able to conquer the mighty Pacific.

The Sky Gods: Mythological Stories of Uranus Across Ten Cultures

Throughout history, civilizations have looked to the sky and woven stories of gods who reign over the heavens. These sky deities often symbolize the vastness and power of the sky, playing crucial roles in the creation and order of the universe. Here, we explore the mythological stories of Uranus and his counterparts in ten different cultures.

Greek Mythology: Uranus
In Greek mythology, Uranus (Ouranos) is the primordial god of the sky and the heavens. He is one of the first beings, fathering the Titans, the Cyclopes, and the Hecatoncheires with Gaia, the Earth goddess. Uranus's rule was tyrannical, leading Gaia to conspire with their son Cronus. Armed with a sickle given by Gaia, Cronus overthrew Uranus by castrating him. From Uranus's blood and severed genitals sprang the Erinyes (Furies), Giants, and Meliae (ash tree nymphs).

Roman Mythology: Caelus
The Roman equivalent of Uranus is Caelus. Though less detailed in myth than Uranus, Caelus is similarly depicted as the personification of the sky and heavens. He fathered Saturn (the Roman counterpart of Cronus) with Terra (the Earth). Caelus's role in Roman mythology reflects the Greeks' influence, illustrating a shared cultural reverence for the sky as a divine entity.

Egyptian Mythology: Nut
In Egyptian mythology, Nut is the goddess of the sky. She and Geb (the Earth) were once inseparable lovers, but the air god Shu separated them to create space for life. Nut is often portrayed arching over the Earth, her body adorned with stars. Her daily cycle of swallowing the sun god Ra and giving birth to him each morning symbolizes the sky's eternal nature.

Mesopotamian Mythology: Anu
Anu, or An, is the sky god in Sumerian mythology. He is associated with the heavens and constellations and is part of a divine triad with Enlil and Enki. Anu plays a central role in many myths, including the epic of Gilgamesh, where he is depicted as a supreme deity. Anu's authority over the cosmos underscores the importance of the sky in Mesopotamian belief.

Norse Mythology: Tyr and Ymir
In Norse mythology, the sky is personified by the god Tyr, who is associated with war and justice. Another figure, Ymir, is a primordial being whose body was used to create the cosmos. Ymir's skull became the heavens, highlighting the Norse view of the sky as a fundamental part of the universe's structure.

Hindu Mythology: Dyaus Pita

In early Hinduism, Dyaus Pita is the sky god comparable to the Greek Uranus. He is the father of Agni (fire) and Indra (rain and thunder), and the consort of Prithvi, the Earth goddess. Often invoked in the Vedas, Dyaus Pita represents the sky's life-giving and protective aspects.

Chinese Mythology: Tian and Pan Gu

In Chinese mythology, Tian represents the concept of Heaven rather than a personified deity. Tian is crucial to the Mandate of Heaven, the divine right to rule. Additionally, Pan Gu is a mythological figure who created the world, with his body forming the heavens and Earth. These beliefs illustrate the sky's central role in Chinese cosmology and governance.

Polynesian Mythology: Rangi and Papa

In Māori mythology, Rangi (Ranginui) is the sky father, and Papa (Papatuanuku) is the earth mother. Their children, including the god of war Tūmatauenga, forcibly separated their parents to create space for humans to live. This separation myth reflects the dynamic relationship between the sky and Earth in Polynesian thought.

Japanese Mythology: Takamimusubi

In Shinto, the sky is represented by the god Takamimusubi, one of the three primordial deities. Takamimusubi, along with Amenominakanushi and Kamimusubi, played a role in the creation of the world and other gods. These deities embody the sky's creative and ordering power in Japanese mythology.

Mayan Mythology: Itzamna

The Mayan sky god Itzamna is a creator deity associated with wisdom and the night sky. Often depicted as an aged man, Itzamna is linked with writing and medicine, illustrating the Mayan view of the sky as a source of knowledge and healing.

Conclusion

From the Greek Uranus to the Mayan Itzamna, sky gods across different cultures reflect the profound impact of the heavens on human imagination and belief. These deities not only symbolize the vastness and power of the sky but also play essential roles in the creation and order of the world. Through these mythological stories, we see a shared human reverence for the sky and its mysteries.

