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Galactica

Astronomy and Space Science Magazine

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

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

Chandrayaan 3: Victory for India's Space Program, National Space Day Celebration

The historic landing on the Moon's south pole on August 23, 2023, showcased India's growing space technology prowess and inspired the declaration of August 23rd as National Space Day in India.

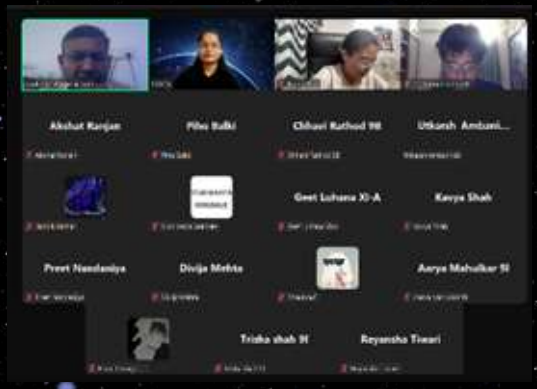
The program aimed to study the Moon's surface, starting with Chandrayaan-1, which discovered water molecules. Chandrayaan-3, launched on July 14, 2023, aimed to soft land on the Moon's south pole, a region of scientific interest due to potential water ice deposits and unique conditions. This mission included Vikram Lander and Pragyan Rover, equipped with advanced scientific instruments.

Shiv Shakti point, located between Manzinus C and Simpelius N, was the site of India's successful landing on the Moon's south pole, revealing elements like sulfur, iron, calcium, aluminum.

National Space Day 2024: A Celebration of Innovation and Exploration: National Space Day, marking a year since the successful landing of Chandrayaan-3, was celebrated on 23 August 2024. SPACE India similarly organized various activities to educate people and engage across the nation.

The activities are listed below:

- Webinar: To the Moon and Beyond.
- Cosmic Mind Forum.
- SPACE-Associated Schools Celebrations.
- Wall of Stellar Messages.
- Astronomy Exhibition in Schools, Pan-India.



Virtual Training of Pan-India schools: Schools received virtual training for the Pan-India Astronomy Exhibitions. Educators at Space India introduced Astronomy and Space Science, including thorough explanations of the activities to be conducted and the accomplishments of the Chandrayaan Program. The following are the specifics of some schools' celebrations

Celebrating National Space Day at Harvest International School, Sarjapur: Harvest International School in Sarjapur, Bengaluru, celebrated National Space Day with a model exhibition featuring replicas of the LVM3 M4 rocket, Vikram Lander, and Pragyan Rover. The event also featured hands-on activities like crater-making, moon phases exploration, hydro rocket demonstrations, and telescope viewing. The event was a success, with both parents and students expressing interest in learning more about space. The Principal of Harvest International School thanked Space India for their support and praised the event for inspiring young minds to dream big and reach for the star.

Celebrating National Space Day at Guru Tegh Bahadur School, Dhuri:

On National Space Day, Guru Tegh Bahadur School in Dhuri hosted an event where over 900 students participated in engaging activities and experiments related to astronomy and space science. The students learned about ISRO's successful Chandrayaan-3 mission. The Space India team demonstrated a comet-making activity to help students understand the basic ingredients and features of a comet. Students created models of the Vikram lander and Pragyan rover, explaining the different payloads of both. They also made a model of the launch vehicle LVM3-M4. Additional activities followed, including a hydro rocket launch. The Space India team was honored with the 'Guest of Honour' award by the school administration.

Celebrating National Space Day at Millennium School and Delhi Public School, Lucknow:

Space India educator along with students as volunteers hosted a series of activities for National Space Day at two prestigious schools, The Millennium School and Delhi Public School. The day began with a presentation on Chandrayaan-3, India's latest lunar mission, and its objectives. Students then participated in an interactive spectroscopy session, showcasing their understanding of light and space exploration. They also participated in a model-making workshop, constructing detailed replicas of space missions, and simulated the impact of meteorites on the moon's surface. The event concluded with a hydro rocketry demonstration, allowing students to apply physics and engineering principles.



Celebrating National Space Day at Delhi Public School and Anand Niketan School, Ahmedabad:

In Ahmedabad, National Space Day was celebrated with enthusiasm at two different schools: Delhi Public School on 22-08-2024 and Anand Niketan School on 23-08-2024. Mr. Prabhakar Laxman Kulkarni visited Anand Niketan School as a chief guest and boosted student's confidence. The event featured engaging activities that highlighted the wonders of space like hydro rocket demonstrations, moon phase simulations, crater creation on a lunar surface, and spectroscopy, with volunteers actively participating. Students fueled the event with their passion and love for space. There was an extensive presentation on Chandrayaan 3, detailing its components, along with the models of Pragyan rover and Vikram lander for in-depth understanding.



The Chandrayaan-3 mission, a significant achievement in India's space exploration, has inspired millions and opened up opportunities for future missions. This success has taken the world's attention, and National Space Day, serves as a tribute to India's journey from humble beginnings in space research to a frontline player in the global space community.

Elementary Level for Universe for All Program

Students enrolled in the "Universe for All" program at Space Observatory and Astronomy Research (SOAR), Delhi Public School, Faridabad, have recently completed their beginner's level and have now been promoted to the Elementary level. This advancement marks a significant achievement in their astronomy education and opens up new horizons for exploration and learning. The transition was marked by an engaging and inspiring session held from August 21 to August 22, where students gathered for their first class of the Elementary level.

The promotion to the Elementary level is a testament to the students' dedication and progress in their studies. The excitement among the students was palpable as they stepped into this new phase of their learning journey. This heightened enthusiasm was evident as they eagerly participated in discussions and activities designed to introduce them to more advanced concepts in astronomy. The first class served as both a celebration of their accomplishments and a gateway to the more complex topics they will encounter in the coming months.

During this initial session, the students were introduced to the curriculum and topics they will explore throughout the Elementary level. The program is designed to build upon the foundational knowledge they acquired during the beginner's level, incorporating more sophisticated concepts and techniques. The curriculum promises to delve deeper into the wonders of the universe, covering areas such as stellar evolution, planetary science, and galactic dynamics. Students will also engage in hands-on activities and experiments, which are intended to enhance their understanding and foster a deeper appreciation for the field of astronomy.

The students' response to the new curriculum was one of great enthusiasm and curiosity. As the topics for the upcoming year were outlined, it was clear that their eagerness to learn had only intensified. The excitement in the classroom was matched by a noticeable increase in their engagement and participation. Students asked insightful questions and expressed a keen interest in exploring the more advanced subjects that lay ahead. This level of curiosity and commitment is a strong indicator of their passion for astronomy and their readiness to tackle the challenges of the Elementary level.

The first class of the Elementary level not only provided an overview of the year's topics but also set the tone for the rest of the program. It emphasized the importance of critical thinking and problem-solving in understanding complex astronomical phenomena. The session included interactive elements designed to stimulate intellectual curiosity and encourage students to think deeply about the universe and their place within it.

Overall, the transition from the beginner's level to the Elementary level has been met with enthusiasm and anticipation. The students' excitement and eagerness to learn more about astronomy highlight their dedication and passion for the subject. As they embark on this new phase of their educational journey, they are poised to explore more intricate aspects of space science, furthering their knowledge and appreciation of the cosmos.

The "Universe for All" program continues to provide a dynamic and enriching learning environment for these young astronomers. With each step forward, the students are gaining a deeper understanding of the universe and developing skills that will serve them well in their future studies and beyond. This transition to the Elementary level represents not only a milestone in their academic journey but also a testament to their growing commitment to exploring the wonders of space.

CELEBRATION OF NATIONAL SPACE DAY AMONG DIFFERENT UITS SCHOOLS

On August 23rd, National Space Day was celebrated with immense enthusiasm across several schools under the 'Universe In The School' (UITS) program by Space India Technology and Education Private Limited. This day was dedicated to fostering a deeper understanding of space science and celebrating India's strides in space exploration, particularly with the success of Chandrayaan-3. Various schools organized events, workshops, and activities, all designed to ignite curiosity about the universe and inspire future space enthusiasts.

Delhi Public School, Greater Faridabad

Delhi Public School, Greater Faridabad, led the celebrations with two major events: the 'Moon Museum' and the 'Cosmic Mind Forum.' The Moon Museum, an innovative and educational initiative, featured a variety of student-created exhibits, including a 3D model of the Moon, a detailed replica of Chandrayaan-3, and a working model of the Pragyan rover. These exhibits were a testament to the students' understanding and enthusiasm for space missions, offering a hands-on learning experience that deepened their knowledge of space.

The 'Cosmic Mind Forum' was another highlight, featuring esteemed guests like Ms. Shalini Bahmba, Co-Founder and Director of Capacity Building at Space India, and Dr. Ugur Guven, an aerospace engineering professor and Member of the UN CSSTEAP Advisory Council. This event encouraged students to delve deeper into space science, with media coverage amplifying the excitement and sharing the school's enthusiasm with a broader audience. The forum underscored the importance of dreaming big and pursuing careers in space science, perfectly aligning with the objectives of National Space Day.

K.R. Mangalam World School, Vaishali

At K.R. Mangalam World School, Vaishali, the National Space Day celebrations began with a special assembly where students depicted the inspiring journey of the Chandrayaan-3 mission. Through a well-coordinated performance, they conveyed the message that perseverance leads to success, drawing lessons from the Chandrayaan-2 mission. Students showcased their creativity by making models of landers and rovers, along with detailed drawings, collages, and posters. Engaging activities like a space-themed quiz and extempore sessions further fueled their curiosity about space exploration.

Principal Ms. Seema Behl delivered an inspiring speech on the significance of National Space Day, emphasizing its importance in light of Chandrayaan-3's success. The day concluded with a virtual panel discussion where students interacted with experts, asking insightful questions and deepening their understanding of space science. This event was a resounding success, igniting a passion for space exploration among the young minds.

G.D. Goenka Public School, Model Town

National Space Day at G.D. Goenka Public School, Model Town, was a grand celebration of the Chandrayaan-3 mission and India's contributions to space exploration. Students participated in various activities that sparked excitement, creativity, and a deeper understanding of space science. The event left a lasting impression on students, encouraging them to dream big and consider their place in India's ongoing space story.

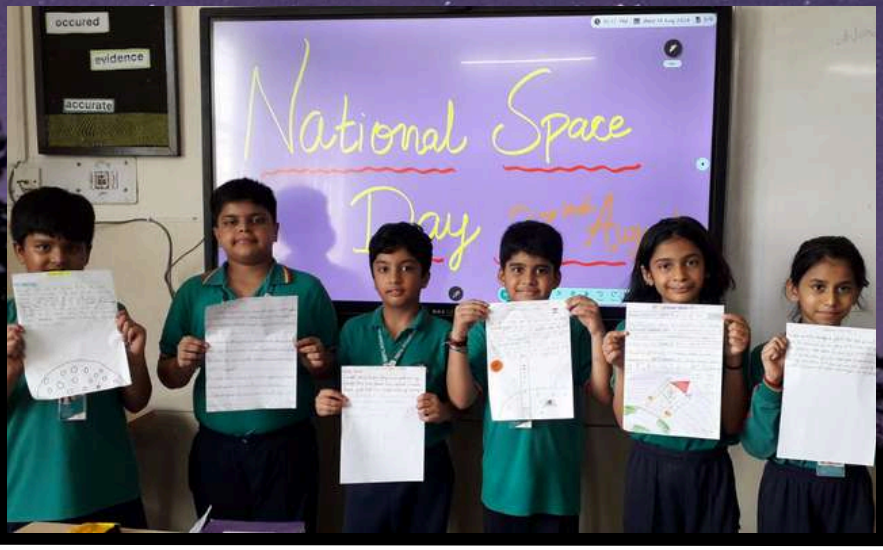
Bal Bharati Public School, Pitampura

Bal Bharati Public School, Pitampura, celebrated National Space Day with a series of interactive workshops, module presentations, and quizzes for students from grades II to VIII. The space educators put special emphasis on popularizing the 'Bharat On The Moon' portal, developed by CBSE, among students and their families. The workshops were designed to provide a comprehensive understanding of space science, ensuring that the significance of National Space Day was well understood by all participants.

St. Martin Diocesan School, Delhi Cantt.

St. Martin Diocesan School, Delhi Cantt., began their celebrations with a special assembly, setting a tone of pride and excitement among the students and staff. The assembly featured an inspiring speech on Chandrayaan-3's achievements, followed by a skit that creatively showcased the mission's success. The day continued with an interactive quiz that challenged the students' knowledge of space science, sparking their curiosity about the universe.

