

Galactica

Astronomy and Space Science Magazine

What's Inside?

SPACE Insights

Highlights From September

Moon Phases And Planet Visibility

What's Awaiting in October

Student's Corner

Historical Events Happened In October

October Born Legends

Train Your Brain

www.space-global.com

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

Team

Editor in Chief

Sachin Bahmba

Managing Editor

Shivam Gupta

Section Editors

Tanya Maheshwari

Muskan Malhotra

Sruthi Nambiar

Pallavi Verma

Ilma Ansari

HR Team

Editor

Ranjith Kumar E

Assistant Editors

Sruthi Suresh

Priyadharshini D

Contributors

iAstronomers

Space Students

This magazine contains original photos used with permission, as well as free-use images. All included photos are property of the author unless otherwise specified. If you are the owner of an image featured in this publication believed to be used without permission, kindly contact us.



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.

CEO's Message



**Mr. Shivam Gupta,
CEO & 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 impart scientific temperament so the next generation can be entrepreneurs, scientists & astronauts!

LIST OF

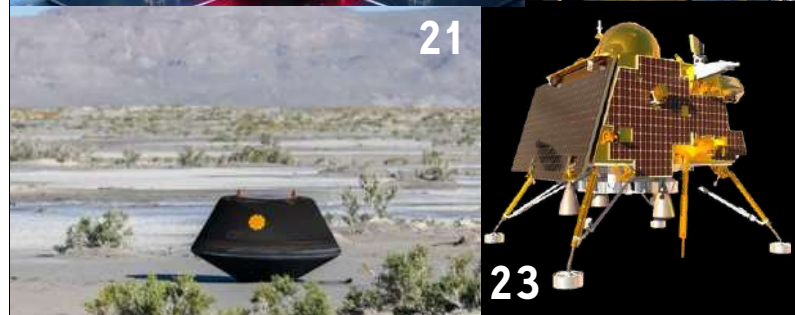
Page no.

Topics

1 SPACE Insights

Highlights of September 2023

- 13 Aditya L1 Probing Sun's mysteries
- 15 ESA's Groundbreaking Experiment Aims to Combat Muscle Loss in ISS Astronauts
- 17 Unearthing Lunar Mysteries: Chandrayaan 3's Intriguing Discovery
- 18 NASA's Perseverance Mars rover wraps up MOXIE oxygen-making experiment
- 19 Atomic Clocks in Space: The New Trick for Uncovering the Secrets of Dark Matter
- 21 OSIRIS-REx: A Triumph of Human Ingenuity
- 23 Chandrayaan-3 Scientific Findings
- 25 Bubble of galaxies could be a fossil of the Big Bang
- 26 Unraveling the Enigma of Antimatter
From the eyes of Webb
- 29 Webb Discovers Methane, Carbon Dioxide in Atmosphere of K2-18 b
- 30 Webb snaps Supersonic Outflow of Young Star
- 31 Webb Finds Carbon Source Europa
- 33 What's up in the Sky**



CONTENTS



Rocket launches - October 2023

- 34 MIURA 1
- 35 PSYCHE
- 37 THEOS-2 & FORMOSAT-7R/TRITON
- 38 GALACTIC 04 SPACESHIP 2
- 39 Angara A5/Briz-M

40 SpaceX Launches - October 2023

Astronomical Events- October 2023

- 41 Venus at greatest western elongation
- 42 Orionids Meteor Shower
- 43 Draconids Meteor shower
- 44 Partial Lunar Eclipse
- 45 Conjunctions for the month
- 46 World Space Week 2023
- 47 **October Born Legends**

49 Students corner

53 Astrophotographs by SPACE Team

Historical Events in October

- 54 The Dawn of the Space Age
- 55 The Satellite of Neptune
- 56 NASA's First Launch
- 57 An Alien Element
- 58 India's Foray into Interplanetary Space
- 59 **Train your brain**

SPACE INSIGHTS

graVITas '23

On the crisp night of September 22, 2023, Vellore Institute of Technology (VIT) witnessed a celestial spectacle like never before. The event, aptly named GraVITas'23, hosted by the astronomy club Stellar, drew in over 150 eager students from various disciplines, all united by their shared passion for the cosmos.

Under the ink-black canvas of the night sky, the students embarked on an unforgettable journey through the universe. The event's focal point was a 5 inch Schmidt Cassegrain telescope, a beacon of light in the inky expanse. It offered a portal to worlds beyond, beginning with the mesmerizing quarter moon, its craters and lunar seas casting ethereal shadows.

As the night unfolded, the gaze of the telescope shifted towards the gas giants, Saturn and Jupiter, with their majestic rings and swirling storms. The detail captured by the lens left students in awe, fostering a newfound appreciation for the sheer grandeur of our solar system.

The journey didn't stop there. The telescope pivoted once more, this time towards the radiant glow of the Orion Nebula, a cosmic nursery teeming with the birth of stars. The ethereal wisps of gas and dust seemed to dance in the gaze of the observers, igniting a sense of wonder and insignificance in equal measure.





The Pleiades, a cluster of brilliant stars, were the final act of this celestial ballet. Through the lenses of the 76mm reflection STC telescope, each star shone with a unique brilliance, casting a spell of cosmic beauty upon the onlookers.

In a gesture that encouraged hands-on exploration, students were provided with 50mm telescopes, allowing them to navigate the night sky on their own. This empowered them to seek out their favorite celestial objects, forging a personal connection with the universe.

The night unfurled against a backdrop of music and laughter, as strangers turned friends gathered in camaraderie, sharing the thrill of discovery under the veil of the cosmos. The dark sky acted as a canvas, painting a vivid backdrop to the vibrant tapestry of student excitement and camaraderie.

As the clock struck 2 a.m., and the first hints of dawn began to kiss the horizon, the event drew to a close. The echoes of laughter and the hum of shared awe lingered, leaving an indelible mark on the memories of all those present. GraVITas'23 had not only been a night of astronomical observation, but a testament to the boundless curiosity and collective spirit that thrives within the student community at VIT.

This unforgettable night served as a reminder of the vastness of the cosmos and the beauty that awaits those who dare to look up. It was a night that will be etched in the hearts of these students, a testament to the power of exploration, community, and the awe-inspiring wonders of the universe.

Exploring the Celestial Dance of Moon and Saturn



iAstronomer club celebrated the astronomical event on the Conjunction of the Moon and Saturn on 27th September 2023 by hosting a live webinar. Conjunction is an astronomical phenomenon where two or more celestial body comes together in the night sky. Catching this phenomenon through a live webinar was a rare and amazing experience for everyone who attended this webinar.

The most exciting thing about this live webinar was that it was hosted by our educator "Mr. Himanshu Gautam" and facilitated by our iAstronomer itself. iAstronomer "Myraa Khattar" took center stage to host this live webinar where she explained the concept of conjunction. She made a beautiful presentation on the conjunction of the Moon and Saturn, where she explained all the details of the conjunction. The highlight of the Conjunction presentation prepared by iAstronomer Myraa Khattar was the use of beautiful features and animation to explain the concept of Conjunction.

The live webinar was not just limited to the Conjunction, it was followed by "Telescopic Orientation" by our educator "Mr. Ashish Negi". All the participants of the Webinar were introduced to the amazing world of the Reflector Telescope. The introduction of the telescope and the working and assembly of the Reflector Telescope, which is also called the Newtonian Telescope were also discussed in this live webinar. The whole concept was explained very practically through the use of Newtonian telescope and Laser light. Laser Light was used to explain the path of light that follows when light coming from distant objects like galaxies, Nebulae and Stars enters the telescope.





As the webinar drew to a close, the audience was treated to a live view of the Moon-Saturn conjunction through telescopic observation led by educators “Mr. Aman Kumar” and “Mr. Ravi Kumar” and senior assistant “Mr. Slamuddin”.



The amazing view of the Moon through the Dobsonian telescope was a hit. Everyone in the webinar enjoyed the Craters, Rays, and Maria which were visible through the Dobsonian telescope on the screen. A Dobsonian telescope is an altazimuth-mounted Newtonian telescope design popularized by John Dobson in 1965 and credited with vastly increasing the size of telescopes available to amateur astronomers.



The live webinar was attended by more than 30 participants. The gasps of amazement and excitement from participants were a testament to the success of the webinar in creating a deep connection between enthusiasts and the celestial wonders above.



MONTHLY TELESCOPIC OBSERVATION

SPACE ARCADE team conducted their 7th Monthly Telescopic Experience session on the 30th of September in Chennai and Delhi respectively.

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 through the 8" Dobsonian telescope and Schmidt-Cassegrain telescope set up by the SPACE team.



Star Party – Lunar Delight

A Night of Moon Observation & Astronomical Adventures

A Star Party aptly named “Lunar Delight” was set up in K.R. Mangalam World School, Vaishali with the joint efforts of the astronomy educator and students on 27th September 2023. The event aimed to inspire and educate grade 6 students about the wonders of our universe and took them on an astronomical journey they will never forget.

The evening was filled with an array of astronomical activities that left the students both educated and entertained. From an awe-inspiring Astro model showcase to the thrilling “Ring the Planet” game, the young enthusiasts were enthralled by every moment. Cosmic quizzes and riddles kept their minds engaged, and as rewards, they received specially crafted bookmarks, serving as keepsakes of this remarkable day.

The excitement continued with a tattoo station where students proudly adorned themselves with temporary space-themed tattoos, solidifying their connection to the celestial wonders. Students had the unique opportunity to experience the gravitational differences on planets and moon by checking their weight, an eye-opening activity that left them astounded. Stomp rocketry had everyone launching their creations skyward, while the sky map puzzle challenged their problem-solving skills. The virtual space walk through VR technology provided an immersive journey beyond our planet’s boundaries, igniting a sense of wonder and curiosity. One of the highlights of the evening was the hydro-rocketry event, where the school’s esteemed Principal, Ms. Seema Behl, launched a hydro rocket, symbolizing the school’s commitment to nurturing young talent in science and exploration.

Students excitedly posed for pictures with aliens, astronaut, rocket, earth props, and a moon cutout, creating lasting memories of their cosmic adventures. As the evening drew to a close, students, parents, and teachers gathered in anticipation to witness the waxing gibbous phase of the Moon and Saturn through a powerful Dobsonian telescope, providing an awe-inspiring view of our celestial neighbors. “Lunar Delight” at K.R. Mangalam World School, Vaishali, was more than just an event; it was a celebration of the boundless curiosity that resides within each student. The memory of this extraordinary evening will continue to inspire future astronomers and space explorers for years to come.



Aaruush '23

AARUUSH, the four-day extravaganza from 21st September to 24th September, held at SRM University, unfolded a celestial odyssey like never before. At the heart of this cosmic spectacle was SPACE India, a beacon for astronomy and space science education. And the star of the show? Our telescopes!!

With enthusiasm in the air, students and faculty alike flocked to our exhibit, eager to unravel the mysteries of the universe. Questions flowed freely, curiosity ignited, and doubts dissolved as we delved into the workings of our telescopic marvel. Each inquiry became an opportunity to enlighten, to share the wonders of space with a captivated audience.

Space India Organisation, being in the field of educating the masses about astronomy and space science, found its perfect platform at AARUUSH. Our mission transcends the bounds of our classrooms, aiming to spark a passion for the cosmos in every individual we encounter.

Throughout the event, we showcased the telescope as a gateway to the universe, a conduit for exploring distant galaxies, stars, and planets. Its lenses unveiled celestial marvels, igniting a sense of wonder in those who dared to look through them.

As the final day of AARUUSH drew to a close, our hearts swelled with pride. We had not only shared the boundless expanse of space with eager minds but had also fostered a community of curious thinkers and stargazers. Our telescope stood as a symbol of the limitless potential of human curiosity and the power of education to bridge the gap between us and the cosmos.

AARUUSH 2023 was a chapter etched in the annals of our cosmic journey, a testament to the insatiable human spirit that yearns to explore, understand, and embrace the vast unknown. With each question answered and doubt dispelled, we took one step closer to a world where the wonders of the universe are within everyone's reach.



A NATIONAL LEVEL TECHNO-MANAGEMENT FEST
AARUSH '23
rising in the spirit of innovation



Project Paridhi

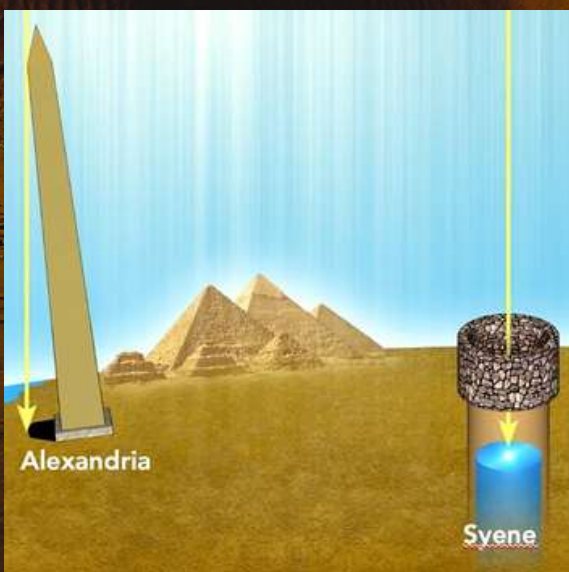
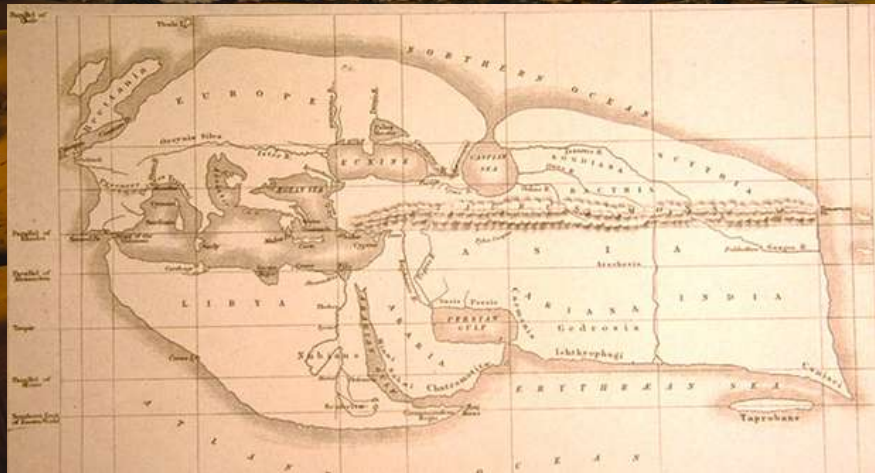
- an ancient astronomical marvel to calculate the circumference of the earth

'Project Paridhi; is a flagship project of SPACE, aimed at promoting practical science education. Inspired by the methods employed by ancient astronomer Eratosthenes over 3000 years ago, students determine the Earth's circumference by measuring shadows cast by the sun throughout the day. Remarkably, Eratosthenes achieved measurements within a 2% deviation from the modern accepted value.

Commencing 12 years ago in 2010, this project embodies the vision of spreading awareness among Indians about the accessibility and simplicity of scientific experimentation. It emphasizes that meaningful scientific exploration can be pursued without requiring intricate or specialized equipment.

In astronomy, we often find that the most profound discoveries stem from the simplest of observations and calculations. Project Paridhi, a stellar initiative by SPACE India, encapsulates this essence by unraveling a fundamental secret –Earth's circumference–through an experiment that dates back to ancient times.

Let us transport ourselves back over two millennia to ancient Alexandria, Egypt. Enter Eratosthenes, a luminary of his time and the chief librarian of the famed Library of Alexandria. Eratosthenes embarked on a quest to fathom the Earth's size in an age devoid of modern tools.



Eratosthenes's ingenious experiment was rooted in observing shadows cast by a vertical object, often a gnomon, under the midday sun's rays. He noted that during the summer solstice in Syene, a city to the south, the Sun cast no shadow, implying that it was directly overhead. Meanwhile, in Alexandria to the north, there was a discernible shadow.

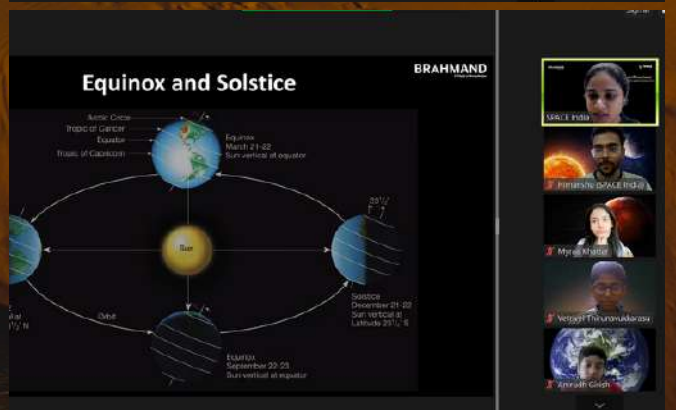
Eratosthenes employed this disparity in shadows to determine the Earth's curvature and size, and his estimates proved astonishingly accurate. He calculated Earth's circumference within a mere 2% of the currently accepted value, a remarkable feat for its time.

Project Paridhi, initiated by SPACE India, is an engaging and hands-on activity designed to measure the Earth's circumference. The project witnessed active participation from students of JBM Global School, Noida, and Bal Bharati Public School, Pitampura. During this educational endeavor, students utilized the Eratosthenes technique to estimate the Earth's circumference accurately. Students enthusiastically embraced the project, carrying out the measurements with precision under the careful supervision and guidance of their educators. The project emphasized the significance of applying scientific methods and encouraged students to delve into practical applications of their academic knowledge. Through this engaging activity, students were able to grasp fundamental concepts while actively participating in scientific exploration.



On 23rd September, Project Paridhi took center stage as part of the iAstronomer club's activities on the event of the autumn equinox. An online demonstration of the "shortest shadow" experiment was conducted, engaging students in a virtual hands-on learning experience. Following the demonstration, students participated in a follow-up discussion and Q&A session where their questions were addressed, enriching their understanding of the experiment. The virtual learning experience allowed students to delve into the mysteries of the cosmos while applying their newfound knowledge practically.

Following the successful demonstration, students could calculate the circumference of the Earth, a testament to the power of hands-on science education. Project Paridhi continues to be a beacon of scientific exploration, connecting students with the marvels of astronomy and space science. It inspires curiosity and pays homage to the pioneering spirit of early astronomers like Eratosthenes.



ADITYA L1 EVENT

In a spectacular display of scientific curiosity and innovation, four UITS Schools in the National Capital Region came together to participate in the Aditya L1 Mission. Delhi Public School, Greater Faridabad; K.R. Mangalam World School, Vaishali; JBM School, Noida; GD Goenka Public School, Model Town; and Sri Venkateshwar International School, Dwarka united to provide their students with an enriching experience in space science. The mission, named after the Hindu sun god, Surya, was a tremendous success, engaging approximately 1200 students in various hands-on activities aimed at understanding and celebrating the Aditya L1 Mission. Aditya L1 Mission, spearheaded by the Indian Space Research Organisation (ISRO), is an ambitious undertaking that focuses on the study of the Sun.

The mission aims to orbit a satellite around Lagrange Point 1 (L1), which is a position between the Earth and the Sun where the gravitational forces of both celestial bodies balance each other out. This unique vantage point provides an unparalleled view of the Sun and offers insights into its various phenomena, such as solar flares, coronal mass ejections, and solar wind.

The students were involved in a range of engaging activities that allowed them to explore and learn about our closest star, the Sun. Students had the opportunity to observe the Sun through specially designed telescopes and solar view goggles. In a creative twist, students took their newfound knowledge and artistic skills to craft face masks representing the Sun. These unique masks not only showcased their artistic talents but also served as a fun way to remember the Sun's features, with fiery colors and solar flares adorning each mask. To better understand the technical aspects of the mission, students took on the challenge of building Aditya L1 Mission models and explain its objectives.