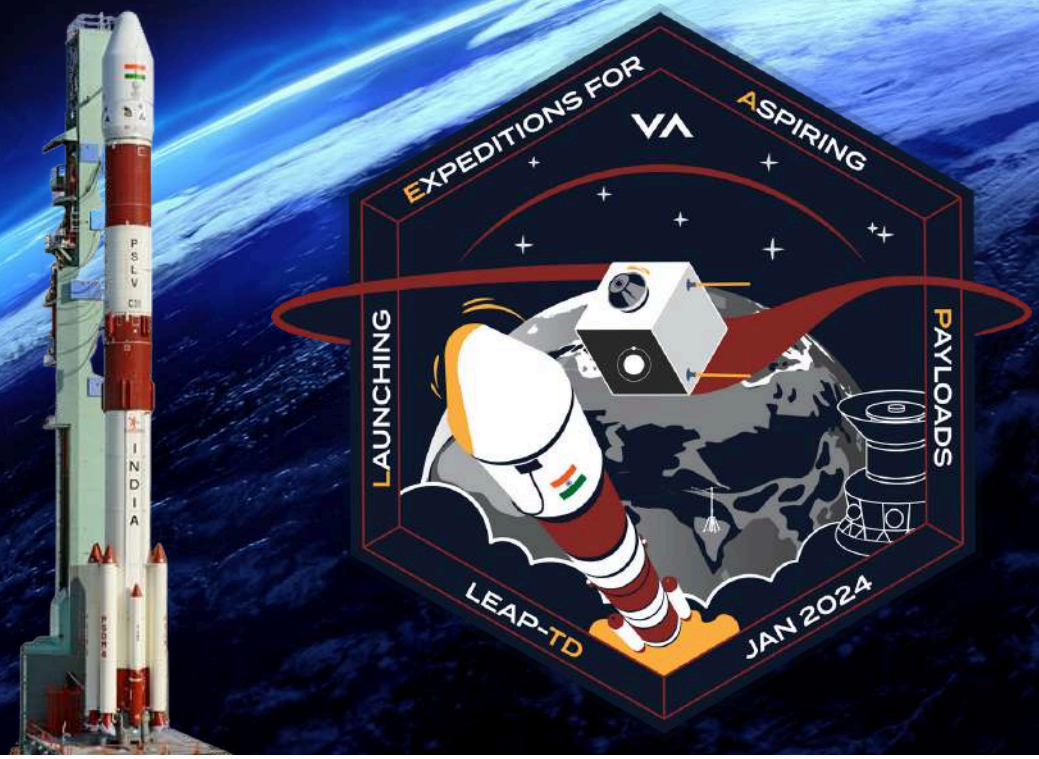
Rocket launches in August 2024

LEAP-1

LEAP-1 is a mission by Dhruv Space aimed at launching a series of small satellites into low Earth orbit (LEO). It is scheduled for launch in August from the Satish Dhawan Space Centre aboard PSLV-XL vehicle.

LEAP stands for "Low Earth Orbit Environment for Application and Research," and the mission is designed to advance the company's capabilities in satellite deployment and space technology. LEAP-1 will involve deploying small satellites that can carry out various functions, such as Earth observation, data collection, or communication tasks. These satellites are typically smaller and more cost-effective compared to traditional satellites.

It will carry experimental payloads or instruments to showcase its functionality and performance in space conditions. It will validate operational procedures and protocols for satellite deployment, operation, and data retrieval. The mission serves as a platform for testing new technologies which includes satellite design, launch procedures, and in-orbit operations. This will help to establish Dhruv Space as a reliable provider of small satellite missions, potentially attracting future customers and partners interested in similar space-based applications.

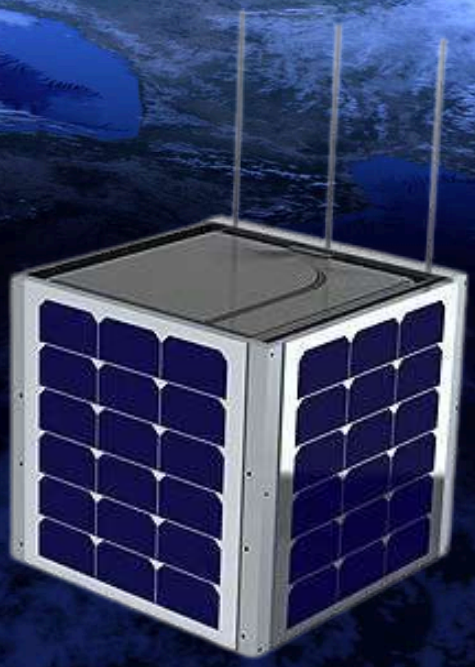


IITMSAT

IITMSAT (IIT Madras Satellite) project was initiated by a group of students of IIT Madras who were inspired with an idea of building a small satellite and launching it into orbit. The mission is scheduled to be launched on August 15, 2024, aboard an SSLV (Small Satellite Launch Vehicle) from the Satish Dhawan Space Centre. The project's scientific goal is to study the energy spectrum of charged particles in the upper ionosphere and understand the effects of solar storms, lightning storms and seismic activity.

With a unique particle detector design, which aim's to measure the energies of particles with almost relativistic velocities, the project aims to demonstrate cost-effective development of a nano-satellite constellation capable of making simultaneous particle measurements in the future.

It is a nano-satellite weighing less than 15 kg built by students of the IIT Madras. It will collect data about electrons and protons in the Earth's upper-ionosphere throughout its mission life of one year. One particularly interesting feature of this mission is that it will expand on existing data for research on an earthquake prediction model based on ionospheric changes before seismic activity. The satellite houses the Space-based Proton and Electron Energy Detector (SPEED), which is designed to measure the fluctuations in the flux of protons and electrons in the upper ionosphere. The IIT Madras Student Satellite consists of seven different sub-system, each performing vital functions of the space-craft orbiting in space.



IITMSAT (IIT Madras Satellite) is an Indian nano-satellite weighing less than 15 kg built by students of the IIT Madras.

G60 × 18

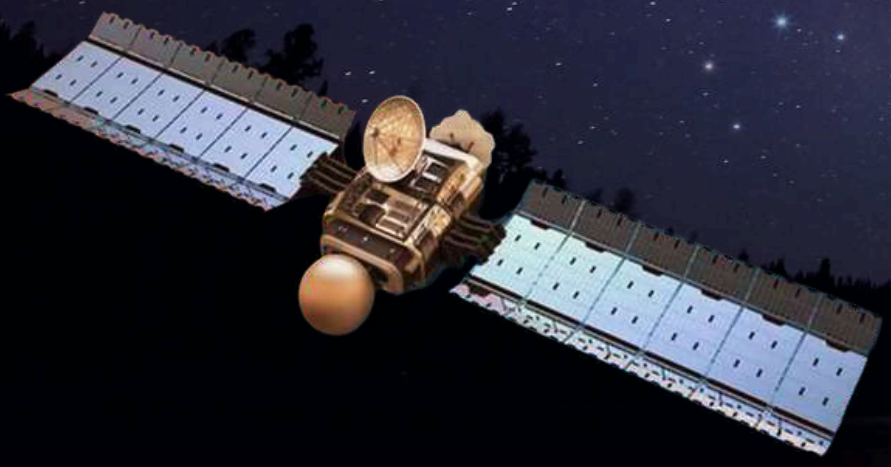
Date: August 5, 2024 Rocket: Long March 6A
Agency: CASC Country: China Launch Site: Taiyuan LA-9A,China

