SPACE™
EMPOWERING LIFE

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Galactica

Astronomy and Space Science Magazine

What's Inside?

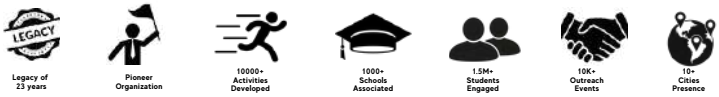
www.space-global.com

COVERPAGE: ESAWEBB

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!

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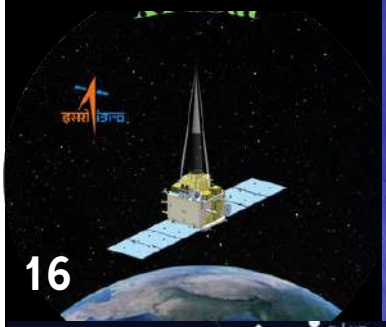

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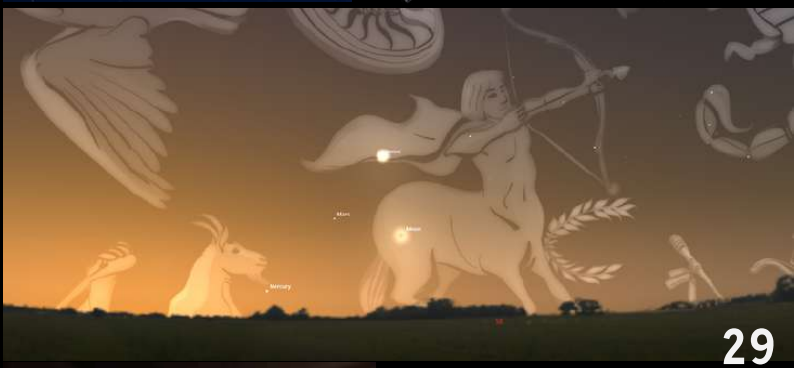

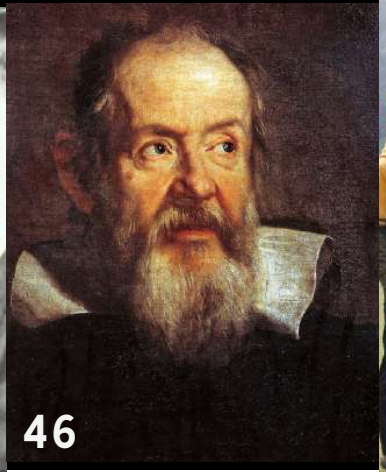

SPACE INSIGHTS

SPACE HQ HOSTED AMERICAN CENTER DELEGATES

Embarking on a Journey Beyond Earth

In a captivating fusion of science and entertainment, Mr. Darryl and Mr. Vikas recently embarked on a cosmic journey at the American Center Spaceship. This unique experience unfolded as a series of hands-on activities, virtual reality adventures, and explorations into the ancient wisdom of Jantar Mantar.

Launching Imagination: Hydro Rockets Soar High

The adventure began with the launch of hydro rockets, a spectacle that combined environmental consciousness with basic principles of physics. Participants, armed with recycled plastic bottles, unleashed the power of air and water pressure, propelling the rockets into the skies. This exciting activity not only underscored the importance of recycling but also served as an engaging introduction to fundamental scientific concepts.

Journey into the Spaceship: Unraveling Celestial Mysteries

As Mr. Darryl and Mr. Vikas stepped into the Spaceship, they found themselves surrounded by an array of astronomical STEM kits. Guided by knowledgeable instructors, the duo delved into the intricacies of celestial bodies, planetary systems, and the marvels of the universe. The interactive session fostered a profound appreciation for the vastness of space and the scientific principles governing it.

Virtual Reality Odyssey: Navigating Galaxies Up Close

The cosmic journey continued with a mind-bending virtual reality experience. Transported into a virtual cosmos, participants navigated through galaxies, witnessing celestial phenomena up close. This cutting-edge technology not only provided a futuristic experience but also deepened their understanding of the scale and complexity of the universe. Virtual reality bridged the gap between imagination and reality, offering a glimpse into the mysteries of the cosmos.

Jantar Mantar Science Exploration: Blending Tradition with Modernity

The exploration reached its zenith with a delve into the science behind Jantar Mantar. Participants engaged in hands-on activities, unraveling the mathematical precision and astronomical knowledge embedded in this ancient Indian observatory. This segment highlighted the seamless blend of tradition and modern scientific understanding, showcasing the richness of our scientific heritage.

Conclusion: A Cosmic Symphony of Education and Entertainment

The visit to the American Center Spaceship proved to be an enriching and enthralling experience, transcending the conventional boundaries of education. Through a meticulously curated blend of practical activities, immersive technology, and insights into ancient wisdom, Mr. Darryl and Mr. Vikas gained a holistic understanding of cosmic phenomena. The event not only fueled their curiosity about the universe but also underscored the importance of making science education captivating and enjoyable.

Recommendations: Propelling Science Education into the Future

Encouraged by the success of this cosmic experience, it is recommended that similar programs be organized for students and enthusiasts alike. The combination of hands-on activities, interactive technology, and a nod to traditional knowledge creates a unique and effective approach to science education. The American Center Spaceship serves as a beacon, unlocking the wonders of the cosmos for those eager to explore the universe's mysteries.In the quest for knowledge and inspiration, the American Center Spaceship stands as a testament to the transformative power of blending education, entertainment, and tradition. As we continue to unlock the secrets of the cosmos, let us embrace innovative approaches that make the pursuit of knowledge a thrilling and unforgettable journey.

'SPACE' AT BRICS CCI ANNUAL RECOGNITION AWARDS 2024

A momentous achievement for the SPACE Group of Companies. Dr Sachin Bahmba, CMD, SPACE India was honoured with the Business Excellence Award in Innovation at the prestigious BRICS CCI Annual Recognition Awards 2024.
The event was graced by the Former President of India, Shri Ram Nath Kovind. This esteemed recognition reaffirms SPACE Group's commitment to pushing the boundaries of innovation and setting new standards in the industry.



ASTRO-TOURISM: BBPS, MANESAR

The students of Bal Bharati Public School(BBPS), Manesar embarked on a captivating two-day, one-night expedition through the celestial wonders and untamed beauty of Sariska, Rajasthan. This transformative journey wove a tapestry of enduring memories, beginning with their departure from the familiar school grounds and punctuated by delightful stops for delectable meals, setting the stage for the adventures ahead.

At Astroport Sariska, the meticulously planned agenda unfolded like a harmonious symphony, seamlessly blending team-building activities and a historical tour to Bhangarh. The evening brought an enchanting astronomy session, unraveling the mysteries of the night sky, followed by the rhythmic joy of traditional Rajasthani dance.

A zenith was reached with a delightful dinner, fostering connections among students and culminating in a tranquil overnight stay at the hotel. As the sun ushered in a new day, a sumptuous breakfast set the tone for the expedition's continuation with an exhilarating jungle safari, offering a kaleidoscopic view of wildlife wonders. The educational adventure peaked with a captivating rocketry session, where students crafted and launched their hydrorockets, adding an extra layer of excitement.

The crescendo came in the form of a lively prize distribution ceremony, acknowledging the students' efforts. A group photograph captured the essence of shared experiences and enduring bonds formed during the journey. A fond farewell bid adieu to Astroport Sariska, and the return journey included a scenic en-route lunch.

As students were dropped off at the school gates, they carried not just sweet memories but also a sense of accomplishment and camaraderie forged through this unforgettable expedition.




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ASTRO-TOURISM -QUEEN'S VALLEY SCHOOL

The students of Queen's Valley School embarked on an enthralling and enlightening two-day, one-night adventure, immersing themselves in the mesmerizing night sky and untamed wilderness of Sariska, Rajasthan. This expedition became a canvas for crafting enduring memories that will undoubtedly linger throughout their lives.

Setting out from the familiar school grounds, the journey was marked by delightful pit stops at the Old Rao Hotel, where the students relished scrumptious meals, fueling their excitement for the adventures ahead. The meticulously curated itinerary at Astroport Sariska unfolded with a medley of team-building activities, followed by an awe-inspiring astronomy session that deepened their understanding of the celestial wonders adorning the night sky. Adding a cultural touch to the experience, the students reveled in the joy of traditional Rajasthani dance.

The day reached its pinnacle with a delectable dinner, fostering connections among the students, and concluded with a tranquil overnight stay at the hotel. As the first rays of the sun painted the sky on the following day, the students welcomed a new morning with a nourishing breakfast in the inviting ambiance of the hotel.

The expedition continued with an exhilarating jungle safari, immersing the students in the vibrant world of wildlife. The adventure took an educational turn with a captivating rocketry session, where students crafted and launched their own hydrorockets, adding an extra layer of excitement to their journey. The session culminated in a lively prize distribution ceremony, applauding the efforts and achievements of the students. A group photo captured the essence of shared experiences and bonds formed during the trip.

With a fond farewell to Astroport Sariska, the return journey included an en-route lunch. As the students were dropped off at the school, they carried with them not just sweet memories but also a sense of accomplishment and camaraderie forged through this unforgettable expedition. The journey became a testament to the school's commitment to creating enriching experiences that go beyond the classroom, leaving an indelible mark on each student's heart.

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JBM GLOBAL SCHOOL NOIDA'S SPRING FEST: A CELESTIAL CELEBRATION OF TALENT AND ASTRONOMY

JBM Global School Noida in collaboration with Space India hosted Spring Fest, The cultural events that highlight the students' varied talents are called Spring Fest. The stage provides a venue for students to showcase their artistic abilities and cultural background through everything from contemporary music to traditional dances. A compelling showcase of talent reflecting the great diversity within the school community is presented to parents and staff alike. One of the festival's greatest highlights was the astronomy showcase, which featured a variety of astronomy-related exhibits, including AR-VR shows, Comet making, Solar observation, pop rocketry, hydro rocketry, discovering the skies, ring the planet, and the Lungs Capacity Test. fun-filled Astronomy based activities were conducted which were thoroughly enjoyed by people of all age groups- from students to parents. Apart from being a stress buster for the children; this was an interactive, informative and fun zone in the school which caught everyone's attention.

ASTRONOMY SHOWCASE "STELLAR EXPLORATION: G.D. GOENKA'S ASTRONOMY EXTRAVAGANZA"

In an enthralling celebration of cosmic curiosity, G.D. Goenka Public School, Model Town, recently partnered with Space India to host a captivating Astronomy Showcase. Tailored for the young minds of classes 2 and 3, the event unfolded on 20th January, 2024 , transforming the school into a celestial playground.

The primary aim of the showcase was simple: to ignite a passion for astronomy. The collaboration between the school and Space India seamlessly blended traditional observations with cutting-edge technology, offering an immersive experience for budding astronomers.

Masterclass - Space Economy "A New frontier of Human Endeavour"

On 19th January 2024, the American Center hosted a Masterclass. Entitled 'Space Economy- A New Frontier of Human Endeavor,' it was conducted by Dr Venkateswaran Narayanaswamy, a Fulbright scholar and Professor in the Department of Mechanical and Aerospace Engineering at North Carolina State University. Dr Narayanaswamy's current research focuses on scramjet propulsion, laser diagnostics, and combustion. His aim to aid in developing next-generation clean and efficient propulsion technologies made him the ideal candidate to introduce the topic of space economy to students and the public.

By keeping the winter chill in mind, attendees could attend the session in person, at the American Center, or virtually. The Space Team, space enthusiasts that we are, attended the session in person despite the cold wave passing through the National Capital Region.

Dr Narayanaswamy started his presentation by talking about how space technology is currently helping us. Recently, when Cyclone Michaung made landfall, satellites' data helped predict the length of time Chennai would be under the cyclone's wrath alongside the amount of rainfall the city would receive. Meanwhile, in other countries, farmers use satellite imaging to monitor their fields.

After this, he focused on how previous space missions have changed our view of the world and universe. Like the iconic photo of Mars' blue sunset. Dr Narayanaswamy explained that due to the CO_2 in the Martian atmosphere, the day and twilight sky of Mars is different from Earth. This changed our perception of the other planets and allowed us to understand that due to the atmospheric content of a planet, the view of the sky will be different when compared to Earth.

After this profound thought, Dr Narayanaswamy introduced the space economy, giving a brief explanation of the topic before discussing its benefits in the long term. (To those curious, it is leveraging space resources in integrating space into the global trade ecosystem to those who are curious). A big issue nowadays is the limited amount of space on the ground. With the space economy, factories, which cover large areas of land, could be relocated to space, freeing up space. Additionally, due to the features of space, specific industries, such as solar panel manufacturers and the pharmaceutical industry will be able to manufacture products that would be products, they would not be able to on Earth or decrease their cost of production.

After this, Dr Narayanaswamy talked about the various missions that have already taken place, proving that such endeavours are possible, even if they are not economically viable currently. He also spoke about the future of space infrastructure, an industry which is a cradle for innovation to overcome the technical challenges that persist. The main technical challenge that needs to be overcome is the amount of payload a rocket can take up to space is restricted by the amount of fuel required for a launch. Dr Narayanaswamy's research focuses on this issue.

Before concluding his presentation, Dr Narayanaswamy acknowledged the female scientists who have driven a lot of missions while stating that he hopes many students in the audience will pursue space economy as a career track. After this, he accepted questions from the audience, which he answered on a variety of topics such as the Big Bang, microgravity, fission and fusion, concepts he had introduced in his lecture, as well as questions related to international resources and politics alongside the potential impact the Space Economy could have on observational astronomy.

INSPIRING YOUNG MINDS AT THE INDIA INTERNATIONAL SCIENCE FAIR: A JOURNEY THROUGH COSMIC MARVELS

Inspiring Young Minds at the India International Science Fair: A Journey Through Cosmic Marvels
The India International Science Fair (IISF) is a vibrant hub where curiosity reigns supreme. This year, our team proudly donned the hats of scientific storytellers, captivating over 2,000 minds – from wide-eyed children to seasoned science enthusiasts – on an enthralling exploration of the universe's captivating secrets.

Demystifying Rockets and Space Rocks: Unveiling Celestial Wonders
Our cosmic escapade began with the fundamental building blocks – rockets and space rocks. We peeled back the layers of science, explaining how rockets defy Earth's gravitational pull, venturing into the inky vastness, while asteroids and meteoroids streak across the celestial canvas in fiery displays. Witnessing the audience's faces illuminated with wonder, we eagerly delved into a captivating exchange, answering a barrage of inquisitive questions.