One of the highlights of the event was the creation of posters and picture collages dedicated to the Aditya L1 Mission. These visually stunning displays portrayed the mission's objectives, its significance in the field of space science, and the hope it brings for future scientific endeavors.



Unlocking the Secrets of the Sun: Aditya-L1 Mission

The universe never ceases to amaze us, and right in our cosmic backyard, the Sun has always held a special place. Recently, we had an incredible opportunity to delve into the fascinating world of solar science through two enlightening events: a webinar by Puneet, an iAstronomer with a passion for the stars, and an "Ask an Astronomer" meeting featuring Dr. Piyali Chatterjee, an Associate Professor at the Indian Institute of Astrophysics in Bangalore. These events revolved around the Aditya-L1 mission, illuminating the intricate layers of the Sun, expounding upon the mission's core objectives, and underscoring its profound significance. Additionally, Dr. Piyali Chatterjee offered invaluable career guidance and insights to our aspiring iastronomers, further enriching the experience.

The mission's ambitious objectives include studying the corona to comprehend its behavior and high temperatures and monitoring the Sun's magnetic fields, which shape our solar system. In our "Ask an Astronomer" meeting, Dr. Piyali Chatterjee, a distinguished expert in solar science, provided further insights. Her presence underscored the importance of collaborative efforts in scientific endeavors. Aditya-L1 is a testament to the dedication of scientists and researchers who work tirelessly to unravel the mysteries of our universe. This "Ask an Astronomer" meeting was hosted by our iAstronomer, Liesha, and this event significantly bolstered her confidence while also making a valuable contribution to her personal development and growth.

In conclusion, the Aditya-L1 mission is a testament to human curiosity and ingenuity. It takes us closer to the heart of the Sun than ever before, providing a window into the workings of our nearest star. Puneet's webinar and Dr. Piyali Chatterjee's expertise brought this mission to life, making complex scientific concepts accessible to all. As we journey into the depths of space, it's heartening to know that our quest for knowledge knows no bounds, and our reach extends even to the blazing heart of our solar system.

HIGHLIGHTS OF SEPTEMBER 2023

Aditya L1 Probing

India's space endeavors continue to soar as the nation embarks on its first-ever solar observatory mission, Aditya-L1. Launched atop a Polar Satellite Launch Vehicle (PSLV) from the Satish Dhawan Space Centre, this pioneering probe marks a significant stride towards understanding our solar system's powerhouse.

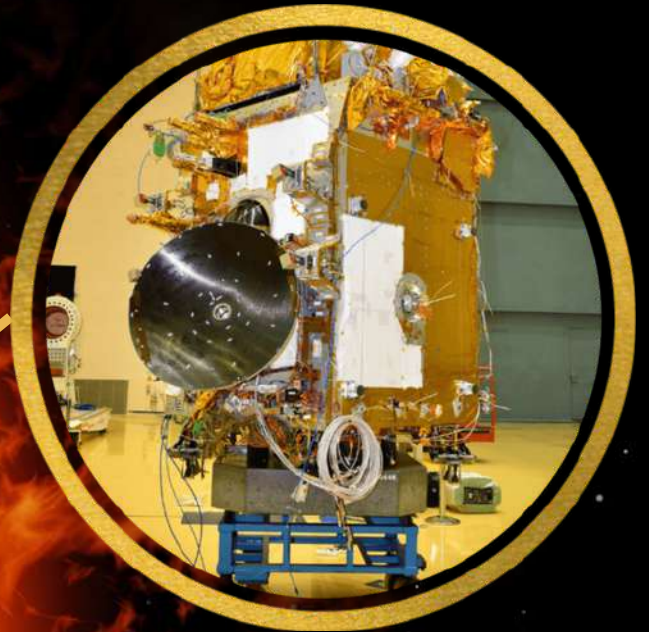
Aditya-L1, weighing 3,260 pounds, initially entered low Earth orbit (LEO). However, its ultimate destination lies at Earth-sun Lagrange Point 1 (L1), approximately 1 million miles away from Earth. Positioned at this gravitationally stable point, Aditya-L1 will offer uninterrupted views of the sun, granting scientists invaluable real-time insights into solar dynamics and space weather.

Currently, another sun-observing craft, the Solar and Heliospheric Observatory (SOHO), stationed at L1, collaborates in this celestial endeavor. Aditya-L1, once settled at L1, will employ a suite of instruments to scrutinize particles, magnetic fields, the sun's surface (photosphere), and its atmosphere.



Aditya - L1

Sun's Mysteries



These observations aim to unravel the enigmas of solar phenomena, from flares to coronal mass ejections (CMEs) that can influence Earth's technological infrastructure.

Among Aditya-L1's quests is to address the "coronal heating problem," an enigma perplexing heliophysics. The sun's corona, with temperatures soaring up to 2 million degrees Fahrenheit, defies conventional logic by being hotter than its surface. The cause of this temperature anomaly remains a baffling scientific puzzle.

Furthermore, Aditya-L1 seeks to decode the composition and acceleration mechanisms of the solar wind, an unending stream of charged particles emanating from the sun. By doing so, this mission will undoubtedly propel our comprehension of the sun's pivotal role in our cosmic neighborhood.

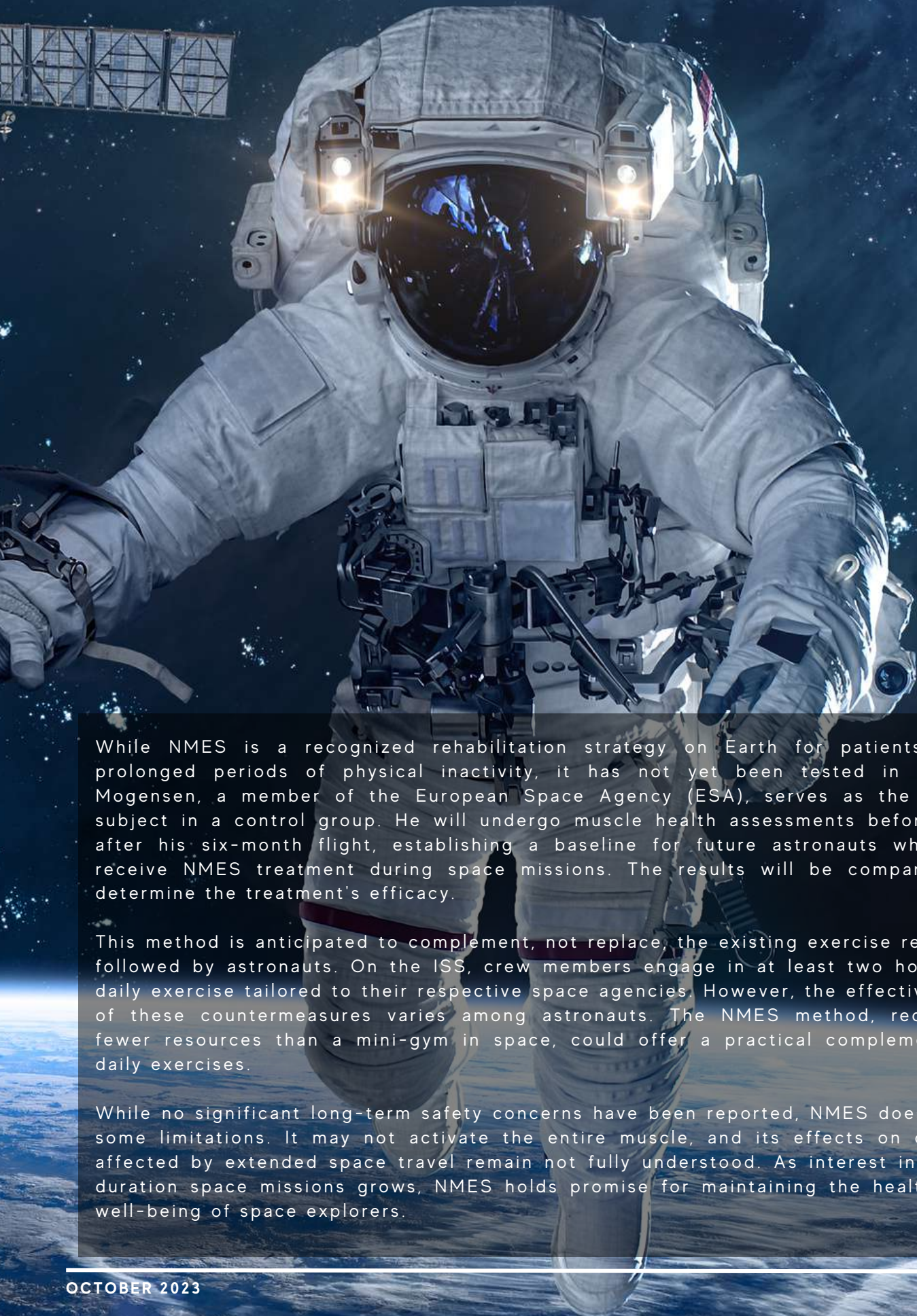
As Aditya-L1 embarks on its four-month voyage to L1, the scientific community eagerly anticipates a flood of revelations, destined to illuminate the intricacies of our life-giving star.

ESA's Groundbreaking Experiment Aims to Combat Muscle Loss in ISS Astronauts

On Aug. 27, Danish astronaut Andreas Mogensen made history as the first European to pilot the SpaceX Dragon spacecraft to the International Space Station (ISS).

Over the next six months, Mogensen will conduct over 30 research activities, including 3-D printing in space, utilizing virtual reality for mental health support, and capturing images of thunder clouds on Earth for scientific study. One experiment stands out for its potential impact on healthcare for both astronauts and people on Earth.

The experiment aims to address muscle loss, an inevitable consequence of extended space missions. Research indicates that an astronaut aged 30 to 50 can lose half their strength after six months in space, equating to the muscle mass of an 80-year-old upon return. The new technique, called Neuromuscular Electrical Stimulation (NMES), seeks to counteract this by electrically stimulating specific muscles, prompting them to regain mass and strength, potentially expediting recovery.



While NMES is a recognized rehabilitation strategy on Earth for patients with prolonged periods of physical inactivity, it has not yet been tested in space. Mogensen, a member of the European Space Agency (ESA), serves as the initial subject in a control group. He will undergo muscle health assessments before and after his six-month flight, establishing a baseline for future astronauts who will receive NMES treatment during space missions. The results will be compared to determine the treatment's efficacy.

This method is anticipated to complement, not replace, the existing exercise regimen followed by astronauts. On the ISS, crew members engage in at least two hours of daily exercise tailored to their respective space agencies. However, the effectiveness of these countermeasures varies among astronauts. The NMES method, requiring fewer resources than a mini-gym in space, could offer a practical complement to daily exercises.

While no significant long-term safety concerns have been reported, NMES does have some limitations. It may not activate the entire muscle, and its effects on organs affected by extended space travel remain not fully understood. As interest in long-duration space missions grows, NMES holds promise for maintaining the health and well-being of space explorers.

Unearthing Lunar Mysteries: Chandrayaan 3's Intriguing Discovery

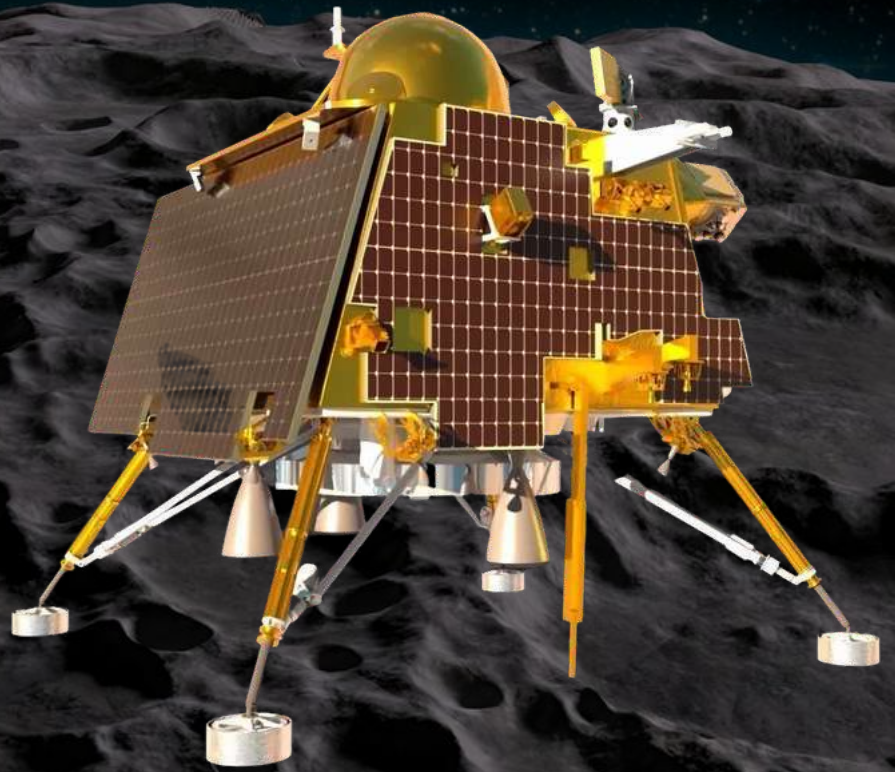
India's Chandrayaan-3 mission, on its third day on the lunar surface, has potentially unearthed a long-awaited phenomenon: a moonquake, unseen since the 1970s. Equipped with the Instrument for Lunar Seismic Activity (ILSA), the Vikram Lander registered seismic signals on August 26, 2023. Having touched down on the moon's south pole on August 23, as part of the Chandrayaan-3 mission, this could mark India's inaugural lunar surface mission.

If validated, this moonquake, coupled with observations of the Pragyan rover's movements, offers a unique opportunity to fathom the enigmatic lunar interior. On this, the Indian Space Research Organisation (ISRO) reported, "The lander recorded an event, appearing to be a natural one, on August 26, 2023. The source of this event is under investigation."

Moonquakes were initially identified during the Apollo lunar missions, establishing the moon's intricate geological composition. Unlike Mars' moons Phobos and Deimos, the moon reveals an interior diversity. Recent advancements in data analytics and simulations have enabled scientists to delve into Apollo mission data, unraveling the moon's cryptic core. In 2011, NASA unveiled parallels between Earth and the moon, hinting at a fluid iron core enveloping a compact, solid iron nucleus.

In May 2023, gravitational field assessments corroborated the hypothesis, suggesting that patches of the molten mantle may have risen to the surface as iron clusters, inducing quakes.

Nonetheless, the moon remains devoid of a magnetic field, diverging from Earth's magnetic-rich core. This peculiarity raises intriguing questions, especially regarding the appearance of ancient rocks akin to those formed in a potent geomagnetic field, as unearthed during NASA's Apollo missions. Chandrayaan-3, currently in dormant mode due to its solar-powered configuration, anticipates reactivation on September 22. As the lunar night retreats, the lander and rover stand poised to decipher these longstanding lunar enigmas.



NASA'S PERSEVERANCE MARS ROVER WRAPS UP MOXIE OXYGEN-MAKING EXPERIMENT

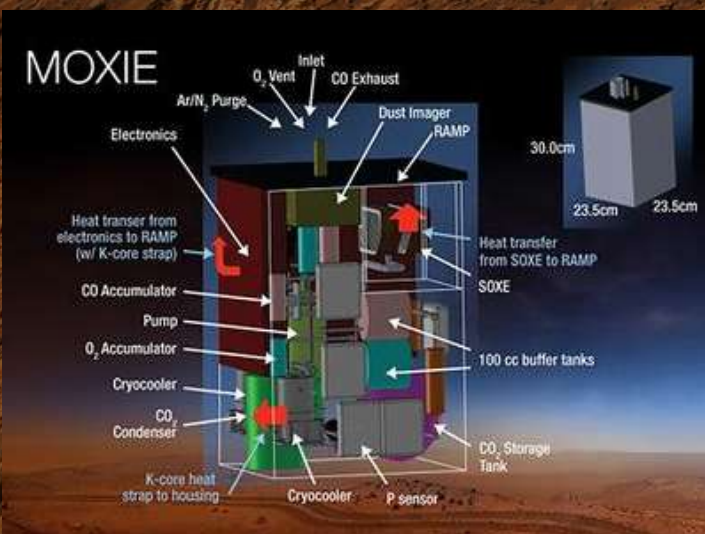
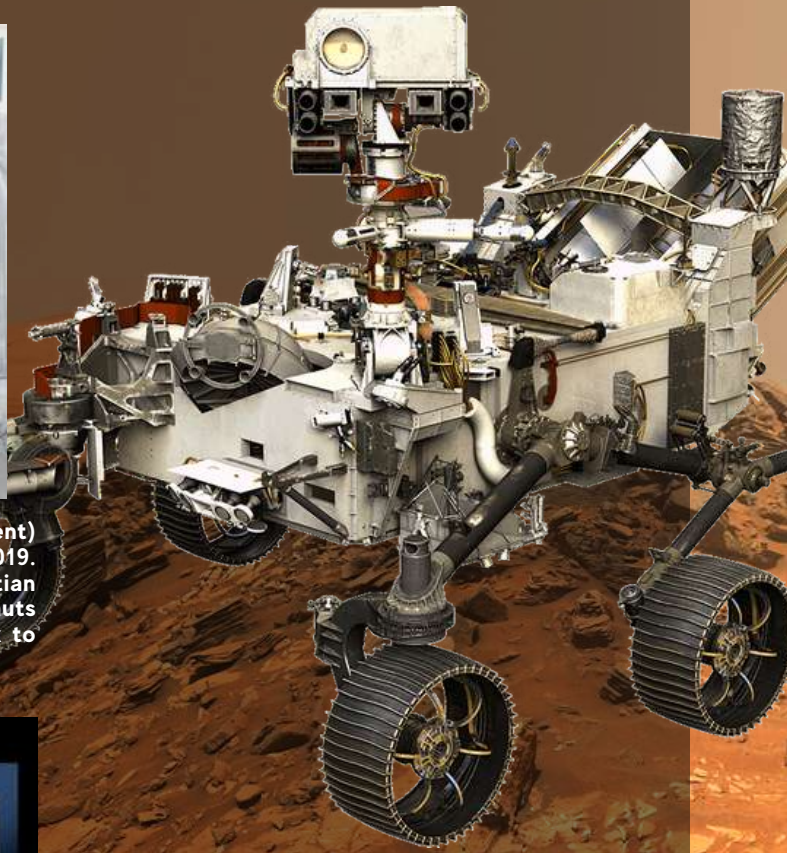
NASA's Perseverance Mars rover has successfully completed its MOXIE (Mars Oxygen In-Situ Resource Utilization Experiment) mission. MOXIE is a groundbreaking experiment designed to demonstrate the feasibility of producing oxygen from the thin Martian atmosphere, which is composed primarily of carbon dioxide.

The MOXIE instrument, about the size of a car battery, was installed on Perseverance and has been operating for several months. It works by using a process called electrolysis to separate oxygen atoms from carbon dioxide molecules. This demonstration of in-situ oxygen production is a crucial step in preparing for future manned missions to Mars.



MOXIE (Mars Oxygen In-situ Resource Utilization Experiment) is lowered into the chassis of NASA's Perseverance in 2019. During the mission, MOXIE extracted oxygen from the Martian atmosphere 16 times, testing a way that future astronauts could make rocket propellant that would launch them back to Earth.

Credits: NASA/JPL-Caltech



The ability to generate oxygen on Mars is essential for a number of reasons. Firstly, oxygen is crucial for the survival of astronauts, both for breathing and for use as a propellant in rockets for the return journey to Earth. Additionally, oxygen production on Mars would significantly reduce the amount of oxygen that needs to be transported from Earth, making missions more feasible and cost-effective.

MOXIE's successful operation marks a significant milestone in NASA's efforts to prepare for human exploration of Mars. It demonstrates that it is possible to create essential resources directly on the Red Planet, reducing reliance on Earth for critical supplies. This achievement brings us one step closer to the eventual goal of sending humans to Mars and establishing a sustainable presence on the planet.