The first launch for China's G60 Starlink megaconstellation of over 12,000 satellites is set for early August. The launch is set for August 5 with the mission expected to carry 18 satellites. The constellation aims to provide global internet access, challenging U.S. projects including Starlink. It is also intended to secure finite orbital slots and frequencies and provide national internet coverage and data security. The move is part of a national drive to foster commercial space development while boosting innovation and high-tech industry clusters. The initiative aims to boost China's overall space capabilities.

GSAT-20 [CMS-03]

Date: Mid August, 2024 Rocket: Falcon 9 Block 5
Agency: NSIL / Dish TV Country: India Launch Site: Cape Canaveral SLC-40, USA

GSAT-20 (also known as CMS-03 or GSAT-N2) is a communication satellite being developed by Indian Space Research Organisation and will be launched by a SpaceX Falcon 9. The GSAT-20 satellite is funded, owned and operated by New Space India Limited. The entire capacity onboard CMS-02 satellite will be leased to Dish TV. GSAT-20 will be a continuation of GSAT series of communication satellites. The satellite is intended to add data transmission capacity to the communication infrastructure required by Smart Cities Mission of India.



Tanager

Date: Early August, 2024 Rocket: Falcon 9 Block 5
Agency: Carbon Mapper / Planet Labs / JPL Country: USA
Launch Site: Vandenberg SLC-4E, USA

The hyperspectral data provided by the Tanager satellites aims to complement and enhance our unprecedented dataset. Tanager is a family of birds who, similar to our planet, are threatened with endangerment if no substantive and data-backed actions are taken to protect ecosystems and resources. By helping to identify the spectral "signatures" of chemicals, materials, and processes across the globe, hyperspectral data can reveal otherwise hidden trends and could fill intelligence gaps and mitigate risks by exposing these challenges to decision. Hyperspectral imaging offers a vast array of spectral insights as it divides the spectrum across a multitude of spectral bands, enabling analysts to review phenomena in many differentiated colors that are typically beyond human visual perception.

A Sky Full of SARs (Acadia-3)

Date: August, 2024 Rocket: Electron
Agency: Capella SpaceCountry: USA Launch Site: Mahia LC-1BMahia LC-1B, New Zealand

Capella Space introduced its latest generation of satellites named "Acadia", which offer increased imaging capability and improved communications connectivity. These satellites are smaller and lighter than previous models, but offer higher resolution and detection capabilities, enabling better Earth observation and more accurate decision-making. Capella Space's new generation of satellites feature synthetic aperture radar (SAR) technology, which allows them to capture images of the Earth in all weather conditions and at any time of the day or night. In addition, these satellites have enhanced communication capabilities, allowing them to transmit data and images faster and more efficiently.

Starlink Group

Starlink group 7-19/20/25/26 8-3/4 9-5/6 10-6

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 the missions are scheduled to be launched in August 2024 but may subject to change.

Happy Birthday

Maria Mitchell


August 1, 1818

Maria Mitchell (August 1, 1818 – June 28, 1889) was an American astronomer, librarian, naturalist, and educator. In 1847, she discovered a comet named 1847 that was later known as "Miss Mitchell's Comet" in her honor. She won a gold medal prize for her discovery, which was presented to her by King Christian VIII of Denmark in 1848. Mitchell was the first internationally known woman to work as both a professional astronomer and a professor of astronomy after accepting a position at Vassar College in 1865.She was also the first woman elected Fellow of the American Academy of Arts and Sciences and the American Association for the Advancement of Science.


August 19, 1646

John Flamsteed

John Flamsteed FRS (19 August 1646 – 31 December 1719) was an English astronomer and the first Astronomer Royal. He was born in Denby, Derbyshire, England, the only son of Stephen Flamsteed. He was educated at the free school of Derby, near where his father carried on a malting business. His main achievements were the preparation of a 3,000-star catalogue, Catalogus Britannicus, and a star atlas called Atlas Coelestis, both published posthumously. He also made the first recorded observations of Uranus, although he mistakenly catalogued it as a star, and he laid the foundation stone for the Royal Greenwich Observatory.

Manali Kallat Vainu Bappu


August 10, 1927,

Manali Kallat Vainu Bappu (10 August 1927 – 19 August 1982) was an Indian astronomer and president of the International Astronomical Union. Bappu helped to establish several astronomical institutions in India, including the Vainu Bappu Observatory which is named after him, and he also contributed to the establishment of the modern Indian Institute of Astrophysics. In 1957, he discovered the Wilson–Bappu effect jointly with American astronomer Olin Chaddock Wilson.On 2 July 1949, he spotted a bright moving object, when he turned to his professor, Bart Bok, he confirmed the discovery. The International Astronomical Union officially named the comet as the Bappu-Bok-Newkirk comet (C/1949N1).

Happy Birthday

Vikram Ambalal Sarabhai

Vikram Ambalal Sarabhai Jain (12 August 1919 – 30 December 1971) came from the well-known Bania Jain family. He attended Gujarat College, Ahmedabad, but later moved to the University of Cambridge, England, where he took his tripos in natural sciences in 1940. In 1945 he returned to Cambridge to pursue his PhD and wrote a thesis, "on Cosmic Ray Investigations in Tropical Latitudes", in 1947. He is also an Indian physicist and astronomer who initiated space research and helped to develop nuclear power in India. Often regarded as the "Father of Indian space program", Sarabhai was honoured with Padma Bhushan in 1966 and the Padma Vibhushan (posthumously) in 1972.