Dancing in the Cosmic Dust: The Enthralling World of Comets
Next, we shifted our focus to comets, those enigmatic icy wanderers leaving mesmerizing trails of dust and gas. We unravelled their formation in the solar system's distant reaches and explored their potential impact on our planet. The audience remained spellbound by these cosmic travelers' tales, their eyes widening at the thought of "celestial snowballs" hurtling through the immense expanse.

Igniting Hands-on Exploration: The Thrill of Hydro Rocketry
Our mission went beyond passive observation. We aimed to ignite the spark of curiosity and inspire hands-on exploration. Enter hydro rocketry! We demonstrated how the simple power of water pressure can propel a humble bottle skyward. The highlight? The audience actively participated, launching their mini-rockets with gleeful shouts, experiencing the thrill of scientific discovery firsthand.

A Universe of Sparkling Minds – A Legacy of Inspiration
As the curtains closed on IISF, the echo of positive energy resonated. The sparkle in the eyes of over 2,000 individuals, their insatiable thirst for knowledge, and their newfound appreciation for the universe's wonders filled us with immense satisfaction. We had planted the seeds of curiosity, hoping they blossom into a lifelong love for science and exploration.

In a world fueled by scientific advancements, fostering such enthusiasm ensures that the torch of discovery continues to illuminate the hearts and minds of future generations. The India International Science Fair served as a launchpad, not only allowing us to share our cosmic fascination but also igniting the flames of curiosity that will continue to illuminate the path of scientific exploration.




MOON-SATURN CONJUNCTION UNVEILED IN A VIRTUAL SPECTACLE

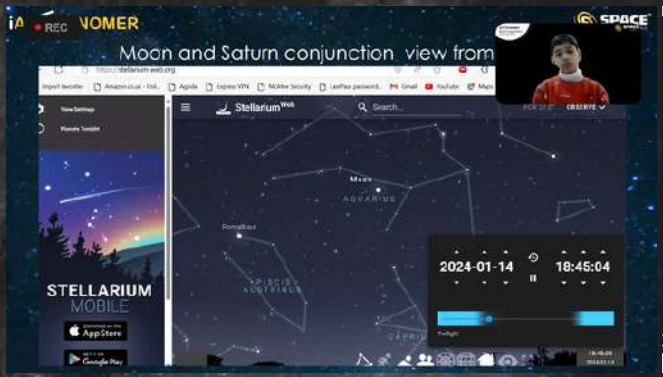
iASTRONOMER

In a remarkable blend of astronomy and education, the convergence of the Moon and Saturn on January 14, 2024, became an extraordinary event marked by an online meeting by the EdTech team with iAstronomer. Hosted by Yadnya Sagar, an iAstronomer student, the session unfolded with an insightful PowerPoint presentation highlighting the significance of this celestial conjunction.

The event commenced with a warm welcome and introduction by co-host educator Himanshu Gautam. Setting the stage for the upcoming astronomical journey, he highlighted the collaboration between iAstronomers and the EdTech team to make this virtual meeting possible. The most exciting part of the event was Yadnya Sagar sharing a fascinating presentation. He discussed why the meeting was so special - because the Moon and Saturn rarely came together. He explained how unique and important this celestial event was. His presentation set the stage for the rest of the activities and helped everyone at the meeting understand more about this incredible cosmic show. It was like he gave everyone a behind-the-scenes look at what was happening in the sky. One of the key elements discussed during the presentation was the Moon's trajectory at the Delhi location. As the audience awaited the main event, they learned that the Moon would rise from the East direction at 9:39 AM (IST) and set at 9:02 PM (IST). The Moon would shine with a magnitude of -10.57, creating a mesmerizing display in the night sky.

Keeping the audience engaged, Ashish Negi, an educator from the EdTech team, conducted an interactive quiz. Participants had the opportunity to test their knowledge about the Moon, Saturn, and celestial phenomena. The quiz added an element of excitement and educational value to the virtual gathering. Aman, another educator from the EdTech team, brought the event to its peak by providing a live view of the Moon-Saturn conjunction. Using a DSLR camera 7D with a powerful 600mm lens, the audience was treated to a close-up view of the celestial pairing. Aman's live stream transported participants into the cosmic realms, offering a rare and breathtaking glimpse of the conjunction.

The convergence of technology, education, and astronomy reached new heights as the EdTech team and iAstronomer students collaborated to bring the Moon-Saturn conjunction to audiences. This virtual event showcased the power of online platforms like Zoom in fostering learning and appreciation for celestial wonders, making the vast cosmos accessible to enthusiasts of all ages.



SALLY RIDE EARTHKAM MISSION 87

PAN India Online Conduction

SPACE India recently organized a Sally Ride EarthKAM workshop, reaching out to students from over 300 schools and members of the iAstronomer club, an online astronomy club. With an attendance of more than 600 enthusiastic students, the workshop aimed to impart knowledge on capturing mesmerizing images of our planet from the vantage point of the International Space Station (ISS). This year marked a significant milestone as Space India orchestrated the Sally Ride EarthKAM Mission 87 workshop, drawing students from various locations. The captivating workshop unfolded from January 22nd to January 25th, offering an immersive experience to participants eager to explore the wonders of space and learn the art of capturing Earth from the International Space Station (ISS).

The workshop commenced with an introduction to the Sally Ride EarthKAM program, named after the trailblazing astronaut Dr. Sally Ride. Dr. Ride, the first American woman in space, left an indelible mark on space exploration and education. Her inspiration laid the foundation for initiatives like Kidsat, fostering curiosity and passion for space among young minds. Participants were enlightened about the intricacies of the ISS, its orbits, and its role in scientific research. Understanding the mechanics of the ISS and its vital contribution to space exploration added a layer of depth to the workshop. The session not only delved into the technical aspects but also presented an overview of the awe-inspiring beauty of Earth as seen from space.

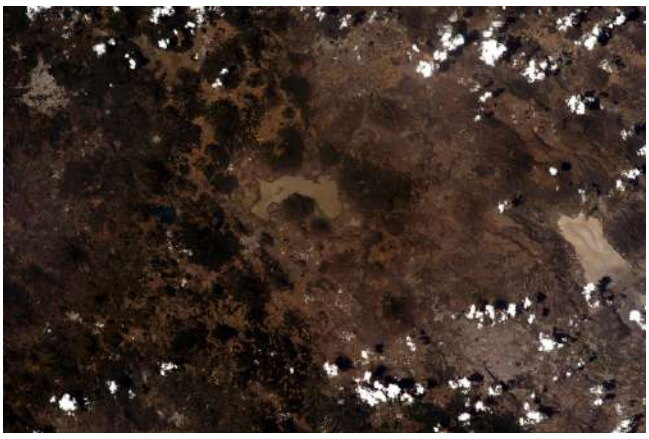
One of the highlights of the workshop was the exploration of the Sally Ride EarthKAM itself. Students were guided through the process of capturing images using this unique system installed on the ISS. The hands-on experience provided a glimpse into the world of astronauts and the technology they use to observe and document Earth. Dr. Sally Ride's legacy was revisited, shedding light on her role as a pioneer in space exploration and education. Her vision for Kidsat, an educational outreach program, resonated throughout the workshop, emphasizing the importance of nurturing a passion for science and exploration from a young age.

The EarthKAM workshop also featured an in-depth discussion on the International Space Station–its purpose, functions, and the collaborative efforts of nations involved in its operation. Participants were treated to a virtual gallery showcasing stunning images captured by students in previous years, providing a visual testament to the program's success.

What set this workshop apart was the perfect blend of education and enjoyment. Students not only absorbed valuable information about space and the ISS but also had a blast capturing their own images. The interactive nature of the classes sparked curiosity, encouraging students to ask questions and engage actively with the material.

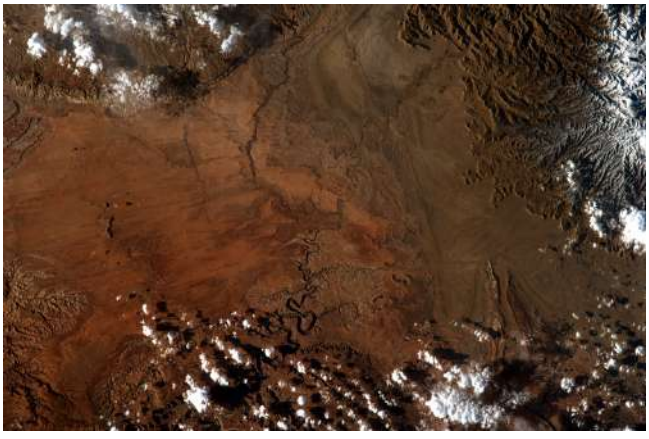
As the workshop concluded, participants expressed their delight at the unique learning experience. The combination of theoretical knowledge, practical application, and the thrill of capturing Earth from space made the Sally Ride EarthKAM workshop a resounding success. SPACE India's commitment to fostering scientific curiosity and education shone brightly through this initiative, leaving a lasting impact on the minds of the young participants.

In the vast expanse of space, initiatives like these serve as beacons, guiding the next generation of scientists, astronomers, and explorers. The Sally Ride EarthKAM workshop exemplified the spirit of exploration and education, igniting a spark that will undoubtedly fuel the passion for the cosmos in the hearts of these young students for years to come.



Mexico, North America by Aastha Panghal, G D Goenka Public School, Jhajjar

Australia, Oceania by Amogh NG, National Hill View Public School, Bangalore



Green River, Utah by Arnav Venkatesh, National Hill View Public School, Bangalore

El Salvador, North America by Yukta Badola, Maa Anandmayee Memorial School, Raiwala

Capturing the Cosmos: A Step-by-Step Star Trail Photography Tutorial for Stunning Night Sky Images

A star trail is a type of photograph that uses long exposure times to capture diurnal circles, the apparent motion of stars in the night sky due to Earth's rotation. A star-trail photograph shows individual stars as streaks across the image, with longer exposures yielding longer arcs. Typical shutter speeds for a star trail range from 15 minutes to several hours, requiring a "Bulb" setting on the camera to open the shutter for a period longer than usual. However, a more practiced technique is to blend a number of frames together to create the final star trail image. Star trail photographs are possible because of the rotation of Earth about its axis. For observers in the Northern Hemisphere, aiming the camera northward creates an image with concentric circular arcs centred on the north celestial pole (very near Polaris).

For those in the Southern Hemisphere, this same effect is achieved by aiming the camera southward. As star trails are generally a result of long-exposure photography capturing the Earth's rotation due to this the appearances of star trails can be different.

The different patterns of star trails are::

1. Circular Trails: Achieved when pointing the camera towards the celestial pole (North or South), causing stars to rotate around the pole in a circular pattern

2. Straight Trails: Captured when facing east or west, resulting in stars moving in straight lines across the frame.

3. Radiant Trails: Created by capturing meteors during a meteor shower, where the radiant point(apparent origin) of the meteor shower produces short streaks.

About us:- India's First Astronomy And Space Experience Destinations

Astroports are the first concept-based unique tourism destinations in India focusing on experiential learning. The strategically designed serene sites are located in nature's lap far away from the polluted cities with a heavy twinkling sky above. Astroports are built to provide not only the comforts and facilities of a 'conventional' tourist destination but also lead to exploring and learning through well researched and well-presented programs/activities.

Now, we'll learn how to capture a star trail.

1. Choose the Right Location: Pick a location away from city lights to minimize light pollution and enhance visibility of stars.
2. Use a Tripod: Mount your camera on a sturdy tripod to avoid camera shake during long exposures.
3. Set Your Camera to Manual Mode: Take control of exposure settings. Start with a wide aperture (low f-number) and a high ISO for initial test shots.
4. Focusing: Use manual focus and set it to infinity. Alternatively, focus on a bright star or distant object.
5. Exposure Time: Experiment with exposure times. Start with shorter exposures (20-30 seconds) to prevent star trails in individual frames. Also you can follow the 500-Rule which states that to obtain a clear image of stars without trails, take the number 500 and divided it by the focal length to get your exposure time. For example, a 20 mm lens would call for an exposure of about 25 seconds and theoretically, still obtain the stars without trails.
6. Bulb Mode: If your camera has a bulb mode, use it for exposures longer than your camera's maximum shutter speed.
7. Battery Life: Ensure your camera battery is fully charged, or use an external power source for extended shooting.
8. Frame Composition: Compose your shot with an interesting foreground to add depth to the finaimage.
9. Post-Processing: Combine the individual images using software like Adobe Photoshop or specialized star trail stacking tools like starstax. Adjust color balance, contrast, and other settings in GIMP as needed.

Astrophotographs from Astroport Sites:

1500D ISO 400 f 3.5 Shutter speed 30sec Shot for approx. 2 hours taken from sariska

Canon 1500D_Shutter speed - 25 sec_Apparture - 4.5_ISO - 800, taken from Dhela

Shot on(Redmi Note 10S) Shutter speed 30sec_ISO 640_WB 3200_Shot for approximately 3 hours taken from sariska

Mobile Galaxy f23 ISO 3200 f 8.5 Shutter speed 4sec Shot for approximately 1_2 hours taken from Dhela

Canon 1500D, ISO 800, f 3.5, Shutter speed 25sec, approximately 2 hours taken from Dhela.

Canon 1500D, ISO 800, f 4.5, Shutter speed 30sec, approximately 2 hours taken from Ashtamudi,Kollam

Canon 1500D ISO 400 f 3.5 Shutter speed 30sec Shot for approx 2 hours taken from diwarsamudra.

Canon 1500D ISO 400 f 3.5 Shutter speed 30sec Shot for approx. 2 hours taken from Ajmer

Experience Universe at Astroport near you:

- Astroport Dhela at Tusk and Roar Resort, Uttarakhand
- Astroport Ajmer at Ramada Ajmer, Rajasthan
- Astroport Ashtamudi at Club Mahindra, Kerala
- Astroport Sariska, Alwar,Rajasthan

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MONTHLY TELESCOPIC OBSERVATION

SPACE ARCADE team conducted 2024's 1st Monthly Telescopic Experience session on the 20th of January 2024 in Chennai and Delhi.

People from various places joined the observation with their telescopes, binoculars, and other astronomical equipment. They learned and experienced the breathtaking view of the Moon and planets such as Saturn and Jupiter. 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, Planets Saturn & Jupiter through the 8'' Dobsonian telescope and Schmidt-Cassegrain telescope set up by the SPACE team.