Atomic Clocks in Space: The New Trick for Uncovering the Secrets of Dark Matter

A groundbreaking study published in *Nature Astronomy* has proposed an innovative approach to unraveling the secrets of dark matter by utilizing an atomic clock on a spacecraft orbiting in close proximity to the Sun, inside the orbit of Mercury. This research presents a potentially transformative method for understanding the elusive substance that constitutes a significant portion of the universe.

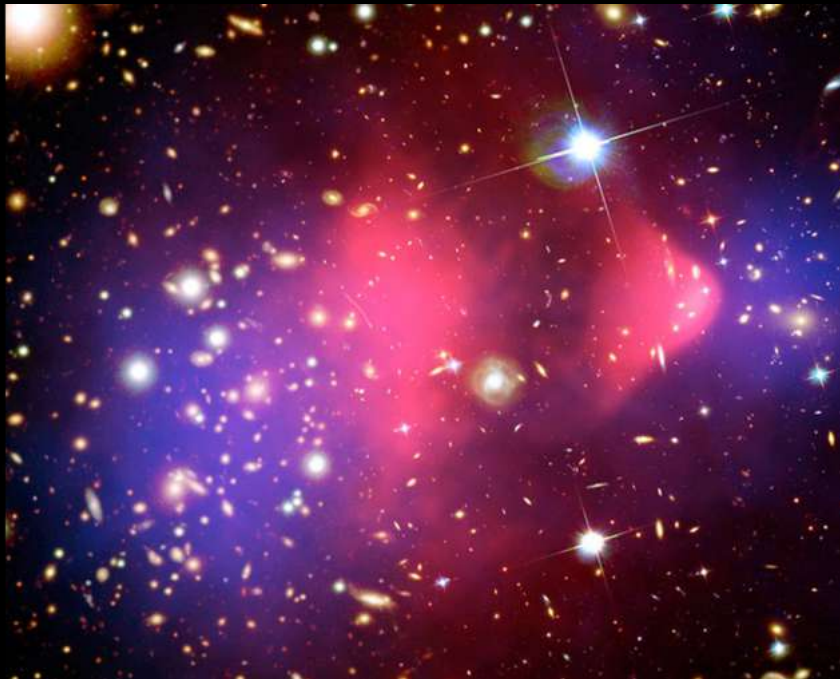
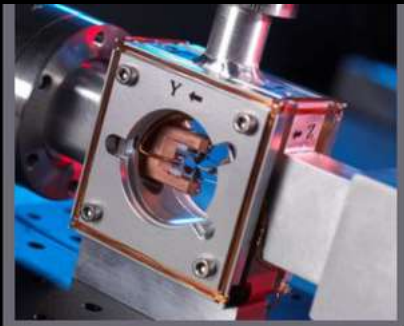
Dark matter, constituting over 80% of the universe's mass, has remained elusive and undetectable on Earth despite extensive experimental endeavors. Central to these efforts is the assumption regarding the local density of dark matter, influencing the sensitivity of experiments by determining the number of dark matter particles interacting with detectors.

In certain models, the density of dark matter can be considerably higher than conventionally assumed, leading to potential concentrations in specific regions. This study focuses on experimental searches utilizing atoms or nuclei, as they exhibit exceptional sensitivity to dark matter signals, especially when dark matter particles possess minuscule masses.

The research team, including Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU) Project Researcher Joshua Eby, University of California, Irvine Postdoctoral Fellow Yu-Dai Tsai, and University of Delaware Professor Marianna S. Safronova, identified a region between the orbit of Mercury and the Sun where dark matter density may be exceptionally high, enhancing sensitivity to oscillating signals. These oscillations in the constants of nature induced by light dark matter particles, such as variations in the mass of the electron or the interaction strength of the electromagnetic force, lead to predictable modifications in transition energies of atoms and nuclei.

Atomic clocks, operating by precisely measuring photon frequency emissions during state transitions in atoms, can pick up these signals. The presence of ultralight dark matter near the clock experiment can alter these frequencies, causing slight fluctuations in photon energy.

Eby emphasized, "The more dark matter there is around the experiment, the larger these oscillations are, so the local density of dark matter matters a lot when analyzing the signal."



(Left) Atomic clocks in use at the NPL (Right) the bullet cluster a collision between two galaxies with a morphology that indicates the presence of dark matter (Image credit: X-ray: NASA/CXC/M.Markevitch et al.; Optical: NASA/STScI; Magellan/U.Arizona/D.Clowe et al.; Lensing Map: NASA/STScI; ESO WFI; Magellan/U.Arizona/D.Clowe et al/NPL/University of Sussex)

While the exact density of dark matter near the Sun remains uncertain, even a relatively low-sensitivity search could yield vital insights. In the region between the Sun and Mercury, where constraints on planet orbits are minimal, a measurement on a spacecraft could swiftly establish leading limits on dark matter within these models.

The technology required to test this theory already exists, with the NASA Parker Solar Probe positioned closer to the Sun than any previous human-made craft. Equipped with shielding, this probe is set to move even closer to the Sun, providing a potential platform for the experiment. Apart from unraveling dark matter's mysteries, space-based atomic clocks hold promise for enhancing timekeeping on long-distance space missions, including potential journeys to Mars.



The most precise clock ever flown in space, NASA's Deep Space Atomic Clock, could improve spacecraft navigation throughout the solar system. This illustration shows the spacecraft carrying the clock.

OSIRIS-REx: A Triumph of Human Ingenuity

After years of dedication and meticulous planning, NASA's OSIRIS-REx mission has achieved an extraordinary milestone in space exploration. On Sunday, at 8:52 a.m. MDT (8:22 pm, Indian Standard Time (IST), the eagerly awaited capsule containing rocks and dust from asteroid Bennu touched down in the Department of Defense's Utah Test and Training Range near Salt Lake City.

One of the most critical tasks for the OSIRIS-REx team was to establish a "nitrogen purge" around the sample. This process involves maintaining a continuous flow of nitrogen into the capsule, ensuring the preservation of the sample's purity by keeping earthly contaminants at bay.

The collected samples from Bennu hold immense scientific value. They promise to unravel mysteries surrounding planet formation, shed light on the origin of organics and water that contributed to life on Earth, and enhance our understanding of potentially hazardous asteroids.

NASA Administrator Bill Nelson congratulated the OSIRIS-REx team, praising the mission as the first American asteroid sample return in history. He emphasized the importance of this endeavor in safeguarding our planet from potentially hazardous celestial bodies.

The returned Bennu sample, estimated to be around 8.8 ounces or 250 grams, will be transported to NASA's Johnson Space Center in Houston. There, curation scientists will carefully analyze, weigh, and distribute pieces of Bennu to researchers worldwide.

This achievement is the result of a massive collaborative effort involving hundreds of individuals who steered the spacecraft's journey from its launch on September 8, 2016. The team navigated the spacecraft to Bennu, identified a safe sample-collection site, executed the collection, and ensured a successful return journey.





The sample return capsule from NASA's OSIRIS-REx mission is seen shortly after touching down in the desert, on Sunday, Sept. 24, 2023, at the Department of Defense's Utah Test and Training Range. The sample was collected from the asteroid Bennu in October 2020 by NASA's OSIRIS-REx spacecraft.

Credits: NASA/Keegan Barber



This picture was taken from outside a temporary clean room set up in a hangar on the Department of Defense's Utah Test and Training Range. In the picture, OSIRIS-Rex team members are disassembling a capsule, with asteroid sample inside, that landed on the military range on Sept. 24, 2023. Credit: Keegan Barber.

Dante Lauretta, principal investigator for OSIRIS-REx, expressed his elation, recognizing this achievement not only as a triumph for the OSIRIS-REx team but for the entire scientific community. He emphasized that this marks just the beginning of a new phase of research into our solar system's secrets.

The spacecraft, having traveled billions of miles, released its sample capsule toward Earth's atmosphere at 6:42 a.m. EDT. Traveling at an astonishing speed of 27,650 mph, the capsule skillfully navigated the atmosphere before landing off the coast of California. With the deployment of two parachutes, it gently touched down at 11 mph on the military range.

Radar, infrared, and optical instruments meticulously tracked the capsule's descent, leading the recovery team to its precise landing coordinates. Within minutes, they confirmed the capsule's safety and transported it to a temporary clean room, where it remains under continuous supervision. The OSIRIS-REx mission exemplifies what can be achieved through collaborative ingenuity and a shared purpose. It not only adds a remarkable chapter to the annals of space exploration but also paves the way for deeper insights into our solar system's intricacies.

In the grand narrative of space exploration, OSIRIS-REx stands as a testament to human determination, creativity, and the boundless possibilities that lie beyond our earthly bounds.



NASA curation team members along with Lockheed Martin recovery specialists look on after the successful removal of the sample return canister lid. Credit: NASA/Robert Markowitz

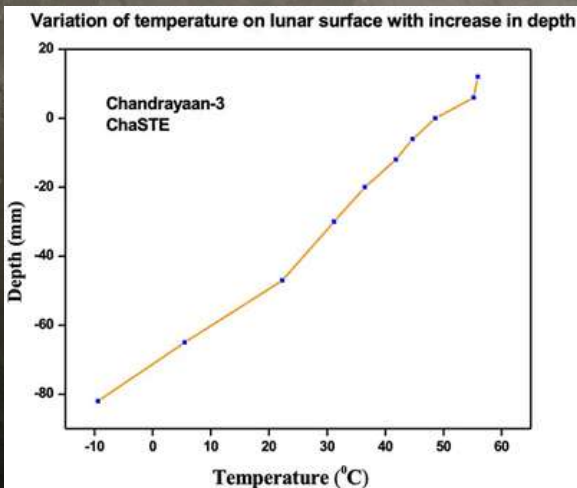


Lockheed Martin Recovery Specialists Levi Hanish and Michael Kaye remove the lid of the sample return canister. Credit: NASA/Robert Markowitz

CHANDRAYAAN-3 SCIENTIFIC FINDINGS

All eyes are on Chandrayaan-3, as ISRO attempts to revive 'The Vikram lander and Pragyan rover today. With dawn breaking on the Moon, ISRO is now gearing up to try to reestablish communication with its lunar mission Chandrayaan-3's solar-powered lander Vikram and rover Pragyan, to revive them so that they can continue with scientific experiments. Both the lander and the rover were put into sleep mode earlier this month on September 4 and 2 respectively, ahead of the lunar night setting in on Earth's only natural satellite.

The major challenge for 'Pragyan and Vikram' would be to come back in action after surviving the chilling -200 degrees Celsius of temperature. If the onboard instruments survive the low temperature on the Moon, the modules can come back to life and continue their mission to send information from the moon for the next fourteen days. If things go as per the plan, the rover will start moving after the commands are fed into the rover. Later, the same procedure will be repeated on the lander module.



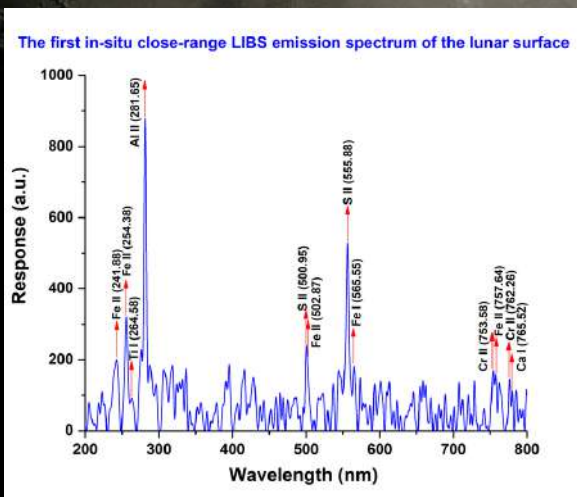
The first observations from the ChaSTE payload onboard Vikram Lander:

ChaSTE (Chandra's Surface Thermophysical Experiment) measures the temperature profile of the lunar topsoil around the pole, to understand the thermal behavior of the moon's surface. It has a temperature probe equipped with a controlled penetration mechanism capable of reaching a depth of 10 cm beneath the surface. The probe is fitted with 10 individual temperature sensors.

LIBS confirms the presence of Sulphur (S) on the lunar surface through unambiguous in-situ measurements:

The Chandrayaan-3 Rover's Laser-Induced Breakdown Spectroscopy (LIBS) instrument achieved a historic feat, providing in-situ measurements of the lunar surface composition near the south pole. This groundbreaking discovery unequivocally confirmed the presence of Sulphur (S), a revelation beyond the capabilities of orbiter instruments.

Utilizing intense laser pulses, LIBS generated a plasma from surface materials, enabling precise elemental analysis. Initial findings showcased Aluminum (Al), Sulphur (S), Calcium (Ca), Iron (Fe), Chromium (Cr), and Titanium (Ti). Further investigations unveiled manganese (Mn), silicon (Si), and oxygen (O). Ongoing research focuses on Hydrogen's presence. This achievement marks a significant leap in lunar exploration, expanding our understanding of celestial bodies beyond Earth.



APXS on-board Ch-3 rover detects the presence of minor elements

The APXS instrument on Chandrayaan-3's rover is ideal for analyzing soil and rocks on airless planetary bodies like the Moon. It employs radioactive sources to emit alpha particles and X-rays, revealing elemental composition. Recent observations have detected minor elements, notably Sulfur, alongside anticipated ones like Aluminum, Silicon, Calcium, and Iron. This complements LIBS findings, reinforcing Sulfur's presence. Ongoing scientific scrutiny aims to glean deeper insights.

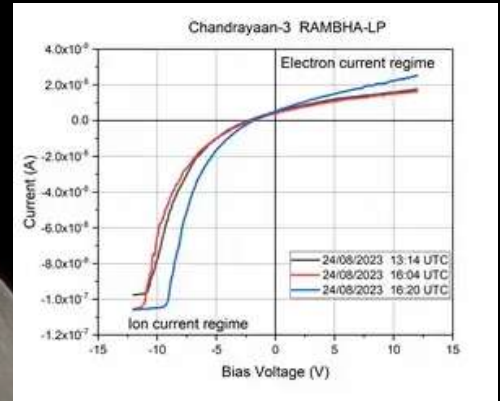
RAMBHA-LP on-board Chandrayaan-3 measures near-surface plasma content

First in-situ measurements of the surface-bound Lunar plasma environment over the south polar region have been carried out by the Radio Anatomy of Moon Bound Hypersensitive ionosphere and Atmosphere - Langmuir Probe (RAMBHA-LP) payload onboard Chandrayaan-3 Lander.

Langmuir (after Irving Langmuir) probe is a device used for characterising a plasma. It features a 5 cm metallic spherical probe mounted on a 1-meter boom attached to the Chandrayaan-3 Lander's upper deck. The probe is deployed using a hold-release mechanism after the lander's lunar touchdown. The extended boom length ensures that the spherical probe operates within the undisturbed lunar plasma environment, isolated from the lander's body.

The system can detect minute return currents, as low as pico-amperes, with a dwell time of 1 millisecond. By applying a sweeping bias potential ranging from -12 to +12 V in increments of 0.1 V to the Langmuir probe, the system can accurately determine ion and electron densities as well as their energies based on the measured return current.

The initial assessment indicates that the plasma encompassing the lunar surface is relatively sparse, characterized by a number density ranging from approximately 5 to 30 million electrons per cubic meter. This evaluation specifically pertains to the early stages of the lunar daytime. The Probe operates without interruption, aiming to explore the changes occurring in the near-surface plasma environment throughout the lunar day. These ongoing observations hold significant implications for comprehending the process of charging within the lunar near-surface region, particularly in response to the fluctuations in solar space weather conditions.

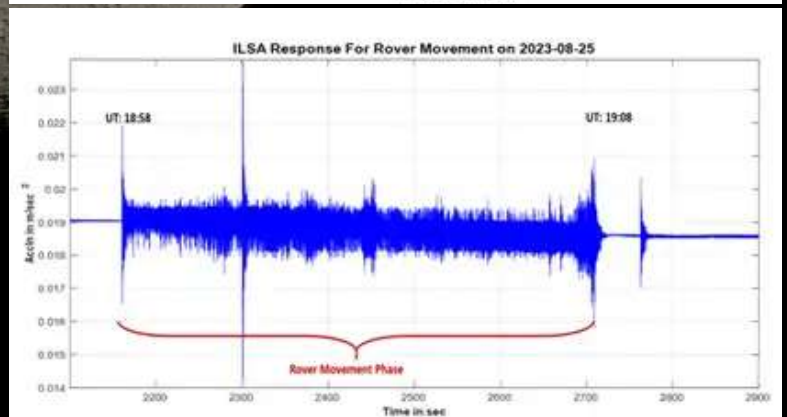
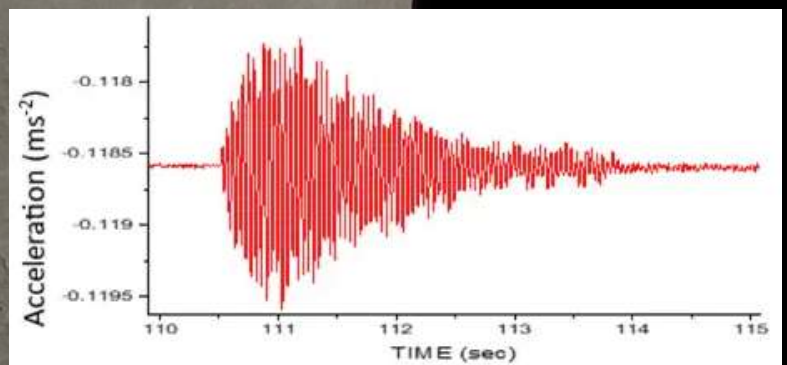


ILSA listens to the movements around the landing site

The Instrument for Lunar Seismic Activity (ILSA) payload on the Chandrayaan 3 Lander is the first instance of a Micro Electro Mechanical Systems (MEMS) technology-based instrument on the moon. It has recorded the vibrations occurring due to the movements of Rover and other payloads.

ILSA comprises a cluster of six high-sensitivity accelerometers, which are indigenously fabricated using the Silicon Micromachining process. The core sensing element consists of a spring-mass system with comb-structured electrodes. External vibrations lead to a deflection of the spring, resulting in a change in capacitance which is converted into voltage.

ILSA's primary objective is to measure ground vibrations generated by natural quakes, impacts, and artificial events. The vibrations recorded during the rover's navigation on August 25, 2023, are depicted in the figure. Additionally, an event, seemingly natural, recorded on August 26, 2023, is also shown. The source of this event is currently under investigation.