One of the day's highlights was a virtual panel discussion with special guests from the field of space research and education. This discussion offered students a unique opportunity to engage with experts and learn about the future of space exploration. The celebrations also included a painting competition on the theme "Space and Beyond", where students expressed their creativity and imagination. The day concluded with a thrilling hydro-rocketry activity for Grade 10 students, leaving them inspired and motivated to explore the endless possibilities of space.



K.R. Mangalam World School, Vikaspuri

K.R. Mangalam World School, Vikaspuri, also marked National Space Day with a series of engaging activities which included Rocketry competition, crater making activity using simple materials and many more such activities. The day was filled with excitement as students participated in various space-themed activities, showcasing their creativity and knowledge. The school made sure that National Space Day was a memorable experience for all students, fostering a deeper interest in space science and exploration.

K.R. Mangalam World School, Gurgaon

At K.R. Mangalam World School, Gurgaon, the celebrations continued with similar enthusiasm. Students were engaged in various workshops and activities that highlighted the significance of space exploration and India's contributions to the field. The school's commitment to promoting space science education was evident in the way students eagerly participated in the day's events.

Matrikiran School, Gurgaon

Matrikiran School, Gurgaon, also joined the celebrations, with students participating in a range of space-themed activities. The school collaborated closely with Space India to ensure that students received a comprehensive understanding of space science and its importance in the modern world. The activities were designed to inspire students and encourage them to consider careers in space exploration.

Sri Venkateshwar International School, Dwarka

Sri Venkateshwar International School, Dwarka, celebrated National Space Day with great enthusiasm. The school organized workshops and activities that focused on space science and exploration, making the day an educational and inspiring experience for all students. The students here made 3D models of rockets and posters showcasing their interest in taking pride in their country's grand endeavors in Space. The school's collaboration with Space India under the UITS program ensured that students were provided with the resources and guidance needed to deepen their understanding of space.

Conclusion:

The National Space Day celebrations across various UITS schools, organized by Space India, were a testament to the organization's commitment to popularizing space science and astronomy among young learners. The events not only celebrated India's achievements in space exploration but also nurtured the next generation of space enthusiasts. The collaborative efforts of Space India and the participating schools ensured that National Space Day was a memorable and inspiring experience for all involved, aligning with the Nation's New Education Policy and its vision of becoming a developed country.

MONTHLY TELESCOPIC OBSERVATION

SPACE ARCADE team conducted 2024's 8th Monthly Telescopic Experience session on the 17th of August 2024 in Chennai.

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

ASTROPORT

Celebrating National Space Day

Chandrayaan-3, launched by ISRO on July 14, 2023, was a landmark mission for India, aimed at achieving a successful soft landing on the Moon following the partial failure of Chandrayaan-2 in 2019. This mission was more than just a technological endeavor; it was a symbol of national pride and a step toward realizing a long-held ambition. It focused on exploring the Moon's south pole, offering the potential for new scientific discoveries and demonstrating India's advancing space capabilities. With this mission, India joined the ranks of the United States, the Soviet Union (now Russia), China, and itself as a nation capable of landing on the Moon, showcasing a remarkable achievement in determination and innovation.

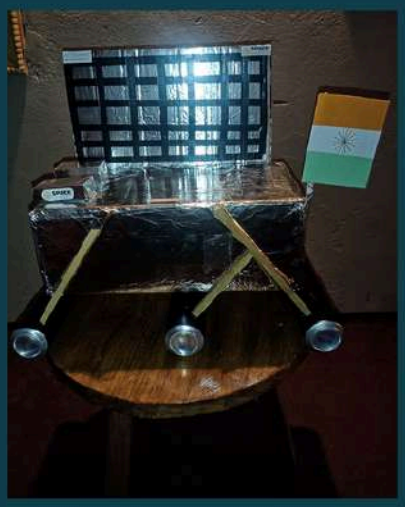
India's lunar exploration journey began with the pioneering Chandrayaan-1 in 2008, which discovered water molecules on the Moon and established India's presence in lunar exploration. The ambitious Chandrayaan-2 followed in 2019, featuring an orbiter, a lander named Vikram, and a rover called Pragyan. While the orbiter succeeded and continues to provide valuable data, Vikram's landing ended in a crash, posing a challenge and an opportunity for learning. Chandrayaan-3, building on these experiences, aimed to achieve a successful soft landing on the Moon's surface, marking a new milestone in India's space exploration history.

Chandrayaan-3's mission faced numerous challenges and budgetary constraints. Following the partial setback of Chandrayaan-2, perfecting the technology for a flawless soft landing was a significant task, with the harsh lunar environment and complex terrain adding to the difficulty. ISRO had to achieve cost efficiency, balancing the mission's ambitious objectives with a modest budget while ensuring rigorous testing of every technological upgrade. Despite these hurdles, the successful lunar landing of Chandrayaan-3 emerged as a testament to ISRO's innovation and resourcefulness, reflecting its ability to achieve remarkable feats within budget constraints.

"Today marks a historic milestone for India as Chandrayaan-3 successfully lands on the Moon. This achievement is a testament to the dedication and hard work of the entire ISRO team. After overcoming significant challenges and learning from past experiences, we have realized a dream of reaching the Moon's surface. This mission not only highlights our technological advancements but also underscores India's growing capabilities in space exploration. We remain committed to pushing the boundaries of science and innovation for future discoveries." S. Somanath, Chairman of ISRO

Chandrayaan-3's design centered around its lander, Vikram, and its rover, Pragyan. The lander, equipped with a propulsion system, landing gear, and various sensors and cameras, was engineered for a controlled descent and a soft landing on the Moon's surface. Once the landing was successfully achieved, the rover, Pragyan, was deployed. It featured scientific instruments to analyze lunar soil and surface composition, and a mobility system to navigate the lunar terrain. Both the lander and rover depended on a sophisticated communication system for data transmission, a power system with solar panels and batteries, and a thermal control system to handle the extreme lunar temperatures, ensuring their effective operation throughout the mission.

During the Integrated Module Phase of Chandrayaan-3, the spacecraft's components—orbiter, lander (Vikram), and rover (Pragyan)—were assembled and thoroughly tested as a unified system before launch. This phase involved integrating the lander and rover with the orbiter, and testing all systems, including power, communication, and propulsion, to ensure compatibility and functionality. Comprehensive testing included functional and environmental simulations to confirm that the spacecraft could withstand space conditions and launch stresses. The phase concluded with system-level validations to ensure that all components operated seamlessly and met mission requirements, preparing the spacecraft for its journey to the Moon.

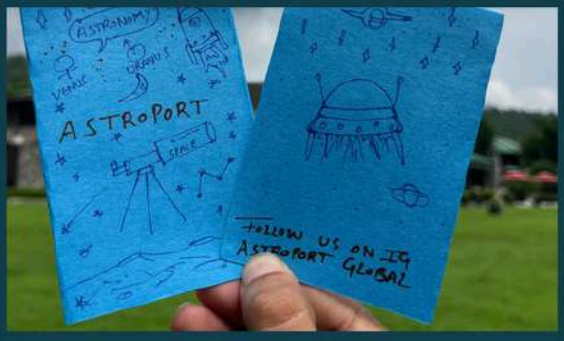


Chandrayaan-3's mission began with its launch on July 14, 2023, aboard a GSLV Mk III rocket from Sriharikota. After launch, the spacecraft followed a cruise phase involving orbital maneuvers to set a trajectory toward the Moon. Following a Trans-Lunar Injection maneuver, it entered lunar orbit on August 5, 2023, and underwent several orbit adjustments to prepare for descent. The descent phase began with the lander, Vikram, detaching from the orbiter and performing controlled burns to slow its descent.

On August 23, 2023, Vikram achieved a successful soft landing on the Moon's surface, after which the rover, Pragyan, was deployed and began conducting scientific experiments and transmitting data back to Earth.

Looking ahead, ISRO plans to further its space exploration goals with several ambitious projects. Building on Chandrayaan-3's success, ISRO aims to enhance lunar exploration with Chandrayaan-4 and demonstrate human spaceflight capabilities with the Gaganyaan mission. Future endeavors include Mars exploration, asteroid missions, and the development of a space station.

At Astroport, we celebrate the success of Chandrayaan-3, which inspires us all to elevate our scientific curiosity. By fostering a passion for astronomy, we offer opportunities for students and enthusiasts of all ages to explore the cosmos and deepen their understanding of the universe.



HIGHLIGHTS OF AUGUST 2024

THE SUN MIGHT JUST HAD A RECORD-BREAKING NUMBER OF VISIBLE SUNSPOTS

A record number of sunspots on the sun as seen on Aug. 8, 2024 by a NASA spacecraft. (Image credit: NOAA/SWPC/NASA)

On August 8, photographs from NASA's Solar Dynamics Observatory (SDO) may have shown hundreds of distinct sunspots to scientists.

Sunspots may appear minuscule to us, but they are not. On the surface of the sun, these are actually dark regions that are usually the size of the entire Earth. They also have powerful magnetic fields that have the ability to produce solar flares, which shoot electromagnetic radiation bursts into space. These explosions are the precursors of coronal mass ejections (CMEs), which have the potential to produce solar storms on Earth.

The solar cycle, an 11-year dynamic, creates strong magnetic energy on the sun due to differential rotation. This can lead to sunspot formation when strong enough. The Solar Cycle 25 is more active than previously predicted, according to NOAA's Space Weather Prediction Center.

Intense geomagnetic storms that produced breathtaking auroras globally, especially from unusual vantage positions, have already made Solar Cycle 25 famous. Now, it may also be the largest daily sunspot number (SSN) in over 20 years. The SWPC stated in a recent release that, according to measurements made with its resources, the figure came in at 337. This would be the first time since March 2001 that scientists have observed a daily SSN that numerous.

"We utilized a conventional calculation based on sunspot reports from United States Air Force (USAF) solar observatories, which we get at SWPC. However, our sunspot number is not the official one; the Solar Influences Data Center (SIDC) and Belgium provide that later," Dahl stated. "In the meantime, we generate a daily overview of all the active regions every day and examine each group of spots visible on the sun, calculating their potential for solar flare and energetic particle events (R- and S-scale events).

As you may remember, there were a lot of active sunspot locations on August 8. It was only the start of an event that continued until August 10 and saw five CMEs shot by solar flares toward Earth, which prompted the issuance of geomagnetic storm watches for our planet over the weekend of August 11-12.

"On August 8, there was an R3 level flare that was linked to a CME (AR 3774), which was linked to yet another CME. Although there had been several of them in the week preceding this one, Dahal stated that a G2 Watch was maintained through the weekend since this CME seemed to have a higher degree of confidence for an Earth-directed component. "This was indeed suspected to be the CME that did arrive and eventually led to G1-G3 levels, and even a 3-hour period of G4 being reached."

MENTAL HEALTH IN SPACE: ISS EXPERIMENTS HELP KEEP ASTRONAUTS HAPPY OFF EARTH

Over 25 years of research on the International Space Station (ISS) has provided new avenues for understanding astronaut mental health. The ISS hosts various experiments focused on mental health, such as virtual reality and taking pictures of Earth, to help astronauts during missions lasting six months to 12 months.

European Space Agency astronaut Andreas Mogensen testing a VIVE Focus 3 virtual reality headset on the International Space Station. (Image credit: NASA / ESA)

Now-retired Canadian Space Agency astronaut Chris Hadfield wearing a forehead sensor for the Circadian Rhythms experiment. (Image credit: NASA)

NASA and other space agencies aim to learn how to keep astronauts happy, not only for long-duration moon missions with the Artemis program but also for isolated, confined environments on Earth.

Over 25 years of research on the International Space Station (ISS) has provided new avenues for understanding astronaut mental health. The ISS hosts various experiments focused on mental health, such as virtual reality and taking pictures of Earth, to help astronauts during missions lasting six months to 12 months. NASA and other space agencies aim to learn how to keep astronauts happy, not only for long-duration moon missions with the Artemis program but also for isolated, confined environments on Earth.

The Circadian Light project is testing a new lighting system on the ISS to see how lighting patterns help astronauts maintain a more normal daily or circadian rhythm. The ISS lighting panel seeks to better mimic natural conditions on Earth, such as those caused by the sun's trek across our sky.

The goal is to see how astronaut well-being can be improved through matters such as sleep and stress reduction, which may also help shift workers.

Circadian Light builds on an earlier experiment called Circadian Rhythms, which examined how daily rhythms change during long-duration spaceflight and its non-24-hour cycles of light and dark. NeuroMapping aims to dive into the brain's structure and function to see how matters such as multi-tasking change in space and how they change again when an astronaut returns to Earth.