HIGHLIGHTS OF JANUARY 2024

NASA's Juno spacecraft reveals Jupiter's volcanic moon io like never before in spectacular new images

Being the first orbiter to peer thus closely, NASA's Juno probe has been examining behind the thick, intimidating clouds that encircle the massive planet since it got there in 2016. It looks for answers addressing the formation and history of Jupiter, our solar system, and other massive planets in the universe.

On Saturday, Dec. 30, 2023, as Juno passed close to Io, the solar system's most volcanically active body, it was able to take incredibly detailed pictures of the Jovian moon. Only in 2001, when NASA's Galileo spacecraft crossed 112 miles (181 kilometers) over Io's south pole, did a spacecraft go closer to the planet.

Io is being pulled in two different directions by Jupiter's strong gravity and the weaker pull of two other moons, which is causing internal turbulence, lava lakes covering its surface, and eruptions. Just slightly bigger than the Moon but the most volcanically active planet in the solar system will be the subject of Juno's next approach on February 3 once again.

Indeed, it won't be the last time that Juno passes close to Io; instead, these flybys will get farther and farther apart, starting with a transit at around 6,830 miles (11,000 km) and ending with a final flyby at about 62,100 miles (100,000 km).

In September 2025, with the last approach to Io, Juno will complete its extended mission (its initial mission ended in July 2021). This will mark the end of the spacecraft's nine-year investigation of the gas giant and its moons as it deliberately crashes into Jupiter's atmosphere.

Earth's Core Wobbles Every 8.5 Seconds, New Study Suggests

Scientists in China just revealed something at the pinnacle of our planet: the Earth's inner core wobbles around its rotational axis once every 8.5 years. According to the researchers' latest analysis, this shift is most likely caused by a minor misalignment between the inner core and the Earth's mantle—the layer beneath the Earth's crust.

The Earth's core is divided into a churning liquid outer border and a mainly solid inner layer beginning roughly 1,800 miles (2896 kilometers) under the surface. This region contributes to a number of our planet's geophysical processes, including the length of each day and the Earth's magnetic field, which helps protect humans from the sun's damaging rays.

In 2019, the geophysical researchers, under the direction of Wuhan University's Hao Ding, examined the movement of the Earth's rotating axis, or polar rotation, with respect to its crust in order to gain a deeper understanding of the inner workings of this core. They found a small polar motion anomaly that occurred around every 8.5 years, suggesting the possibility of a "inner core wobble," akin to the wobble of a spinning top.

Contrary to the conventional theory of Earth rotation, which "assumes that the rotation axis of the Earth's inner core and the rotation axis of the mantle coincide," their research indicates that the reason of this wobble is most likely a tilt of 0.17 degrees between the Earth's inner core and mantle.

According to John Vidale, an Earth science professor at the University of Southern California, the new study "helps discern the difference in composition between the metal in the solid inner and liquid outer core as well as estimates direction and speed of the wobble of the inner core,". "Nothing here to save humanity this week, but the work adds basic building blocks to understand our planet."

Apart from the inner core wobble, the research team ruled out hydrological, oceanic, and atmospheric variables that could have contributed to the pole motion deviation. However, according to Vidale, "it takes many kinds of experts to assemble the kind of analysis done in this study," therefore it is challenging to determine these sources weren't involved.

In the future, this finding might aid scientists in comprehending the relationships between the Earth's interior core and phenomena that affect people, such as magnetic field shifts and earthquakes

INDIA Launches X - Ray Satellite to study Black Holes, Supernovas and more

The first specifically designed scientific satellite from ISRO to do research in space-based polarization measurements of X-ray radiation from astronomical sources is called XPoSat (X-ray Polarimeter Satellite).

On January 1, 2024, at 09:10 IST, ISRO's PSLV-C58 launched the XPOSAT satellite into an eastward low inclination orbit. Following the injection of XPOSAT, the PS4 stage will undergo two restarts in order to decrease the orbit to a 350 km circular orbit, which will allow the Orbital Platform (OP) experiments to continue in the 3-axis stabilized mode. With the help of ISRO and IN-SPACe, the PSLV Orbital Experimental Module-3 (POEM-3) experiment will be carried out with the goal of delivering ten designated payloads.

Changes are made to the Satellite setup using the IMS-2 bus platform. The IRS satellite legacy is the basis for the mainframe systems' configuration. POLIX (Polarimeter Instrument in X-rays) and XSPECT (X-ray Spectroscopy and Timing) are its two payloads. Raman Research Institute is responsible for POLIX, whereas Space Astronomy Group of URSC is in charge of XSPECT.

Objectives of the mission:

- To measure polarisation of X-rays in the energy band 8-30keV emanating from about 50 potential cosmic sources through Thomson Scattering by POLIX payload.
- To carry out long term spectral and temporal studies of cosmic X-ray sources in the energy band 0.8-15keV by XSPECT payload.
- To carry out polarisation and spectroscopic measurements of X-ray emissions from cosmic sources by POLIX and XSPECT payloads respectively in the common energy band.

Scientific Goals of the mission:

- To study the distribution of magnetic field, geometric anisotropies, alignment w.r.t line of sight, nature of accelerator in galactic cosmic X-Ray sources by measuring degree of polarization and its angle.
- Structure and geometry of magnetic field of neutron stars, mechanism of X-Ray beaming and its relation with luminosity and mass of accretion rate of powered pulsars.
- Detailed understanding of galactic black hole binary sources.
- To study and confirm about production of X-Rays is either from polar cap of neutron star or outer cap of pulsar magnetosphere.
- To distinguish the synchrotron mechanism as dominant over thermal emission in Supernova remnants.

FLOATING `MAGIC ISLANDS` ON SATURNS MOON `TITAN` MAY BE A HONEYCOMB SHAPED SNOW

Finally, a scientific explanation for Titan, Saturn's largest moon's floating "magic islands" may exist. Researchers think they're honeycomb-shaped clusters of snow that resemble glaciers.
The Cassini-Huygens spacecraft first noticed the so-called islands in 2014 as it peered through the orange haze that surrounded Titan, a moon larger than the planet Mercury. Scientists were at a loss as to why the islands, which appeared as shifting bright spots on the Saturnian moon above liquid ethane and methane lakes, would disappear. From observation, no one could figure out how these transient blocks could exist, then just disappear.

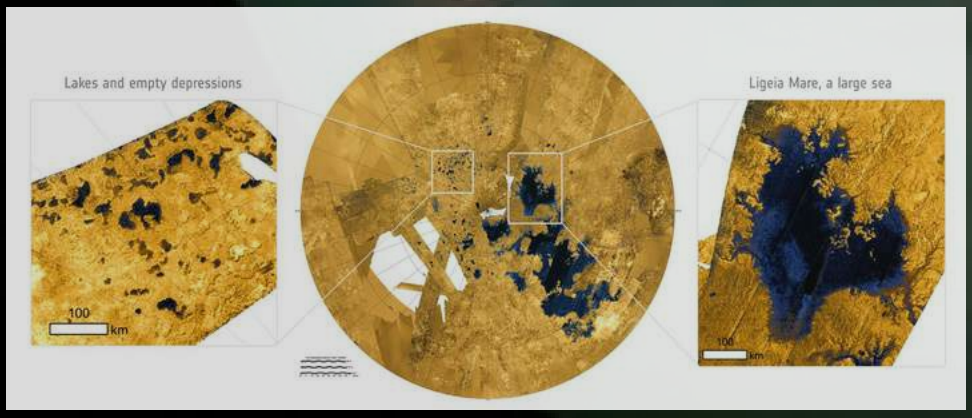
According to researchers, these "magical islands" are essentially suspended bits of porous, frozen organic substances fashioned like Swiss cheese or honeycomb. It is likely that the solids gather after falling from Titan's sky in the form of snow. “They wanted to investigate whether the magic islands could actually be organics floating on the surface, like pumice that can float on water here on Earth before finally sinking".

Models of Titan first seem to indicate that solids would sink right away. Titan's liquid areas would contain low surface tension ethane and methane, whereas the frozen solids would have tremendous density. This suggests that these frozen materials, whether magical or not, wouldn't float for long enough to be confused for islands.

However, the team claims that there is a mechanism that would enable these snows to float on liquid lakes that contain ethane or methane. The hollow holes and tubes in the snow clumps would allow them to float until methane or ethane seeps inside, filling the voids and making the clumps sink if they were big enough and porous like Swiss cheese.

According to the model Yu and her colleagues constructed, individual snow clumps would be too small to allow this to occur, but huge portions could break off and drop away and float on methane/ethene lakes if enough of this snow massed together on Titan's lakeside shoreline.

Similar to how sheets of ice break off from Earth's glaciers and float into seas, this process is known as "calving. "She and the team came to the conclusion that this is because these liquid entities' smooth surfaces are covered in a thin layer of frozen particles that floats on top of them.



(Image credit: Center: NASA/JPL-Caltech/ASI/USGS; left and right: NASA/ESA. Acknowledgement: T. Cornet, ESA)

JAPAN BECOMES FIFTH COUNTRY TO LAND A SPACECRAFT ON THE MOON

On January 20, 2024, Japan made a lunar landing with its Smart Lander for Investigating the Moon, or SLIM, vessel. Japan has made history by landing on the moon for the first time, ranking it as the fifth nation to do so. This is a noteworthy accomplishment that enhances Japan's standing as a space technology leader.

Japan's accomplishment is more than just symbolic; by using the lander, the country is showcasing several novel technologies. The spacecraft's revolutionary precise landing capability is indicated by the moniker, Smart Lander for Investigating the Moon.

This technology could help with landings in the future by reducing the need for extensive clearings and enabling spacecraft to land in relatively small places amidst rugged or uneven terrain. This skill will be especially crucial in the future as nations concentrate on extremely narrowly focused regions of the lunar south pole.

Two tiny rovers that the lander also carried will each showcase a novel method of lunar mobility.

- Lunar Excursion Vehicle 1 employs a hopping mechanism to move around the Moon and is equipped with scientific instruments and a camera.

- The government, business, and academic sectors collaborated to produce Lunar Excursion Vehicle 2, a spherical that is small enough to fit in your palm. Its two parts gently split apart once it's on the surface, enabling it to roll.

Compared to earlier lunar landers that had landing zones that extended several kilometers, SLIM is intended to land in a zone as tiny as 328 feet (100 meters).

Although the spacecraft made a successful landing and successfully deployed its rovers, SLIM's solar cells were malfunctioning, which meant that it could only run for a few hours. Nevertheless, the probe, which lost power due to its solar panels being angled incorrectly, was probably able to generate it again due to a shift in the direction of the sun.

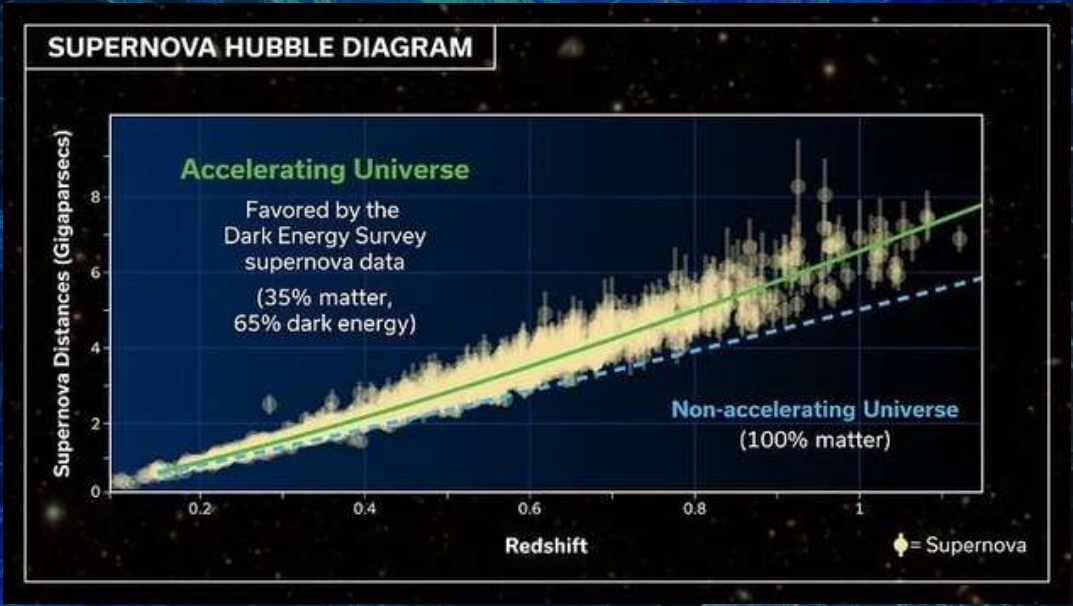
Decade long Dark Energy Survey offers a new insights into the expansion of the universe

The Dark Energy Camera's survey of more than 1,500 supernovas has put significant limits on the universe's accelerated expansion. The findings cast doubt on the traditional model of cosmology by implying that dark energy, the enigmatic component responsible for this cosmic acceleration, may vary in density over time.

Physicists were taken aback by this, as they had anticipated that the universe would expand quickly following the Big Bang. The expansion of the universe should have slowed down, but it is accelerating.

Scientists are unable to pinpoint the exact cause of the unexplained and unsettling cosmic acceleration, but dark energy has been proposed as a stand-in for whatever it may be. The fact that dark energy is now believed to make up between 65% and 70% of all the energy and matter in the universe exacerbates this issue.

The team behind the Dark Energy Survey revealed that the new findings, which were showcased at the 243rd meeting of the American Astronomical Society on January 8, 2024, are in line with the standard model of cosmology, also known as the "Lambda cold dark matter" model (ΛCDM), which describes an expanding universe.