Chris Hadfield

Chris Austin Hadfield (born August 29, 1959) is a Canadian retired astronaut, engineer, fighter pilot, musician, and writer. The first Canadian to perform extravehicular activity in outer space, he has flown two Space Shuttle missions and also served as commander of the International Space Station (ISS). Prior to his career as an astronaut, he served in the Canadian Armed Forces for 25 years as an Air Command fighter pilot. He announced his retirement shortly after a 35 years service and has five published books including his autobiography, the NYT-bestseller An Astronaut's Guide to Life on Earth.

Neil Alden Armstrong

Neil Alden Armstrong (August 5, 1930 – August 25, 2012) was an American astronaut and aeronautical engineer who in 1969 became the first person to walk on the Moon. He was also a naval aviator, test pilot, and university professor. He was born and raised in Wapakoneta, Ohio. He entered Purdue University, studying aeronautical engineering, with the U.S. Navy paying his tuition under the Holloway Plan. He became a midshipman in 1949 and a naval aviator the following year. Then he became a test pilot at Edwards Air Force Base in California, than a project pilot on Century Series fighters and flew them seven times. He was also a participant in the U.S. Air Force's Man in Space Soonest.

STUDENT'S CORNER

Robots in Space

Sourajit Mandal, Astronomy Camp

Imagine someone, continuously moving across the dusty red plains of Mars, taking pictures, and drilling rocks to find clues about ancient life. It sounds like science fiction...right? But it's actually the everyday work of plenty of robotic explorers in space. From the moon's surface to the depths of our solar system, these robotic heroes are paving the way for human exploration, bravely venturing where no human can go yet. These robots are not just tools but they're our robotic partners, helping to expand human knowledge and capability.

The journey of robots in space is considered to be started by Sputnik 1 made by the Soviets in 1957. The first rover in a different planet began with the Soviet Union's Lunokhod rovers in the 1970s, which explored the lunar surface, sending back extremely valuable data. The first rover sent to Mars by NASA was Sojourner sent to Mars via the Pathfinder mission.

This advancement continued with NASA's Mars rovers, Spirit and Opportunity, which were sent to Mars to explore the Martian surface for years beyond their expected lifespans. Their findings revolutionized our understanding of Mars, revealing signs of past water activity.

Today's space robots are more advanced than ever. The Mars Curiosity and Perseverance rovers are equipped with cutting-edge technology, including high-definition cameras, environmental sensors, and sophisticated laboratories to analyse soil and rock samples. The Ingenuity helicopter, another marvel, has demonstrated the feasibility of aerial exploration on other planets, achieving the first powered flight on Mars.

The future of robots in space looks incredibly promising. Upcoming missions include the Mars Sample Return mission, which aims to bring Martian soil samples back to Earth for detailed analysis. Autonomous robots are also being designed for asteroid mining, extracting valuable resources from these celestial bodies. Concepts for robotic habitats on the Moon and Mars are in development, where robots will construct and maintain bases for future human explorers.

Robots offer numerous benefits in space exploration. They can endure harsh environments that would be lethal to humans, operate continuously without the need for rest, and perform complex tasks with precision. However, challenges remain, such as communication delays between Earth and distant robots, and the technical difficulties of building machines that can withstand extreme conditions and perform autonomously for extended periods.

Robots in space have become indispensable partners in our quest to explore the cosmos. They extend our reach, allowing us to gather data and make discoveries that would be impossible otherwise. As technology advances, the role of these mechanical explorers will only grow, bringing us closer to the stars and paving the way for human presence beyond Earth.

VISUAL ARTS FROM SPACE ASSOCIATED ASTRONOMERS

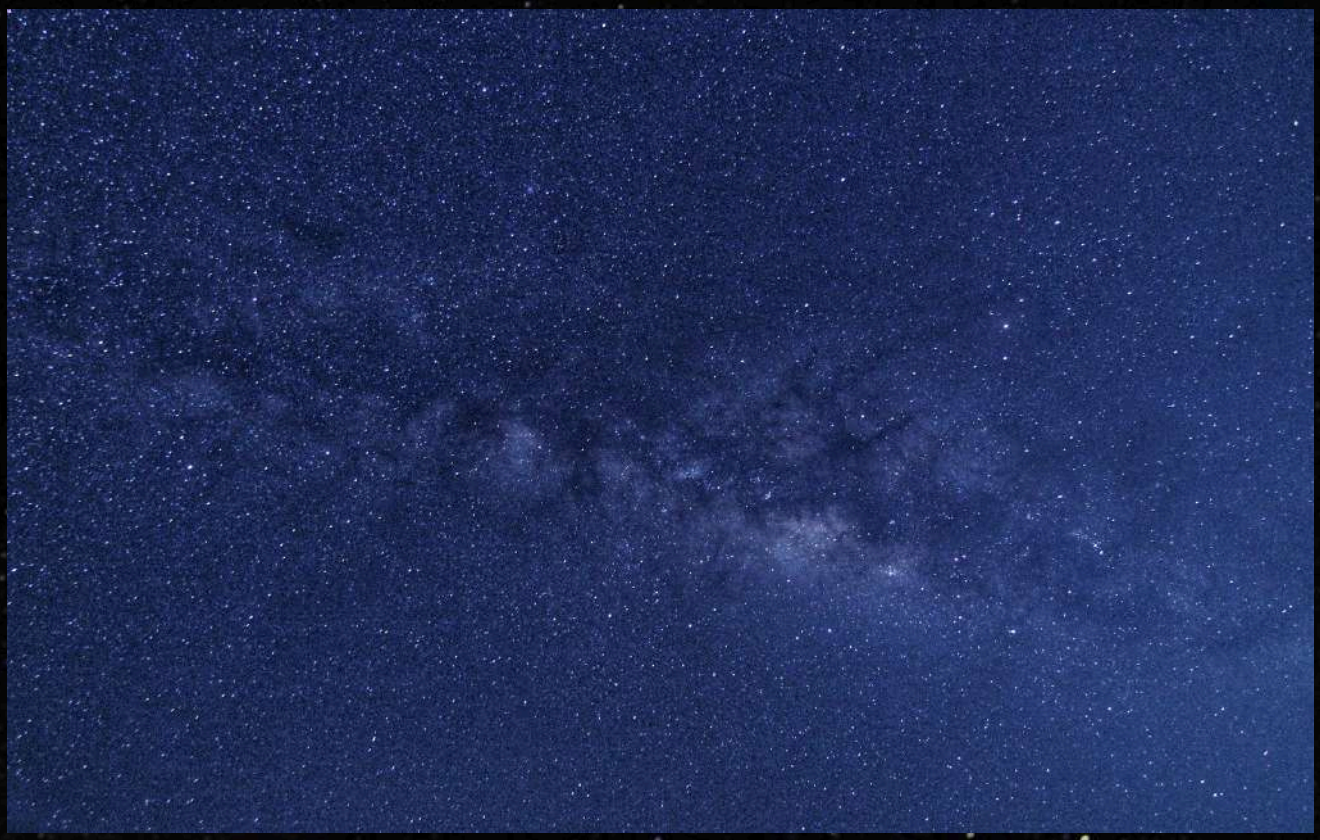
Phases of the Moon Captured by Aditya Pawar, AIASC Participant.