Crew Earth Observations, an investigation from the European Space Agency (ESA), uses virtual reality technology for astronauts to simulate being in different environments. This tool could be used to deal with psychological issues such as stress, anxiety, and post-traumatic stress disorder on Earth. ESA astronaut Andreas Mogensen, one of the study participants, enjoyed using VR for applications such as exercise on a stationary bike.

WITH SPACE AGENCIES RACING TO THE MOON, SCIENTISTS ARE MAKING A LUNAR 'TIME ZONE'

Living on the moon presents several challenges, including acquiring oxygen to breathe, bringing or growing food from Earth, and creating a habitat. Accurate clocking time on the moon is also a challenge. NASA's Artemis program aims to return humans to the moon in the near future, and space agencies and commercial space companies are racing to reach the lunar surface.

Researchers from the National Institute of Standards and Technology (NIST) may have finally solved the long-standing problem of designing a reliable clock for lunar living by creating a new "moon time" reference for timekeeping.

Here on Earth, we use atomic clocks to keep meticulous track of time. Atomic clocks are exactly what they sound like; they're a way of measuring time using the properties of an atom. These brilliant little inventions are used for many of the technological advances we rely on today, especially GPS.

If Artemis astronauts and future citizens of the moon want Google Maps to direct them to the nearest lunar crater, they'll need precise clocks to make space GPS a reality – but we can't just use the same atomic GPS clocks as we do on Earth.

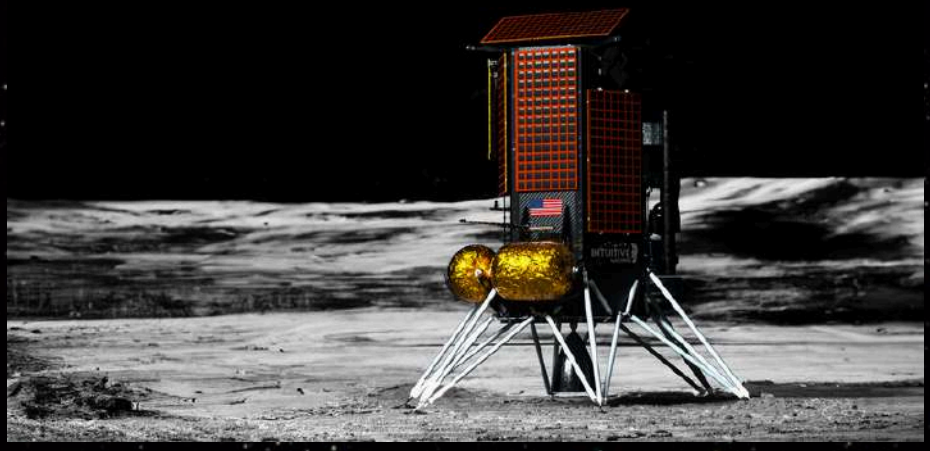
Atmospheric clocks, used for GPS, are used for precise tracking of time on Earth, but the gravitational force of the moon makes atomic clocks there tick faster by about 56 microseconds per day. This disrupts systems that rely on exact timing. Communication between Earth and the moon is even more complicated due to Albert Einstein's theory of special relativity, as time passes differently for each observer.

The NIST researchers created a new "moon time" reference for timekeeping, synchronizing the entire moon to one 'time zone' adjusted for the moon's gravity. The goal is to ensure that spacecraft can land within a few meters of their intended destination.

This is the first step towards a lunar GPS system, allowing for complicated coordination between satellites and inhabitants on the moon. As NASA plans for a long-term lunar base and mining operations on the moon, this will be a key technology to develop.

The proposed framework underpinning lunar coordinate time could eventually enable exploration beyond the moon and even beyond our solar system once humans develop the capability for such ambitious missions.

NASA SELECTS INTUITIVE MACHINES FOR SOUTH POLE LUNAR LANDER MISSION



An artist's concept of Intuitive Machines' Nova-C lunar lander on the Moon's South Pole. Credit: Intuitive Machines

NASA has awarded Intuitive Machines of Houston $116.9 million to deliver six NASA payloads to the lunar South Pole in 2027, as part of the agency's broader Artemis campaign. The payloads will be delivered to areas with frigid nighttime temperatures, rugged terrain, and permanently shadowed regions that could help reveal the origin of water throughout our solar system. This marks the 10th CLPS delivery NASA has awarded and the fourth planned for delivery to the South Pole of the Moon.

The instruments on this newly awarded flight will help achieve multiple scientific objectives and strengthen our understanding of the Moon's environment. They will help answer key questions about where volatiles (such as water, ice, or gas) are found on the lunar surface and measure radiation in the South Pole region, which could advance our exploration efforts on the Moon and help us with continued exploration of Mars.

These instruments, collectively are expected to be about 174 pounds in mass, include the Lunar Explorer Instrument for Space Biology Applications, Package for Resource Observation and In-Situ Prospecting for Exploration, Characterization and Testing, Laser Retroreflector Array, Surface Exosphere Alterations by Landers, Fluxgate Magnetometer, and Lunar Compact Infrared Imaging System. These instruments will help NASA conduct science and continue working toward a long-term human presence on the Moon.

Under CLPS, multiple commercial deliveries to different geographic regions will help NASA conduct science and continue working toward a long-term human presence on the Moon. Future deliveries will include sophisticated science experiments and technology demonstrations as part of the agency's Artemis campaign. Two upcoming CLPS flights slated to launch near the end of 2024 will deliver NASA payloads to the Moon's nearside and South Pole, including the Intuitive Machines-2 delivery of NASA's first on-site demonstration of searching for water and other chemical compounds 3.3 feet below the surface of the Moon, using a drill and mass spectrometer.

T Coronae Borealis nova could become a 'new star'

T Coronae Borealis, also known as T CrB or the 'Blaze Star', is set to become visible to the naked eye this year, with its apparent brightness temporarily increasing. This star system, located in Corona Borealis, the Northern Crown, is a recurring nova that brightens due to a physical interaction between two stars in a binary system: one a red giant and one a white dwarf.

The material accretes from the red giant onto the white dwarf until enough mass has transferred to set off a thermonuclear detonation, causing T CrB to brighten significantly, possibly as bright as second magnitude, on par with Polaris and Gemma.

T Coronae Borealis normally shines at a brightness of magnitude +10, which is the measurement astronomers use to describe the relative brightness of one celestial object compared to others.

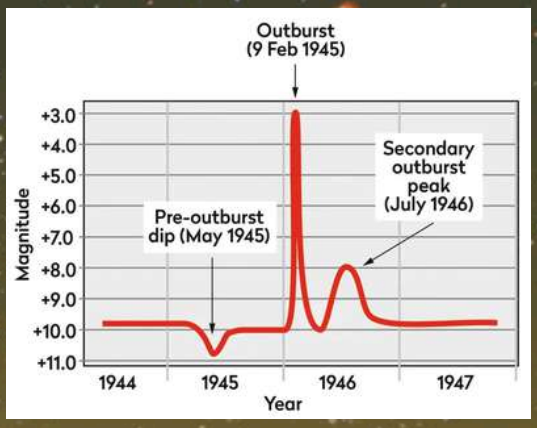
The higher the number, the dimmer the object. T Coronae Borealis is expected to jump to magnitude +2 during the nova event, making it similar in brightness to the North Star, Polaris. It could be visible to the naked eye for several days and potentially visible for over a week through binoculars.

A nova is not the same as a supernova, which occurs when a massive star explodes at the end of its life, having run out of fuel. T Coronae Borealis is a recurring nova, meaning it temporarily becomes thousands of times brighter. It was last seen doing so in 1946 and is a binary star system, meaning the'star' is really two stars orbiting each other.

To know when T Coronae Borealis will brighten, scientists have precisely measured the amount of matter it takes for this to happen and the rate that it is accumulating on the white dwarf. Astronomers predict that the next explosion will occur between February and September 2024. The star is usually mag. +10.0 and only visible through a telescope, but the nova is expected to increase its brightness to mag. +2.0, comparable to Polaris, the North Star.

When it brightens, it should remain naked-eye visible for several days and visible in binoculars for about a week following. You can keep watch for yourself by looking to the constellation of Corona Borealis, between Boötes and Hercules.

Chart showing the location of the constellation Corona Borealis, the location of the T Coronae Borealis nova event. Credit: Stellarium



T CrB has a dramatic outburst every 80 years – and it's due one right around now

Boeing Starliner Astronauts will spend at least 240 days Stuck in Space — is that a New Record?

NASA has announced plans to bring astronauts Butch Wilmore and Sunita Williams home from the International Space Station (ISS) no earlier than February 2025, at least eight months longer than their initial eight-day trip. The return flight will use a SpaceX vehicle instead of the troubled Boeing Starliner spacecraft, with no confirmed date.

In the best-case scenario, the Starliner crew's time in space will amount to no fewer than 240 consecutive days since the spacecraft's launch on June 5, 2024. A March departure could bump that number up to nearly 270 days.

Eight consecutive months in space is not a new record. Astronauts typically spend an average of six months aboard the ISS, where they conduct experiments and maintain the space station before returning to Earth. However, missions can extend many months longer due to long-duration experiments and unforeseen incidents.

NASA astronauts Butch Wilmore and Sunita Williams will spend more than 240 days in space before their journey home. How does that compare to spaceflight records? (Image credit: NASA)

The record for the most consecutive days in space by an American goes to astronaut Frank Rubio, who spent 371 days aboard the ISS from September 2022 to September 2023. Rubio's stay in space more than doubled after a small meteoroid slammed into the Russian Soyuz spacecraft, causing irreparable damage. Rubio, along with Russian cosmonauts Sergey Prokopyev and Dmitri Petelin, had to wait another six months in space before a replacement Soyuz capsule arrived to bring them home.

NASA's twins study revealed that astronauts experience changes during long stays in orbit, including changes in gene expression, body weight, and gut microbiome composition. Most of these changes revert to normal after six months back on Earth, but the study of spaceflight on human health is still in its infancy.

Japan Declares Its SLIM Moon Lander Dead At Last

After not being able to get in touch with the lander since April, Japan has decided to terminate its SLIM lunar mission. On September 7, 2023, the Japan Aerospace Exploration Agency (JAXA) launched the Smart Lander for Investigating Moon (SLIM) from Tanegashima Space Center aboard an H-IIA rocket. On January 19 of this year, the little lander achieved a successful if uneven touchdown on the lip of Shioli Crater.

A huge surprise was delivered when the 440-pound (200-kg) solar-powered lander survived three distinct cold lunar nights, beyond its intended one-day operation on the surface. Put another way, in February, March, and even April, SLIM powered up and spoke with ground workers back on Earth; now, however, JAXA claims the game is over.

The agency "concluded operations" on August 23 after "being unable to establish communication with the spacecraft during the operational periods from May to July," according to a statement released by JAXA on August 26. The mission crew had been trying every month to get a signal from SLIM, even though the spacecraft's last communication with Earth was in late April. The SLIM lander achieved its primary goal, even if it landed on its side.

"The landing precision was evaluated with a position error of approximately 10 meters (32.8 feet) from the target point, confirming the world's first successful pinpoint landing;" the announcement said. The "Moon Sniper" spacecraft accomplished additional goals as well, employing its Multi-Band Camera (MBC) to record spectral data in 10 wavelength bands on 10 rocks, exceeding expectations beyond its surprise revivals after its initial day on the moon.

An added advantage was that when NASA's Lunar Reconnaissance Orbiter (LRO) passed over the mission landing site, it was able to ping SLIM's retroreflector. "We extend our deepest gratitude to all parties involved in the development and operation of SLIM for their cooperation and support, as well as all those who encouraged the mission," the statement said. Additionally, Japan and India are collaborating on a mission to land on the lunar south pole that may launch later this year.

SLIM [ISAS]

WHAT'S UP IN THE SKY - SEPTEMBER 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
Morning planet, best on 5 September. Superior conjunction 30 September.

Venus
Evening planet, improving slowly. Best at end of month.

Mars
Improving morning planet, near open cluster M35 on 9 September.

Jupiter
Excellent position at the end of September, reaching 60° altitude in darkness.

Saturn
Opposition on 8 September, well presented all month, making Saturn among the best planets to see tonight, September 2024.

Uranus
Well placed planet, able to reach 56° altitude under dark skies from mid-September.

Neptune
Opposition on 21 September and visible at peak altitude under dark skies for the whole month.

BRIGHT DEEP SKY OBJECTS

Like shiny flakes sparkling in a snow globe, over 100,000 stars whirl within the globular cluster M13, one of the brightest star clusters visible from the Northern Hemisphere. Located 25,000 light-years from Earth with an apparent magnitude of 5.8, this glittering metropolis of stars in the constellation Hercules can be spotted with a pair of binoculars most easily in July.