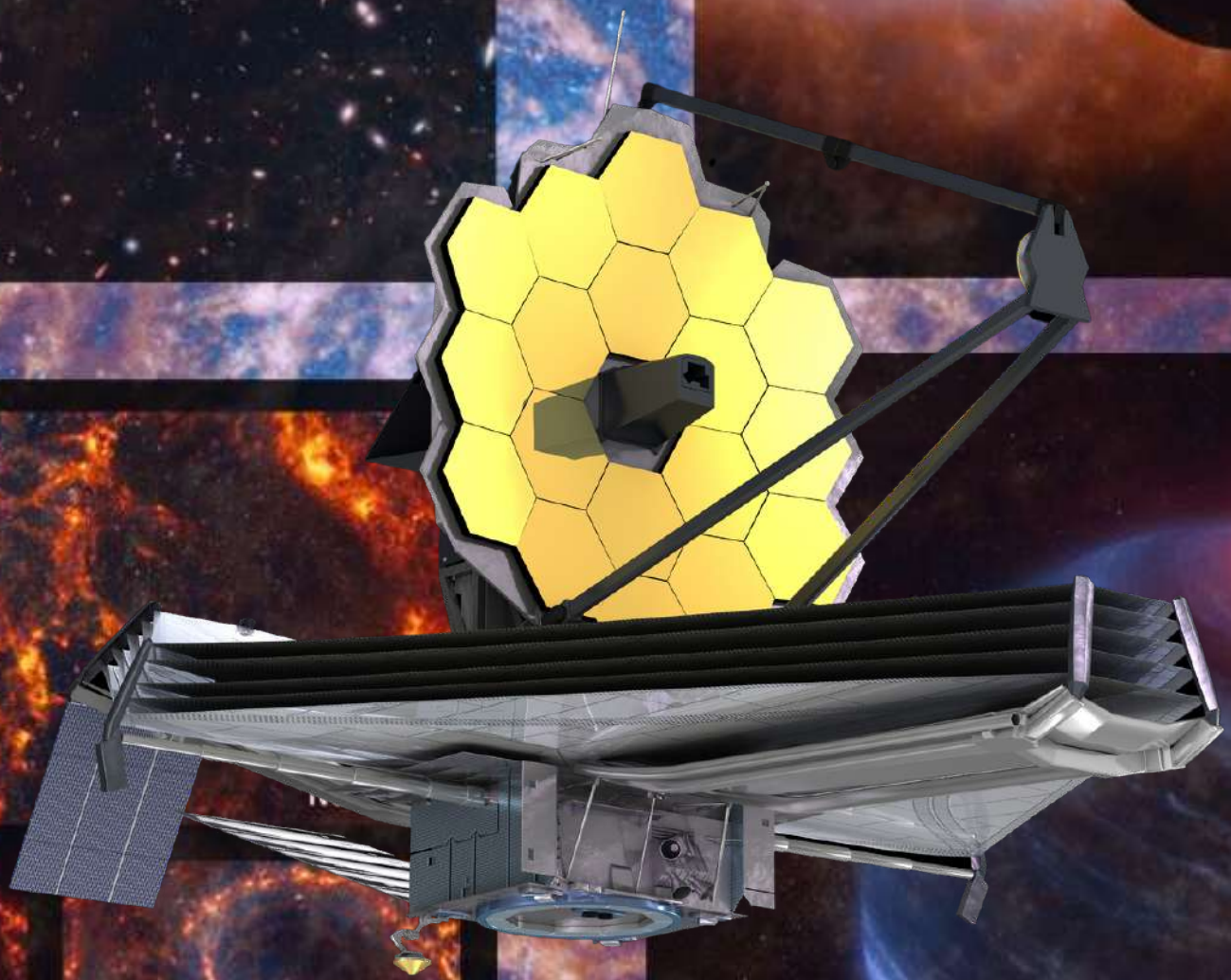
Although they allow leeway for more intricate universe models, these set the strictest limits on the history of expansion across the universe's 13.8 billion-year lifetime.

Combining the distances of these explosions with their rate of retreat from Earth, the scientists could map out a record of cosmic expansion with such a finding of large sample size of Type Ia supernovas across such a broad range of cosmic distances. This served as a gauge to assess if the dark energy density had stabilized, which it did not appear to have done

This could pose a challenge to the ΛCDM model of the universe, a mathematical framework that predicts the evolution of the cosmos using only a few essential parameters such as matter density, matter type, and dark energy behavior.

This is due to the fact that ΓCDM makes the assumption that the density of dark energy is constant and does not change as the universe expands, which recent results from the supernova survey raise doubts about.

JWST



NGC 4535

NASA's Webb Finds Signs of Possible Aurorae on Isolated Brown Dwarf

NASA's James Webb Space Telescope discovered an isolated brown dwarf, W1935, emitting infrared methane, implying auroral processes despite lacking a host star. On Earth, aurorae result from solar wind interacting with the magnetic field, creating lights near poles. W1935's absence of a stellar wind raises a mystery, suggesting possible interactions with interstellar plasma or a nearby active moon. Investigating cold brown dwarfs, the team, led by Jackie Faherty, found W1935's unexpected methane emission. Computer models revealed a temperature inversion in W1935's atmosphere, puzzling researchers. Comparing to our solar system's gas giants, the discovery extends auroral understanding beyond star-dependent systems. W1935 is the first extraterrestrial auroral candidate with methane emission, challenging existing models.

These findings are being presented at the 243rd meeting of the American Astronomical Society in New Orleans.

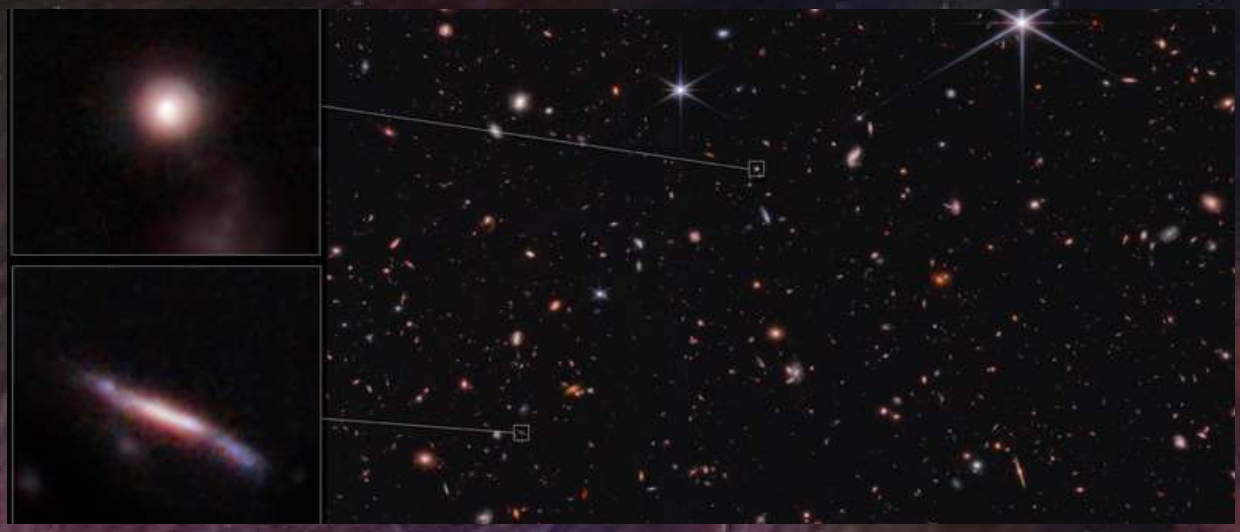
To help explain the mystery of the infrared emission from methane, the team turned to our solar system. Methane in emission is a common feature in gas giants like Jupiter and Saturn. The upper-atmosphere heating that powers this emission is linked to aurorae.

On Earth, aurorae are created when energetic particles blown into space from the Sun are captured by Earth's magnetic field. They cascade down into our atmosphere along magnetic field lines near Earth's poles, colliding with gas molecules and creating eerie, dancing curtains of light. Jupiter and Saturn have similar auroral processes that involve interacting with the solar wind, but they also get auroral contributions from nearby active moons like IO (for Jupiter) and Enceladus (for Saturn).

NASA's Webb Discovers Dusty -Cat's Tail in Beta Pictoris System

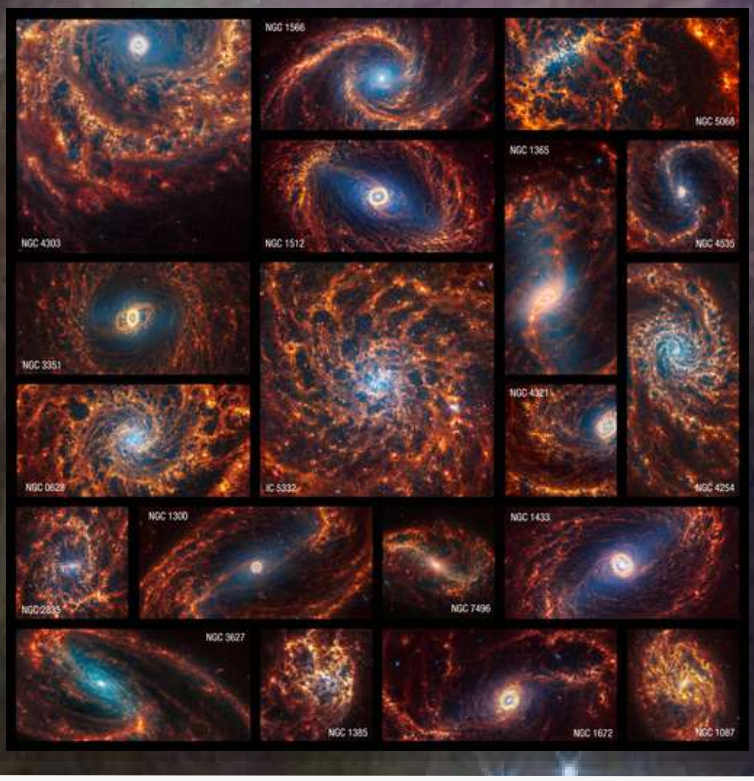
NASA's James Webb Space Telescope, researchers have unveiled a novel feature within the Beta Pictoris (Beta Pic) planetary system, situated 63 light-years away. Initially recognized for hosting the first visually documented dust disk around a distant star, Beta Pic's latest revelation discloses an angular extension of dust, reminiscent of a cat's tail, emerging from the secondary debris disk. Analysis of Webb's mid-infrared data additionally indicated temperature variations between the two disks, implying diverse compositions. The scientific team suggests that the peculiar cat's tail formation likely resulted from a dust-generating event approximately a century ago, potentially triggered by a collision that propelled dust particles into a unique filament. This discovery challenges prior assumptions about the system's stability and dynamism.

Webb Shows Many Early Galaxies Looked Like Pool Noodles, Surfboards



Researchers using NASA's James Webb Space Telescope have discovered that galaxies in the early universe are often flat and elongated, resembling surfboards and pool noodles, rather than round shapes like volleyballs or frisbees. Analyzing images from the Cosmic Evolution Early Release Science (CEERS) Survey, the team found that 50 to 80% of studied galaxies from 600 million to 6 billion years ago appeared flattened. The findings challenge the expectation that such shapes are uncommon nearby. The galaxies are less massive than nearby spirals and ellipticals, serving as precursors to larger galaxies. Webb's high-resolution infrared images provide new insights into early universe structures, expanding our understanding of galaxy formation.

NASA's Webb Depicts Staggering Structure in 19 Nearby Spiral Galaxies



NASA's James Webb Space Telescope has revealed mesmerizing images of spiral galaxies, a result of the Physics at High Angular resolution in Nearby GalaxieS (PHANGS) program. Supported by over 150 astronomers globally, the program utilized Webb's near- and mid-infrared capabilities to capture unprecedented details. The Near-Infrared Camera (NIRCam) showcased millions of stars in blue tones, unveiling clumps in spiral arms and star-forming regions. The Mid-Infrared Instrument (MIRI) highlighted glowing dust and identified areas with potential new star formation. Webb's images displayed large spherical shells, potentially formed by exploding stars, and provided insights into galaxy structure, star formation, and the influence of supermassive black holes in galaxy cores. The PHANGS team released a comprehensive star cluster catalog, fostering extensive research opportunities.

ROCKET LAUNCHES IN FEBRUARY 2024

Progress MS-26 (87P)

- Date: February 15, 2024
- Rocket: Soyuz 2.1a
- Agency: Russian Federal Space Agency (ROSCOSMOS)
- Country: RUS
- Launch Site: Baikonur cosmodrome, Republic of kazaskhstan

Purpose: The Soyuz 2.1A upgraded its flight control system from analog to digital, enabling launches from fixed platforms. This modification also accommodated larger fairings and payloads. Currently, it is utilized for crewed Soyuz and Progress missions to the International Space Station (ISS).

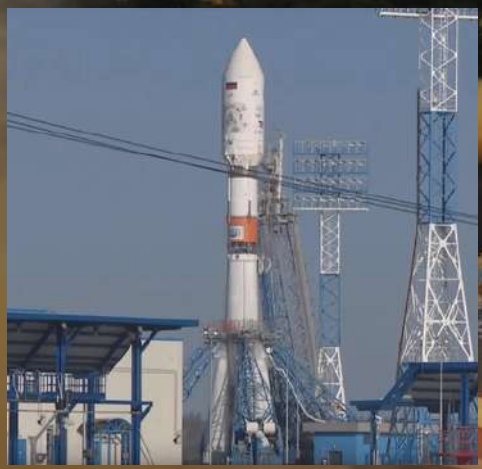
Capella Acadia 3

- Date: Expected in February - 28,2024
- Time: 7:30 AM - 11:30 AM GMT+5:30
- Rocket: Electron
- Agency: Rocket Lab
- Launch Site: Oneinui station , mahia, peninsula,new zealand
- Purpose: The payload comprises a singular SAR Earth-imaging Acadia satellite, representing a cutting-edge generation of satellites created, produced, and managed by Capella Space.The Electron rocket, created by Rocket Lab, is a two-stage orbital launch vehicle with an optional third stage. This compact launch vehicle is specifically designed for deploying small satellites and cubesats into sun-synchronous orbit and low Earth orbit.

Meteor-M No.2-4

- Date: February 29, 2024
- Time: 11:13 AM GMT+5:30
- Rocket: Soyuz 2.1a/Fregat-M
- Agency: Russian Federal Space Agency (ROSCOSMOS)

Purpose: The 2.1a variant incorporates a shift from an analog to a digital flight control system, along with enhanced engines on both the booster and the first stage, featuring improved injection systems. The updated digital flight control and telemetry systems grant the rocket the capability to launch from a stationary, as opposed to an angled, launch platform, and adjust its trajectory mid-flight.



INSAT-3DS

- Date: February 17 , 2024
- Time: 02/17/2024 11:30 UTC
- Rocket: GSLV Mk II
- Agency: ISRO (Indian Space Research Organisation)
- Country: India
- Launch Site: Satish Dhawan Space Centre
- Purpose: INSAT-3DS, an Indian weather satellite, is crafted by the Indian Space Research Organisation (ISRO) and functions within the Indian National Satellite System under ISRO's operation. Its primary role involves delivering meteorological services to India through a 6-channel imager and a 19-channel sounder. Additionally, INSAT-3DS plays a crucial role in offering search and rescue information and facilitating message relay for terrestrial data collection platforms. This satellite serves as a successor to INSAT-3DR.