BUBBLE OF GALAXIES SPANNING 1 BILLION LIGHT-YEARS COULD BE A FOSSIL OF THE BIG BANG

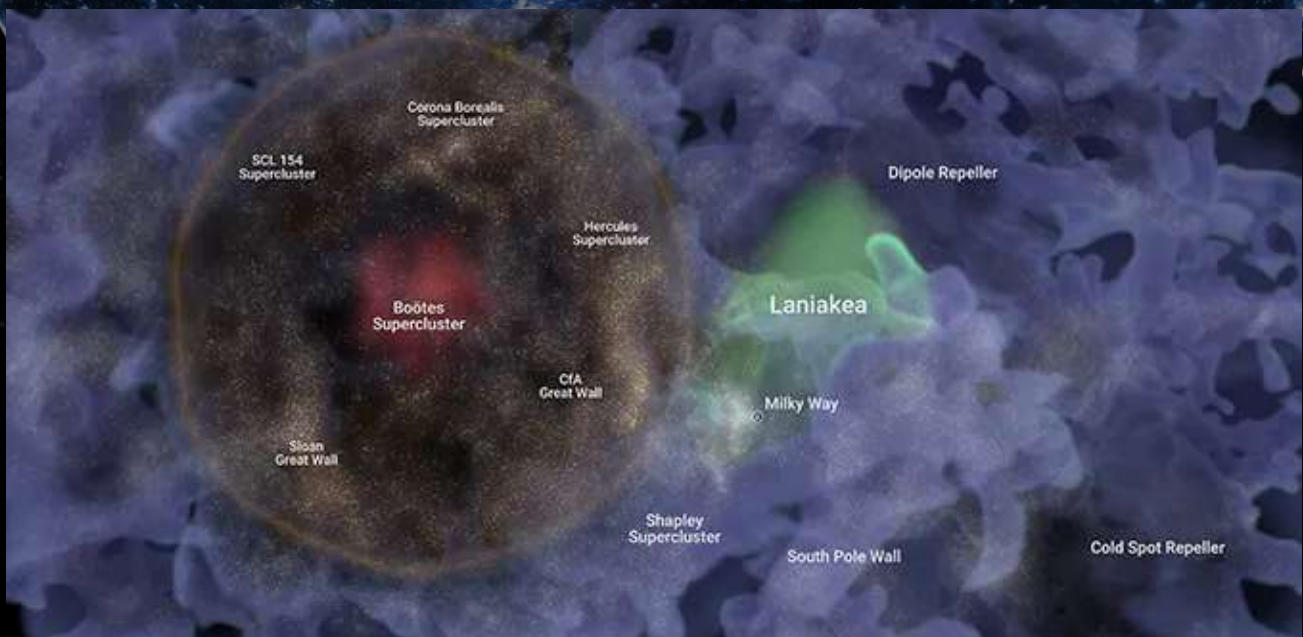
In a monumental discovery, astronomers have unveiled the first-ever "bubble of galaxies," an astronomical structure of staggering proportions, believed to be a preserved relic from the early stages of the universe, shortly after the Big Bang. This colossal bubble spans an astonishing one billion light-years, dwarfing the Milky Way galaxy by a factor of 10,000. Despite its monumental scale, this cosmic bubble, imperceptible to the naked eye, lies relatively nearby at a distance of 820 million light-years from our home galaxy, categorized as part of the "nearby universe" by astronomers.

This extraordinary structure resembles a "spherical shell with a heart," according to Daniel Pomarede, an astrophysicist at France's Atomic Energy Commission. Nestled within this heart is the Bootes supercluster, surrounded by a vast expanse known as "the Great Nothing." This shell encompasses several other known galaxy superclusters, including the immense Sloan Great Wall. The discovery, detailed in research co-authored by Pomarede and published in *The Astrophysical Journal*, represents a culmination of a protracted scientific endeavor. It affirms a concept initially posited by renowned US cosmologist Jim Peebles, who postulated the existence of baryon acoustic oscillations (BAOs) in the early universe—a consequence of gravitational and radiation forces creating sound waves in the hot plasma.

Around 380,000 years post-Big Bang, as the universe cooled, these oscillations were preserved, becoming fossilized bubbles. Over time, they expanded with the universe, akin to other remnants from the aftermath of the Big Bang. While BAO signals were first detected in 2005, this newfound bubble stands as the first solitary baryon acoustic oscillation.

Named Ho'oleilana, meaning "sent murmurs of awakening" from a Hawaiian creation chant, this bubble was serendipitously discovered during Brent Tully's galaxy catalog exploration. It is so immense that it stretches to the very edges of the surveyed sky sector. Through meticulous analysis and mathematical modeling, the researchers unveiled the three-dimensional contours of Ho'oleilana and the galaxy archipelagos ensconced within.

This groundbreaking discovery could be just the beginning, as future space telescopes and radio observatories promise further revelations about the enigmatic structures that populate our universe.



An illustration of the billion light year wide bubble of galaxies named Ho'oleilana. (Image credit: Frédéric Durillon, Animea Studio; Daniel Pomarède, IRFU, CEA University Paris-Saclay.)

UNRAVELING THE ENIGMA OF ANTIMATTER A GRAVITY-DEFYING REVELATION

The recent breakthrough in the study of antimatter has unveiled a world of astonishing paradoxes. Antimatter, often considered the enigmatic counterpart to normal matter, has long puzzled scientists with its counterintuitive behavior. The revelation that antimatter responds to gravity in a manner akin to regular matter marks a watershed moment in the realm of particle physics.

The experiment, conducted by an international team of physicists, involved the meticulous creation, trapping, and study of antihydrogen particles at CERN. Within a magnetic bottle, the particles were subjected to varying magnetic field strengths, allowing researchers to observe the subtle effects of gravity. Astonishingly, a staggering 80% of the particles exhibited a downward motion, conclusively demonstrating that antihydrogen succumbs to gravity's pull.

This discovery not only provides concrete evidence of antimatter's gravitational behavior but also bolsters Einstein's general theory of relativity, asserting that all masses, regardless of their internal composition, react to gravity uniformly. The gravitational acceleration observed in antihydrogen aligns closely with that of normal matter, further solidifying this groundbreaking observation.

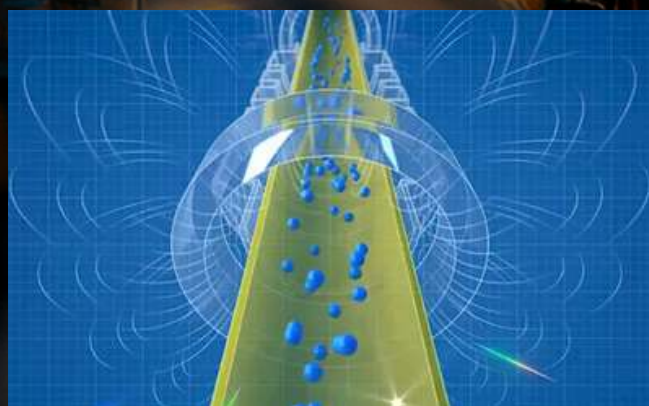
However, this revelation raises a tantalizing question: if matter and antimatter behave so similarly, what accounts for the universe's conspicuous absence of antimatter? The Standard Model of particle physics postulates that matter and antimatter pairs annihilate each other upon contact, leaving behind pure energy. Yet, the prevailing dominance of matter in the observable universe remains an unsolved puzzle.

The experiment's precision, while consistent with general relativity, does not provide insight into the scarcity of antimatter. The processes that tipped the cosmic balance in favor of matter over antimatter during the universe's evolution remain shrouded in mystery.

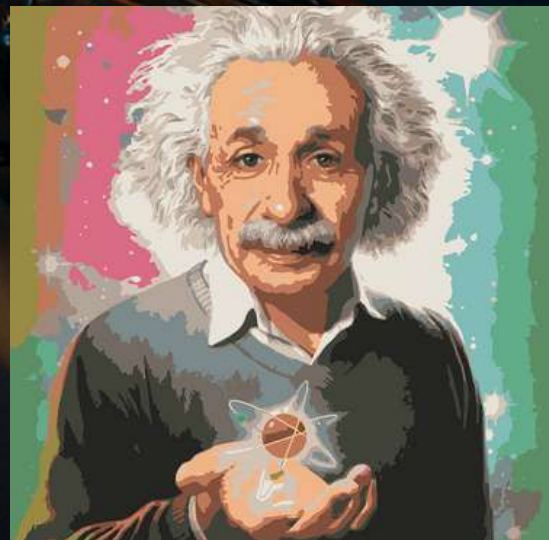


As scientists continue to push the boundaries of knowledge, the pursuit of antimatter's gravitational nature promises to unlock new realms of understanding. While the prospects of uncovering the universe's missing antimatter may seem daunting, the pursuit is not in vain. With the potential for future experiments to yield even more precise measurements, there remains hope for further revelations that could reshape our understanding of the cosmos.

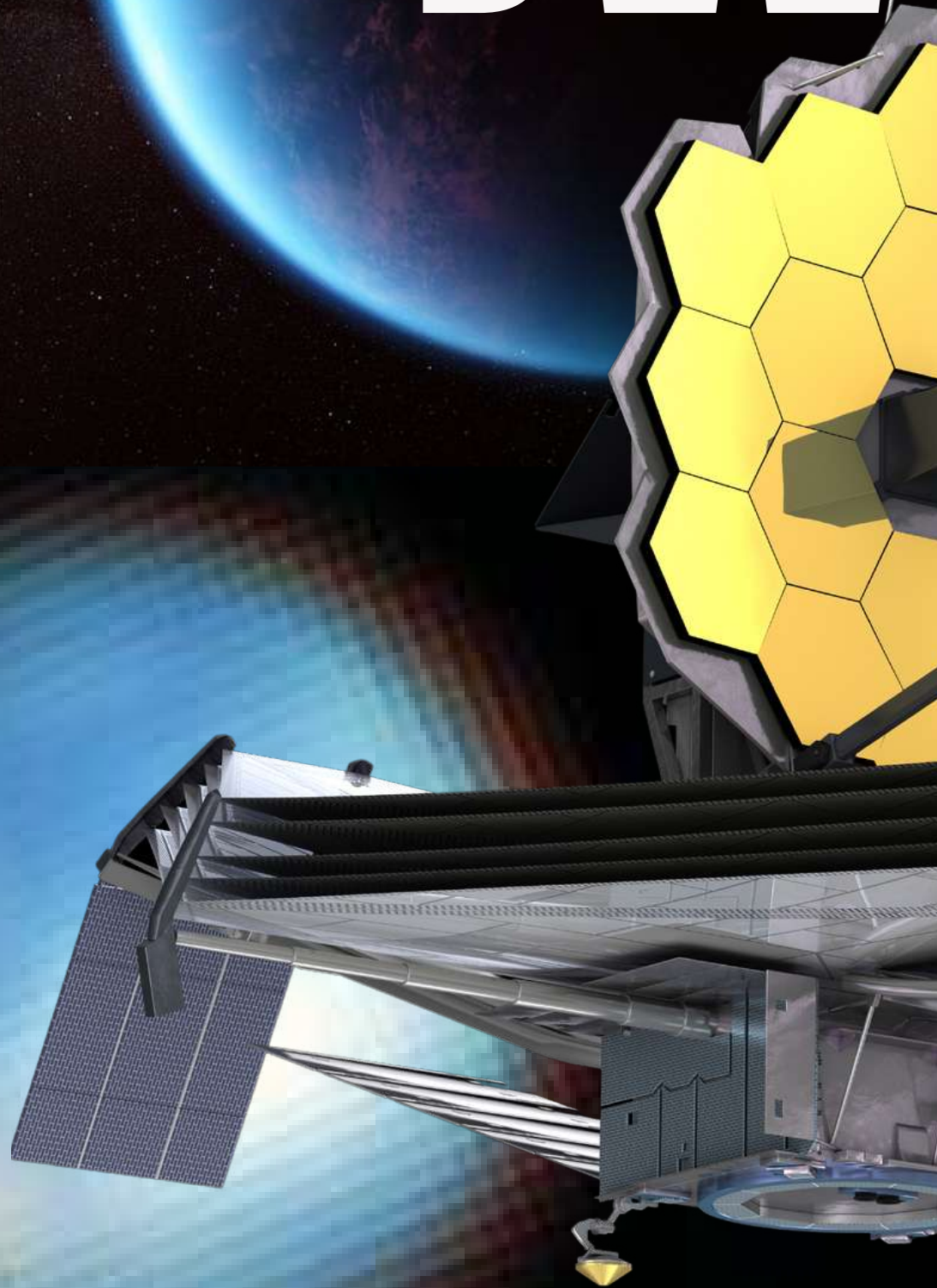
Antimatter Particles (Photo Credit: X/ @CERN)



Einstein Was Right: Experiment Confirms Antimatter Reacts to Gravity (Image credit: Keyi "Onyx" Li/U.S. National Science Foundation)



JWST



GALACTICA

ST



WEBB DISCOVERS METHANE, CARBON DIOXIDE IN ATMOSPHERE OF K2-18 B

NASA's James Webb Space Telescope has conducted a groundbreaking investigation into K2-18 b, an exoplanet approximately 8.6 times the mass of Earth. This distant world orbits a cool dwarf star, K2-18, in the habitable zone and is located 120 light-years away in the constellation Leo. K2-18 b falls into a category known as 'sub-Neptunes', which are exoplanets with sizes ranging between Earth and Neptune, a class not present in our own solar system.

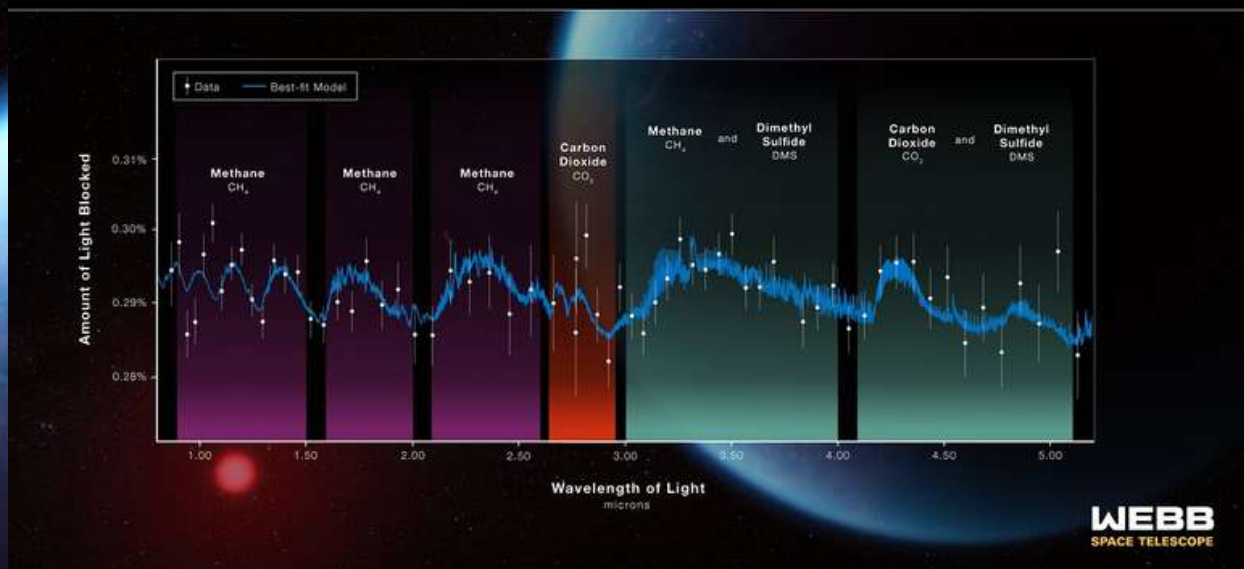
The recent Webb observations have unveiled the presence of carbon-bearing molecules, including methane and carbon dioxide, in K2-18 b's atmosphere. These findings, along with a scarcity of ammonia, suggest the potential existence of a water ocean beneath a hydrogen-rich atmosphere on this planet. Additionally, the telescope's data indicates a possible detection of dimethyl sulfide (DMS), a molecule typically produced by life on Earth, particularly by marine phytoplankton.

While K2-18 b lies within the habitable zone and hosts carbon-bearing molecules, its large size, about 2.6 times that of Earth, implies the likelihood of a substantial mantle of high-pressure ice, akin to Neptune. The planet's ocean, though predicted to be present, might be too hot for habitability.

EXOPLANET K2-18 b

ATMOSPHERE COMPOSITION

NIRISS and NIRSpec (G395H)



This discovery adds weight to the hypothesis that K2-18 b could be a Hycean exoplanet, a classification associated with environments conducive to life. The ability to analyze atmospheres of exoplanets is a thriving field in astronomy, despite the challenges posed by the brightness of parent stars. By studying the light as it passes through K2-18 b's atmosphere during transits, astronomers were able to glean crucial information about its gases.

The team behind this research plans to conduct further investigations using Webb's MIRI spectrograph, with the hope of confirming and expanding upon their initial findings. Ultimately, these results mark a significant step toward understanding the potential habitability of Hycean worlds, and they fuel the broader quest to identify life on distant exoplanets.

JWST SNAPS SUPERSONIC OUTFLOW OF YOUNG STAR

NASA's James Webb Space Telescope has captured a striking image of HH 211, a Herbig-Haro (HH) object, unveiling a celestial spectacle around a Class 0 protostar. This protostar mirrors our Sun's early stages, just tens of thousands of years old, and a mere 8% of its current mass. The telescope's infrared capabilities prove pivotal in studying nascent stars, as they remain shrouded within their birth molecular clouds. This allows Webb to peer through the obscuring veil of gas and dust, making HH 211 an ideal subject.

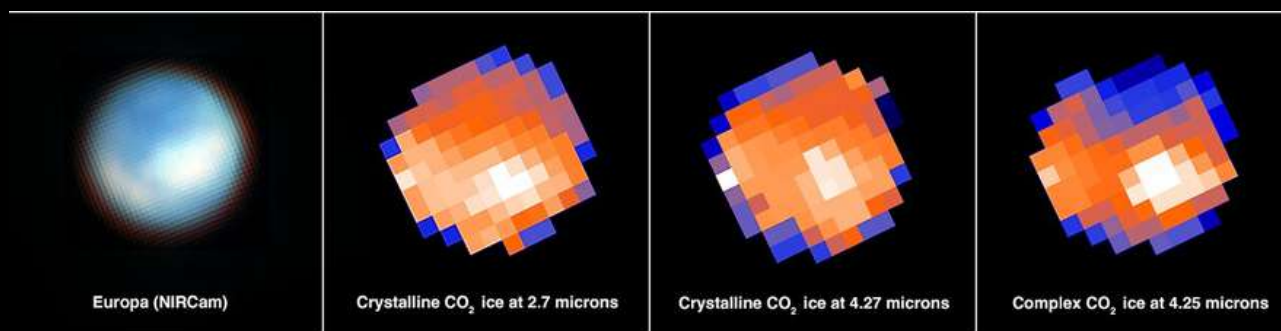
In this high-resolution image, a sequence of bow shocks is displayed in the southeast and northwest, propelled by a narrow bipolar jet emanating from the central protostar. Remarkably, Webb's image showcases details at a spatial resolution 5 to 10 times finer than any prior observations of HH 211. The inner jet exhibits a symmetric oscillation, hinting at the possibility of an unresolved binary star system at the core.

Previous ground-based observations highlighted expansive bow shocks in motion and cavity-like formations in shocked hydrogen and carbon monoxide. Additionally, a convoluted bipolar jet in silicon monoxide was detected. Webb's new data has revealed that HH 211's outflow exhibits a more leisurely pace compared to more mature protostars with analogous outflows. The innermost outflow segments were found to travel at speeds ranging from 48 to 60 miles per second. Notably, the disparity in velocity between these segments and the oncoming shockwave is minimal. This leads researchers to infer that the outflows from fledgling stars, like the one at the heart of HH 211, are predominantly composed of intact molecules, as the relatively modest shockwave velocities lack the energy needed to dismantle them into simpler atomic constituents.

NASA'S WEBB FINDS CARBON SOURCE ON SURFACE OF JUPITER'S MOON EUROPA

Jupiter's moon Europa is one of a handful of worlds in our solar system that could potentially harbor conditions suitable for life. Previous research has shown that beneath its water-ice crust lies a salty ocean of liquid water with a rocky seafloor. However, planetary scientists had not confirmed if that ocean contained the chemicals needed for life, particularly carbon.

Astronomers using data from NASA's James Webb Space Telescope have identified carbon dioxide in a specific region on the icy surface of Europa. Analysis indicates that this carbon likely originated in the subsurface ocean and was not delivered by meteorites or other external sources. Moreover, it was deposited on a geologically recent timescale. This discovery has important implications for the potential habitability of Europa's ocean.



This graphic shows a map of Europa's surface with NIRCams (Near Infrared Camera) on NASA's James Webb Space Telescope in the first panel and compositional maps derived from Webb's NIRSpec/IFU (Near Infrared Spectrograph's Integral Field Unit) data in the following three panels. In the compositional maps, the white pixels correspond to carbon dioxide in the large-scale region of disrupted chaos terrain known as Tara Regio (center and right), with additional concentrations within portions of the chaos region Powys Regio (left). The second and third panels show evidence of crystalline carbon dioxide, while the fourth panel indicates a complexed and amorphous form of carbon dioxide.