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.

This Hubble image of M92's core is a composite made using observations at visible and infrared wavelengths. Located 27,000 light-years from Earth in the constellation Hercules, this globular cluster – a ball of stars that orbits our galaxy's core like a satellite – was first discovered by the German astronomer Johann Elert Bode in 1777.

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 - AUGUST 2024

James Webb Space Telescope Challenge Early Galaxy Theories

Astronomers using NASA's James Webb Space Telescope (JWST) were surprised to find massive galaxies in the early universe, challenging current cosmological models. Initial observations suggested that these galaxies were too large to fit within the standard model of cosmology, which explains the universe's composition and evolution since the Big Bang. However, a new study led by University of Texas at Austin graduate student Katherine Chworowsky offers an explanation: black holes within these galaxies are making them appear more massive than they actually are.

The study, published in the Astronomical Journal, reveals that black holes in some early galaxies rapidly consume surrounding gas, generating heat and light through friction. This additional brightness can give the false impression that these galaxies contain many more stars, leading to overestimates of their mass. When this effect is accounted for, the galaxies' sizes align more closely with predictions from the standard cosmological model.

The evidence comes from the Cosmic Evolution Early Release Science (CEERS) Survey, which used JWST's Near-Infrared Camera (NIRCam) to capture deep-field images of early galaxies. While the discovery of black holes has resolved the issue of apparent massiveness, there are still more galaxies in the early universe than expected, suggesting that star formation may have occurred more efficiently in the past.

Further analysis of these galaxies, known as "little red dots," indicates the presence of black hole accretion disks, reinforcing the idea that some of the observed light comes from gas swirling around black holes rather than stars. Though the standard model of cosmology remains intact, these findings highlight the need for new insights into star formation and galaxy evolution in the early universe.

JWST Findings Offer Fresh Perspective on the Hubble Tension in Cosmology

Recent data from the James Webb Space Telescope (JWST) has shed new light on the universe's expansion rate, offering fresh insights into the "Hubble tension," a long-standing issue in cosmology. This tension arises from conflicting results between two major methods of measuring the Hubble constant, which indicates the universe's rate of expansion. One method, based on the cosmic microwave background (CMB) radiation from the Big Bang, yields a lower value, while the other, which observes stars in nearby galaxies, suggests a higher rate.

Led by University of Chicago astronomer Wendy Freedman, a new study aimed to address this discrepancy by analyzing light from 10 nearby galaxies using the JWST. The team employed three independent methods—Cepheid variable stars, the Tip of the Red Giant Branch, and carbon stars—all known for their predictable brightness. Remarkably, the results from these methods aligned closely with the CMB-based measurements, suggesting that the perceived conflict between the two approaches may not be as severe as once thought.

This finding is significant because it supports the standard model of the universe's evolution, indicating that the discrepancy might not point to a fundamental flaw in our understanding of cosmology. While the debate over the Hubble tension continues, this study provides a clearer picture of the universe's expansion and paves the way for future research. Freedman emphasized the importance of ongoing JWST observations to further investigate and resolve this issue, potentially leading to a deeper understanding of the cosmos.

JWST Observations Hint at an Underground Ocean on Uranus's Moon Ariel

Recent observations from the James Webb Space Telescope (JWST) suggest that Ariel, one of Uranus's 27 moons, might harbor an underground liquid ocean. This intriguing discovery was made during a 21-hour observation as part of the "Moons of Uranus" project, which aimed to detect signs of water, ammonia, organic molecules, and carbon dioxide ice.

In a surprising find, JWST detected carbon dioxide ice on Ariel, despite the moon's considerable distance from the Sun, where such ice would typically sublimate into gas. This ice was primarily located on the side of the moon facing away from its orbital direction.

Additionally, carbon monoxide, detected for the first time on Ariel, further deepens the mystery. Carbon monoxide is stable only at extremely low temperatures, much lower than Ariel's average surface temperature of about 65 degrees Fahrenheit.

The presence of these substances has significant implications for our understanding of Ariel's geology. Researchers speculate that the carbon dioxide ice might originate from an underground ocean, escaping through surface cracks. Another hypothesis is that radiation from Uranus's magnetic field could be breaking down molecules on the moon's surface, leading to the formation of carbon dioxide ice.

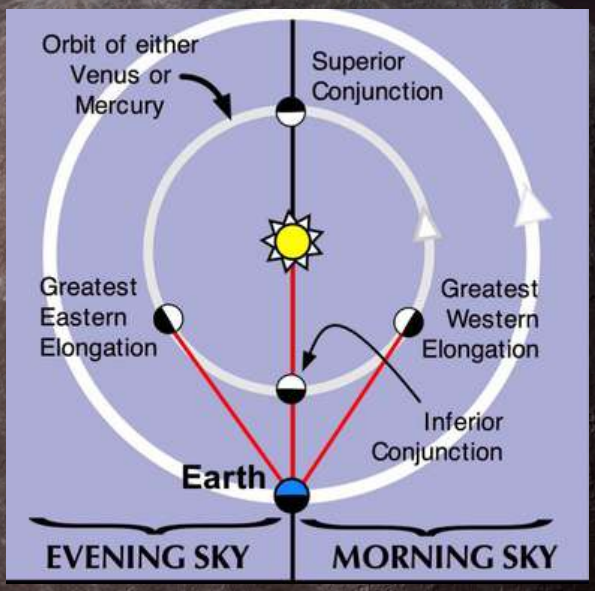
ASTRONOMICAL EVENTS - SEPTEMBER 2024

Mercury at Greatest Western Elongation

During its August-September 2024 morning apparition, Mercury will reach its peak altitude of 17° above the horizon on 5 September, shining at magnitude -0.3. Observation will become easier as Mercury transitions from a thin crescent to a more visible gibbous phase. Initially difficult to spot as it emerges from inferior conjunction with its unilluminated side facing Earth, Mercury will gradually brighten and become more visible as its phase changes.

What is an Elongation?

Elongation refers to the angular distance between the Sun and one of the inner planets, Mercury, or Venus, on the sky's dome. Measured in degrees eastward or westward of the Sun, the greatest elongations mark the optimal time to observe these planets, as they are at their farthest from the Sun's glare. At its greatest eastern elongation, Mercury is visible as an evening object that sets in the west after the sun. At its greatest western elongation, Mercury is visible as a morning object that rises in the east before the sun.



Observing Mercury:

Mercury, being close to the Sun, often gets lost in its glare and is visible only for a few weeks during its greatest elongation, which occurs every 3–4 months, either in the morning or evening skies. When Mercury is east of the Sun, it is visible in the evening; when west, it is visible before sunrise. In India, its altitude at sunrise during morning apparitions ranges from 17° to 23°, peaking at 17° on 5 September 2024.

Mercury's visibility is influenced by two main factors:

Ecliptic Inclination: Mercury's altitude above the horizon depends on the ecliptic's angle at sunrise or sunset. A shallow ecliptic requires Mercury to be farther from the Sun to be visible, while a steep ecliptic allows it to appear higher even if closer to the Sun. The ecliptic is steepest at sunset during the spring equinox and at sunrise during the autumn equinox, affecting visibility differently in each hemisphere.

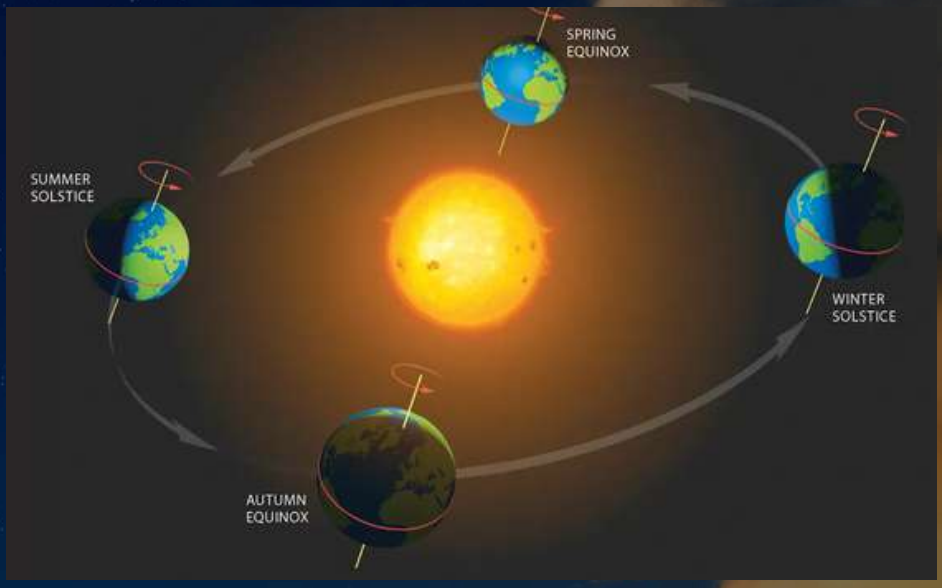
Elliptical Orbit: Mercury's elliptical orbit causes its distance from the Sun to vary, affecting its separation at greatest elongation, which can range from 18° to 28°. During the August-September 2024 apparition, Mercury will reach a maximum separation of 18°.

The ecliptic's angle has a more significant impact on visibility, making Mercury easier to observe in the southern hemisphere, where favorable inclinations often coincide with its aphelion. In contrast, in the northern hemisphere, favorable inclinations align with its perihelion, making observation more difficult.

Autumn Equinox

The September equinox marks the start of autumn in the northern hemisphere and spring in the southern hemisphere. On this day, Earth experiences nearly equal daylight and darkness—around 12 hours each—as the Sun crosses the celestial equator. The term "equinox" comes from Latin, meaning "equal night."
During the equinox, the Sun is located in the Virgo constellation, with a right ascension of about 12 hours. Everywhere on Earth, the Sun rises due east and sets due west. Equinoxes occur because Earth's axis is tilted at 23.5°, causing the seasons. At the equinoxes, in March and September, the Sun is directly above the equator.

Earth's orbit takes 365.242 days, causing equinoxes to shift by nearly 6 hours each year. To correct this, we add a leap day every four years. The exact timing of equinoxes shifts slightly each year due to Earth's slow wobble, known as precession.



Comet C/2023 A3 (Tsuchinshan-ATLAS) passes perihelion

Comet C/2023 A3 (Tsuchinshan-ATLAS) will make its closest approach to the Sun on September 27, at a distance of 0.39 AU. However, from New Delhi, it won't be observable on this day, as it will be low in the sky and reach its highest point during daylight hours.

The comet is expected to be very bright, potentially visible to the naked eye, although its exact brightness depends on its activity in the coming months. As C/2023 A3 approaches the Sun, it is likely to develop a striking cometary tail as its ice and dust particles heat up and evaporate.
This comet will be best visible from the Northern Hemisphere, though it will be too close to the Sun to see during late August and most of September. By the end, on September 30th, it will move far enough from the Sun to become visible in the morning sky of the Southern Hemisphere, possibly reaching a brightness of magnitude -1.

In September, C/2023 A3 will enter Venus's orbit and reach perihelion on September 27. During this period, it may break apart due to the Sun's intense heat. If it survives, the comet will make its closest approach to Earth on October 12, at a distance of 0.48 AU, and will be visible to the naked eye at its maximum brightness.

OPPOSITIONS FOR THE MONTH

Opposition in astronomy occurs when Earth is directly between the Sun and another planet or celestial body, making the object appear on the opposite side of the sky from the Sun. This alignment is possible only for planets farther from the Sun than Earth—like Mars, Jupiter, Saturn, Uranus, and Neptune. At opposition, the planet is closest to Earth, appearing larger and brighter, making it an ideal time for observation. The planet rises at sunset, reaches its highest point at midnight, and sets at sunrise, allowing it to be visible all night. During opposition, the solar system aligns so that the planet is at perigee, or its nearest point to Earth. This event is especially significant for stargazers and astrophotographers, as it provides the best conditions for viewing and photographing these distant worlds.

Saturn at Opposition

On 8th of September 2024, Saturn will reach opposition in the constellation Aquarius, making it visible for much of the night. From 7:14 pm to 5:20 am, it will be observable, peaking at 12:17 am at 64° above the southern horizon. During this time, Saturn is closest to Earth, known as perigee, appearing brighter and slightly larger, though its distance of 8.66 AU means its angular size varies little. Saturn's rings will be nearly edge-on, potentially showing the Seeliger Effect, where the rings brighten as ice particles reflect sunlight directly. Despite being at its closest, Saturn will still look like a bright star to the naked eye, with a disk size of 19.2 arcseconds and a magnitude of 0.6.