Moon Captured by Zeeshan, Club student.

ASTROPHOTOGRAPHS BY SPACE TEAM

Moon captured by Mr. Shirilmon S, Senior Executive, GAPL.

Sun with Sunspots captured by Ms. Priyadharshini D, Educator, STEPL.



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

HISTORICAL EVENTS HAPPENED IN AUGUST

INDIA ON THE MOON!!!

A nation holds its breath as an unseen scientist calls out the status of a spacecraft. Eyes stay focused on a screen as anticipation builds. Would this spacecraft have the same ending as its predecessor did four years previously? Or will the conclusion be different?

On 23rd August 2023, at three minutes past six in the evening, local time, India got its answer. Chandrayaan 3's lander, Vikram, and rover, Prgyaan, had safely soft-landed on the Lunar surface. With this success, India became the fourth country in history to deliberately land a spacecraft on our nearest neighbour.

That was not the only achievement.

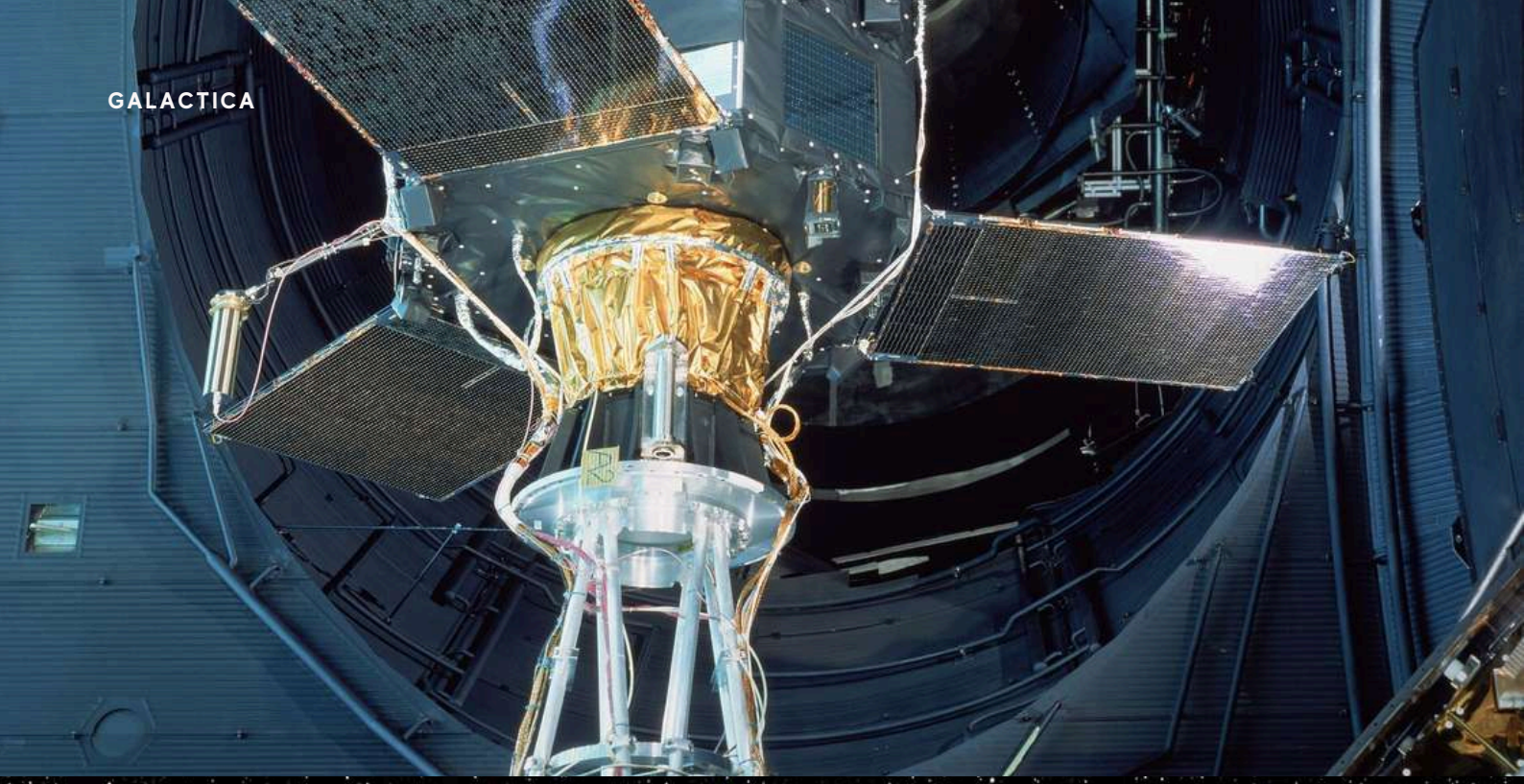
The position of Vikram's landing, near the lunar south pole, made India the first country to land in the previously unexplored region. The moon's south pole has an uneven surface and is full of craters and boulders making it tricky to land safely there. Vikram's landing site, now called the Shiv Shakti Point, is on a plateau that is south of the Mazinus crater and west of Boguslawsky crater. When compared to Earth, the latitude is similar to the edge of Antarctica on Earth. Until January 2024, this was the furthest southern landing on the moon.