Image Processing Credit: Geronimo Villanueva (NASA/GSFC), Alyssa Pagan (STScI)

"On Earth, life likes chemical diversity – the more diversity, the better. We're carbon-based life. Understanding the chemistry of Europa's ocean will help us determine whether it's hostile to life as we know it, or if it might be a good place for life," said Geronimo Villanueva of NASA's Goddard Space Flight Center in Greenbelt, Maryland, lead author of one of two independent papers describing the findings.

"We now think that we have observational evidence that the carbon we see on Europa's surface came from the ocean. That's not a trivial thing. Carbon is a biologically essential element," added Samantha Trumbo of Cornell University in Ithaca, New York, lead author of the second paper analyzing these data.

NASA plans to launch its Europa Clipper spacecraft, which will perform dozens of close flybys of Europa to further investigate whether it could have conditions suitable for life, in October 2024.

GALACTICA

A Surface-Ocean Connection

Webb finds that on Europa's surface, carbon dioxide is most abundant in a region called Tara Regio – a geologically young area of generally resurfaced terrain known as "chaos terrain." The surface ice has been disrupted, and there likely has been an exchange of material between the subsurface ocean and the icy surface.

"Previous observations from the Hubble Space Telescope show evidence for ocean-derived salt in Tara Regio," explained Trumbo. "Now we're seeing that carbon dioxide is heavily concentrated there as well. We think this implies that the carbon probably has its ultimate origin in the internal ocean."

"Scientists are debating how much Europa's ocean connects to its surface. I think that question has been a big driver of Europa exploration," said Villanueva. "This suggests that we may be able to learn some basic things about the ocean's composition even before we drill through the ice to get the full picture."

Both teams identified the carbon dioxide using data from the integral field unit of Webb's Near-Infrared Spectrograph (NIRSpec). This instrument mode provides spectra with a resolution of 200 x 200 miles (320 x 320 kilometers) on the surface of Europa, which has a diameter of 1,944 miles, allowing astronomers to determine where specific chemicals are located.

Carbon dioxide isn't stable on Europa's surface. Therefore, the scientists say it's likely that it was supplied on a geologically recent timescale – a conclusion bolstered by its concentration in a region of young terrain.


"These observations only took a few minutes of the observatory's time," said Heidi Hammel of the Association of Universities for Research in Astronomy, a Webb interdisciplinary scientist leading Webb's Cycle 1 Guaranteed Time Observations of the solar system. "Even with this short period of time, we were able to do really big science. This work gives a first hint of all the amazing solar system science we'll be able to do with Webb."

Searching for a Plume

Villanueva's team also looked for evidence of a plume of water vapor erupting from Europa's surface. Researchers using NASA's Hubble Space Telescope reported tentative detections of plumes in 2013, 2016, and 2017. However, finding definitive proof has been difficult.

The new Webb data shows no evidence of plume activity, which allowed Villanueva's team to set a strict upper limit on the rate of material potentially being ejected. The team stressed, however, that their non-detection does not rule out a plume.

"There is always a possibility that these plumes are variable and that you can only see them at certain times. All we can say with 100% confidence is that we did not detect a plume at Europa when we made these observations with Webb," said Hammel.



NIRCam (the Near Infrared Camera) on NASA's James Webb Space Telescope captured this picture of the surface of Jupiter's moon Europa. Webb identified carbon dioxide on the icy surface of Europa that likely originated in the moon's subsurface ocean.

Image Processing Credit: Geronimo Villanueva (NASA/GSFC), Alyssa Pagan (STScI)

WHAT'S UP IN THE SKY - OCTOBER 2023

LUNAR CALENDAR

IMPORTANCE OF MOON PHASES FOR STARGAZERS

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

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

Monthly Lunar Calendar October 2023

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

PLANETS VISIBILITY

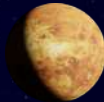
Mercury

Visible during the first week of October, bright in the morning but lost after.



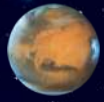
Venus

Brilliant morning planet at greatest western elongation on 23 October, 46.4° from the Sun.



Mars

Mars appears along with the sun, thus not visible this month.



Jupiter

Jupiter is very bright (mag. -2.8) and really well placed this month in southern Aries.



Saturn

Well placed evening planet. A gibbous Moon is nearby on the evenings of 24 October.



Uranus

Well-placed with Jupiter nearby; both joined by a gibbous Moon on 1/2 October.



Neptune

Well-placed evening planet. Reaches the highest point, due south in darkness all month.



BRIGHT DEEP SKY OBJECTS

Messier 25 (M25) is a bright, prominent open cluster located in Sagittarius constellation. The cluster lies at a distance of 2,000 light years from Earth, and has an apparent magnitude of 4.6. Its designation in the Index Catalogue is IC 4725. It lies 6.5 degrees north and a little east of Lambda Sagittarii, the star that marks the top of the Teapot asterism in Sagittarius.



Lagoon Nebula (M8) was discovered in 1654 by the Italian astronomer Giovanni, sought to catalog nebulous objects in the night sky so they would not be mistaken for comets. This star-forming cloud of interstellar gas is located in the constellation Sagittarius and its apparent magnitude of 6 makes it faintly visible to the naked eye in dark skies.

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



The Andromeda Galaxy is a barred spiral galaxy and is the nearest major galaxy to the Milky Way. It was originally named the Andromeda Nebula and is cataloged as Messier 31, M31, and NGC 224. Andromeda has a diameter of about 152,000 light-years and is approximately 2.5 million light-years from Earth.

ROCKET LAUNCHES IN OCTOBER 2023

MIURA 1



PLD Space is ready to launch its first flight on October 7th, 2023 at 11 AM.

The first flight of PLD Space's MIURA 1 SN1 technology demonstrator allows the collection of as much data as possible for the validation and design of the technology to be transferred and integrated into MIURA 5. In addition, this first suborbital flight allows ZARM Research Institution to study microgravity conditions, gathering information necessary for scientific experiments in future suborbital flights. Finally, a PLD Space team shall pick up the rocket in the Atlantic Ocean once the splashdown is completed.

MIURA1 is a suborbital launch vehicle, privately developed in Europe. The first space system is fully designed by PLD Space to take your payloads into space and bring them back safely. Our goal is to push forward scientific research and technology development under microgravity conditions.

The 1st flight of our technological demonstrator MIURA 1 SN1 will allow us to gather as much data as possible for the validation and design of the technology that will be later transferred to and integrated in MIURA 5.

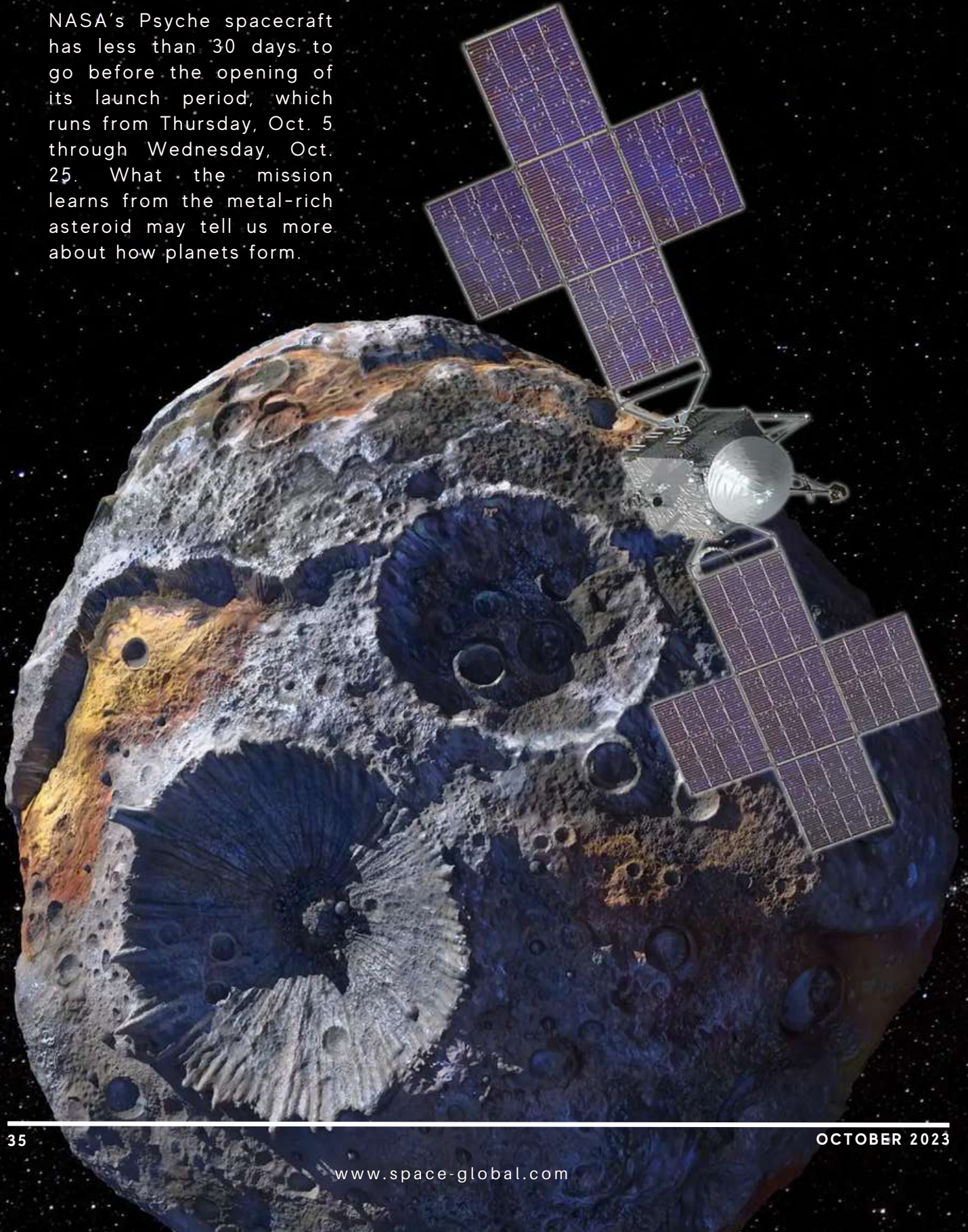
Additionally, this 1st suborbital flight will permit ZARM to study microgravity conditions through the gathering of valuable data needed for scientific experiments to be carried out in future suborbital flights.

The flight will last 12 minutes, during which microgravity conditions will be experienced from an altitude of 80km, and will reach its peak at an altitude of around 150km. A team from PLD Space will recover the rocket from the Atlantic Ocean once landing has occurred. (Credits: PLD Space)

Psyche

Bound for a metal-rich asteroid of the same name, the Psyche mission is targeting October 5 to launch from NASA's Kennedy Space Center in Florida.

NASA's Psyche spacecraft has less than 30 days to go before the opening of its launch period, which runs from Thursday, Oct. 5 through Wednesday, Oct. 25. What the mission learns from the metal-rich asteroid may tell us more about how planets form.

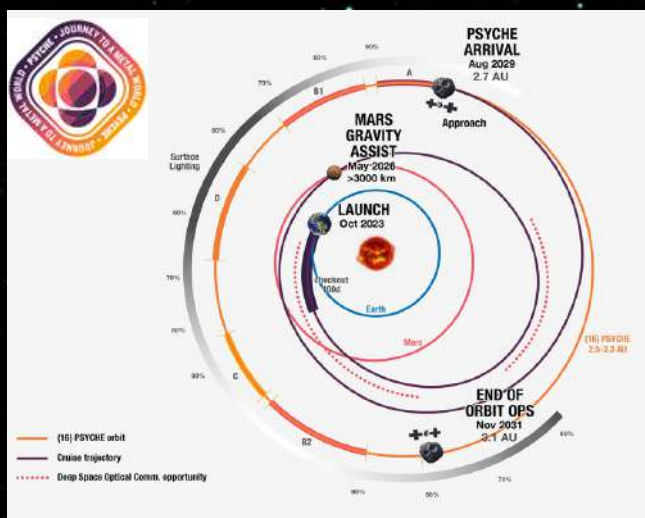


GALACTICA

"These missions take so many people and so much meticulous, rigorous, personally driven work," said Lindy Elkins-Tanton, principal investigator for Psyche at Arizona State University. "I am ready to be ecstatic. We all are, but we are not ecstatic yet. Let's launch and establish communications – then we can scream, jump, and hug each other!"

The spacecraft's solar arrays are folded like an envelope into their stowed position. Xenon gas – fuel for the journey to the asteroid belt – is loaded. All four thrusters have passed their final tests. Engineers have confirmed the massive high-gain antenna is set to transmit data. The software is tested and ready. The science instruments – a multispectral imager, magnetometer, and gamma-ray and neutron spectrometer – that will investigate the asteroid Psyche are poised for action.

Within two weeks, technicians will begin encapsulating the spacecraft in its payload fairing – the cone at the top of the rocket – and the spacecraft will move to SpaceX facilities at NASA's Kennedy Space Center in Florida. Psyche is set to launch atop a SpaceX Falcon Heavy from the center's Launch Complex 39A at 10:38 a.m. EDT (8:08 pm IST) on Oct. 5.



It's getting increasingly real," said Henry Stone, Psyche's project manager at NASA's Jet Propulsion Laboratory in Southern California. "We are counting the days. The team is more than ready to send this spacecraft off on its journey, and it's very exciting."

After escaping Earth's gravity, Psyche will use solar electric propulsion to accomplish its six-year journey to the asteroid. The efficient propulsion system works by accelerating and expelling charged atoms, or ions, of the neutral gas xenon – creating a thrust that gently propels the spacecraft with a force akin to what you'd feel holding a single AA battery in your hand. Technicians recently loaded 2,392 pounds (1,085 kilograms) of xenon onto the spacecraft over the course of about two weeks.

Measuring roughly 173 miles (279 kilometers) at its widest point, the asteroid Psyche presents a unique opportunity to explore a metal-rich body that may be part of a core of a planetesimal, the building block of an early planet. Once the spacecraft reaches Psyche in the main asteroid belt between Mars and Jupiter, it will spend about 26 months orbiting the asteroid, gathering images and other data that will tell scientists more about its history and what it is made of.



THEOS-2 & FORMOSAT-7R/TRITON

Arianespace will launch a Vega rocket on October 5th at 3:06 a.m. IST, designated VV23, sending a collection of 12 satellites into a sun-synchronous orbit. The main payload is the Thailand Earth Observation System-2 (THEOS-2), which is an Earth-observing satellite built by Airbus Defense and Space on behalf of the Kingdom of Thailand. It's designed to complement THEOS-1, which launched in 2008. The secondary payload is FORMOSAT-7R/TRITON, which was developed by the Taiwanese Space Agency (TASA). It's Global Navigation Satellite System-Reflectometry (GNSS-R) tool will help meteorologists gather wind data over oceans to help with forecasting the trajectory and intensity of typhoons. (Image credits: Arianespace)

THEOS-2 is Thailand's first Earth observation satellite. Built by Airbus Defense and Space and based on the Astrobuss-S platform, it is designed for optical measurements with a ground resolution of approximately 1 meter. TRITON or FORMOSAT-7R is an additional satellite by NSPO added to the joint Taiwanese-US FORMOSAT 7 / COSMIC-2 constellation for collecting atmospheric data for weather prediction and for ionosphere, climate and gravity research. Its GNSS Reflectometry payload can be used to calculate the wind speed over sea surfaces. PROBA-V-CC (Project for On-Board Autonomy - Vegetation - Companion CubeSat) is a mission that will fly a scaled-down version of the vegetation-monitoring instrument aboard the Earth-observing PROBA-V to conduct combined experimental observations with its predecessor.



GALACTIC 04 SPACESHIP 2

Virgin Galactic plans to fly again!! The company announced that it's targeting October 5 for the launch of Galactic 04, its fourth commercial spaceflight and ninth space mission overall.

There will be three space tourists aboard, one apiece from the U.S., the U.K., and Pakistan. Galactic 04 will therefore break new ground: Nobody from Pakistan has made it to the final frontier before, according to Virgin Galactic.

Virgin Galactic hasn't released the names of the Galactic 04 trio yet. However, one of the crew members made such an announcement himself. "On Thursday 5th October I WILL FLY TO SPACE. I've waited all my life to write those words," British advertising executive Trevor Beattie, who bought his ticket more than 15 years ago, wrote on X (formerly Twitter).

Galactic 04 will lift off from Spaceport America in New Mexico, carrying the customers to suborbital space and back. They'll make the journey aboard Virgin's VSS Unity space plane, which will be hauled into the sky by a carrier craft named VMS Eve. Eve will drop Unity at an altitude of about 50,000 feet (15,000 meters); the space plane will then fire up its rocket motor to get to suborbital space.

According to the company, the Galactic 04 trio will become Virgin Galactic's 17th, 18th, and 19th astronauts. Joining them in Unity's cabin will be Beth Moses, Virgin Galactic's chief astronaut instructor. Kelly Latimer and C.J. Sturckow will fly VSS Unity, and Nicola Pecile and Jameel Janjua will be under Eve's control. (Image credits: Virgin Galactic)



ANGARA A5 / BRIZ-M

Angara A5 is all set to launch the rocket on October 1st at 11 AM from Cosmodrome Site 1A.

The Khrunichev State Research and Production Space Center has signed contracts for the production of 12 Angara-A5 heavy-lift launch vehicles. They are to be produced at the Center's Production Association Polyot enterprise in the city of Omsk.

According to Nikolai Sevastyanov, Khrunichev Space Center Chairman, Board of Directors, 12 launch vehicles have been confirmed so far, but about 27 Angara-A5 launches will be necessary to update the Russian orbit group until 2027.

The second Angara developed was the Angara A5 heavy-lift launch vehicle, which consists of one URM-1 core and four URM-1 boosters, a 3.6m URM-2 second stage, and an upper stage, either the Briz-M or the KVTK. Weighing 773 tonnes at lift-off, Angara A5 has a payload capacity of 24.5 tonnes to a 200 km (120 mi) x 60° orbit. Angara A5 is able to deliver 5.4 tonnes to GTO with Briz-M, or 7.5 tonnes to the same orbit with KVTK.

In the Angara A5, the four URM-1s used as boosters operate at full thrust for approximately 214 seconds, then separate. The URM-1 forming the vehicle's core is operated at full thrust for lift off, then throttled down to 30% to conserve propellant. The core is throttled back up after the boosters have separated and continues burning for another 110 seconds. (Image credits: Renderspeed)

SpaceX Launches - October 2023

STARLINK GROUP 6-21 FALCON 9 BLOCK 5

Space X is intended to launch the next batch of Starlink satellites. Starlink Group 6-21 is all set to launch on October 5th at 11 AM from Cape Canaveral.