On 8th Sept at 12.17 am

Neptune at Opposition

On 21st Sept at 12.10 am

On 8th of September 2024, Neptune will reach opposition in the constellation Pisces, making it visible throughout much of the night. In India, Neptune will be observable from 7:46 pm to 4:35 am, starting at 21° above the eastern horizon, peaking at 70° above the southern horizon around 12:10 am, and setting below 21° on the western horizon by 4:35 am. At opposition, Neptune is closest to Earth, known as perigee, and appears at its brightest. However, due to its vast distance of about 30.07 AU from the Sun, its angular size remains nearly constant. Even at its closest approach, Neptune appears as a star-like point to the naked eye, with a disk size of 2.4 arcseconds and a magnitude of 7.8.

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 September 1st, the red Planet Mars will meet the Giant planet Jupiter in the East direction. The pair will be visible in the sky at around 12.35 a.m. but the close to each other at around 01.30 a.m. Mars will be at a magnitude of 0.74 & Jupiter will have a magnitude of -2.13.

Place: New Delhi/ Date: 1st September / Time:01.00 a.m.

Place: New Delhi/ Date: 17th September / Time: 07.30 p.m.

Conjunction of Moon and Saturn

On September 17th, the Ringed planet Saturn and the Moon will have the closest approach in the night sky & reaching an altitude of 18° above the south-eastern horizon. The Moon will be at magnitude -12.80, and Saturn at mag 0.6. And it will be visible around 06.00 p.m. in the night.

Conjunction of Moon, Mars and Jupiter

On September 25th, 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 -11.87, the planets Jupiter is at a magnitude of -2.29 and Mars at a magnitude of 0.55. The Moon, Mars and Jupiter, together will be seen in the night sky around 12.00 a.m.

Place: New Delhi / Date: 25th September / Time: 04.45 a.m.

Neptune: Exploring Sea Deities Across Mythologies

Neptune, the Roman god of the sea, is closely associated with the Greek god Poseidon. Many cultures have their own sea deities and mythological figures associated with the oceans, rivers, and water bodies. Below are 15 mythological stories or figures related to Neptune or similar sea deities across different regions:

Greece (Poseidon): Poseidon, the Greek counterpart of Neptune, was one of the Olympian gods. He was the god of the sea, earthquakes, and horses. One famous myth involves Poseidon competing with Athena for the patronage of Athens. Poseidon struck the ground with his trident, creating a saltwater spring, but Athena offered an olive tree, which the people valued more.

Rome (Neptune): In Roman mythology, Neptune was the god of the sea, similar to Poseidon in Greek mythology. He was celebrated during the festival of Neptunalia, where people sought his favor for protection during voyages and abundant fishing. He was also believed to control fresh water sources.

Norse (Aegir): Aegir was a giant and god associated with the sea in Norse mythology. He was known for hosting elaborate feasts for the gods in his underwater hall. Aegir was both a benevolent and feared figure, known for causing storms when angered.

Hindu (Varuna): Varuna is a Vedic deity associated with the ocean, the night sky, and the cosmic order in Hindu mythology. He is depicted as a wise god who maintains the balance of the cosmos and is often invoked for protection at sea.

Japanese (Ryujin): Ryujin, the dragon god of the sea in Japanese mythology, lived in a palace under the sea. He controlled the tides with magical jewels and was a guardian of the ocean's creatures. Ryujin was often invoked by fishermen and sailors for safe j**ourneys.**

Polynesian (Tangaroa): Tangaroa, or Kanaloa in Hawaiian mythology, is one of the major gods of the Polynesian pantheon. He is the god of the sea and marine life. Tangaroa is a creator god, responsible for the existence of the oceans and all creatures within it.

Celtic (Manannán mac Lir): Manannán mac Lir is a sea god in Irish mythology, often associated with the Isle of Man. He is depicted as a powerful figure who possesses a magical boat that can sail without a sail, as well as a cloak that makes him invisible.

Egyptian (Sobek): Sobek was an ancient Egyptian deity associated with the Nile, water, and fertility. He was depicted as a crocodile or a man with a crocodile head. Sobek was believed to control the waters of the Nile and protect the people from the dangers of the river.

Mesopotamian: Ea, also known as Enki, was a god of water, wisdom, and creation in Mesopotamian mythology. He resided in the Apsu, the freshwater ocean beneath the earth, and was responsible for the creation of humanity and the protection of the world.

Chinese (Dragon Kings): In Chinese mythology, the Dragon Kings are four divine rulers of the seas, each governing one of the cardinal directions. The most prominent of these is the Dragon King of the East Sea, who controls rain, floods, and water-related phenomena.

These stories and deities highlight the universal importance of the sea and water in various cultures, reflecting humanity's deep connection with these natural elements.

Recording the Skies

China has a long and detailed history of astronomy, with meticulous records lasting 3,000 years. The ancient Chinese were the most persistent and accurate observers of the celestial skies, and, for several centuries, the records they maintained were the only ones available to modern astronomers.

In ancient China, astronomy arose from the worship of heaven and belonged to the royals. Emperors employed astronomers to chart the heavens and record their observations. The lunisolar Chinese calendar was derived from this and was considered to be a symbol of the dynasty.

Chinese astronomy is fascinating yet different. Chinese astronomers used the circumpolar stars as the reference point for the heavens. In particular, ancient Chinese utilized the orientation of the Big Dipper constellation relative to the pole star in the early eventing. This was a notable contrast with the rest of the world, whose observation was based on the rising and setting of the celestial bodies against the ecliptic and horizon. The ancient Chinese also divided the sky into 12 branches with 10 stems arranged around the ecliptic, giving a 60-year cycle.

Additionally, Unlike their Indo-European contempories who focused on understand the world around them through theories they developed, Chinese astronomers were more interested in refining their observations and ensuring that their measurements were accurate. As the first Chinese astronomical records are from around 3,000 B.C., the records they maintained were accurate to an unprecedented degree. They also recorded unusual celestial phenomena such as novae, comets and meteor showers, leaving a detailed record for us.

One of the notable events that they observed was a supernova that occurred in 1054 A.D. This supernova, which is dubbed, SN 1054, is the first record of a supernova sighting. Today we can see the remnants of SN1054 as the Crab Nebula.

Ancient Chinese astronomers were also some of the earliest observers and recorders of sunspots. Finally, they have the world's oldest completely preserved star atlas from 700 AD.

Even in the modern day, China contributes to global knowledge with modern telescopes and astronomers as well as their ancient records.

Rocket launches in September 2024

PROBA-3

In September 2024, the Indian Space Research Organization (ISRO) is set to launch the European Space Agency's (ESA) Proba-3 mission using the Polar Satellite Launch Vehicle (PSLV). Proba-3 is a groundbreaking mission focused on demonstrating precision formation flying in space, which is a first for any space mission.

Proba-3 consists of two satellites, which will fly in a precise formation 144 meters apart. Together, they will form a giant solar coronagraph—a device that can study the Sun's corona, the outermost layer of the Sun's atmosphere. This formation will allow the mission to block out the Sun's bright disk and observe the faint corona with unprecedented detail, closer to the Sun's surface than ever before.

The mission's success relies heavily on advanced technologies that maintain the relative positioning of the two satellites with millimeter accuracy. This level of precision is crucial for the mission's main goal: to simulate an artificial solar eclipse, providing continuous and clear observations of the Sun's corona. The mission will serve as a testbed for future space missions requiring similar formation flying techniques.Proba-3 will be launched from the Satish Dhawan Space Centre, and the mission is expected to last around two years

The Proba-3 mission includes two spacecraft, Coronagraph (left) and Occulter (right). (Image credit: European Space Agency)

TDS-01

The TDS-01 (Technology Demonstration Satellite-01) mission, slated for launch in September 2024, represents a significant technological advancement for the Indian Space Research Organisation (ISRO). This mission will utilize the PSLV-XL (Polar Satellite Launch Vehicle) to place the satellite into geostationary transfer orbit (GTO), with the launch taking place from the Satish Dhawan Space Centre in Sriharikota.

TDS-01 is designed to test and validate several cutting-edge technologies that are critical for future space missions. Among the key payloads are 300 mN electric thrusters developed by ISRO's Institute of Plasma Research, which will be used for precise satellite maneuvering.The satellite will also carry atomic clocks, essential for accurate timekeeping and synchronization in space-based systems, and traveling wave tube amplifiers (TWTA) to enhance communication signal strength. Additionally, the mission will include a quantum communication suite (QuTDS) to explore advanced quantum communication technologies, which could revolutionize secure data transmission in space.

This mission underscores ISRO's growing expertise in deploying and operating advanced space technologies, contributing to its reputation as a leading player in the global space industry

(Image credit: European Space Agency)

Artistic imagination of TDS-01 (Technology Demonstration Satellite-01) in space.

EscaPADE

Date: September 29, 2024 Rocket: New Glenn
Agency: Blue Origin Country: USA Launch Site: Cape Canaveral, FL, USA

The EscaPADE stands for Escape and Plasma Acceleration and Dynamics Explorers this marks a significant step in interplanetary exploration. This mission involves two small spacecraft designed to study the dynamics of Mars' magnetosphere and its interaction with the solar wind. EscaPADE, part of NASA's Small Innovative Missions for Planetary Exploration program, aims to understand how solar wind energy affects Mars' atmosphere, focusing on ion escape and plasma dynamics. Success in this mission will not only enhance our understanding of Mars but also establish New Glenn as a reliable launch vehicle for future missions NASA. (Image credit: Techtimes.com)

FLTA006

Date: End of september 2024 Rocket: Firefly Alpha
Agency: Firefly Aerospace Country: USA Site: Vandenberg SFB, CA, USA.

The FLTA006 mission, also known as Lockheed Martin Demo 1, is scheduled to launch in September 2024 aboard Firefly Aerospace's Alpha rocket. This mission is part of a multi-launch agreement between Firefly Aerospace and Lockheed Martin, which includes up to 25 launches of technology demonstration satellites into low Earth orbit (LEO) through 2029. The FLTA006 mission will launch from the Vandenberg Space Force Base in California and will serve as a responsive space operation, showcasing Firefly's capability to conduct rapid launch operations. This mission is designed to support Lockheed Martin's efforts in advancing new space technologies and exploring responsive space solutions for various applications . (Image credit: spacelaunchschedule.com)

Starlink Group

The Starlink mission scheduled for September 2024 is part of SpaceX's ongoing efforts to expand its second-generation satellite constellation. This mission will launch a batch of Starlink v2-mini satellites using the Falcon 9 Block 5 rocket. These satellites are designed to enhance global internet coverage, especially in remote areas, and will likely include both Direct to Cell and regular v2-mini satellites. The launch will take place from Space Launch Complex 40 (SLC-40) at Cape Canaveral Space Force Station in Florida
This launch is part of SpaceX's broader plan to maintain a rapid launch cadence, continuing its record-breaking year with multiple Starlink launches aimed at bolstering the constellation's capabilities and coverage

SpaceX launches in September 2024

Crew-9

Date: September 25, 2024 Rocket: Falcon 9 Block 5
Agency: SpaceX Country: USA Launch Site: Space Launch Complex 40 Cape Canaveral, FL, USA

The SpaceX crew-9 mission is part of NASA's ongoing Commercial Crew Program which will transport a team of astronauts aboard the Crew Dragon spacecraft to the International Space Station (ISS), where they will conduct various scientific research, technology demonstrations, and maintenance activities vital to the station's operation . The mission aims to ensure the continuous human presence on the ISS and contribute to ongoing scientific advancements in microgravity environments. The crew is expected to spend approximately six months in orbit before returning to Earth

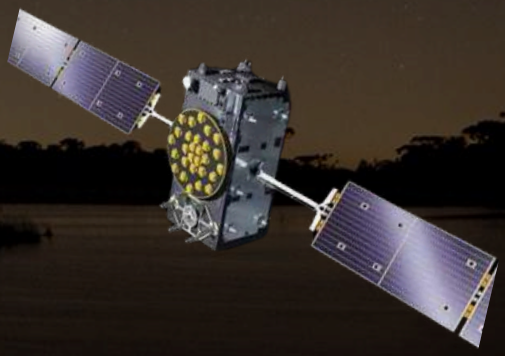
4x Astranis MicroGEO

Date: September 2024 Rocket: Falcon 9 Block 5
Agency: SpaceX Country: USA Launch Site: Cape Canaveral, FL, USA