Launched on 14th July 2023, Chandrayaan 3 was the Indian Space Research Organization's (ISRO's) third lunar mission and is to follow up on the previous two lunar missions. Chandrayaan 1, ISRO's first lunar mission, launched 15 years earlier discovered the presence of water molecules on the moon and the presence of an atmosphere during the lunar daytime. Chandrayaan 3 built on the discovery by looking for the presence of water on the lunar surface.

The lunar south pole was targeted as sunlight, in certain areas, never touched the surface. This could preserve any potential lunar ice on the surface. If enough water is found, the region could, in the future, support humans living on the moon and supply propellant for spacecraft travelling to Mars and further away. Other space programs are also interested in the region and plan to visit it.

The spacecraft carried five scientific instruments to study the physical characteristics of the Moon's Surface, the lunar atmosphere and tectonic activity below the lunar surface. The robotic duo will collect the information over one lunar say, or 14 Earth days, after which the spacecraft batteries will drain.

The success of Vikram's lander and Prgyaan's rollout will be celebrated annually on 23rd August as National Space Day.



PINPOINTING THE STARS

On 8th August 1989, Ariane 4 launched into the skies. Aboard is a precious cargo built by the European aerospace industry for the European Space Agency. Celebrations of the Hipparcos launch nearly turned to disappointment when one of the booster motors failed, and the spacecraft could not reach the planned altitude. However, a quick solution from the scientists allowed for the mission to continue, though the spacecraft was to be in an elongated orbit which risked radiation damage to the solar panels. Fortunately, the panels were more resilient than expected.

High Precision Parallax Collecting Satellite, or Hipparcos, was the first spacecraft in space that was focused on precision astrometry. The spacecraft was to map the sky more accurately than ever before. This was done by measuring the intrinsic brightness, proper motion and parallaxes of the stars (to calculate the distance and tangential velocity of the object). Combining these values with the redial velocity measurement from spectroscopy, scientists can calculate the motion of the stars.

Hipparcos was also named after Hipparchus of Nicea, a pioneer in cataloguing stars and measuring their distance. He tracked the measurements of the stars until he eventually produced a catalogue with 1080 stars which he described as bright or small. His catalogue was the first of the many to be compiled.

The mission collected data until March 1993, with the mission termination occurring in August 1993, 4 years after launch. During this time, each star selected for the study was observed 100 times. When the mission terminated, all the mission goals were successfully fulfilled, with more than 2 million stars mapped out to varying levels of precision.

These stars were listed in 3 different catalogues. Hipparcous Catalogues, published in 1997, contained 118,218 stars mapped to a precision of one milliarcsecond. An accuracy that earth-based observatories are unable to reach due to the atmosphere. Published at the same time, the Tycho Catalogue, named after Tycho Brahe, contained 1 058 332 stars to a lesser precision. 3 years later, in 2000, Tycho 2 catalogue was published with 2,539,913 stars. Altogether 99% of stars with a magnitude of 11, stars that are almost 100,000 times fainter than Sirius, were catalogued.

Hipparcos not only gave an unprecedented 3D view of the distances and movements of stars in the vicinity of the Sun and the Earth, but it has also changed our view of the universe. The data from the mission has helped us predict the impact of Comet Shoemaker-Levy 9 on Jupiter, identify stars that are close to the sun, force us to rethink our theories, and make the universe bigger and younger while confirming Einstein's prediction on the effect of gravity on starlight.

Though Hipparcos was unprecedented in the data it provided, it was still a pioneering mission. Its work is currently being refined by ESA's GAIA mission, launched in 2013.

NEUTRON STAR COLLISIONS

On 17th August 2017, a chirp is heard at two of the three Laser Interferometer Gravitational-Wave Observatory (LIGO) detectors. Approximately, at the same time, across the pond, Virgo long form VIRGO) detects the same signal. Unlike the previous gravitational wave detections, which lasted a fraction of a second, the chirp heard at 8.41 a.m. EDT lasted approximately 100 seconds.

Nearly two seconds after Ligo first detected the signal, the INTEGRAL spacecraft and NASA's Fermi space telescope detected a gamma-ray burst (GRB170817A) from the same region in space. These initial detections enabled the launch of follow-up observations of electromagnetic radiation by telescopes around the world.

For the first time, a collision of two neutron stars has been detected and they were detected through gravitational waves.