Gaganyaan-1

- Date: Expected in Febuary, 2024
- Location: Satish Dhawan Space Centre
- Rocket: LVM-3
- Agency: ISRO
- Country: INDIA

Purpose: The Gaganyaan spacecraft is set to be launched by a Human-rated LVM 3 from the Satish Dhawan Space Centre and inserted into a 170 x 408 km orbit. Circularization maneuver is slated for the third orbit, and the landing procedure will mimic that of the TV-D1.

Following this mission, ISRO plans to conduct four additional abort tests before launching Gaganyaan with the inclusion of the humanoid robot Vyommitra. Gaganyaan-1, the initial uncrewed test flight of the Gaganyaan program, is scheduled for launch in the first quarter of 2024. Originally slated for December 2020, and then December 2021, the launch faced delays due to the COVID-19 pandemic. The flight plan was finalized by April 2022, with the launch anticipated in 2024, following TV-D1, TV-D2, TV-D3, and TV-D4. In April 2022, there was a proposal to depressurize the crew module.

SPACE X LAUNCHES IN FEBRUARY 2024

PACE(Planton,Aerosol,Cloud,ocean,Ecosystem)

- Date: February 6, 2024
- Time: 12:00 PM GMT+5:30
- Rocket: Falcon 9 Block 5
- Agency: SpaceX
- Country: USA
- Launch Site: Cape Canaveral, FL, USA
- Purpose: PACE, a NASA Earth observation satellite mission, is designed for global ocean color measurements, aiming to offer comprehensive data records on ocean ecology and global biogeochemistry, including aspects of the carbon cycle. Additionally, it incorporates polarimetry measurements to extend data records on clouds and aerosols.

Nova-C IM-1

Date: February 14, 2024
Time: Expected in February
Rocket: Falcon 9 Block 5
Agency: SpaceX
Country: USA
Launch Site: Cape Canaveral, FL, USA
Purpose: The inaugural launch of the Nova-C lander, created by Intuitive Machines, marks a significant milestone. This mission is integral to the CLPS program, carrying diverse NASA payloads in alignment with the Artemis lunar program, alongside several commercial payloads.

Crew-8

- Date: February 22 , 2024
- Rocket: Falcon 9 Block 5
- Agency: SpaceX
- Country: USA
- Purpose:SpaceX Crew-8 stands as the eighth crewed operational mission within NASA's Commercial Crew Program, utilizing a Crew Dragon spacecraft for transport to the International Space Station (ISS). Simultaneously, Falcon 9, a two-stage rocket developed and produced by SpaceX, ensures the secure and dependable transportation of satellites and the Dragon spacecraft into Earth's orbit. The Block 5 variant represents the fifth significant upgrade in the rocket's evolution, specifically focusing on enhancing its capability for rapid reusability.

Integrated Flight Test 3

- Date: February , 2024, Expected
- Location: Orbital launch mount A,SpaceX Starbase, TX, USA
-
- Rocket: Starship
- Agency: SpaceX
- Country: USA
- Purpose: The third test flight of the two-stage Starship launch vehicle, representing a fully reusable super heavy-lift launch system.SpaceX has conducted eleven prototype launches of its Starship spacecraft, consisting of suborbital and low-altitude tests, along with two orbital trajectory flights featuring the entire Starship launch vehicle and a prototype atop the Super Heavy first-stage booster. These prototypes include Starhopper, SN5, SN6, SN8, SN9, SN10, SN11, SN15, S24/B7, and S25/B9.
- Unlike traditional launch vehicle and spacecraft designs, Starship is planned as a fully-reusable two-stage super heavy-lift launch vehicle. Notably, the upper stage of Starship serves a dual purpose, functioning both as a second stage for reaching orbital velocity during Earth launches and, eventually, serving as a long-duration spacecraft in outer space. The spacecraft is uniquely designed to transport humans to Mars and explore destinations beyond our Solar System.

STARLINK LAUNCHES IN MONTH OF FEBRUARY

Starlink Group 6-39| Starlink Group 6-40| Starlink Group 6-41| Starlink Group 6-42| Starlink Group 6-43 | SpaceX will launch Five more batches of Starlink satellites in the month of February for their high-speed low earth orbit internet constellation on Falcon 9 Block 5 rocket from Cape Canaveral ,FL,USA.

Falcon 9 is a two-stage rocket designed and manufactured by SpaceX for the reliable and safe transport of satellites and the Dragon spacecraft into orbit. The Block 5 variant is the fifth major interval aimed at improving upon the ability for rapid reusability.

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

WHAT'S UP IN THE SKY - FEBRUARY 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
Unlikely to be seen. Superior conjunction on 28 February.

Venus
Morning planet, visibility deteriorating as it approaches the sun.

Mars
Too low and dim to be seen properly in the morning sky this month.

Jupiter
Evening planet, best placed at start of month when still at decent altitude. Position deteriorates through month.

Saturn
Not viable this month, solar conjunction on 28 February.

Uranus
Evening planet, losing altitude as darkness falls. Currently Close to Jupiter.

Neptune
Lost in the evening twilight at the end of the month.

BRIGHT DEEP SKY OBJECTS

The Owl Nebula, sometimes referred to as Messier 97, M97, or NGC 3587, is a planetary nebula in the Ursa Major constellation that is located about 2,030 light years away. Its approximate cross-sectional shape is circular, and its estimated age is 8,000 years and is visible though small telescope.

Messier 82, a starburst galaxy in the Ursa Major constellation, sometimes referred to as NGC 3034, the Cigar Galaxy. It is located around 12 million light-years away. It is the second-largest member of the M81 Group, perfect deep sky object for binocular observations and with a small telescope. It has an apparent magnitude of 8.41.

An intermediate spiral galaxy, Messier 106 is also identified as NCG 4258. Nestled in the Canes Venatici constellation, which is comparable in size to the Andromeda Galaxy, it is one of the closest and biggest galaxies. When viewing a dark sky, M106 is plainly visible via most binoculars and telescopes. This galaxy is 23.68 million light years away.

Located in the Ursa Major constellation, Messier 81, sometimes referred to as NGC 3031 or Bode's Galaxy, is a magnificent spiral galaxy situated around 12 million light-years away. Spot Bode's Galaxy about 10° northwest of Dubhe, in the corner of the Big Dipper's bowl with an apparent magnitude of 6.9 and can be observed with binoculars or telescope even in light polluted sky.

ASTRONOMICAL EVENTS - FEBRUARY 2024

LUNAR OCCULTATION OF ANTARES

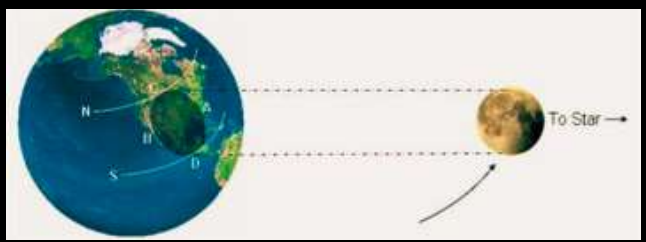
The term "occultation" is derived from the Latin word "occult", which means "to hide". Occultation is the full obscuration of the light of one astronomical body, usually a star, by another, such as a planet or a satellite. For example, a total solar eclipse occurs when the Moon occults the Sun. Astronomers may calculate the angular diameters of some stars and if they are binary systems (a pair of stars in orbit around a shared center of gravity) by carefully analyzing their intensity decline when they fall behind the Moon.

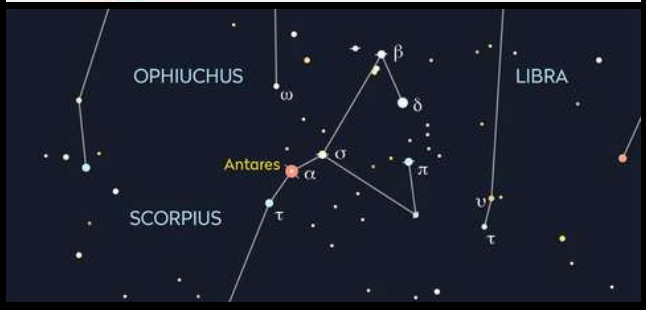
Occultations of stars allow astronomers to establish the precise sizes and forms of planets, asteroids, and satellites, as well as the temperatures of planetary atmospheres. During a star occultation on March 10, 1977, scientists unexpectedly found Uranus' rings. Primary occultations include lunar and asteroid occultations, as the International Occultation Timing Association (IOTA) reported. Lunar occultations are divided into Total Lunar Occultation and Grazing Occultation.

In a total lunar occultation, the viewer will witness just one occultation event: the star disappears as the moon passes in front of it, or the star reappears as the moon travels away from it. A grazing lunar occultation occurs when the moon's very edge passes in front of the star, and the star may disappear and reappear several times as the mountains on the moon's edge individually occult the star. The graphic below shows the geometry of total and grazing lunar occultations. As the Moon goes through its orbit, its projection on Earth causes a total lunar occultation of the star for viewers between points C and D, while a grazing lunar occultation of the star occurs at points C and D or along lines N and S.

Lunar occultations have provided observers with the opportunity to find double and multiple stars. First-magnitude Antares, for example, obscures its fifth-magnitude companion Antares B, but during a lunar occultation, when the Moon obscures the primary star, the companion star appears momentarily. Antares is a red, semiregular variable star with an apparent visual magnitude of around 1.1. It is the brightest star in the zodiacal constellation Scorpius and is also one of the biggest known stars. The Moon will pass in front of Antares (Alpha Scorpii), creating a lunar occultation visible from Asia.

When to look: Monday, 05 February 2024 from 04:36 IST to 08:32 IST.
Where: Constellation Scorpius (or Scorpio) which is the eighth sign of the Zodiac.
Magnitude: Antares with a magnitude of 1.1 will be occulted by 25 days old moon.
Disappearance: At 04:45 IST in the South-Eastern sky with an altitude of 19.1 degrees.
Reappearance: At 06:03 IST with an altitude of 29.1 degrees.
Location: Asia also visible from India.





Alpha Centaurid Meteor Shower

The α-Centaurid meteor shower will be active from 28 January to 21 February, producing its peak rate of meteors around 9 February. Over this period, there will be a chance of seeing α-Centaurid meteors whenever the shower's radiant point in the constellation Centaurus is above the horizon, with the number of visible meteors increasing the higher the radiant point is in the sky. The Alpha Centaurids are a meteor shower in the constellation Centaurus, peaking in early February each year. It is known for producing a relatively small number of meteors per hour at its peak, often in the range of 5-7.

Planetary Alignment

Place: New Delhi / Date: 8th February / Time: 06:40 AM

Planets revolve around the Sun at multiple rates and distances. This implies that they constantly move relative to one another in our night sky. Hence, their paths occasionally appear to overlap, resulting in an alignment or conjunction. The word "Planetary alignment" doesn't mean that the planets are lined up perfectly straight in space. Rather, it is a celestial event where numerous planets seem close together in the sky from Earth's perspective. The alignments we see from Earth are based on our line of sight.

When to look: On February 7th & 8th, 2024 at 06:40 a.m. IST; just before the sunrise
Where: Constellation Sagittarius, the Archer which is one of the Zodiac constellation
Planets aligned: Mars, Mercury, Venus, and the Moon
Type: A mini morning alignment

CONJUNCTIONS FOR THE MONTH

A phenomenon grabs the imagination of scientists and stargazers alike in the vast panorama of the night sky, where stars shine like distant diamonds and planets roam over the cosmic canvas. Conjunctions, those ethereal moments in the heavens when heavenly bodies appear to collide, provide a mesmerizing sight that connects us to the beauty of the cosmos. The word "Conjunction" comes from Latin, meaning to join together. From Earth's perspective, a conjunction occurs when two planets or a planet and the Moon or Sun align. Solar conjunctions are invisible to us. Moon-planet conjunctions occur throughout the month, every month, as the Moon passes past each planet. The planets in The Great Conjunction and when multiple align are rare and captivating conjunctions. Technically speaking, objects are said to be in conjunction in that instant when they have the same right ascension on our sky's dome. Practically speaking, objects in conjunction will likely be visible near each other for some days.

Conjunction of Moon and Jupiter

On February 15th, the gaseous giant Jupiter will meet the 6-day-old Moon in the constellation Aries. The apparent distance between the two objects will be 3°09' in the late night. They will be in the Western direction. Jupiter is at a magnitude of -2.3 and the Moon has a magnitude of -11.6.

Place: New Delhi / Date: 15th February / Time:08:55 p.m.

Place: New Delhi / Date: 17th February / Time: 08:49 p.m.

Conjunction of Moon and Pleiades

On February 17th, the seven sisters or Messier 45 (M45) will meet the 7-day-old Moon in the constellation Taurus. The apparent distance between the two objects will be 0°46' in the night towards the Western direction. The Pleiades is at a magnitude of 1.3 and the Moon has a magnitude of -12.

Conjunction of Venus and Mars

On February 23rd, the Earth's twin sister Venus will meet the red planet Mars in the constellation Capricornus. The apparent distance between the two objects will be 0°36' in the late night. They will be in the Eastern direction. Venus is at a magnitude of -3.9 and the Mars has a magnitude of 1.3.

Place: New Delhi / Date: 22nd February / Time: 06:00 a.m.

The Radiant Tapestry: Cultural Perspectives on the Sun as a Divine Force

The sun, a celestial body that has captivated human imagination for millennia, holds a special place in the beliefs and mythologies of diverse cultures around the world. As the life-giving source of light and warmth, it's no wonder that many societies have revered the sun as a symbol of positivity, power, and divinity. In this exploration, we delve into the rich tapestry of cultural beliefs surrounding the sun, uncovering the shared threads that weave through civilizations across the globe.

Ancient Egyptian Worship:

In ancient Egypt, the sun was personified as the god Ra, one of the most significant deities in their pantheon. Ra was believed to traverse the sky in a solar boat, bringing light and life to the world. The daily journey of the sun represented the eternal cycle of life, death, and rebirth, a concept deeply ingrained in Egyptian mythology.

Japanese Amaterasu:

Japanese mythology venerates Amaterasu, the goddess of the sun and the universe. According to Shinto beliefs, Amaterasu withdrew into a cave, plunging the world into darkness. The gods then devised a plan to lure her out, successfully coaxing her with a dazzling mirror. This myth symbolizes the sun's vital role in sustaining life and the triumph of light over darkness.