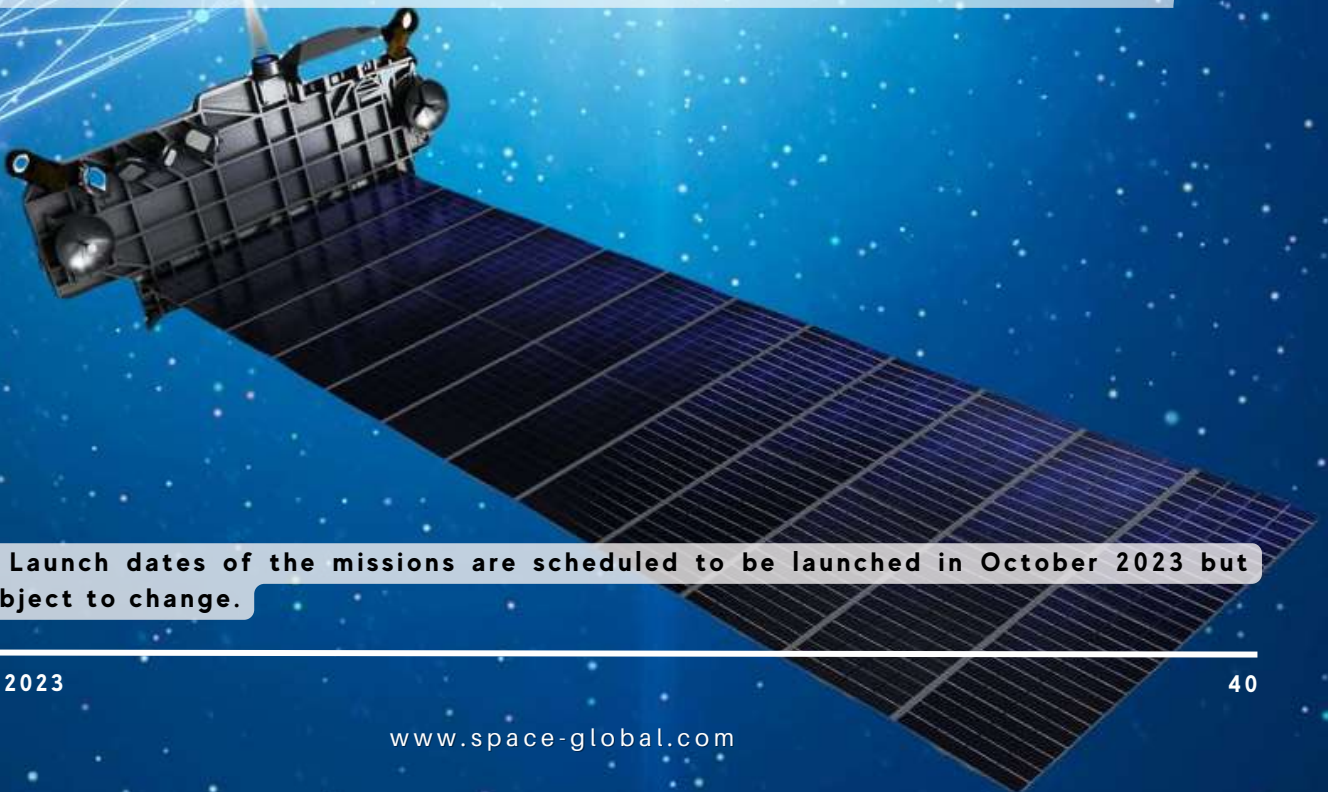
Starlink is the world's first and largest satellite constellation using a low Earth orbit to deliver broadband internet capable of supporting streaming, online gaming, video calls, and more.

Leveraging advanced satellites and user hardware coupled with our deep experience with both spacecraft and on-orbit operations, Starlink delivers high-speed, low-latency internet to users all over the world.

HOW STARLINK WORKS

Most satellite internet services come from single geostationary satellites that orbit the planet at 35,786 km. As a result, the round trip data time between the user and satellite—also known as latency—is high, making it nearly impossible to support streaming, online gaming, video calls, or other high data rate activities.

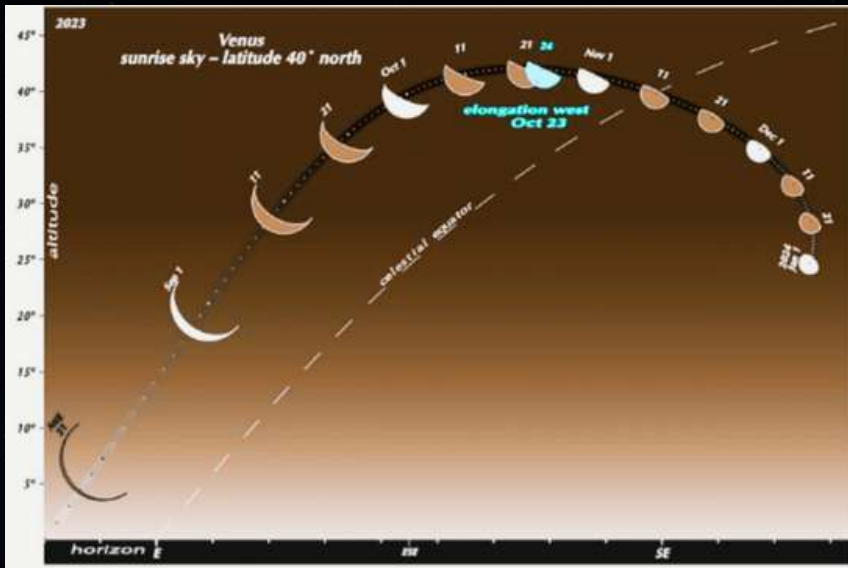
Starlink is a constellation of thousands of satellites that orbit the planet much closer to Earth, at about 550km, and cover the entire globe. Because Starlink satellites are in a low orbit, latency is significantly lower—around 25 ms vs 600+ ms.



****Note: Launch dates of the missions are scheduled to be launched in October 2023 but may subject to change.**

ASTRONOMICAL EVENTS - OCTOBER 2023

VENUS AT GREATEST WESTERN ELONGATION



**BEST DAY
TO OBSERVE
VENUS**

Venus's greatest morning elongation in 2023 from the Northern Hemisphere as viewed through a powerful telescope. (Image Credit: Earthsky)

Venus has a closer orbit around the Sun than Earth. As a result, the planet is rarely far from the Sun when we see it in the sky: we usually view it after sunset or before sunrise. At its brightest and most brilliant, Venus is certainly the brightest and most dazzling planet, and it is lovingly known as the evening star or the morning star. For around nine months, Venus is the evening star. It then quickly passes in front of the Sun, becoming the morning star. After nine months, it moves more slowly behind the Sun and becomes the evening star once more. The elongation of a planet is the distance between it and the Sun as seen from Earth. It is expressed in degrees. The greatest elongation east is the furthest distance Venus reaches from the Sun in the evening sky. (The term "east" refers to Venus's location east of the Sun as they journey from east to west across the sky. Venus, on the other hand, glows in the western sky after sunset.) Similarly, Venus's greatest elongation west is the furthest distance from the Sun that it reaches in the morning sky. In all situations, Venus's maximum elongation is around 46° .

When to watch: Venus raced between the Earth and sun in August 2023, then emerged quickly into the east before sunrise. And it'll remain visible in the morning sky until around May 2024.

Where to look: Look in the sunrise direction while the sky is still dark or just getting light. You can't miss Venus as the very bright morning "star."

Greatest elongation is at 4:30 a.m. on October 23, 2023. Venus's distance from sun on the sky's dome is 46 degrees.

Greatest elongation magnitude: Venus shines with dazzling brightness at magnitude -4.3 .

Through a telescope: Venus appears 50% illuminated, in a 3rd quarter phase, 24 arcseconds across.

"Maximum & Minimum Angular distance of Venus from the sun (seen from the Earth) at greatest elongation are 45 & 12 degrees respectively."

ORIONIDS METEOR SHOWER

The Orionids are regarded as one of the most spectacular showers of the year, peaking in mid-October each year. Orionid meteors are notable for their brightness as well as speed. These meteors are swift and venturing into Earth's atmosphere at 148,000 mph (66 km/s). Fast meteors can leave a bright trail that can last for several seconds to minutes. Fast meteors can sometimes become fireballs: when gazing at the Orionid meteor shower, look for lengthy bursts of light. The Orionids are also framed by some of the brightest stars in the night sky, providing a stunning backdrop for these amazing meteors. The Orionids are viewable in both the Northern and Southern hemispheres during the hours after midnight. Their radiant point in the sky from which the Orionids appear to come – is the constellation, Orion. Orion is also where we get the name for the shower: Orionids.

The pieces of space debris that interact with our atmosphere to create the Orionids originate from comet IP/Halley. Each time that Halley returns to the inner solar system its nucleus sheds ice and rocky dust into space. The dust grains eventually become the Orionids in October and the Eta Aquarids in May if they collide with Earth's atmosphere.

Comet Halley takes about 76 years to orbit the Sun once. The last time Comet Halley was seen by casual observers was in 1986. Comet Halley will not enter the inner solar system again until 2061.

The comet is named after Edmond Halley, who found in 1705 that three earlier comets appeared to reappear every 76 years or so, implying that these observations were all of the same comet. The comet returned as anticipated, and it was named after Halley. Comet Halley is undoubtedly the most well-known comet, having been observed for millennia. The Orionids are the second meteor shower in the year created by Halley's Comet, the Eta Aquarids in May are also created by the famous comet.

Predicted peak: For October 22, 2023, at 05:30 IST

Overall duration of shower: Sept.26 - Nov.22

Radiant: The radiant rises before midnight & is highest in the sky around 2 a.m.

Nearest moon phase: 1st quarter moon falls at 08:59 IST on October 22. So, at the Orionids' peak, the moon will be setting around midnight and not interfere with the meteor shower.

Expected meteors at peak, under ideal conditions: Under a dark sky with no moon, up to 20 meteors are visible every hour.



(Image Credit & Copyright: Lu Shupe)

DRACONIDS METEOR SHOWER

Since the mid-1800s, scientists have known that almost all meteor showers are born through frozen comets. When one of these visitors from deep space enters the inner solar system, heat from the sun forces ice on the comet's surface to sublimate or transform from ice to gas. This is responsible for a comet's stunning tail.

As the ice evaporates, the comet emits dust, sand grains, & even boulder-sized bits of stone, which are left behind in its path. With each circle, the process generates a stream of debris along the comet's path that lasts long after the filthy ice ball has returned to the solar system's outskirts. In some cases, Earth crosses through the debris streams during its trip around the sun. As the planet plows through the cometary leftovers, rocky bits slam into our atmosphere and burn up, creating a spectacular display in the night sky.

Meteor showers acquire their name based on the constellation from which they appear to originate. The Draconids owe their name to the constellation Draco: The Dragon, and are created when the Earth passes through the dust debris left by comet 21P/Giacobini-Zinner hence, they're sometimes referred to as the "Giacobinids". The comet takes about 6.6 years to make a single revolution around the Sun. The Draconid shower is a real oddity, in that the radiant point stands highest in the sky as darkness falls. That means, unlike many meteor showers, more Draconids are likely to fly in the evening hours than in the morning hours after midnight. This shower is usually a sleeper, producing only a handful of languid meteors per hour in most years.

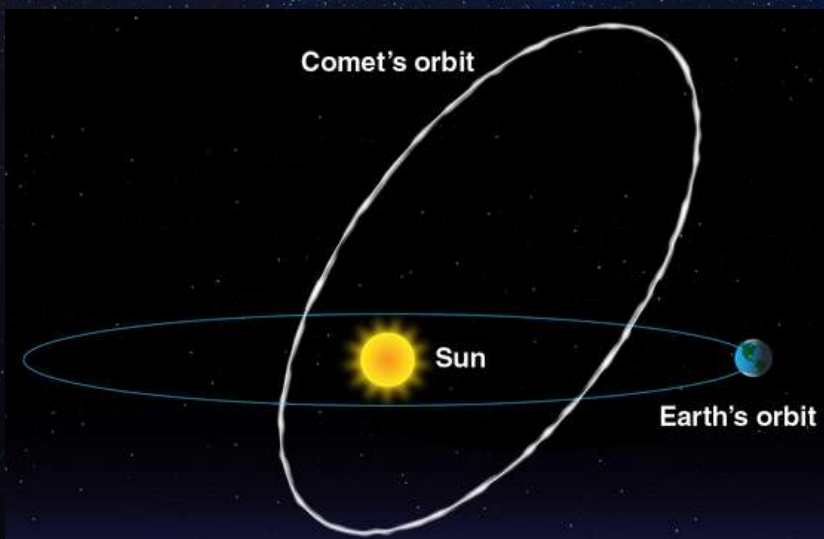
Predicted peak: October 9, 2023, at 12:30 IST

Overall duration of shower: October 6-10

Radiant: Highest in the sky in the evening hours.

Nearest moon phase: Last quarter moon is 18:48 IST on October 6. In 2023, a waning crescent moon will be visible on the mornings of October 8 & 9.

Expected meteors at peak, under ideal conditions: Under a dark sky with no moon, you might catch 10 Draconid meteors per hour.



(Image Credit: NASA)



PARTIAL LUNAR ECLIPSE

The Moon's orbital path around the Earth is inclined at an angle of 5° to the Earth's orbital plane around the Sun. This tilt is what causes infrequent eclipses rather than monthly eclipses. The points where the two orbital planes meet are called lunar nodes. When the Moon is near a node at full moon or a new moon, these eclipses occur.

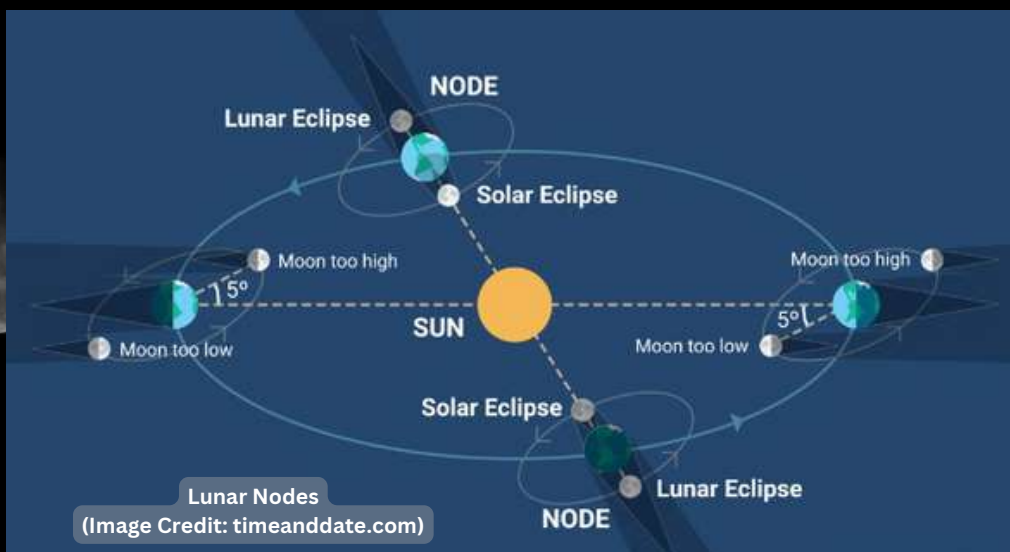
The word "Eclipse" means partial or total blocking of light of one celestial object by another. Lunar eclipses occur when the Earth comes between the sun and the moon, casting a shadow on the moon's surface, and are only visible during the time of the full moon. The Earth's shadow can be divided into two different parts: the umbra and the penumbra. The Umbra is the center portion of the shadow where the Earth completely blocks direct sunlight. However, since the Sun appears to be one-quarter the size of Earth in the lunar sky, the planet only partially shields direct sunlight within the outer section of the shadow which is known as the Penumbra shadow.

Based on how the sun, Earth, and moon are positioned and which shadow type is involved, at the time of the occurrence this lunar eclipse is further classified into three categories i.e. Total lunar eclipse, Partial lunar eclipse & Penumbral lunar eclipse. Partial lunar eclipse occurs because of an incorrect alignment of the Sun, Earth, and Moon, i.e. the Moon passes through just a portion of the Earth's umbra. That means one part of the moon is in the Earth's umbra, while the other part is in the Earth's penumbra. The shadow during this phenomenon develops and then fades, never completely covering the Moon. All lunar eclipses are safe to watch with the naked eye, which makes them advantageous compared to solar eclipses. This is due to the fact that lunar eclipses just reflect sunlight; they are no brighter than a full Moon, which you have most likely safely viewed many times before.

Visibility: On October 28, 2023; from 01:06 a.m. to 02:23 a.m. IST

Visible from locations: With clear skies, can be seen from anywhere on the night side of the Earth. The full eclipse will be visible from certain locations including Africa, Oceania, North & South America, Asia, & Europe

Maxima: At 1:45 a.m. IST; 12% of the lunar disk will lie in shadow.



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. In astronomy, conjunctions relate to two or more objects brought together in the sky. 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 October 2nd, the gas giant Jupiter will meet the 17-day-old Moon in the constellation Aries. The apparent distance between the two objects will be $3^{\circ}23'$ in the late night. They will be in the Eastern direction. Jupiter is at a magnitude of -2.8 and the Moon has a magnitude of -11.66 .



Place: New Delhi / Date: 2nd October / Time: 08:45 PM

Conjunction of Moon and Saturn

On October 24th, the ringed planet Saturn will meet the 10-day-old Moon in the constellation Aquarius. The apparent distance between the two objects will be $2^{\circ}46'$ in the late night. They will be in the Western direction. Saturn is at a magnitude of 0.5 and the Moon has a magnitude of -12.4 .



Place: New Delhi / Date: 24th October / Time: 08:45 PM

WORLD SPACE WEEK 2023

WHAT IS WORLD SPACE WEEK?

The United Nations General Assembly declared in 1999 that World Space Week (WSW) will be held each year from October 4-10. The dates were in recognition of the October 4, 1957 launch of the first human-made Earth satellite, Sputnik 1, thus opening the way for space exploration and the October 10, 1967 signing of the Treaty on Principles Governing the Activities of States in the Exploration and Peaceful Uses of Outer Space, including the Moon and Other Celestial Bodies.

World Space Week is an international celebration of science and technology and their contribution to the betterment of the human condition. World Space Week aims to:

- Provide unique leverage in space outreach and education
- Educate people around the world about the benefits that they receive from space
- Encourage greater use of space for sustainable economic development
- Demonstrate public support for space programs
- Excite young people about science, technology, engineering, and math Foster international cooperation in space outreach and education.



The World Space Week 2023 theme is "Space and Entrepreneurship" to be celebrated from 4th October to 10th October 2023. At SPACE, we are committed to inspiring the next generation of space enthusiasts, and this year's World Space Week promises to be an unforgettable experience.

We are excited to share with you three fantastic competitions:

1. National Astro Video Podcast Competition
2. SAT from Trash Competition
3. National AstroToon Competition



We believe that these competitions will not only ignite curiosity but also provide a platform for your students to excel and express their passion for space. We are proud to announce that Mr. Sachin Bahmba, CMD SPACE India is the National Coordinator of World Space Week from India.

Let's make World Space Week 2023 an educational and inspiring journey for your students. Together, we can nurture a generation of space enthusiasts who will shape the future of space exploration.

For more details visit the competitions: <https://space-india.com/outreach/world-space-week/>

To know more about World Space Week: <https://www.worldspaceweek.org/>

Registration link for competitions: <https://docs.google.com/forms/d/e/1FAIpQLSf55QLvdFKwcrPy-2DEtkhsCSuRH7UzD7WkdBblPgkxpSzhMg/viewform>

Registration and submission of artwork will be open from 4th October to 15th October 2023.

Happy



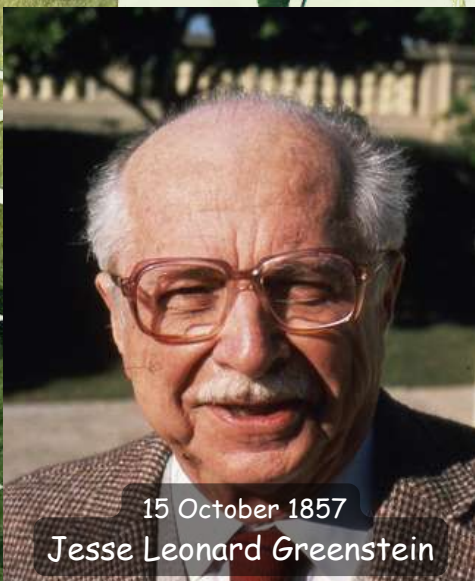
5 October 1857
Neil deGrasse Tyson

Neil deGrasse Tyson (October 5 1958 – present) is a popular American astrophysicist, lecturer, author, podcaster NASA consultant, online educator, and TV personality. Growing up in New York, Dr Tyson's introduction to the night sky was through a visit to the Hayden Planetarium. An avid science believer, he has hosted multiple TV shows and podcasts, appeared on radio, and published several books and essays. He was appointed by the head of NASA to serve on its Advisory Council which guides NASA in fitting its ambitious visions into restricted budgets. Currently, Dr Tyson is a research associate in the Department of Astrophysics at the American Museum of Natural History. He is also the head of Hayden Planetarium, the same building which ignited his love for astronomy.