This mission will deploy four MicroGEO satellites designed by Astranis. These satellites are much smaller and more affordable making them ideal for providing targeted, high-bandwidth internet service.Astranis aims to revolutionize broadband connectivity. The MicroGEO satellites will operate in geostationary orbit and are designed to enhance internet coverage, The mission is part of Astranis' broader plan to deploy 100 such satellites by 2030, which will significantly increase global broadband availability including potential use by the U.S. Department of Defense.
(Image credit: spacelaunchschedule.com)

Galileo L13

Date: September 13, 2024 Rocket: Falcon 9 Block 5
Agency: SpaceX Country: USA Launch Site: Cape Canaveral, FL, USA



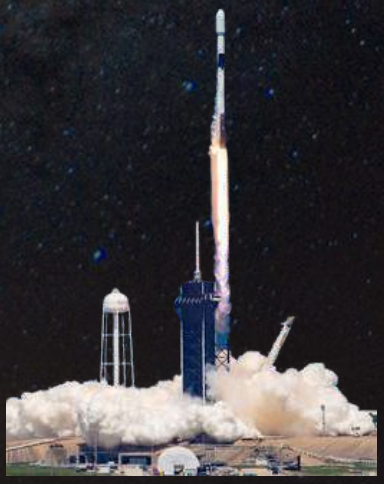
The Galileo L13 mission involves the launch of two Galileo satellites (FOC FM26 & FM28).This mission is part of Europe's Galileo navigation system, which aims to provide an independent and highly precise global positioning system, serving as an alternative to the U.S. GPS and Russia's GLONASS. The Galileo satellites offer enhanced positioning services and contribute to Europe's strategic autonomy in satellite navigation. Originally planned for launch on other rockets like Soyuz-ST and Ariane 6, these satellites were eventually moved to SpaceX's Falcon 9 due to availability and scheduling issues. The launch will take place from Cape Canaveral, Florida. (Image credit: esa.int)

Integrated Flight Test 5

Date: September 2024 Rocket: Starship
Agency: SpaceX Country: USA Launch Site: SpaceX Starbase, TX, USA

This mission aims to create a fully reusable spacecraft capable of deep space missions, including crewed missions to Mars.
IFT-5 will involve testing the integration and performance of the Starship vehicle with its Super Heavy booster. . The successful completion of IFT-5 is expected to bring SpaceX closer to its goal of achieving operational flights for Starship.
(Image credit: spacelaunchschedule.com)

SDA Tranche 1 Transport Layer A



Date: September 2024 Rocket: Falcon 9 block 5
Agency: SpaceX Country: USA Launch Site: Vandenberg SFB, CA, USA

The mission main effort is to establish a robust satellite network for the Proliferated Warfighter Space Architecture (PWSA). This will deploy the first batch of 161 operational satellites, with the goal of creating a resilient and rapidly deployable space-based communication network. The launch will feature 126 data transport satellites, primarily designed to support the U.S. military's global communications by enhancing the Link 16 tactical data networ. This launch marks the beginning of an 11-month campaign, with the entire constellation expected to achieve initial operational capability by mid-2025.
(Image credit: spacelaunchschedule.com)

BlueBird Block 1

Date: September 2024 Rocket: Falcon 9 block 5 Agency: SpaceX
Country: USA Launch Site: cape canaveral, FL,USA

This mission will see the launch of the first five commercial satellites in the BlueBird series, designed to provide direct-to-smartphone broadband connectivity from low Earth orbit (LEO). These satellites are part of a broader effort by AST SpaceMobile to create a space-based cellular network, aimed at bridging the digital divide by delivering global internet access.

Each of these satellites is expected to have ten times the capacity of its predecessor, the BlueWalker 3 prototype, which had already demonstrated significant capabilities since its launch in 2022. The mission is a crucial step in AST SpaceMobile's plan to establish a robust satellite network capable of supporting high-speed mobile communications globally.
(Image credits: SpaceX)

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

Happy Birthday

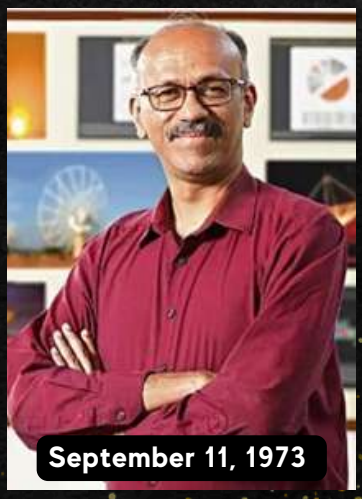
Konstantin Tsiolkovsky

Konstantin Tsiolkovsky (5 September 1857 – 19 September 1935) was a Russian research scientist in aeronautics and often considered as the "Russian Father of Rocketry", his groundbreaking theories and calculations laid the foundation for space exploration. He was also among the first to work out the theoretical problems of rocket travel in space. He made significant contributions to rocket science and space research during the early 20th century and is known for his visionary ideas that laid the groundwork for future developments in space exploration. During his lifetime he published over 500 works on space travel and related subjects, including science fiction novels.

James Edward Keeler

James Edward Keeler (September 10, 1857 – August 12, 1900) was an American astronomer known for his significant contributions to the study of Saturn's rings and confirmed that it is not a solid unit but is composed of a vast swarm of tiny particles. He is best known for his pioneering use of astrophotography to study galaxies. Keeler's work contributed to the development of galaxy classification systems, helping astronomers to categorize and understand the diverse range of galaxies in the universe. His work had a profound impact on the field of astronomy and helped to lay the foundation for modern astrophysics.

Nissim Kanekar



Nissim Kanekar (born 11 September 1973) is an Indian astrophysicist, cosmologist and a professor at National Centre for Radio Astrophysics of Tata institute of Fundamental Research. The Infosys Prize 2022 in Physical Sciences was awarded to him for his study of galaxies in an era, the so-called "high noon" period, in which stars were being formed at a maximum rate. One of the principal contributions of Kanekar was the establishment of observational bounds for the study of the evolution of the electron proton mass ratio.

Happy Birthday

James Walter Christy

James W .Christy (born September 15, 1938) is an American astronomer known for discovering Charon, the largest moon of the dwarf planet Pluto. In 1978, while working at the U.S. Naval Observatory, Christy noticed an unusual bulge on Pluto's images. After careful analysis, he realized it was a moon, which he named Charon after the mythological ferryman of the dead. His work has made a significant contribution to our understanding of the solar system and the Kuiper Belt. Christy's work laid the foundation for subsequent missions, such as NASA's New Horizons mission, which provided detailed images and data on Pluto and its moons.

Sunita Williams

Sunita Williams (born September 19, 1965) is an American astronaut, retired U.S. Navy officer and former record holder for most spacewalks by a woman and most spacewalk time for a woman. On April 16, 2007, she became the first person to complete a marathon from the International Space Station (ISS), a feat that solidified her place in history. She has made significant contributions to the ISS and is renowned for her scientific research and public outreach efforts. She became the commander of the International Space Station (ISS) on September 17, 2012, being only the second woman to achieve the feat.

Sathish Dhawan

Satish Dhawan (born September 25, 1920), an Indian mathematician and aerospace engineer, is widely regarded as the "Father of the Indian Space Program" for his critical role in establishing and advancing India's space capabilities. He succeeded Vikram Sarabhai as Chairman of the Indian Space Research Organisation (ISRO) in 1972, significantly contributing to the organization's growth and achievements. In honor of his contributions, the Indian satellite launch centre at Sriharikota, Andhra Pradesh, was renamed the Prof. Satish Dhawan Space Centre following his death in 2002. Dhawan was one of the most prominent researchers in his field, leaving a lasting impact on both the Indian scientific community and the global aerospace sector.

STUDENT'S CORNER

Stars that Don't Die

Sourajit Mandal, Astronomy Club

Our Sun is over 5 billion years old. 5 billion! That's a lot! But what if I told you that somewhere out there in the big vast cosmos, there could be stars that outlive our Sun by a margin not comprehendible by our tiny little brains? These aren't ordinary stars. They don't burn out and die like the ones we know of already. Instead, we presume they are powered by something far more mysterious... something we don't really know anything about... dark matter. This sounds like science fiction, right? Whatever it sounds like, recent discoveries show that these stars might actually exist, completely defying everything we thought we knew about stellar life cycles.

At the center of our galaxy, stars have been detected revolving around the supermassive blackhole. These stars have been found in an area where no stars could form since the blackhole would have shred apart the gas clouds they are formed from. That means, these stars are much older and must have come from somewhere else in the universe. But here's the problem- the stars appear much, much younger than they should be. It is almost as if they have found a cheat code to immortality! However, we have found a wild theory to explain their existence. They work on dark matter!

Unlike normal stars like our very own sun that rely on nuclear fusion, these hypothetical dark matter stars operate on a completely different principle. Think of them as cosmic engines, powered by the gravitational interactions of dark matter particles. As these particles collide and interact in the star's core, they release immense energy, creating a sustained glow that could last for billions of years.

If these dark matter stars are real, they could solve the mystery for the formation of supermassive black holes. These cosmic giants are believed to be the remnants of massive stars that have collapsed under their own gravity. If dark matter stars are more common than we thought, they could have provided the seeds for many of the supermassive black holes we observe today.

While the evidence for dark matter stars is compelling, this is still a developing field. More observations and theoretical work are needed to confirm their existence and understand their properties fully. But the possibility of immortal stars adds an exciting new chapter to the ongoing story of our universe.

So, the next time you look up at the night sky, imagine a universe filled with stars that never die. Stars that might sound like a dream, but with the pace of astronomical discoveries, who knows what the future holds?

Sunita William's Space Mission Delayed Return to Earth

Aadhav S , IAstronomer

People all around the world might have known about the mysterious delay of Sunita William's space mission. Who is Sunita Williams? Sunita Williams is an American astronaut who is 58 years old, born on the 19th of September 1965. There are three questions being asked all around the world. Why? When? And how?

Why?

First let us talk about why she made the decision to go to space. It was a brand-new Boeing spacecraft called the Starliner. Sunita Williams herself told it was a test flight and was expecting some findings which could be used to improve the next flight. Not only Sunita Williams went on the mission to space. But also, another astronaut called Barry E. Wilmore accompanied her. Barry E. Wilmore, also known as Butch Wilmore is a 61-year-old American astronaut, born on the 29th of December 1962.

When?

Both Sunita Williams and Butch Wilmore decided to start the mission at June 6th 2024. It has been more than 50 days now of them being stranded in space. She is currently at the ISS (International Space Station). It is said that she will only arrive at February 2025.

How?

Now for the last and final question, how? It is said that some issues were found on the spacecraft. Including: Software issues, Helium leaks and thruster anomalies, were detected in the Boeing Starliner spacecraft. Hence, delaying the return of the two NASA astronauts.

Barry "Butch" Wilmore and Sunita Williams are still there, floating high above the Earth nearly two months later in the ISS. Sunita Williams said that she is happy to be there. SpaceX astronauts have sent extra food and water. They have also sent clothes. But their extended stay can do a lot of serious issues to the human body like: Bone and muscle strength could have got weaker by 20 percent.

Conclusion: The astronauts said they were "absolutely confident" in the return trip. We just need to wait for a few more months for their arrival

MOON CAPTURES FROM SPACE ASSOCIATED ASTRONOMERS

Gibbous Moon Captured by Sudheeksha R, IAstronomer

Moon Captured by Samar Pratap Singh, Club student

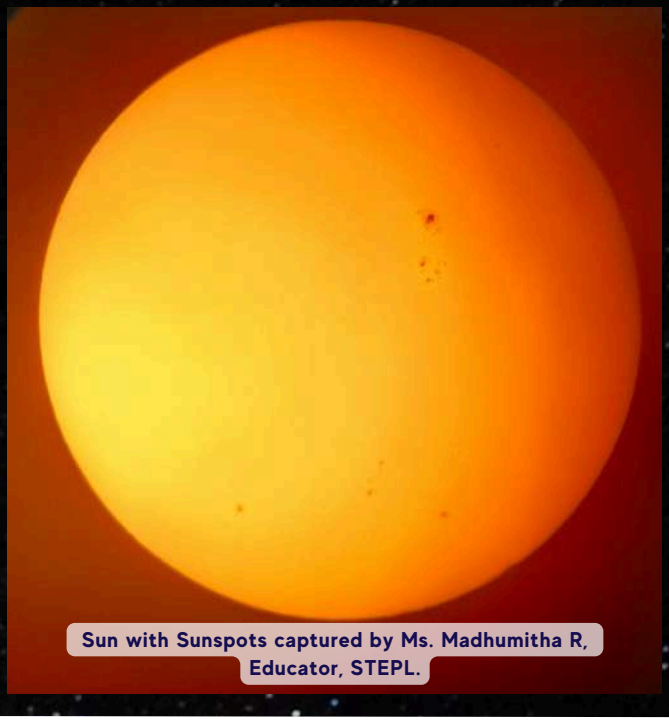
Gibbous Moon Captured by Vaseegaran Y,IAstronomer

Full Moon Captured by T. Vetrivel IAstronomer

ASTROPHOTOGRAPHS BY SPACE TEAM

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

Swan Nebula (M17) captured by Mr. Shirilmon S, Senior Executive, GAPL.