Chinese Sun Worship:

In ancient China, the sun was venerated as a symbol of yang, embodying warmth, brightness, and positive energy. The worship of the sun played a crucial role in Chinese cosmology, reflecting the cyclical nature of life and the interconnectedness of all things. The concept of "yang" and "yin" was central to Chinese philosophy, and the sun was seen as a manifestation of the masculine, active force.

Indian Surya and the Cosmic Order:

In Hinduism, Surya, the sun god, is revered as a cosmic force that sustains life on Earth. Depicted riding a chariot drawn by seven horses, Surya symbolizes the seven days of the week. In Hindu cosmology, the sun is considered a key element in maintaining the balance of the universe and is an integral part of rituals and ceremonies.

Native American Solar Connection:

Various Native American tribes share a deep connection with the sun, associating it with life, growth, and spirituality. The Hopi people, for instance, celebrate the Snake Dance to honor the sun as a source of vitality and fertility. The sun's journey across the sky is often incorporated into tribal mythology, emphasizing the cyclical nature of existence.

Roman Sol Invictus and the Greek Helios:
In ancient Rome, the sun god Sol Invictus was worshiped as an unconquered and invincible force. Similarly, in Greek mythology, Helios personified the sun and rode a golden chariot across the sky. Both cultures recognized the sun's role in agriculture, prosperity, and the overall well-being of society.

Arab Sun Myths and Islamic Influences:
In Arab cultures, the sun is often associated with light, knowledge, and divine guidance. Islamic traditions also acknowledge the significance of the sun, with verses in the Quran highlighting its role in the Creator's design. The sun's symbolism is woven into Islamic art, literature, and architecture, reflecting its spiritual and cultural importance.

United States:
In the U.S., Native American tribes view the sun as a source of life, growth, and spirituality. Rituals, like the Hopi Snake Dance, honor the sun's vital role, emphasizing its cyclical journey as a reflection of the interconnectedness of all living things.

Norway:
In Norse mythology, the sun is personified as Sol, the sun goddess who rides a chariot across the sky. The Norse believed the sun's movements were influenced by celestial beings, emphasizing the constant struggle between cosmic forces.

New Zealand:
Maori culture in New Zealand acknowledges the sun as a celestial navigator. The sun's position in the sky is utilized for navigation, emphasizing its practical significance in Maori seafaring traditions.

Aztec Huitzilopochtli:
The Aztecs of ancient Mesoamerica revered Huitzilopochtli as the sun god and the patron deity of war. Believing that the sun required human sacrifice to ensure its continued rise, the Aztecs offered captives in elaborate ceremonies. Huitzilopochtli's association with the sun showcased the dual nature of celestial bodies, representing both creation and destruction.

Norse Sun Goddess Sol:
In Norse mythology, Sol was the sun goddess who traversed the sky in a chariot, chased by a wolf. The Norse believed that the sun's movements were influenced by these celestial beings, emphasizing the constant struggle between cosmic forces. Sol's radiant journey was considered a symbol of order and the cyclic nature of time.

Inca Sun God Inti:
The Inca civilization in South America revered Inti as the sun god, symbolizing both the life-giving energy of the sun and its role in sustaining agricultural abundance. Inti was central to Incan rituals and ceremonies, reflecting the intricate connection between the sun, the land, and the prosperity of their empire.

The sun's influence transcends borders, weaving through the tapestry of human civilization. Whether as a divine force, a symbol of cosmic order, or a source of life, the multicultural perspectives on the sun underscore its universal significance. Across the Chinese, Japanese, Indian, American, Roman, Greek, and Arab civilizations, the sun remains a celestial entity that has inspired awe and reverence, uniting humanity through the shared experience of gazing upon the radiant orb that graces our skies. The sun, with its timeless and universal appeal, continues to illuminate not only the physical world but also the diverse beliefs and myths that shape the cultural fabric of humanity.

Calendars, Sirius, and Ancient Egypt

Calendars are ubiquitous in current society. Usually, a calendar is a system that attempts to arrange events chronologically by listing observable events, thus providing a framework to reference and determine time intervals between said events. Utilizing a calendar, one can determine the precise beginning and end of seasons, plan future events and coordinate with others. The word *calendar* comes from the Latin *kalendae* which means the first day of the month. This harkens back to ancient Rome where the first day of each month was publicly announced, signalling to people it was time to settle any debts from the previous month. Records of these payments and debts were kept in accounting books called calendria.

Astronomical cycles are not always involved in the development of calendars but more often than not, they are. The astronomical cycles that influence the development of a calendrical system could be the phases of the moon, the rising or setting of specific stars and asterisms, the movement of sunrise and sunset along the horizon or the changing arc of the sun as it journeys through the sky and the movements of planets across the sky. However, astronomical cycles are not the only influence. The role that culture and society play when developing calendars is stronger. While calendars served a social purpose, they also reinforced the power of the social elites by sustaining the prevailing ideologies thus forming an important part of the cultural fabric.

Currently, the oldest known calendar is dated to be from 10,000 years ago belonging to a hunter-gatherer society. However, due to a lack of written records, archaeologists can only infer as to what the calendar was used for, utilizing the standard knowledge of how the societies work.

Many ancient civilisations had their calendar system. The Sothic Calendar, developed by the ancient Egyptians is the most well-known and unlike other calendars of its time, it tracked the movement of Sirius along the night sky. This was due to the coincidental helical rising of the star with the flooding of the Nile. This played an important role in shaping the civilisation's religious beliefs, agricultural practices, and their understanding of the cosmos. For example, the temples of Ancient Egypt were aligned with the star and the mourning period was 70 days (the length of time Sirius “disappears” from the night sky). The year itself was divided into three seasons, once again, based on Sirius’s position in the sky.

Even today, the helical rising of Sirius is an important event in Egyptian astronomy, and some regions of the country celebrate the celestial connection to the dog star.

STUDENT'S CORNER

Unraveling the Mysteries of Extraterrestrial Life

Nikhilesh B
Iastronomer

The Universe, vast and mysterious, has captivated the human imagination for centuries. One of the most intriguing questions that has persisted throughout history is the existence of extraterrestrial life, commonly referred to as aliens. While evidence of alien life remains elusive, the possibility of their existence continues to inspire scientific inquiry, philosophical debates, and imaginative speculations.

The concept of extraterrestrial life has deep roots in human history. Ancient civilizations often attributed celestial phenomena to the influence of gods or otherworldly beings. The advent of modern science, however, prompted a more systematic exploration of the universe and the potential for life beyond Earth

In recent decades, advancements in astronomy, astrobiology, and technology have provided new tools and perspectives for the scientific community to search for signs of extraterrestrial life. The discovery of exoplanets—planets outside our solar system—in the habitable zone, where conditions may support life, has fuelled optimism. Scientists also study extremophiles on Earth—organisms thriving in extreme environments—as potential analogs for extraterrestrial life.

The Search for Extraterrestrial Intelligence (SETI) represents one of the most dedicated efforts to detect signals or communication from intelligent civilizations beyond Earth. SETI projects utilize radio telescopes and other instruments to monitor the cosmos for anomalous signals that could indicate the presence of extraterrestrial intelligence.

The Fermi Paradox raises the question of why, given the vast number of potentially habitable planets in the universe, we have not yet detected any signs of extraterrestrial civilizations. The Drake Equation attempts to estimate the number of active, communicative extraterrestrial civilizations in the Milky Way galaxy, highlighting the uncertainties and variables involved in making such predictions

Advancements in space exploration have allowed humanity to study planets and moons within our solar system in greater detail. Robotic missions and telescopic observations provide valuable data about the potential habitability of celestial bodies. Mars, Europa, and Enceladus are among the targets of interest due to their potential for hosting microbial life.

The search for extraterrestrial life raises ethical and philosophical questions. How should humanity approach potential contact with extraterrestrial civilizations? What are the ethical implications of discovering microbial life on other planets? These questions prompt reflections on our place in the cosmos and the responsibilities that come with the exploration of other worlds.

Aliens have become a staple of popular culture, influencing literature, films, and art. Whether portrayed as benevolent beings, menacing invaders, or enigmatic entities, the concept of aliens captures the human fascination with the unknown. Popular media often explores the societal and personal implications of encountering extraterrestrial life.

The quest to unravel the mysteries of extraterrestrial life continues to drive scientific exploration and capture the human imagination. While evidence of alien life remains elusive, the search for answers contributes to our understanding of the universe and our place within it. As technology advances and our knowledge of the cosmos expands, the possibility of discovering extraterrestrial life becomes an increasingly tantalizing prospect. Until then, the search for aliens remains one of the most captivating and enduring quests in the history of human curiosity.

Dark matter and dark energy

Sourajit Mandal
Astronomy camp

Well look around you. Everything around you are made up of matter. This matter makes up most of the universe. Actually, not most, not even close to most. The universe is just made up of 5% matter. The rest of it... is dark...literally. 25% of the universe is made up of dark matter. And the remaining 70% of the universe consists of dark energy.

So, let's talk about dark matter and dark energy. What do we know about dark matter and dark energy? Well, we don't know much! Dark matter and dark energy are theories we have in order to solve some of the absurd things observed in our universe.

First let's talk about dark energy. Dark energy is a hypothetical form of energy that opposes gravity and is thought to be the cause of the universe's accelerating expansion. It's a mysterious force that scientists call dark energy for lack of a better name. We don't know anything much about dark energy. We only know its estimated amount in the universe calculated from the rate of expansion of the universe if it exists.

First, let's talk about dark matter. It was the year 1933. Fritz Zwicky was studying the Coma cluster of galaxies. He found that the orbital speeds of the galaxies were much more than what was expected. It looked like there was a lot more matter present than that was visible. He termed this invisible matter as 'Dunkle Materie'. This was the origin of the term Dark Matter. This is one of our first assumptions why dark matter exists.

The concept of Dark matter was ignored until 40 years later when Vera Ruben and Kent Ford were observing the motion of stars in the Andromeda galaxy. In a galaxy such as our Milky Way or Andromeda, the stars towards the center are generally expected to rotate faster than the stars towards the edge of the galaxy which is not the case. When we observe a galaxy, it is noticed that the stars towards the edge move around at the same speed as the stars in the center of the galaxy. This can occur only when the galaxy is covered by a massive amount of matter which is not detected by our instruments but interacts with gravity. To sum up what all we already may know about dark matter:

1. It may exist
2. If it exists then it interacts with gravity.
3. If it exists then there is a lot of it.

There have been at least 50 experiments in the last few decades in order to make a direct detection of dark matter. None of them have been able to find any direct evidence of dark matter. The most famous and controversial one of these- DAMA/LIBRA also failed to prove the existence of dark matter in its replication experiment. This is a major disadvantage in order to prove the existence of dark matter. We have no way of detecting these dark matter particles since these are supposed to only react with gravity.

Another way to solve the problems which gave rise to the theory of dark matter is modifying the theory of general relativity. But that is a very hard thing to do since the theory already is well established and works for most scenarios perfectly.

At this point of time we only have 3 options:

1. Modify the theory of relativity and change our understanding of gravity.
2. Somehow find dark matter and dark energy.
3. Wait till the next Einstein is born.

PARKER SOLAR PROBE- JOURNEY TO TOUCH THE SUN

Navya Kiran
Iastronomer

INTRODUCTION

We all know that the sun is a flaming hot ball of gas that is placed at the centre of the solar system. Its temperature rises to more than 6000 degrees Celsius, which can melt lead. Scientists for ages have thought that reaching the sun and observing it from close is going to be beyond impossible, but one wonderful mission proved that we can do anything- NASA's Parker Solar Probe. Here is Parker Probes' journey and how achieved such an outstanding thing.

ABOUT IT

Parker Solar Probe was the legendary spacecraft of NASA (National Aeronautics and Space Administration) which was launched on August 12, 2018, to fly through the corona (atmosphere) of the sun and study the science and do experiments to find out more data about the sun. With it getting closer to the atmosphere every second, it faced brutal consequences and struggles but provided us with unprecedented observations of the sun.

REASON

The probe was launched for the following reasons:-

·Trace the flow of energy that heats and accelerates the solar corona and solar wind.

·Determine the structure and dynamics of the plasma and magnetic fields at the sources of the solar wind.

·Explore mechanisms that accelerate and transport energetic particles.

MAIN THEORY

Well, now the main question arises: - How is the satellite able to manage such heat? Scientists before this mission claimed that it would be impossible for any spacecraft to survive near the sun as it is made up of metal. So, why did the probe didn't melt? The scientific explanation lies in the corona itself. It is stated the corona is hotter than the sun itself, and that's when the concept between heat and temperature comes in. Temperature sees how many particles there in the corona are which are giving out energy. While heat sees how much energy they are giving out. So according to scientists, although the particles in the corona are giving a lot of energy and vibrating like crazy, they are enough and if compared to a pan of boiling water, less. So, if there are fewer particles, the energy and the heat are less too. This theory is the backbone for the probe as it is the main reason the probe isn't melting. It is the same as putting your hands in a hot oven.

PARTS OF THE PROBE

The probe had 4 main instruments which helped it in this amazing journey:-

1. **FIELDS** (Electromagnetic Fields Investigation). The instrument suite captures the scale and shape of electric and magnetic fields in the Sun's atmosphere. FIELDS measures waves and turbulence in the inner heliosphere
2. **IS⊙IS** (Integrated Science Investigation of the Sun). The instrument uses two complementary instruments to measure particles across a wide range of energies. By measuring electrons, protons and ions, IS⊙IS will understand the particles' lifecycles
3. **WISPR** (Wide-field Imager for Solar Probe). These optical telescopes acquire images of the corona and inner heliosphere.
4. **SWEAP** (Solar Wind Electrons Alphas and Protons). This investigation will count the electrons, protons and helium ions, and measure their properties such as velocity, density, and temperature.

Parker Solar Probe was nothing short of legendary. He achieved the one milestone that scientists thought was impossible.

Space student interaction with "Moon Man of India"

JOURNEY TO THE MOON

Celestial Q&A Adventure with Dr. Mylswamy Annadurai and B. Aaradhiya (IAstronomer)

Embark on a journey through space as we uncover the mysteries of the Moon with Dr. Mylswamy Annadurai, fondly known as the "Moon Man of India." In a fascinating Q&A session, Dr. Mylswamy Annadurai talks with our curious interviewer, B. Aaradhiya, about why it's important to learn about the Moon and what special experiences await those who visit its serene surface. Join us on this space adventure, where we'll explore the Moon's secrets and invite you to imagine what lies beyond our world. Welcome to an out-of-this-world experience that sparks your curiosity and takes you to new celestial realms.