Riccardo Giacconi (6th October 1931 – 9th December 2018) was an Italian-American Astronomer who holds the title "Father of X-ray astronomy." His most notable accomplishment was being a co-recipient of the 2002 Nobel Prize in Physics due to his pioneering contributions to astrophysics, which have led to the discovery of cosmic X-ray sources. He also developed the first focusing X-ray telescope and wrote the proposal for NASA's Chandra X-Ray Observatory. However, his contributions to astronomy span the entire electromagnetic spectrum and he directed the development and operation of major space- and ground-based facilities. These facilities have expanded the scientific boundaries over the past 50 years. Many astronomers base their research on data collected from observatories that he conceived, built or directed.



6 October 1857
Riccardo Giacconi

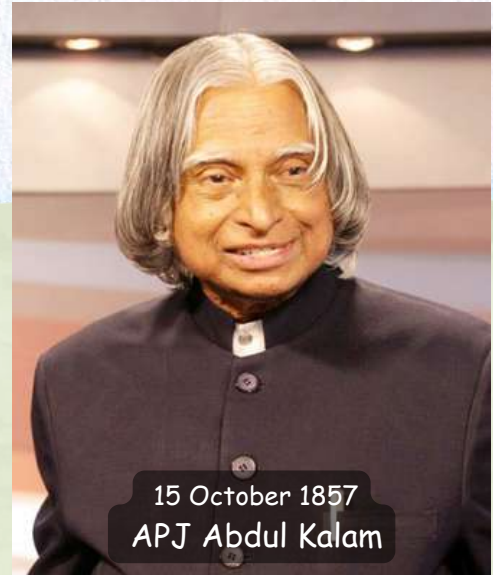


15 October 1857
Jesse Leonard Greenstein

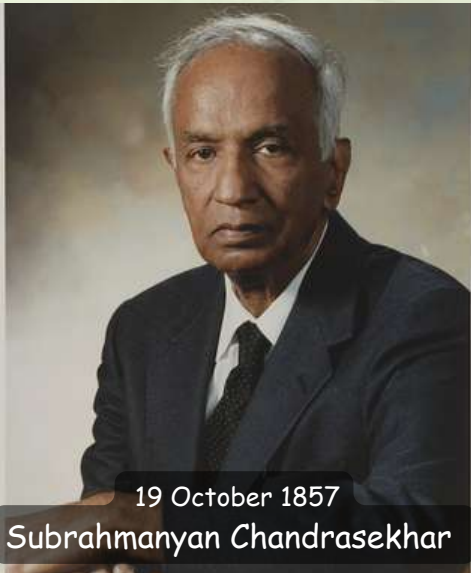
Jesse Leonard Greenstein (October 15, 1909–October 21, 2002) shaped the present organization of astronomers as it was conducted in the United States. Born and brought up in Brooklyn New York, he was a leader in U.S. astronomy and his advice was listened to by universities and governments. An early investigator of quasars and white dwarfs, he also worked on a wide variety of topics (the nature of interstellar grains, and the evolution of the chemical composition of stars.) His work on these topics provided the current fundamental knowledge. He founded and directed the graduate astronomy program at the California Institute of Technology (CALTECH). He was also an important advisor to government agencies and held many administrative positions throughout his career.

Birthday

Avul Pakir Jainulabdeen Abdul Kalam or APJ Abdul Kalam (15 October 1931 - 27 July 2015) was an aerospace scientist and the 11th president of India (2002 - 2007). Born and raised in Rameswaram, Tamil Nadu, he studied physics and aerospace engineering. He spent the next four decades as a scientist and science administrator in India's Defence Research and Development Organization (DRDO) and Indian Space Research Organization (ISRO). Affectionately known as "The People's President", Dr. Abdul Kalam was also known as the "Missile Man of India" due to his work on the development of ballistic missiles and launch vehicle technology.



15 October 1857
APJ Abdul Kalam



19 October 1857
Subrahmanyan Chandrasekhar

Subrahmanyan Chandrasekhar FRS (19 October 1910 - 21 August 1995) was an Indian-American theoretical physicist. Subrahmanyan Chandrasekhar was an astrophysicist who discovered that massive stars can collapse under their gravity and reach enormous or infinite densities (neutron stars and blackhole.) Between 1952 and 1971, he was the managing editor of the *Astrophysics Journal*, where he built it from a small publication to the foremost international journal of astrophysics. In 1983 he was the co-recipient of the Nobel Prize for Physics for his theoretical studies on the physical processes that are important to the structure and evolution of the stars. The Chandrasekhar limit and the Chandra X-Ray Observatory as are many other concepts, institutions and inventions are named after him.

Homi Jehangir Bhabha (30 October 1909 - 24 January 1966) was an Indian nuclear physicist who is the "Father of India's Nuclear Programme". Born and brought up in modern-day Mumbai Maharashtra, Dr Bhabha herded India into the nuclear age by founding the Tata Institute of Fundamental Research. The first chairman of India's Atomic Energy Commission and the secretary of the Department of Atomic Energy, Dr Bhabha was instrumental in developing the strategy of India's nuclear programme. His support of space science was crucial to the birth of India's Space Programme. After his death, the Atomic Energy Establishment, Trombay (AEET), another institute he founded, name was changed to Bhabha Atomic Research Centre in his honour.



30 October 1857
Homi Jehangir Bhabha

Dark Matter: The Cosmic Enigma

Nikhilesh B
Astronomer

Dark matter is one of the most perplexing and mysterious entities in the universe. Unlike ordinary matter, dark matter doesn't emit, absorb, or reflect light, making it invisible to all forms of electromagnetic radiation. This enigmatic substance is believed to account for approximately 27% of the universe's total mass and energy, yet its nature remains largely unknown. In this essay, we will explore the concept of dark matter, its significance in the cosmos, and the ongoing efforts to unravel its secrets.

Dark matter's existence was first postulated in the 1930s by Swiss astronomer Fritz Zwicky when he noticed that galaxies in the Coma Cluster were moving faster than they should based on visible matter alone. He hypothesized the presence of "dunkle Materie," or dark matter, to explain this discrepancy. Since then, numerous pieces of evidence have emerged supporting the existence of dark matter.

One of the most compelling pieces of evidence comes from the observation of galaxy rotation curves. In a galaxy, stars closer to the center should move faster than those farther away due to the gravitational pull of the central mass. However, these galaxies rotate at nearly constant speeds, suggesting the presence of invisible matter exerting an additional gravitational force. Similarly, gravitational lensing—the bending of light by gravity—indicates the presence of unseen mass in galaxy clusters.

Dark matter plays a vital role in shaping the cosmos. Its gravitational influence binds galaxies together in clusters, maintains the stability of galaxies, and even affects the large-scale structure of the universe. Without dark matter, the universe as we know it would look significantly different, and galaxies might not have formed or evolved in the same way.

Additionally, dark matter's role in the universe's expansion is intertwined with another mysterious phenomenon: dark energy. While dark matter's gravity acts to slow down the universe's expansion, dark energy—a repulsive force—pushes it to accelerate. Together, these two dark entities hold the balance in the cosmic dance of creation.

Despite its profound significance, the exact nature of dark matter remains elusive. Scientists have proposed various hypotheses, but none have been definitively proven. Some of the leading candidates for dark matter include weakly interacting massive particles (WIMPs), axions, and primordial black holes, but none have been directly detected or observed.

Why do we not send our trash to the Sun?

Sourajit Mandal
Astronomy Camp student

Humans produce over 3.5 million tonnes plastic every day. This plastic causes pollution. It is responsible for making our planet look dirty. It destroys the beauty of nature. This trash occupies a lot of space on our planet. But we have access to infinite space. With the launch of rockets being more common than ever, why don't we just send our trash to the infinite space available outside Earth? Also... why don't we send our trash to the sun to burn it? This has a variety of reasons.

Sending our trash to the Sun might seem like a solution, but it is not practical for a few reasons. First, the cost of launching our trash into Space and then redirecting it towards the Sun would be astronomically high. According to estimates, processing our waste safely on Earth would cost at least 10 times as much as firing it into the Sun.

So, it would be incredibly expensive to accomplish this task. Additionally, the energy and resources needed to launch and transport such a massive amount of waste would be enormous. It would require a significant amount of fuel, which is not environmentally sustainable. The environmental impact of such an idea would be considerable, considering the amount of fuel and emissions involved.

Furthermore, the logistical challenges of safely transporting and disposing of the trash in the Sun's extreme environment would be immense. If there are rocket failures which occur while trying to launch the trash, a chemical reaction between the trash and the rocket fuel can occur which can result in an even more devastating consequence than not launching the trash altogether.

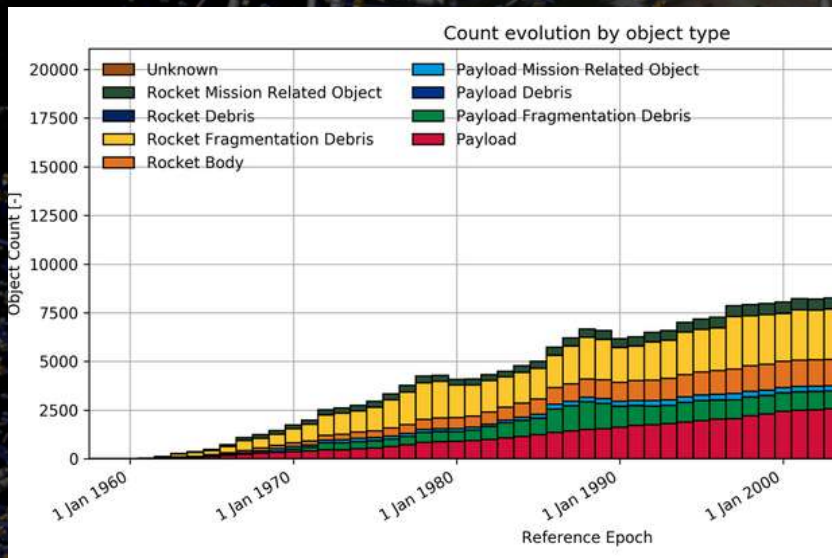
While sending our trash to the Sun might sound like a solution, the high cost, environmental concerns, and technological challenges make it an impractical and unrealistic option. We should try to achieve more practical methods of waste management, such as recycling, waste reduction, and proper disposal techniques, which are more feasible and sustainable ways to address the issue of trash disposal.

SPACE JUNK- A MAJOR CRISIS

Navya Kiran
Astronomer

How often do you think about space? Not much, considering that you use it every day. We depend on thousands of satellites every day for weather forecasts, natural disaster warnings, networks, phone calls, global warming, and much more. But there is a major crisis lurking in space, ready to wreck any satellite coming in its way, and that crisis is known as space junk. Let us know more about it and how it started to form in space.

The year 2022 broke all records for the most number of launched missions in world history. But while we were enjoying our triumph, we forgot all about Earth's sustainability. The satellite that we launched clogged up in the earth's lower earth orbit (LEO) and collected up as space junk.



This graph shows shattered payloads, unlimited parts of rocket, ruined solar panels and pieces of satellite, and mostly small particles like nuts and nails which, although being small, can destroy any satellite coming its way. This is space debris or space junk.

Scientists say that if we don't act fast, it is eventually going to club together in one ball and might even destroy our planet by crashing into the earth. So, to overcome this problem, scientists found several methods to research, gather information, and build new space crafts and other vehicles to end this crisis.

Here are some methods that scientists used to gather information about space debris:-

1. Scientists commonly used simple ground-based telescopes to gather information. However, ground-based telescopes aren't that effective since the clouds in the sky block the view, and we can't see the sky perfectly.
2. The European Space Agency has installed the IZN Laser Ranging Station, which throws a laser beam far away into space, enlightening up the night sky and conducting its research. Its specialty is that it can even conduct its research during daylight when the sun is up! That ultimately increases the time spent researching.
3. ADLER-2, a satellite launched by the ESA in April 2023, is way bigger than its partner ADLER 1 and aims for a 12-month mission to space to collect information and research about the junk in space.
4. Space Junk Trackers are small trackers that are used to find out the amount of space junk up there. It resembles the space junk-like white dots as seen in the picture above, calculating the amount of space junk.

These are some of the facts that scientists have gathered after researching space debris through different methods.

- They found out that as we move on, the amount of shattered payloads, rocket leftovers, ruined satellite parts will also increase over the year.
- They also found out that small particles like nuts and nails are present in more than a million in the lower earth orbit. This can cause great damage to our planet.
- As per the trackers, they also figured out that if we don't maintain our earth, the junk will eventually coil up and the whole earth will be covered in junk, looking like a trashed planet.

These are some things that the space agencies have done to resolve this problem.

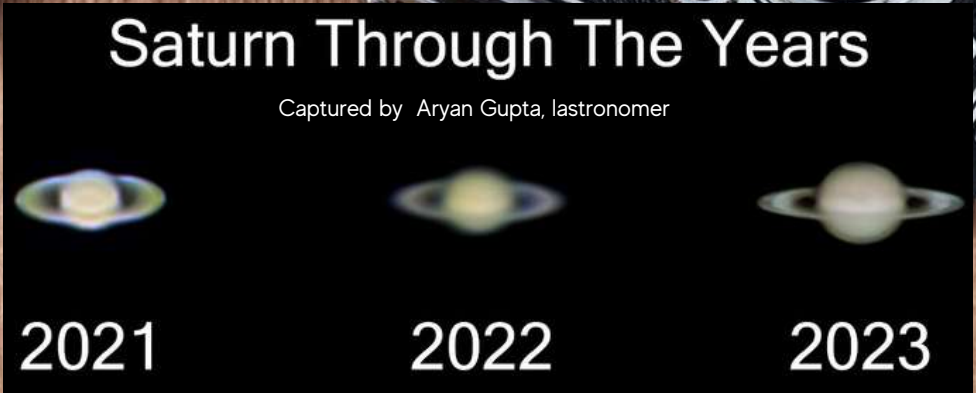
1. Canadarm2 is a contribution to space from the Canadian Space Agency, which is a large robotic arm fixed on the ISS and collects space debris.
2. ClearSpace 1 is a satellite launched by the ESA, which is the World's first debris removal mission, aiming to collect a very dangerous junk called VESPA. It is a leftover part of a rocket launched back in 2013 and this mission will finally collect it using a series of long tentacles, eventually burning up along with VESPA.
3. Agencies aim to make several things such as nets, tentacles, and stronger robotic arms to collect the parts of satellites that have completed their mission and see that there are no leftovers of that satellite.

A laboratory in China has made a laser beam that goes far way in space and destroys junk up to 20 cm long.

VISUAL ARTS FROM SPACE ASSOCIATED ASTRONOMERS



Moon captured by Aryan Gupta,
astronomer



Saturn Through The Years

Captured by Aryan Gupta, astronomer

2021

2022

2023



12:13 am

01:29 am

Jupiter captured by Aryan Gupta, astronomer



Moon captured by Dharshan R, Club
student



Star Trail Captured by Daksh Rathi,
astronomer

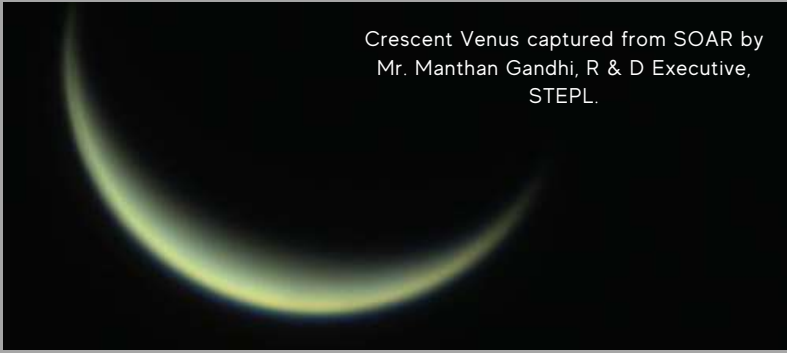


Moon captured by Rohan Jain,
Club student



Moon captured by Shaurya Pratap Singh, Club Student

ASTROPHOTOGRAPHS BY SPACE



Crescent Venus captured from SOAR by Mr. Manthan Gandhi, R & D Executive, STEPL.



Copernicus crater captured from SOAR by Mr. Manthan Gandhi, R & D Executive, STEPL.



Milkyway arm captured by Mr. Ranjith Kumar E, Sr. Educator, STEPL.



Star Trail captured by Mr. Altamas Ali, Educator, STEPL.



Star Trail captured by Mr. Arun Yadav, Educator, STEPL.



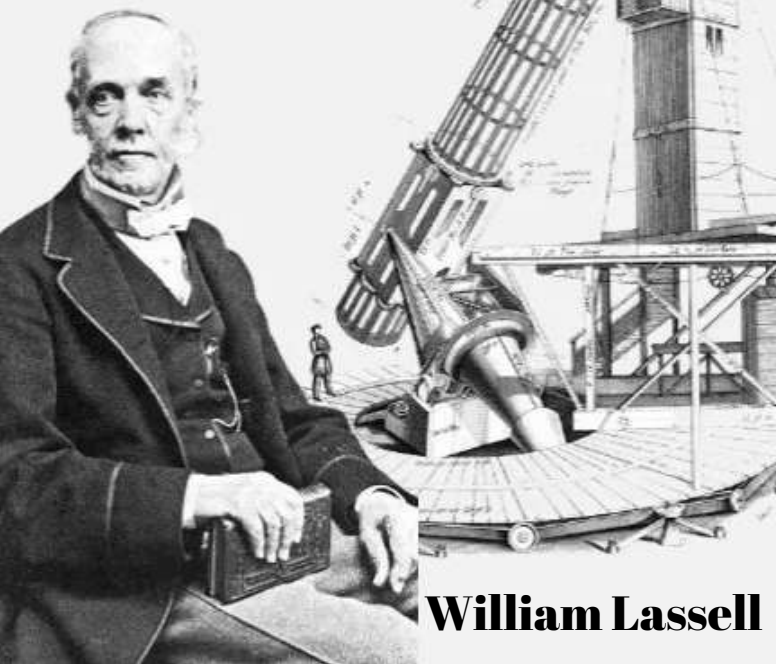
Star Trail captured by Ms. Sanjana Nayak, Educator, STEPL.

HISTORICAL EVENTS HAPPENED IN OCTOBER

THE DAWN OF THE SPACE AGE

It was a chilly October night when the now-dissolved Soviet Union hurtled humanity into the space age. On 4 October 1957, from the Tyuratam launch base in the Kazakh Republic, Prosteyshiy Sputnik-1, or Elementary Satellite 1, was launched into space as the first artificial spacecraft. Referred to as Sputnik 1, or travelling companion, the satellite had a diameter of 58 cm and 83.6 kg and took approximately 98 minutes to finish one orbit around Earth. Amateur radio operators could pick up Sputnik 1's radio signals. The best time to see the highly polished surface of the satellite was before sunrise or after sunset through a pair of binoculars. Sputnik 1's launch corresponded with the International Geophysical Year- a solar period that the International Council of Scientific Unions declared would be an ideal time to launch artificial satellites to study Earth and the solar system. On 4th January 1958, Sputnik 1's journey ended as it burned upon re-entry into Earth's atmosphere. By this time, the satellite had been in orbit for 96 days and completed 1400 orbits around the sun.

Twelve years after Sputnik took to space, humans landed on the Moon.