Sun with Sunspots captured by Ms. Madhumitha R, Educator, STEPL.

Lagoon Nebula (M8) captured by Mr. Shirilmon S, Senior Executive, GAPL.

HISTORICAL EVENTS HAPPENED IN SEPTEMBER

THE SUN'S GATEWAY: ADITYA L1

India's first solar mission, Aditya L1 was launched on September 2, 2023. Aditya L1 is like a spacecraft that will help us learn more about the Sun and its effects on our solar system. It will be placed in a special orbit around a point called Lagrange point 1 (L1), which is about 1.5 million kilometers away from Earth. This orbit allows the spacecraft to constantly watch the Sun without any interruptions. By studying the Sun, we can better understand space weather and how it affects Earth. This mission is a significant achievement for India's space program and will contribute to global solar research. This spacecraft will help us understand the Sun's outer atmosphere called the corona which is much hotter than its surface.

What will Aditya L1 do?

Aditya L1 will:

- **Study the Sun's Corona**: The spacecraft will observe the corona, which is much hotter than the Sun's surface.
- **Analyze Solar Wind:** Aditya L1 will examine the solar wind, a stream of charged particles from the Sun.
- **Monitor Space Weather**: The mission will track space weather events like solar flares and coronal mass ejections.

Why is Aditya L1 important?

This mission marks a big step for India's space program. By studying the Sun, we can:

- **Improve Space Weather Forecasting:** Aditya L1 will help us predict space weather events that can affect Earth.
- **Enhance Solar Research:** The mission will increase our understanding of the Sun and its impact on the solar system.

The Aditya L1 mission marks a significant milestone for India's space program, demonstrating its capabilities in space exploration and solar research.

Findings of Aditya L1

- **Unprecedented Solar Imagery:** Aditya L1's proximity to the Sun and advanced instrumentation will provide breathtaking images of the Sun's surface and corona, revealing new details about solar flares, sunspots, and coronal mass ejections. By studying the solar wind at L1, Aditya L1 will uncover the dynamics of this stream of charged particles, shedding light on its impact on Earth's magnetic field and upper atmosphere.
- **Coronal Heating Mystery:** Aditya L1's observations of the corona will help scientists understand why it's millions of degrees hotter than the Sun's surface, a long-standing puzzle in solar physics.
- **Solar Cycle Insights:** By tracking the Sun's 11-year solar cycle, Aditya L1 will provide valuable data on the cycle's impact on Earth's climate, geomagnetic storms, and upper atmosphere.
- **Interplanetary Medium Exploration:** Aditya L1's in-situ measurements of particles and fields at L1 will reveal the complex interactions between the solar wind and the interplanetary medium, a region of space never explored before.

These findings will significantly enhance our understanding of the Sun and its impact on our solar system, making Aditya L1 a groundbreaking mission in the field of solar physics.

CRASHING ON THE MOON

After the onset of the Space Age, the superpowers of the time turned their eyes towards the Moon. In September 1959, the Soviet Union took another step towards their ambitious goal of having a Russian on the Lunar surface with Luna 2.

Originally named the 'Second Soviet Cosmic Rocket', Luna 2, also known as Lunik 2 and Lunar Probe, was the sixth spacecraft launched to the moon as a part of the Soviet Union's Luna programme. The spacecraft successfully launched from the Baikonur Cosmodrome on 12th September 1959, with a direct path towards the Moon.

Luna 2 was the second spacecraft recognized by the Soviet Union in their ambitious and long-running Luna program, which collected information about the lunar environment in preparation for the nation's attempt to land a man on the Moon. The spacecraft had radio transmitters that could send telemetry information to Earth. It also released a sodium vapour cloud so the spacecraft's movement could be visually observed.

After two days, shortly after midnight Russian time, on 14th September 1959, Luna 2 successfully crash-landed on the lunar surface, shattering upon impact east of Mare Serenitatis, near the Aristides and Archimedes craters. This impact made it the first time a human-made object landed on the surface of another celestial body.

Shortly before impact, Luna 2 sent back data that confirmed the absence of a lunar magnetic field and a lack of evidence of radiation belts on the Moon.

The Soviet Union would also claim the record of making the first controlled or soft landing on the lunar surface over six years later, in March 1966, with Luna 9. However, the USA claimed victory in the Space Race when the first American would land on the lunar surface in July 1969.

JUNO'S JOURNEY FROM CELESTIAL MYSTERY TO ASTEROID PIONEER

Discovery and Early Classification

On September 2, 1804, the astronomical community witnessed a significant breakthrough with the discovery of the asteroid Juno. As the third known asteroid, Juno's discovery marked a pivotal moment in the study of our solar system, highlighting both the limitations and advancements in our understanding of celestial bodies. Initially considered a planet, Juno's classification evolved over time, reflecting the dynamic nature of astronomical science.The discovery of Juno was made by the German astronomer Karl Ludwig Harding, who was instrumental in expanding our knowledge of the solar system beyond the known planets. Harding's identification of Juno came shortly after the discoveries of Ceres and Pallas, the first two asteroids. Initially, Juno was classified as a planet due to its visible movement against the background stars and its significant size compared to known comets.

Reclassification and Significance

As observational technology advanced and more asteroids were discovered, Juno's classification was reassessed. By the mid-19th century, the discovery of additional small celestial bodies led to a revised understanding of these objects. Juno was eventually reclassified as a minor planet, or asteroid, as the astronomical community recognized that it belonged to a new category of small celestial bodies that orbit the Sun. This reclassification underscored the need for a more nuanced understanding of our solar system's composition.

Purpose of Observations

The primary purpose of observing Juno and other asteroids was to gather data on their orbits, sizes, and compositions. These observations provided valuable insights into the formation and evolution of the solar system. Asteroids like Juno are considered remnants from the early solar system, offering clues about the primordial conditions that existed when the Sun and planets were forming.

Scientific Findings

Juno's discovery and subsequent observations contributed to our understanding of the asteroid belt, a region between Mars and Jupiter where many small celestial bodies reside. The study of Juno revealed important information about the density and composition of asteroids, which in turn helped scientists refine models of solar system formation. The findings from Juno and other early asteroids also helped distinguish between different types of asteroids based on their spectral properties and compositions.

Legacy and Impact

The discovery of Juno marked a critical development in the field of astronomy, illustrating the evolving nature of celestial classification and our growing understanding of the solar system. As the third asteroid to be identified, Juno paved the way for future discoveries and advancements in our knowledge of minor planets. Its legacy continues to influence modern asteroid research, highlighting the importance of continued exploration and observation in unraveling the mysteries of our cosmic neighborhood.

DART-ING THROUGH THE SPACE

A 570-kilogram spacecraft hurtles through space towards its destination. After travelling for 306 days, the Double Asteroid Redirection Test spacecraft, DART for short, was reaching its destination.

10 months after launch, DART would demonstrate the world's first planetary defence technology as a feasible mitigation technique for protecting the planet from an asteroid or comet heading towards our planet.

The thought of space rocks hitting or passing by Earth seems ludicrous. Yet this scenario is known to happen and is predicted to happen again. The best-known example is an impact that occurred 66 million years ago when the Chicxulub asteroid slammed into Earth, killing almost three-quarters of all plants and animals on Earth.

With the most recent passing in 2013, NASA formed the Planetary Defense Coordination Office in response to this unique issue. Currently, they are tasked with searching for near-Earth objects while preparing for the event when one is spotted approaching our planet.

DART launched on 24th November 2021 atop a SpaceX Falcon 9 rocket. Built, operated, and managed by John Hopkins APL, the DART mission was a proof of concept mission. Its main objective was to confirm that NASA could navigate a spacecraft to deflect an asteroid's path. The deflection would occur by using a spacecraft to intentionally collide with the space-rock through a technique known as kinetic impact. Thus, in a future scenario where a space-rock is approaching Earth, a similar mission could nudge the rock out of our way.

DART travelled approximately 11 million kilometres to Dimorphos, a secondary asteroid of a near-Earth binary of asteroid (65803) Didymos. Of the two, Dimorphos was targetted as the experiment could measure the change in its orbit around Didymos through ground-based observation. Additionally, the binary pair did not pose any hazard to Earth before or after DART's controlled collision with Dimorphos.

The spacecraft only had a single instrument and a companion hitching a ride. The Didymos Reconnaissance and Asteroid Camera for Optical Navigation, DRACO, captured images of the space rock and aided in identifying Dimorphos. The companion, Light Italian CubeSat for Imaging of Asteroid, LICIACube, provided by the Italian Space Agency, parted with DART 15 days before impact. LICACube captured images of the collision and the resulting cloud of ejected matter. These images would help researchers to accurately understand the effectiveness of the kinetic impact.

DART crashed into Dimorphos on 26th September 2022.
For the mission to be considered a success, Dimorphous' orbital time was to reduce by 73 Additionally, a change of seven minutes in the orbital period indicated that the DART's incident momentum was transferred prefectly to Dimorphous.
After observing the impact, it was calculated that Dimorphos' orbit, which previously took 11 hours and 55 minutes, was reduced by 33 minutes and 15 seconds. The average orbital distance of Dimorphos also changed, reducing by 37 meters. It has also been observed that the asteroid's shape has changed.
Overall, the mission was a success and proved that NASA has the capabilities to deal with such an issue if it were to ever occur in the future.

A follow-up mission by the European Space Agency will take place in the future. Called Hera, the mission will conduct detailed surveys of Dimorphos and Didymos, focusing on the crater left behind by the collision.

FIRST DETECTION OF GRAVITATIONAL WAVES

In September 2015, scientists at the Laser Interferometer Gravitational-Wave Observatory (LIGO) made a groundbreaking discovery that confirmed one of Albert Einstein's long-standing predictions: the existence of gravitational waves. These ripples in space-time, caused by massive accelerating objects like black holes and neutron stars, were predicted in 1916 in Einstein's General Theory of Relativity but had never been directly observed—until LIGO's breakthrough.

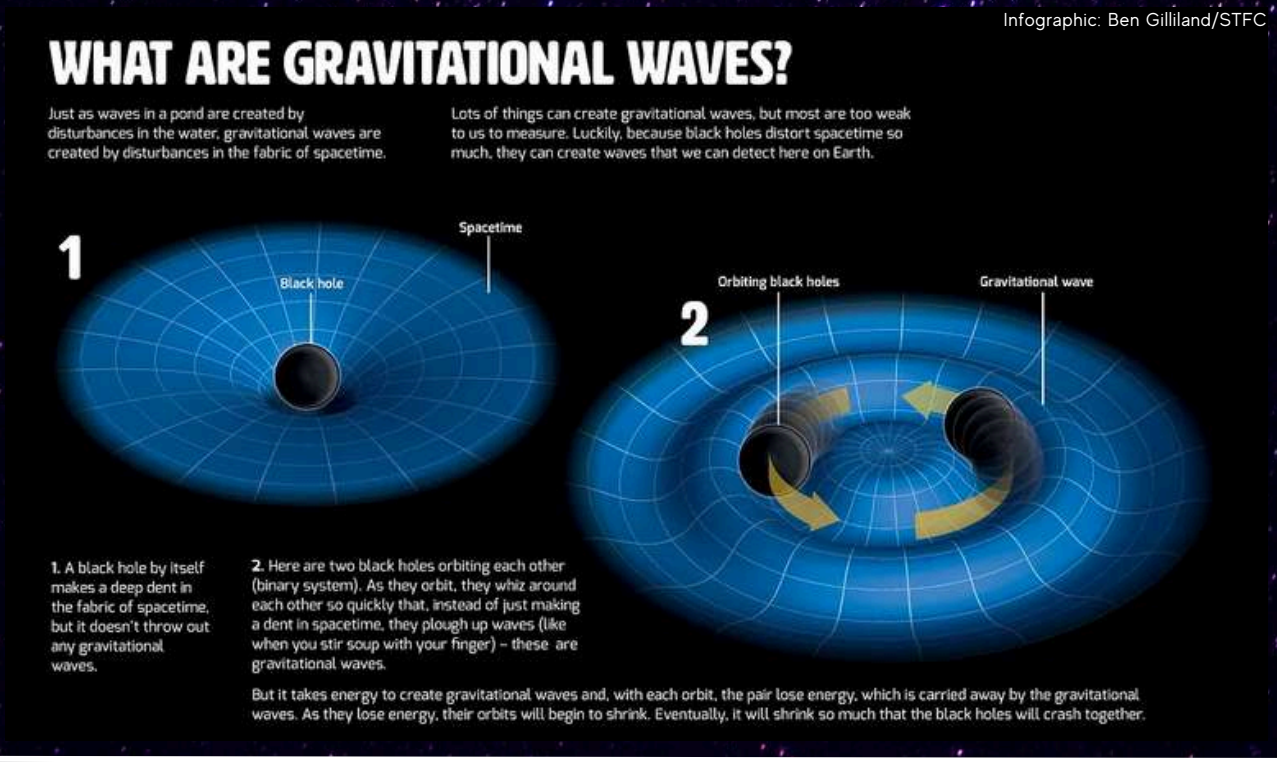
The specific gravitational wave detected by LIGO came from the collision of two black holes, each about 30 times the mass of the Sun. These black holes merged 1.3 billion light-years away, sending gravitational waves across the universe that were finally captured by LIGO's highly sensitive detectors. LIGO has two observatories located thousands of kilometers apart: one in Livingston, Louisiana, and the other in Hanford, Washington.