Gravitational waves are ripples through space-time and result from the most violent and energetic processes in the universe. They were first predicted by Albert Einstein in 1916 with his theory of relativity but were only detected for the first time in 2015, a century later. The strongest gravitational waves are formed from the collision of black holes, neutron star mergers and supernovae. They travel at the speed of light carrying information about their origin. Meanwhile, neutron stars are the smallest, densest, stars known to exist and are formed when massive stars explode in supernovas.

GW170817 was the first gravitational wave observation which was confirmed by non-gravitational means. It was also the first time that humanity observed a cataclysmic astronomical event through gravitational and electromagnetic waves. Due to this, GW170817 is the most precise sky localization of all detection thus far. It originated from the NGC 4993 galaxy, approximately 130 million light years away.

The detection, which showed the expected characteristics of an inspiral of two neutron stars, marked a significant breakthrough for multimessenger astronomy, thus enabling a new way to do astrophysics.

The detection of GW170817 confirmed scientists' predictions of a neutron-neutron encounter while solving other mysteries. Besides confirming that the collision between two neutron stars results in gravitational waves, it confirmed that gamma-ray bursts are a result of neutron star mergers as well as the resultant powerful jets that emit light across the electromagnetic spectrum It also solved the decades-long question of how elements heavier than iron are synthesized.

However, while GW170817 solved old mysteries, it also created new ones. GRB170817A was one of the closest gamma-ray bursts to Earth yet the signal was weaker than expected.

Finally, almost 1500 scientists and engineers across 100 institutions studied the merger. 70 observatories across the world and in space observed the aftermath of this merger.

The discovery and subsequent observations of GW170817 were awarded the Breakthrough of the Year award for 2017 by the journal Science.

Deimos

Phobos

DISCOVERING MOONS OF MARS

In August 1877, American astronomer Asaph Hall made a monumental contribution to our understanding of Mars by discovering its two moons, Deimos and Phobos. Asaph Hall, working at the United States Naval Observatory (USNO) in Washington, D.C., utilized the 26-inch refracting telescope, one of the most powerful instruments of the era, to achieve this remarkable feat.

Asaph Hall's quest to discover Martian moons was driven by the long-standing fascination with Mars and the hypothesis that it might possess natural satellites. On the night of August 11, 1877, after several days of diligent observation, Asaph Hall spotted a faint object near Mars. Through meticulous calculations and observations, he confirmed the object's identity as a moon and named it Deimos, after the Greek god of terror and son of Ares (Mars). Deimos, the smaller of the two moons, has a mean radius of about 6.2 kms and features a smooth, slightly elongated shape covered in regolith (a layer of loose, fragmented material).

Just six days later, on August 17, 1877, Asaph Hall discovered a second object in close proximity to Mars. This object, larger and nearer to Mars than Deimos, was identified as Mars' second moon and named Phobos, after the Greek god of fear and another son of Ares. Phobos, the larger moon, has a mean radius of about 11.3 kms and an irregular, heavily cratered surface, including the prominent Stickney crater.

The discoveries of Deimos and Phobos were groundbreaking for several reasons. Firstly, they demonstrated the advanced capabilities of contemporary astronomical instruments and highlighted Asaph Hall's observational skills. Secondly, the moons provided new insights into Mars, offering valuable data about its environment and gravitational field. The discoveries also had a cultural impact, linking ancient Greek mythology with modern scientific exploration and capturing the public's imagination.

Deimos orbits Mars at a distance of approximately 23,460 kms, taking about 30.3 hours to complete one orbit. Its surface is less cratered than Phobos. In contrast, Phobos orbits much closer to Mars, at about 6,000 kms, completing an orbit in just 7.7 hours. Phobos' close proximity results in significant tidal forces, causing its gradual orbital decay and leading to it rising in the west and setting in the east on Mars.

Asaph Hall's discovery of Deimos and Phobos remains a pivotal moment in astronomical history. These moons continue to intrigue scientists and are considered potential targets for future Mars exploration missions, providing crucial insights into the Martian system's history and evolution.

KORABL-SPUTNIK 2

On August 19, 1960, the Soviet Union launched Sputnik 5, a ground breaking mission that would pave the way for human spaceflight. The spacecraft, also known as Korabl-Sputnik 2, carried a diverse biological payload, including two dogs named Belka and Strelka, forty mice, two rats and several plants and insects. It was part of the larger Sputnik program and is particularly notable for carrying the first living beings to space and returning them safely to Earth.

The primary objective of Sputnik 5 was to test the feasibility of life support systems and study the effects of space travel on living organisms. Achieving a low Earth orbit, the spacecraft completed 18 orbits over approximately 25 hours. The spacecraft had a mass of 4600 kg and contained a sealed pressurized cabin. Throughout the mission, the onboard animals were closely monitored to observe their behavior and physiological responses in the microgravity environment.

Belka and Strelka, the canine cosmonauts, showed signs of stress initially but quickly adapted, eating and moving normally. Their health and behavior were recorded through onboard cameras, providing valuable insights into the effects of space travel on living beings. The mission also included a variety of plants and insects to study the broader biological impacts of space conditions.

On August 20, 1960, Sputnik 5 successfully re-entered the Earth's atmosphere and landed, recovering all the animals alive and in good health. This successful recovery was a monumental achievement, proving that living organisms could endure the rigors of space travel and re-entry.

Sputnik 5's success had far-reaching implications. It demonstrated the reliability of Soviet spacecraft systems, including life support and re-entry technologies. Belka and Strelka became instant celebrities, symbolizing the triumph of Soviet science and technology. One of Strelka's puppies was gifted to U.S. First Lady Jacqueline Kennedy by Soviet Premier Nikita Khrushchev, highlighting a rare moment of goodwill during the Cold War. The mission's success laid the groundwork for future human spaceflights, culminating in Yuri Gagarin's historic flight in 1961.