- **B. Aaradhiya**: Sir, why is it important for people to learn about the Moon?
- **Dr. Mylswamy Annadurai**: Yeah, basically, look at how even the so-called human being, emerging from other animals, is growing in reasoning abilities. They have come to a certain standard of life, impacting how they live, socialize, learn, and update their minds. I think everything possibly started when animals began looking upwards, sparking increased brain stimulation. Many theories exist about that. Beyond that, humans naturally have their own way of understanding the unknown, especially their surroundings and current events. In the vast universe, the moon is the nearest celestial body. What is the moon, and what happens there? Knowing is quite natural. So, I think that beyond the moon's proximity and its orbit around the Earth, its distance also has its own effects on various things like ocean tides and many other aspects. Therefore, I believe we should know more about the moon progressively.
- **B. Aaradhiya**: Dear sir, what unique experiences would someone have when landing on the Moon, and how does the Earth and 'sky' look from there, considering the Moon has no atmosphere?
- **Dr. Mylswamy Annadurai**: If a person were to travel from Earth and had previously observed the sky and the moon during both the day and night on Earth, their experience on the moon would evoke mixed feelings. In the moon's daytime, illuminated by sunlight, the sky appears dark without an atmosphere around the moon. The sun looks like a bright white ball, in contrast to its yellowish appearance from Earth. Moreover, stars are not visible in the daytime on the moon, similar to Earth's daytime.

Conversely, standing on the moon's night side, where sunlight is absent, the sky appears dark, but this time, numerous stars become visible. The absence of atmospheric interference allows for a clearer view of the stars from the moon's night side. Looking back at Earth, it resembles a slightly coloured moon but is significantly larger. When viewed from the moon, Earth appears almost 12-13 times bigger, showcasing phases over a 29.5-day period, similar to how we observe lunar phases from Earth.

Notably, Earth's rotation becomes apparent within a 24-hour period when observed from the moon. Unlike the relatively consistent view from Earth, where we observe similar scenes across months and years, the moon provides a unique perspective. Over a month, you witness phases similar to waxing and waning, mirroring the lunar cycle, but within a 24-hour period, you also observe the rotation of Earth. Despite some differences, the absence of atmosphere and the size disparity contribute to certain similarities in the lunar view of Earth.

As we wrap up our journey through the fascinating Q&A with Dr. Mylswamy Annadurai, the Moon Man of India, and the thoughtful questions from B. Aaradhiya, we find ourselves at the doorstep of cosmic understanding. Exploring why learning about the Moon is important reveals a story of human evolution and our connection to the universe. When we think about the unique experiences one might have on the Moon and the breathtaking view from its surface, the importance of our lunar companion becomes crystal clear. The Moon's lack of atmosphere also helps us appreciate Earth's delicate balance and its marvels. This cosmic conversation inspires us to keep seeking knowledge, fostering curiosity that goes beyond the borders of our home planet. As we end this journey, let's carry the wisdom gained from the Moon, sparking a forever flame of curiosity and discovery in each of us.

Combining Dense and Sparse Photometric Observations to Determine the Physical

Properties of Newly Discovered Near-Earth Asteroids

By Arushi Nath, Founder. MonitorMyPlanet.com and Grade 9 Student

Hundreds of near-Earth asteroids are discovered every month. Determining the physical properties of these asteroids, including their size, rotation period and strength is vital for planetary defense. This requires undertaking photometry on time-series observations of the asteroid. However, due to their recent discovery, the number of continuous or dense observations we have for these asteroids is quite limited.

A possible way to overcome this challenge is to pre-recover the asteroid in the archived images of all-sky surveys and observations made by amateur astronomers. Sky surveys such as Zwicky Transient Facility (ZTF) and Asteroid Terrestrial-impact Last Alert System (ATLAS) take full sky surveys every 2 nights, and several times a night respectively. Furthermore, initiatives such as the American Association of Variable Star Observers (AAVSO) have collected millions of time series observations of the sky while observing variable stars.

I am developing algorithms that use the asteroid's ephemeris to search images in the past five years of archives that may have captured the asteroid. By combining these sparse observations with the most recent dense observations of the asteroids as well as observations from my telescope I would be able to improve the knowledge of their physical properties like size, rotation period and strength much quicker. As many of these surveys are in different filters, it may also be possible to get information on the asteroid's composition.

Using open data, weighted mean, and area of a circle formula, the algorithms centroid known stars and asteroids in the images. The correct aperture size for photometry is calculated using the slope and median functions to measure the pixel brightness of the asteroid across all images. Variations in the asteroid's brightness due to changes in weather and seeing conditions are eliminated using comparison stars of known and constant brightness.

As asteroids orbit the Sun, their brightness varies because their distance from the Sun and Earth changes. To adjust for these changes unity distance and phase angle offsets are calculated, resulting in the asteroid's absolute magnitude and size. Since these observations are very spread out over different apparations, light time correction must be applied to account for changes in time the reflected light from the asteroid takes to reach us.

As asteroids are irregular in shape, different sides reflect different amounts of light, allowing measurement of their rotation period. My algorithm will fit the asteroid's time-series absolute magnitude from individual observations and combine them into composite light curves of different periodicities. The asteroid's rotation period is the periodicity of the composite light curve corresponding to the smallest root mean square error. In the case of binary asteroids, subtracting the rotation period from the composite light curve yields their mutual orbital period.

I am testing this methodology on the binary asteroid Didymos, which was the target of NASA's Double Asteroid Redirection (DART) Mission. By combining observations taken by the mission, my observations and those from sky surveys I would be able to determine the physical properties of the binary asteroid and determine the change in its mutual orbital period before and after the impact.

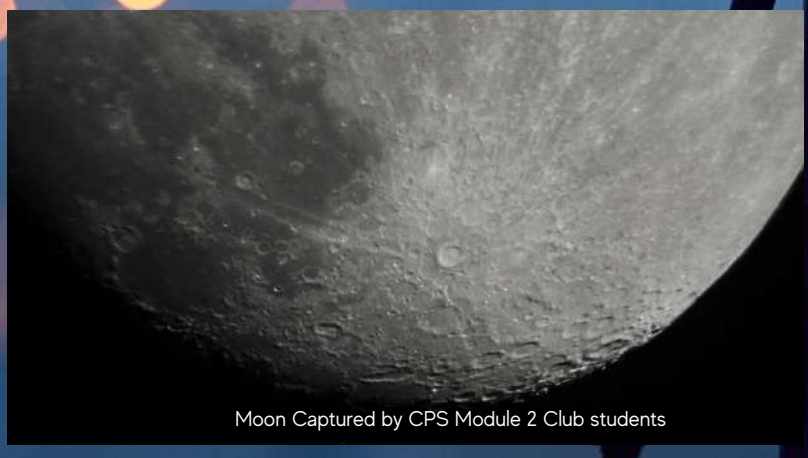
VISUAL ARTS FROM SPACE ASSOCIATED ASTRONOMERS

Jupiter and Saturn captured by Bhaargav Bharadwaj, Space associated Astronomer

Sun captured by Alvin Deepan,Club student

Cassiopeia Constellation and Moon captured by Rohan Jain, Club student

Orion Constellation captured by Shree Viswajith S, Club student



Moon Captured by CPS Module 2 Club students

ASTROPHOTOGRAPHS BY SPACE

North-Eastern Star trails captured by Mr. Ranjith Kumar E, Team Lead, Education - Chennai, STEPL.

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

HISTORICAL EVENTS IN FEBRUARY

THE FIRST LUNAR LANDING

First Image From The Surface Of The Moon

On 3rd February 1966, a capsule landed on the lunar surface. Well, in reality, it bounced first. It bounced several times until coming to rest in Oceanus Procellarum or the Ocean of Storms on the moon. Luna 9 has safely landed on the lunar surface, the first landing that an astronaut could survive.

Launched on January 31st of the same year, Luna 9 was the 12th attempt by the Soviet Union to achieve a soft landing on the moon.

Within 15 minutes of landing, Luna 9 had captured its first photo of the Lunar surface, the first photo of another world's ground. The contrast of the image is not good as, at the time of capture, the Sun was three degrees above the lunar horizon.
From the photos returned, scientists could infer that the spacecraft was near a 25-meter crater and at a 15-degree tilt initially. As the lunar soil shifted under the spacecraft, it settled to a 22.5-degree tilt.

Luna 9 survived till 6th February 1966, when its batteries died. During the three Earth days it spent on the lunar surface, it sent back four panoramic images to Earth.
The success of the Luna 9 mission was a significant step for the future exploration of the moon as the data gathered was important for planning future lunar missions. Additionally, the spacecraft also proved that the lunar surface could support the weight of a lander, solving a conundrum at the time.

In this Family Portrait

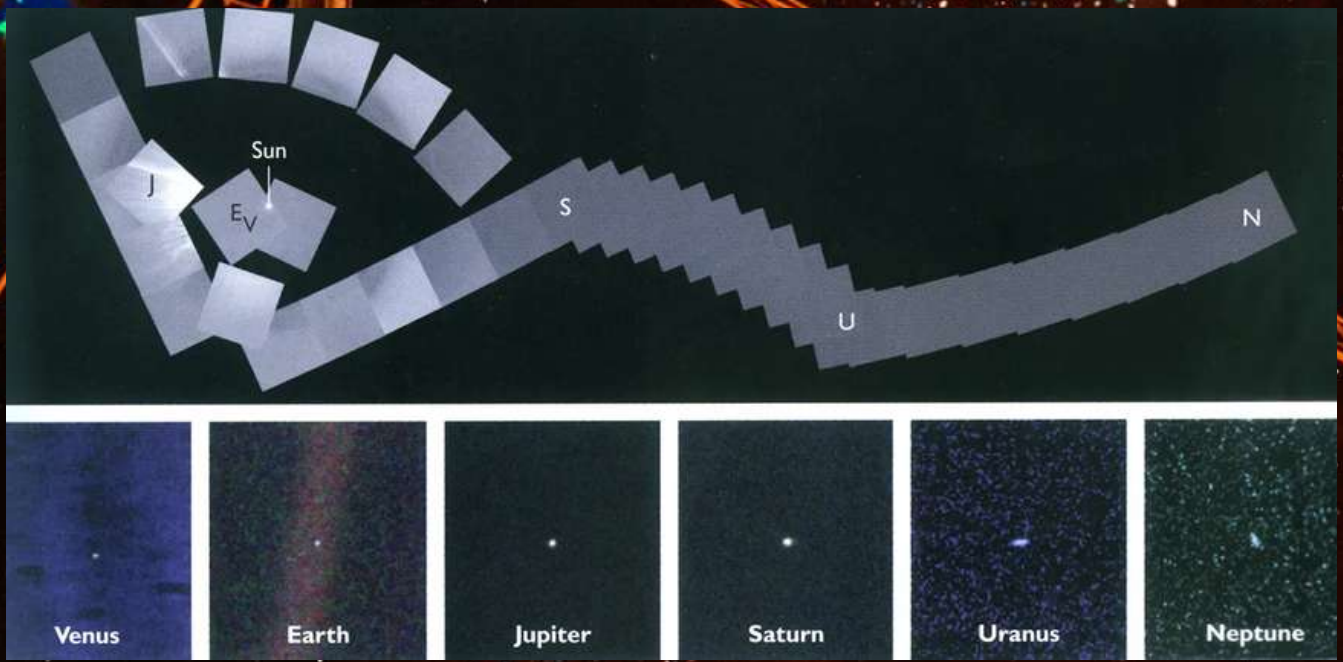
A spacecraft is making its way through towards the edge of the solar system. Back home, scientists are getting ready to shut down certain instruments to prepare the spacecraft for its long and lonely journey ahead. First, though, a command is sent. In response, the spacecraft turns its camera towards the solar system below and clicks a series of photos. Then, the camera got switched off.

The Family Portrait or Portrait of the Planets is the mosaic of the 60 frames that Voyager 1 took. Taken from 6 billion kilometres from Earth, on 14th February 1990, 6 planets and the Sun are visible. Initially, NASA scientists planned to switch off Voyager 1's camera without fanfare, but many scientists, most notably Carl Sagan, campaigned for many years for the photos. NASA listened. Due to the conditions required for such a photo to be captured, only three spacecraft, till today, could have taken such a portrait: Voyager 1, Voyager 2 and New Horizons. At the time, Voyager 1, had a better vantage point of the solar system than Voyager 2 and was thus given mission. The New Horizons spacecraft is too close to the elliptical. Therefore, any planet behind the Sun, from the spacecraft's perspective, cannot be captured.

Six planets are visible in the mosaic: Jupiter, Earth, Venus, Saturn, Uranus, and Neptune. The Sun, the home star of the system, is visible as a tiny point of light, highlighting Voyager 1's distance. Not everyone showed up for the family portrait though. Mercury was too close to the Sun, Mars's position made it hard for Voyager 1's camera to capture it, and Pluto, which was still considered a planet, was too far from the Sun and too small. Still, the mosaic is inspiring and the famous 'Pale Blue Dot' source is here.

Till the time of writing, Voyager 1 is the only spacecraft to have taken such a photo; the Family Portrait is one-of-a-kind.

Today, Voyager 1 continues its lonesome journey into interstellar space.



Discovering Pluto

On 18th February 1930, a man was perusing the photographic plates of the night sky he captured on January 23rd and 29th. Using a blink comparator, he moved between the two plates to see if any objects changed position within the period. After a year of fruitlessly doing the task, that day, he noted a potential movement. After further comparison with a photographic plate taken on January 21st, he confirmed the movement. Clyde Tombaugh had discovered Pluto.

Tombaugh utilizing a blink comparator

The presence of Pluto has been inferred since the late 19th Century. In 1906, Percival Lowell, the founder of Lowell Observatory, started his search for the potential ninth planet which he continued till his death in 1916. Lowell did not know that he had observed Pluto in 1915 but didn't identify the object as the potential ninth planet. Lowell was not the first person to observe Pluto. In August 1909, the Yerkes Observatory recorded the earliest observation of the planet.

The observatory that houses the telescope that discovered Pluto

Pluto, named by an 11-year-old girl, is named after the Roman god of the underworld - keeping up with the planet naming theme, is a tiny planet. With a 2370-kilometre diameter, it is smaller than several countries on Earth. Despite being tiny, Pluto has five known moons, with Charon being its largest. Charon is large enough that Pluto and Charon are often referred to as a double planet. Pluto has an oval-shaped orbit around the Sun, with an average distance of 39 AU. However, throughout its 248-year orbit, its distance varies wildly, with its furthest being 49.3 AU and closest being 30 AU. When Pluto is the closest to the sun, is closer than Neptune. The crossing of Neptune's orbit is the main reason why, in 2006, the IAU changed the status of Pluto from a planet to a dwarf planet.