They work together using laser interferometry, a technique where laser beams are split and sent down two long vacuum tubes. When a gravitational wave passes through, it slightly alters the distance between mirrors placed at the ends of these tubes, creating detectable interference patterns.

This discovery confirmed the existence of black hole mergers, which had been theorized but never observed. It also opened the door to a new field of study: gravitational wave astronomy. By detecting gravitational waves, scientists can now observe cosmic events like black hole collisions and neutron star mergers, which are invisible to traditional electromagnetic telescopes.

Since the initial detection, LIGO has recorded numerous other gravitational wave events, deepening our understanding of the universe. This achievement not only validated Einstein's theory but also revolutionized the way we explore the cosmos, providing a new tool for unraveling the mysteries of gravity and the most energetic processes in the universe.

Infographic: Ben Gilliland/STFC



THE BLUE GIANT REVEALED

In the mid-19th century, astronomers suspected that a new planet existed beyond Uranus. This mysterious world was dubbed "Planet X". Two brilliant mathematicians, Urbain Le Verrier and John Couch Adams, independently worked on calculating its location. Le Verrier's predictions reached Johann Galle on September 23, 1846.

That same night, Galle and his assistant Heinrich Arrest searched for the planet using a refracting telescope. Within an hour, they spotted Neptune, just one degree from Le Verrier's predicted position.

Initially, they thought it was a comet, but its slow movement revealed it to be a planet. The discovery of Neptune sent shockwaves through the scientific community. It confirmed the existence of a new planet and expanded our understanding of the solar system. Neptune is an icy giant, with fierce winds and massive storm systems. Its atmosphere is mostly composed of hydrogen, helium and methane. The planet's diameter stretches approximately 49,528 kilometers, making it the fourth largest in our solar system.

The blue gas giant, which has a diameter four times that of Earth, was named for the Roman god of the sea. It's surrounded by a family of 14 known moons, with Triton being the biggest. It takes a whopping 165 Earth years for Neptune to make one complete trip around the Sun. In 1989, the U.S. planetary spacecraft Voyager 2 was the first human spacecraft to visit Neptune.

The discovery of Neptune showcased the power of international collaboration and mathematical calculations in space exploration. It marked a significant milestone, demonstrating that humans could uncover the secrets of the cosmos through determination and ingenuity. Today, we continue to study Neptune, unraveling its mysteries and marveling at its beauty.

The discovery of Neptune remains an inspiring testament to human curiosity and the wonders of the universe. The discovery of Neptune will always be remembered as a significant milestone in the history of astronomy, inspiring future generations to explore and understand the cosmos.

JUPITER-C ROCKET'S HISTORIC MILESTONE

Historic Achievement

On September 20, 1956, the Jupiter-C rocket made history as it became the first rocket to break through the thermopause and enter the exosphere. This groundbreaking mission, conducted by the United States, set new records and marked a pivotal moment in the field of aerospace technology.

Mission Objectives

The Jupiter-C rocket was designed with the primary goal of testing advanced rocket technology under extreme conditions. As a three-stage vehicle, it aimed to demonstrate improved propulsion capabilities and gather data on performance at unprecedented altitudes and velocities. By reaching the exosphere—where the Earth's atmosphere transitions into space—the mission sought to explore the rocket's endurance and operational efficiency in this challenging environment.

Record-Breaking Performance

The Jupiter-C rocket achieved remarkable feats during its mission. It reached an altitude of 682 miles (1,098 kilometers) and traveled a range of 3,335 miles, setting new records for both altitude and distance. Moreover, the rocket attained a staggering velocity of MACH 18, showcasing its advanced propulsion and aerodynamic design. These achievements underscored the Jupiter-C's role in pushing the boundaries of what was technologically possible at the time.

Scientific Findings and Impact

One of the key scientific objectives of the Jupiter-C mission was to gather data on rocket performance beyond the thermopause. The data collected provided crucial insights into the behavior of materials and technologies in the exosphere. The successful passage through this region demonstrated that the rocket's design could withstand the extreme thermal and aerodynamic stresses associated with high-speed travel at such altitudes.

The mission's findings also contributed valuable information about the rocket's structural integrity and the effectiveness of its propulsion system under high-speed conditions. This data was instrumental in refining future rocket designs and strategies, providing a foundation for subsequent space missions.

Legacy and Future Implications

The success of the Jupiter-C mission had a profound impact on the field of space exploration. It not only showcased the United States' technological advancements but also laid the groundwork for future space exploration endeavors. The insights gained from this mission informed the development of subsequent rockets and space vehicles, marking a significant step forward in humanity's quest to explore and understand the cosmos.

As we reflect on the achievements of September 20, 1956, the Jupiter-C rocket remains a symbol of innovation and progress. Its landmark mission exemplifies the relentless pursuit of knowledge and the drive to push the boundaries of human capability in space exploration.

Independence Day celebrations

On August 14th, we came together to celebrate one of the most significant days in our nation's history–India's Independence Day.

A Momentous occasion filled with national pride and heartfelt gratitude. From the hoisting of the tricolour flag to the stirring speeches and amazing games, this day was a tribute to the courage and sacrifices of those who fought for our freedom.

This Independence Day, our office transformed into a vibrant celebration of patriotism and unity. We adorned the walls and entrances with tricolour, kites, ballons, bunting and flags. The office looked festive with these symbols of our nation's heritage. The program began with the ceremonial hoisting of the tricolour flag, followed by the singing of the national anthem and sweets distribution. After that Ms Tripti Barwal, Merchandise Designer, welcomed and gave brief of importance of Independence Day. Event was followed by inspiring speeches from Mrs. Shalini Bahmba, Co-Founder and Mr. Shivam Gupta, Managing Director who shared their views and made important announcements of the Month.

The event featured a cake cutting-ceremony, mouthwatering lunch and cold drinks alongside an exciting game, "Mesh, Chopsticks and Balls" and Freedom Fighter puzzle which bought out team spirit and fun among Spacians. The program concluded with the photo session and a group dance.

This year's Independence Day festivities were a testament to our shared commitment to celebrating the spirit of freedom and diversity that defines India. From the colourful tricolour decorations to the inspiring speech and interactive activities, each element was a tribute to our nation's heritage and values. The involvement and enthusiasm of our team were key in making this celebration memorable, fostering a deeper connection with our national identity and with each other.

The celebration continued with the acknowledgement of birthdays, work anniversaries and new joiners. New joiners and intern were excited to be a part of Space group and they shared the positive experience with the company and team. It was now a time to announce the most exciting part of the event "Spacian of the Month" award which was given to the Academic Support – Matiala Team. The Team had demonstrated extraordinary dedication and hard work during July month which helped SPACE effectively and efficiently complete sessions at schools and outreach events.

AUGUST – LIFE AT SPACE

August was an exciting month for Spacians. We launched our exclusive ISRO Merchandise on the National Space Day aniversary of Chandrayaan 3 – 23rd August 2024.

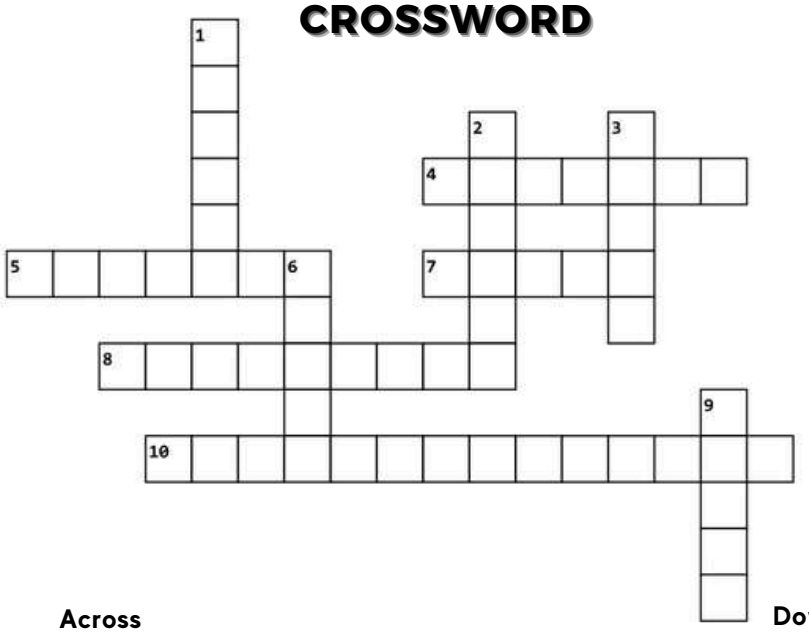
Furthermore, we celebrated our 78th Independence day with our incredible team. A Momentous occasion filled with national pride and heartfelt gratitude. From the hoisting of the tricolour flag to the stirring speeches and amazing games, this day was a tribute to the courage and sacrifices of those who fought for our freedom.

The month wrapped up with the celebration of 1st National Space Day. On the occasion of National Space day, Dr. Sachin Bahmba (Founder at Space Group of Companies) featured as an esteemed panelist at the function organised by AICTE in collaboration with ISRO - Indian Space Research Organization, ISPA- Indian Space Association and IN-Space, titled "Creating a Space Ecosystem: A New Era - Igniting Young Minds for Space Exploration.

Lastly, as an ISRO registered Space Tutor, popularising the National Space Day brought us great pride curating different types of outreach initiatives. We organised interactive sessions, workshops and events at various schools across India. Space Educators made every effort to make this 1st National Space day extradordinary and enjoyable while fulfilling our purpose of Inclucating Scientific Temperament.

TRAIN YOUR BRAIN

CROSSWORD



Across

4. From which constellation do the Perseid meteors appear to originate?
5. Near which crater did Chandrayaan 3's Vikram lander land?
7. In which mythology Uranus is named as Ouranos ?
8. Which spacecraft experienced technical malfunctions, delaying the return of astronauts Sunita Williams and Butch Wilmore?
10. Which Indian physicist and astronomer is known as the "Father of the Indian space program"?

Down

1. What is the name of the nebula in Sagittarius also known as M8?
2. What is the Greek meaning of the word Deimos - the smallest moon of Mars?
3. What is the name of one of the two dogs that flew on Sputnik 5?
6. Cycle What is the name given to the cycle of rising and falling solar activity?
9. From which language is the term 'conjunction' derived?

ASTRONOMY WORD PUZZLE

Find the galaxies from the mixed letters and mark them.

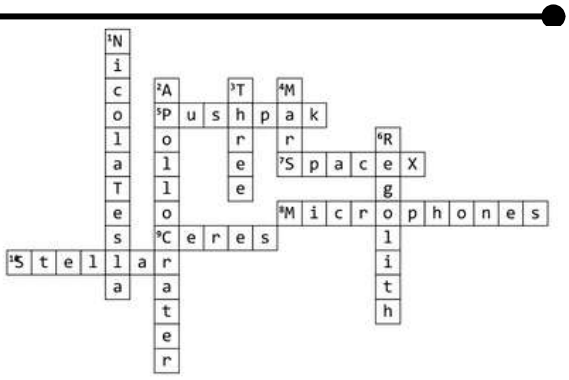
Spacecrafts

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

DEEP IMPACT
SAKIGAKE
OSIRISREX
SUISEI
GIOTTO
VEGA
STARDUST
GALILEO
NEOWISE
NEAR SHOEMAKER
HAYABUSA
DAWN
LUCY
PSYCHE
ROSETTA

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

Answers for last month puzzles.



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