Sputnik 5's successful mission marked a major milestone in space exploration, demonstrating that living beings could survive space travel and re-entry, which was crucial for the future of manned space missions.

Korabl-Sputnik 2. (Credit: © 2009 Anatoly Zak)

The canine passengers on 1K No. 2, Strelka and Belka. (Credits:drewexmachina)

NEWSLETTER

As the monsoon season arrived, bringing with it refreshing showers and vibrant greenery, SPACE India embraced the opportunity to foster a stronger workplace community through our "Monsoon Fiesta" theme. This celebration not only honoured the beauty of the rains but also highlighted the importance of togetherness and engagement among employees.

The program commenced with a warm welcome by Ms. Tripti Barnwal, Merchandise Designer, who introduced the theme and invited Spacians to share their cherished monsoon memories. Employees fondly recalled childhood moments spent playing in the rain, savouring hot cup of Tea and fritters with family, and enjoying the refreshing aroma of the soil after the rain. Some reminisced about splashing in puddles, while others reflected on the various sessions led by educators and assistants during rainy days.

Our Managing Directors, Mr. Mitul Jain and Mr. Shivam Gupta, shared their own monsoon memories and made important announcements for the month. The celebration continued with the acknowledgment of birthdays, work anniversaries, and new joiners, followed by the announcement of the "Spacian of the Month" award, which was conferred upon Mr. Davesh Thakur for his exemplary work in IT and developing the new SPACE ARCADE website with his timely delivery, technical proficiency, and dedication to the project, the website link: www.spacearcade.in/.

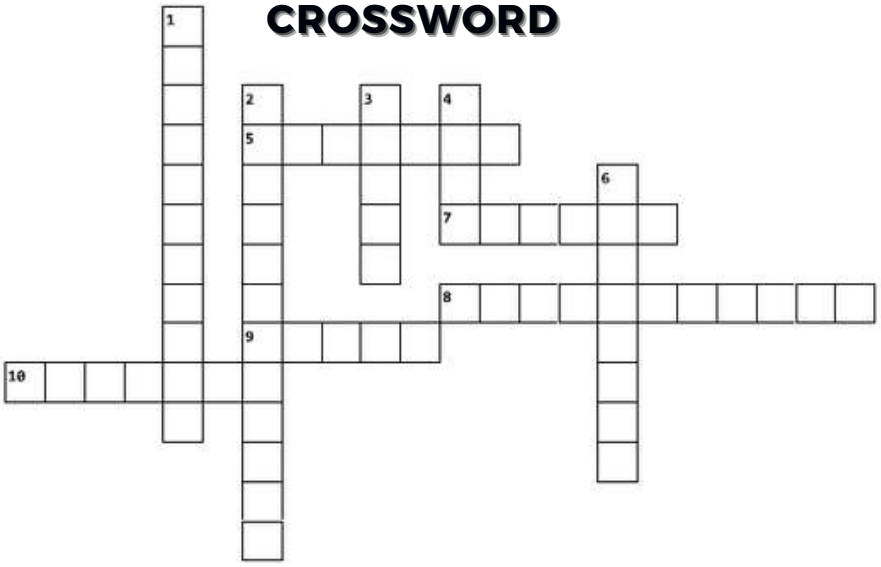
The event featured a cake-cutting ceremony, delightful lunch and refreshments alongside an exciting game, "Grab the Cup," which brought out everyone's competitive spirit and laughter. The program concluded with a photo session and a group dance, cementing the Monsoon Fiesta as a celebration of unity, creativity, and growth.

Through this event, we reinforced our commitment to building a strong workplace community and created lasting memories.

Join our Space Team and be a part of such fun moments that we create at workplace, visit: http://www.space-global.com/career/.

TRAIN YOUR BRAIN

CROSSWORD



Across

5. What is the name of India's winged vehicle used in the RLV LEX-03 test?
7. Which company was chosen to design and construct the U.S. Deorbit Vehicle?
8. What does the Perseverance rover carry to detect sounds on Mars?
9. Which Asteroid did Giuseppe Piazzi discover in 1801?
10. Which type of black hole is formed from the gravitational collapse of a star?

Down

1. Who invented the Alternating current?
2. Where did the Chang'e 6 mission land on the moon?
3. How many Craters did the Physical Research Laboratory (PRL) in Ahmedabad Discovered on mars?
4. Which Planet has its one year equal to 687 days on earth?
6. What is the fine powdered soil on the surface of moon called as?

ASTRONOMY WORD PUZZLE

Find the galaxies from the mixed letters and mark them.

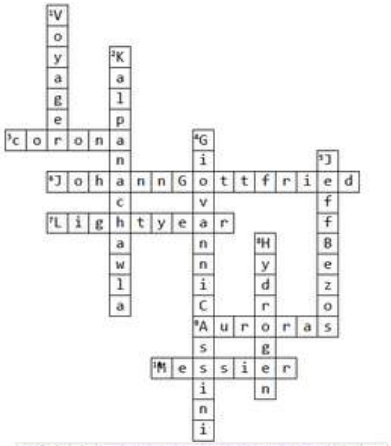
Galaxies

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

SCULPTOR
HOCKEY STICK
GRASSHOPPER
SPIDER
REDSHIFT
SUNFLOWER
PARAMECIUM
MEDUSA
PEEKABOO
TADPOLE
TRIANGULUM
SOMBRERO
CENTAURUS
WHIRLPOOL
MAYALL

Answers for last month puzzles will be shared in next magazine.

Answers for last month puzzles.



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