Triton by Voyager 2 (1989)

The Satellite of Neptune

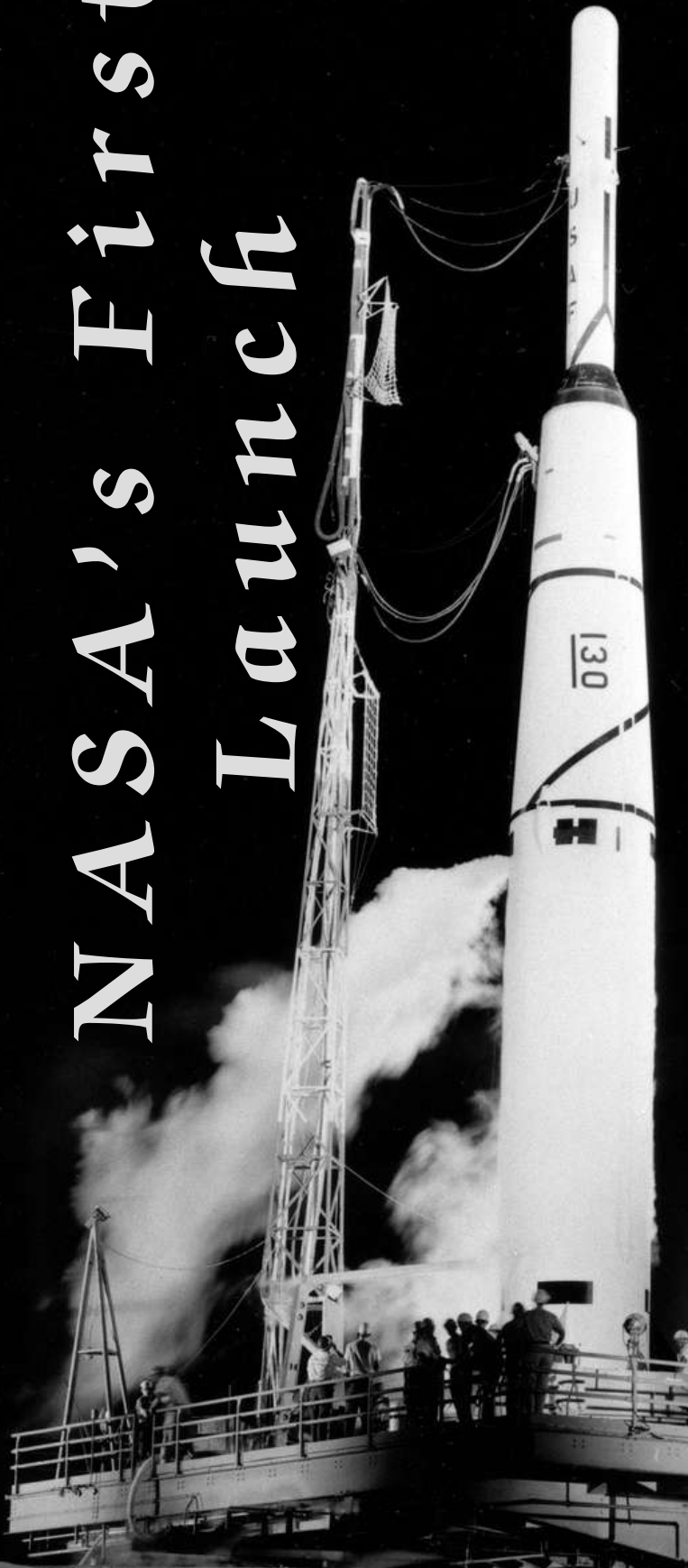
Seventeen days after Johann Gottfried Galle confirmed Neptune's existence, William Lassell, an amateur English astronomer, was observing the planet. While looking through his self-built, two-foot, metal mirror reflector telescope, he discovered Triton. For the next 100 years, Triton remained nameless. When it was referred to, it was called 'the satellite of Neptune' a practice that continued until the discovery of Nereid in 1949. Triton is Neptune's largest satellite and the seventh-largest moon in the Solar System.

Triton is one of the few bodies in the Solar System that is geologically active. Due to its complex geological history, its surface looks young; there are few noticeable impact craters, a smooth volcanic plain, and mounds and round pits formed by icy lava flows. Another side effect of volcanic activity is the presence of a thin atmosphere primarily composed of nitrogen. Additionally, with surface temperatures at -235 degrees Celsius, the nitrogen gas condenses into frost which casts an icy sheen on the surface. This sheen reflects 70% of the sunlight that hits the surface.

The most notable feature of the satellite is its retrograde orbit. It is the only major moon in the solar system that revolves in the opposite direction of its planet's rotation. Due to this unique attribute, Triton is theorized to be a dwarf planet from the Kuiper Belt that was captured by Neptune's gravity millions of years ago. Further evidence for this theory is its similar size, composition, and surface to Pluto, the most famous Kuiper belt object.

Thus far, Triton has only been visited by one spacecraft – Voyager 2 in 1989. During this flyby, Voyager 2 captured several images that our current understanding of the satellite is based on. The New Horizon mission reignited interest in Triton, and within the next decade, another spacecraft will be launched to study Triton.

NASA's First Launch



NASA launched its first spacecraft into space on 11th October 1958. Onboard a Thor-Able rocket, weighing 38-kilogram, Pioneer 1 was part of the first lunar space program. The spacecraft was designed to record micrometeoroid impacts and take measurements of the magnetic field and radiation while obtaining a facsimile image of the lunar surface. However, due to an error, Pioneer never reached the moon. Its flight lasted 43 hours before it burned upon re-entry through Earth's atmosphere. The highest altitude it reached was almost 115,000 km.

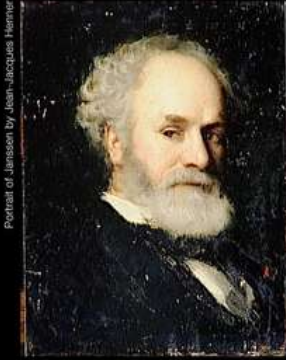
Pioneer 1's instruments, however, verified the existence of Van Allen Radiation Belts that was discovered by Explorer 1 earlier in the year. It measured the strength of the radiation bands and made the first measurements of the hydromagnetic oscillations in the Earth's magnetic field.

Pioneer 1 was the first of the several missions that NASA would and continues to oversee.

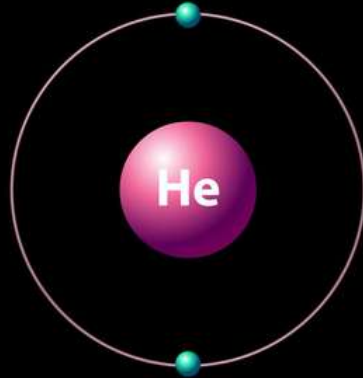


Pioneer 1

An Alien Element

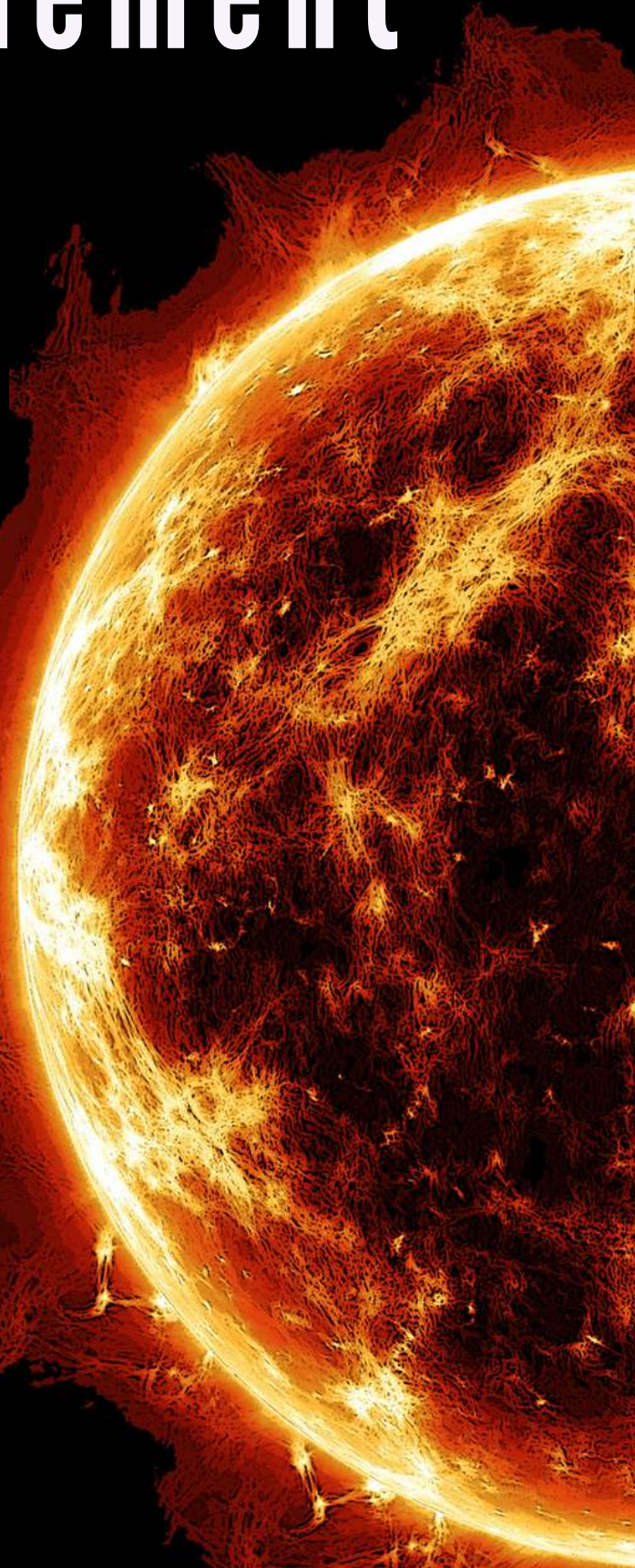


Portrait of Janssen by Jean-Jacques Henner



Physicist Pierre Janssen discovered helium when observing an 1868 solar eclipse in India. Using a spectroscope, he noticed a peculiar line of light in the chromosphere of the eclipse, and surmised its source must be an element not yet discovered.

On 20 October 1868, Sir Joseph Norman Lockyer observed a rogue yellow line in the solar spectrum. With a wavelength around 588 nm, it was slightly less than the lines of sodium. Since no known material could explain the line's presence, Lockyer quickly realized that a previously undiscovered element was the reason for the line. He named this element Helium after 'Helios,' the Greek word for 'sun'. Unbeknownst to him, it was not the first time the yellow line was observed. On 18th August 1868, Pierre Jules César Janssen made a similar observation. Since their papers detailing the observation reached the French academy on the same day, Lockyer and Janssen got joint credit for the discovery of Helium.



INDIA'S FORAY INTO INTERPLANETARY SPACE

On 22nd October dawned as a dreary morning with less-than-ideal conditions for a rocket launch. Over 200 Indian Space Research Organization (ISRO) scientists were tense and anxious. They were racing against time to fix last-minute issues so that the launch would happen.

Though ISRO has had several launches previously, this was different. It was the first time ISRO planned to send a spacecraft that would leave Earth's gravitational influence. This was ISRO's first interplanetary mission, and they were going to the moon.

All fears were laid to rest when, at 0622 hrs, with its 11 instruments and aboard PSLV-C11, Chandrayaan 1 was successfully launched from Satish Dhawan Space Centre at Sriharikota, Andhra Pradesh. Meaning moon vehicle Chandrayaan 1 was the first space probe under ISRO's lunar program.

On 8th November 2008, ISRO scientists heaved a sigh of relief when the satellite got inserted into Lunar orbit.

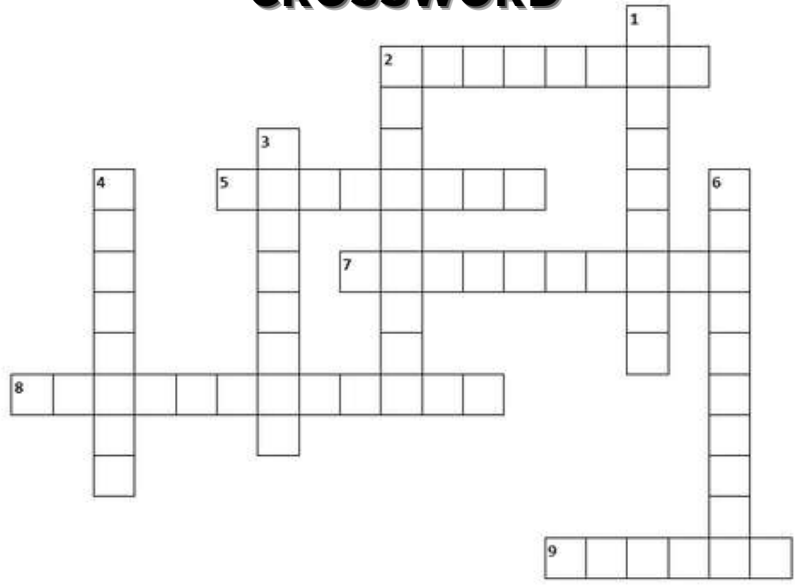
Six days after the insertion, on 14th November 2008, the moon impact probe separated from the Chandrayaan orbiter and struck the Lunar South pole in a controlled matter. With this, ISRO became the fifth National space agency to reach the lunar surface.

Scientific goals of the mission included the chemical, mineralogical and photo-geologic mapping of the Lunar surface. Chandrayaan 1 confirmed the widespread presence of water molecules in lunar soil, with the majority of it concentrated on the poles. This discovery reignited our lunar interest, with several moon missions planned in the coming years.

In August 2009, after the orbiter stopped communicating, ISRO declared the mission over. Even though Chandrayaan 1 operated for 312 days instead of the projected two years, the mission was declared successful as it had fulfilled 95 % of its scientific objective. It has also made more than 3400 orbits around the moon.

TRAIN YOUR BRAIN

CROSSWORD



ACROSS

- 2. Which is India's first space observatory?
- 5. First meteorological satellite built by ISRO, named after the first Indian Woman to go to space.
- 7. What is ISRO's upcoming mission to study the planet Venus?
- 8. In which ISRO mission did we find water on the Moon?
- 9. Which is India's first satellite successfully launched by the indigenous launch vehicle SLV?

DOWN

- 1. ISRO's first crewed mission expected to be launched in 2025 is called as
- 2. Which is India's first mission to space?
- 3. What is India's optical earth observation satellite called as?
- 4. Name the ISRO's first mission to Sun?
- 6. Which is India's first interplanetary mission?

ASTRONOMY WORD PUZZLE

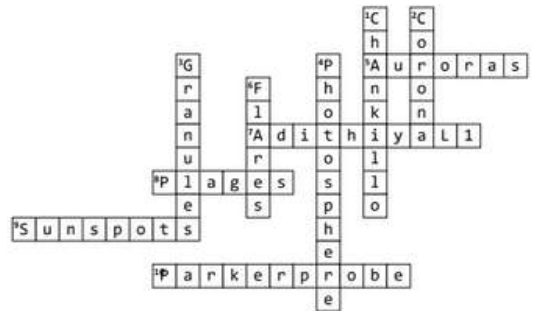
Find the names of the famous moons of Saturn Part 1 from the mixed letters and mark them.

MOONS OF SATURN PART 1

H	S	E	P	I	M	E	T	H	E	U	S	I	S
N	U	T	I	T	A	N	I	U	Y	U	H	J	I
M	D	M	T	T	N	I	H	E	N	A	S	I	Y
I	A	S	L	I	O	T	T	A	A	I	E	R	D
P	L	M	S	S	I	S	J	D	Y	U	A	A	I
A	E	I	S	S	R	M	E	A	U	A	N	Q	O
I	C	A	Y	H	E	O	M	Y	D	E	O	T	N
A	N	Y	H	T	P	R	E	M	M	Q	H	A	E
P	E	A	T	M	Y	I	S	I	H	I	H	A	A
E	R	U	E	E	H	C	S	R	E	R	M	A	U
T	U	U	T	E	N	R	U	C	E	I	O	A	E
U	U	I	T	E	L	E	S	T	O	E	A	I	S
S	Y	K	N	A	R	V	I	N	E	A	E	H	R
O	O	A	H	U	P	K	I	V	I	U	Q	P	H

- HYPERION
- IJIRAQ
- TETHYS
- KIVIUQ
- TELESTO
- YMIR
- DIONE
- RHEA
- NARVI
- MIMAS
- TITAN
- EPIMETHEUS
- JANUS
- IAPETUS
- ENCELADUS

Answers for last month puzzles.



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

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

NEWS LETTER



Educator's Day: Every kid starts their journey of life with the help of an individual known as a teacher.

They contribute and mold our lives from mischievous children to grownups. They hold magical power to change themselves into a kid, a mentor and a friend you can rely on. Educators are one of the major & amazing pillars in Space India; they sowed the seeds of creativity and infinite curiosity in young brains and exploded the bomb of creativity and boundless curiosity towards astronomy and space science.



Prompted by massive revolutions in knowledge, hands-on experience, and better learning, schools worldwide are slowly but surely restructuring themselves.



Birthday of the month- September: Spacian celebrates its birthday with joy on Spaceship. We consider our Spacians to be family, and we will go out of our way to make them feel special on their important day. As is customary, we had delicious cake, McDonald's meals, and lots of dancing.



Space India from Spacian's Eyes (Poster making competition)- All Spacians were thrilled to participate in the poster making competition on the theme of Space India - from the eyes of Spacians. Our excellent Judges (Space India students) chose the Assistants team as the winner!!!

The poster conveys the message that Space India is not just an organization; it's a platform that nurtures the dreams and creativity of young space enthusiasts. It celebrates the power of imagination and the boundless curiosity that drives Spacians to explore the cosmos. The competition and its winner showcase the unity and passion within the Space India community, fostering a sense of wonder and exploration among all Spacians.



Spacian of the Month (Aug'23)- Mr. Vinayak Menon, Assistant Manager - Marketing & Communication

Vinayak has demonstrated outstanding performance and discipline, working late at night to meet company expectations and highlight Space achievements. The marketing team has been constantly reaching social media users with new strategies and 360* marketing plans. Website traffic has grown due to marketing campaigns, generating leads for sales and outreach. The power of sharing is activated, with educators promoting school sessions and schools tagging Space India in posts, resulting in more impressions and reach. Congratulations to Vinayak for his excellent work.



Special Recognition Intern (Aug'23)-

Ms. Stuti Bhatia, Intern - Outreach
She is passionate, determined, and has excelled in various tasks, contributing significantly to Public Relationship by representing Space India on over 29 National News channels, including Chandrayaan 3 and Aditya L1.



Intern's Point of View -

Ms. Stuti Bhatia: My time working at SPACE India has been quite the journey. I've grown as a person here. Initially, my main goal was to find meaningful work and, more importantly, to have that work recognized. In just one month, I can already see that my efforts are not only acknowledged but also improved upon. This is something that everyone hopes for during their early learning stages.

There were certainly days when I faced challenges and had to juggle multiple tasks, but this is a valuable lesson that every newcomer needs to learn. I'm grateful for the lessons I've gained here. I want to express my heartfelt thanks to the people in charge who have struck a perfect balance between professionalism and friendliness within the organization. If you ever plan to work here, you'll discover that you need to share a daily task list with your supervisors, but you can also be open about your emotions because they are always ready to support and uplift you.

I've even made some friends here. Without my experience at SPACE India, I wouldn't have been able to clarify my true career aspirations.

CHECK OUT SPACE OFFERINGS



iASTRONOMER

LEARN ONLINE ABOUT
ASTRONOMY & SPACE SCIENCE
Join the World's largest Astronomy Club

www.space-india.com



Travel To Do Astronomy or Do Astronomy While Travelling

EDUTOURS | CORPORATE TRAVEL | FAMILY TRIPS

Enquire about itineraries:
info@space-global.com



SPACE ARCADE

BUY TELESCOPE &
EXPLORE THE UNIVERSE

www.spacearcade.in



SPACE™

EMPOWERING LIFE



Making School Education Fun & Rocket-Science Easier



In Compliance With New Education Policy

**SPACE INSIGHTS | SCHOOL PROGRAMS | ONLINE PROGRAMS | ASTROTOURISM
SPACE OUTREACH | ASTRONOMICAL EQUIPMENTS | SPACE LABS**

GALACTICA MAGAZINE

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 ☎ +91-95991 91909 / 295784 | +91-92126 69920 / 29

Explore our websites