In 2015, New Horizons flew by Pluto with Clyde Tombaugh's ashes onboard the spacecraft. During this flyby, it showed a region that looked like a heart shape known as the Tombaugh Region, named after Pluto's discoverer. Through the New Horizon mission, we learned that Pluto is geologically active, with the presence of a liquid ocean under the surface and a pale blue nitrogen atmosphere.

LAUNCHING MIR

On 19th February 1986, from the Baikonur Cosmodrome in Kazakhstan, a Proton rocket lifted off. Nine minutes later, upon achieving orbit, its precious payload unfurled the antennas and solar arrays. Once the ground personnel did a thorough check, the core module of the Mir Space Station was ready for occupancy.

Meaning peace or world in Russia, the Mir space program received the green light from the Union of Soviet Socialist Republics (U.S.S.R.) in 1976. Parts of the space station were based on the technologies developed during the predecessing Salyut and Almaz programs. However, Mir was the first modular space station and it was assembled in orbit between 1986 and 1996. During its time in orbit, it was the largest artificial satellite and served as a microgravity research laboratory in which crews conducted different types of experiments. The primary mission of the Mir space program was to develop technologies for the permanent occupation of space and see the effects of long-term space occupancy on humans.

Mir had a 15-year orbital lifetime, where 13 years were occupied by astronauts and cosmonauts. The space station held the record for the longest continuous human presence in space at 3,644 days until 23rd October 2010. While operational, it hosted 125 cosmonauts and astronauts from 12 countries, 77 spacewalks and the longest single spaceflight. Mir holds the record for the three longest single spaceflights.

On 23rd March 2001 Mir's, in a controlled deorbits maneuver, crashed into the Pacific Ocean. However, its legacy lived on in its successor: the International Space Station (ISS). ISS broke Mir's record for the longest continuous human presence. Learnings from Mir were implemented in the building and operation of ISS and elements of the Russian segment of ISS can trace their heritage to MIR. Additionally, derivatives of Mir's design are found in the People's Republic of China's Tiangong and Tianhe space stations.

GERARD KUIPER DISCOVERS MIRANDA MOON OF URANUS

In the vast expanse of our solar system, Gerard Kuiper made a groundbreaking discovery that continues to captivate astronomers and space enthusiasts alike. On February 16, 1948, using the McDonald Observatory in Texas, Kuiper identified Miranda, one of Uranus's many enigmatic satellites.

Miranda, named after the Shakespearean character in "The Tempest," is the smallest and innermost of Uranus's major moons, but its peculiar features make it a celestial wonder. Kuiper's meticulous observations opened a window to the complexities of the outer solar system and expanded our understanding of the dynamics at play in Uranus's satellite system.

In his article, Kuiper delves into the methods and challenges of observing celestial bodies from Earth, highlighting the significance of technological advancements in telescopic capabilities during his time. The discovery of Miranda marked a milestone in planetary science, as it sparked curiosity about the moon's unusual surface features, including deep canyons and towering cliffs that hint at a turbulent past.

Furthermore, Kuiper's work paved the way for subsequent missions, such as Voyager 2's flyby of Uranus in 1986, which provided unprecedented close-up images of Miranda. These images not only validated Kuiper's initial observations but also unveiled new mysteries, fueling ongoing scientific investigations into the moon's geological history.

In conclusion, Gerard Kuiper's discovery of Miranda remains a crucial chapter in the exploration of our solar system. His work not only unveiled a previously unknown moon but also set the stage for future explorations that continue to unravel the secrets hidden within the celestial bodies that grace our night sky.

MIRANDA MOON OF URANUS

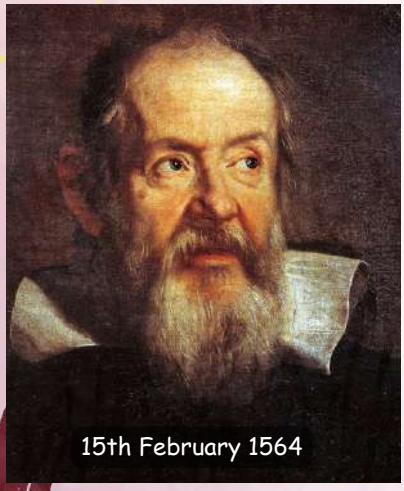
Happy Birtday

Clyde Tombaugh


4th February 1906

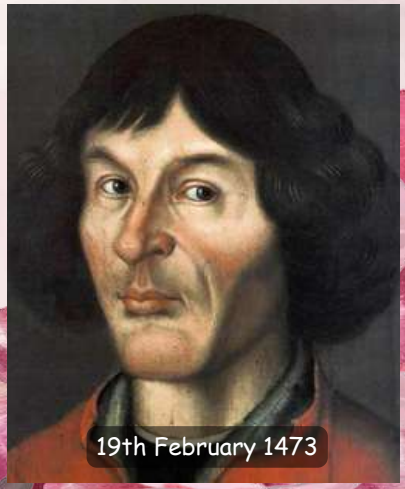
Clyde Tombaugh (04th February 1906 – 17th January 1997) inherited his love of astronomy from his family. Born near Streator, Illinois, his interest in astronomy was first piqued through a visit to the Yerkes Observatory when he was 12 years old. In 1929, he was hired at the Lowell Observatory because of the observations he made through a self-constructed telescope. His discovery of Pluto made Mr Tombaugh the only person to discover a planet in the 20th century, an indirect discoverer of the Kuiper Belt. However, that was not the only space object that he discovered throughout his career. Other celestial objects include a comet, hundreds of asteroids, and several galactic star clusters. Over his lifetime, Mr Tombaugh constructed over 30 telescopes. When the New Horizons spacecraft travelled through the Solar System towards Pluto, it carried a portion of Clyde Tombaugh's ashes.

Galileo Galilei


15th February 1564

Galileo Galilei (15th February 1564 - 8th January 1642), or Galileo, was sometimes described as a polymath. Born in Pisa, when it was part of the Duchy of Florence, Galileo di Vincenzo Bonaiuti de' Galilei is known as the father of observational astronomy. Through his telescope, a modified version of Hans Lippershay's, Galileo observed the Galilean moons of Jupiter, the stars in the Milky Way, the phases of Venus, Saturn's rings, lunar craters, and sunspots. He may also be the first person who observed Neptune. Though, he didn't recognize it as a planet. Galileo was a believer in the Copernican model of the universe and spent the last seven years of his life under house arrest under the orders of the Catholic Church.

Nicolaus Copernicus


19th February 1473

Nicolaus Copernicus (19 February 1473 – 24 May 1543) was a Polish Catholic canon best known for upending the perception of the universe with his model of the universe. Born in Torun, a city on the Vistula River in north-central Poland, Copernicus is known as the father of modern astronomy. His most famous work, 'On the Revolutions of the Celestial Sphere,' was published shortly before his death. The book went introduced a concept that went against the popular geocentric model. Despite going against the Catholic Church's edict at the time, the book, initially, did get any blowback. However, in the early 17th century, when Galileo and Johannes Kepler developed on and popularized the Copernican theory to the wider populace, the Church pushed back. Copernicus is seen as the initiator of the Scientific Revolution.

NEWSLETTER

As 2024 began, Space India took a special moment to look back on its incredible journey–a journey that turned a group of colleagues into a true family. The year started with an inspiring montage that did more than just showcase the team's amazing successes. It celebrated the entire journey, highlighting how they overcame obstacles and created unforgettable moments that brought everyone closer together. These moments were especially felt during fun employee events filled with laughter, learning, and bonding, building a strong sense of community and respect.

The feeling grew even deeper when Ms. Avani Patwa, CEO of Space Technology & Education Pvt. Ltd., led a heartfelt conversation. It was a chance for everyone to share their personal stories and dreams, ending with a unified vision for what lies ahead for Space India. This conversation showed how united and driven everyone is by the same goals.

This sense of togetherness shone brightly during the Republic Day celebration, as the whole team came together to sing the national anthem passionately. Mr. Shivam Gupta, the Managing Director- Space Group spoke about the importance of this day, mixing memories with motivation. His speech was a tribute to each employee's dedication, celebrating the hard work and shared passion that make Space India special.

January also brought a fun sports day, highlighting the company's focus on balancing work and life. The day was packed with activities ranging from cricket to jenga, allowing even remote team members to join in, thanks to a hybrid work setup. This inclusivity sparked joy and made everyone feel part of the Space India family.

NEWSLETTER

Sports Teams, named after India's famous Space missions like Chandrayaan and Mangalyaan, competed in various games, boosting team spirit and friendship. This wasn't just about staying active; it was a celebration of the joy and enthusiasm shared among the team, strengthening the bonds that make Space India more than just a place to work, but a family.

Birthdays

What could be more delightful than being born at the beginning of a new year? As everyone revels in the festivities of the New Year, you have an extra reason to celebrate. Here's to the Spacians born in January, adding an extra sparkle to the joyous occasion.

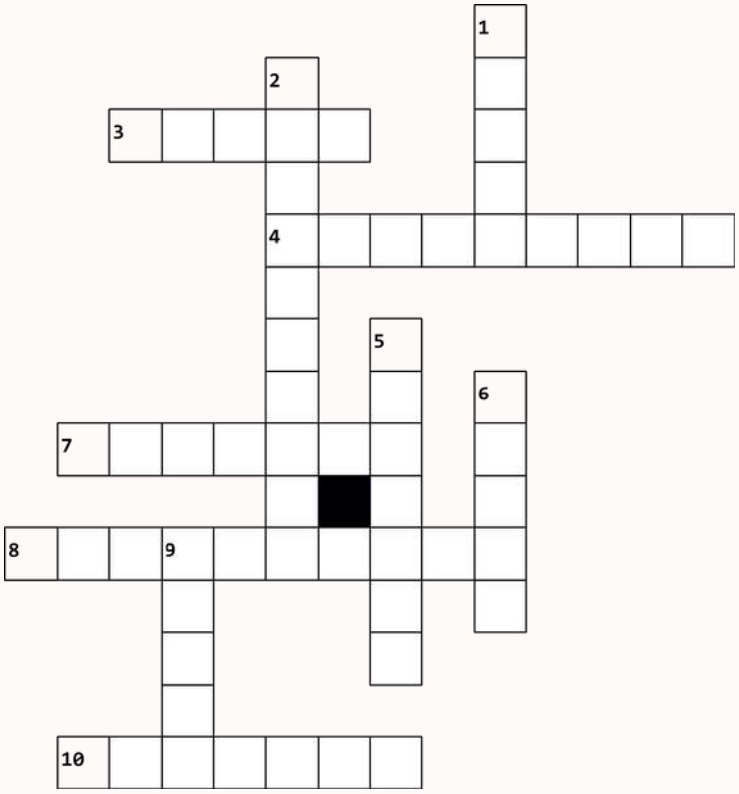
Employee of the Month

Mayur Solanki (Researcher- Research & Development)

Our team has consistently observed Mayur's remarkable growth and dedication. Mayur's creativity and innovative thinking have consistently driven us toward excellence. As one of the most diligent Spacian, his resilience and tenacity through challenging times are commendable. Mayur approaches adversity with perseverance, never shying away from embracing new responsibilities. His inquisitive nature and exceptional ability in resource optimization have significantly contributed to our organization.

TRAIN YOUR BRAIN

CROSSWORD



Across

3. What is the biggest object in the asteroid belt?
4. What is the name of the robotic companion of NASA's Perseverance rover?
7. The Quadrantids Meteor shower are also called as?
8. Name the point where the gravitational forces of two large bodies, such as a planet and the Sun, balance the centrifugal force felt by a smaller object, like a satellite or spacecraft.
10. What specific element was discovered in the lunar soil by Chandrayaan-3?

Down

1.How many payloads did the Indian Solar Observatory Aditiya L1 took?
2. When the Earth is closest to the sun, it is known as?
5. Which spacecraft observed Saturn's last equinox in 2009?
6.Which asteroid caused Betelgeuse to become fainter on December 12, 2023?
9. Name the brightest star in the constellation Orion.

ASTRONOMY WORD PUZZLE

Find the names of the Famous space scientist names from the mixed letters and mark them.

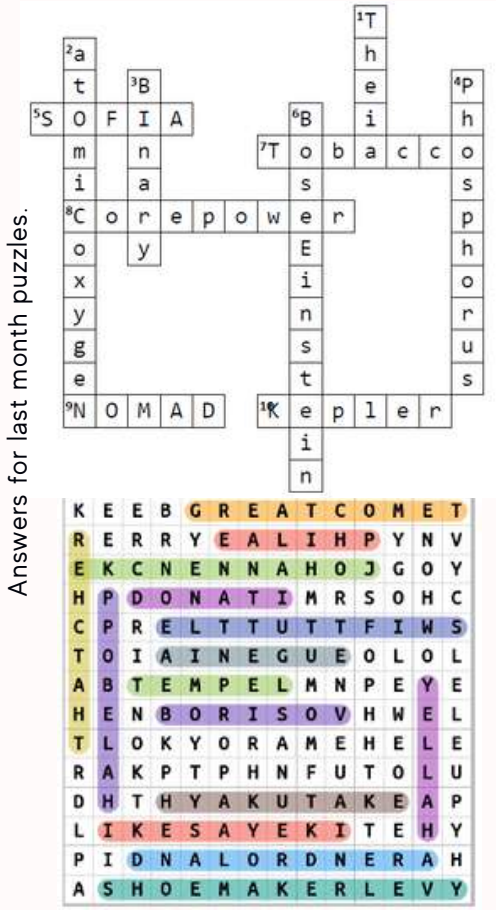
Famous Space Scientist

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

CARLSAGAN
VIKRAMSARABHAI
KEPLER
GALILEO
HUBBLE
TSIOLKOVSKY
WERNHERVON
VERARUBIN
NEILTYSON
HAWKING
FRANKDRAKE
ABDULKALAM
NEWTON
GODDARD
EINSTEIN

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

Answers for last month puzzles.



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SPACE TECHNOLOGY & EDUCATION PVT. LTD.

Plot No.3, Institutional Area, Sector 11, Dwarka, New Delhi 110075, India

www.space-global.com info@space-global.com IVR: +91-7402074020 | Landline: +91-11-45086320

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