

# Galactica

Astronomy and Space Science Magazine



## What's Inside?

SPACE Insights

Highlights From December 2023

Moon Phases And Planet Visibility

What's Awaiting in January 2024

Cultural Astronomy & Celestial Tales

Student's Corner

Historical Events Happened In January

January Born Legends

Train Your Brain

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

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# ABOUT SPACE



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

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

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

## CMD's Message



**Dr. Sachin Bahmba,  
CMD, SPACE**

Space and Astronomy are the future for the young generation of our country. This is a great means to inculcate scientific temperament among the masses. Such astronomy sessions will provide

a hands-on learning platform for students wherein they explore the real world of science, I wish for young students to let their ambitions soar and think big as they are the future of our country.

## MD's Message

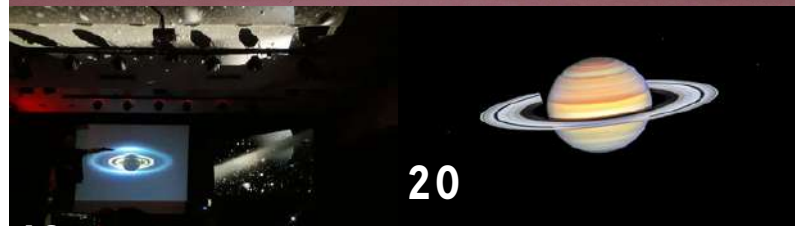


**Mr. Shivam Gupta,  
MD, SPACE**

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

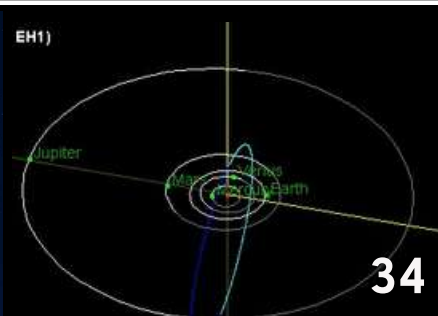
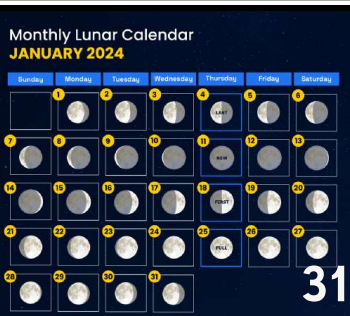
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# Celestial Calendar 2024



## Hello Astronomers!

Space India presents this yearly calendar covering all the major astronomical events that one can witness from the Indian subcontinent. Astronomers all around the world can also record and capture these events along with beautiful astrophotographs. You can also capture and share your photos with us.

For details of each event such as which direction to see, location & coordinates in the sky, timings as per your latitude can be taken from various astronomical apps and softwares. We suggest you use the app/software STELLARIUM. It is available across all platforms android/iOS/Windows/MAC.

## Major Astronomical Events Key



### Conjunction

When the Moon or a planet appears especially close either to another planet or to a bright star. Also used when, Moon or Planet sometimes is close to bright Deep sky objects.



### Eclipse

An event that occurs when the shadow of a planet or moon falls upon a second body.



### Elongation

The angular distance the Moon or a planet is from the Sun. The inner planets of Mercury and Venus are best seen when at maximum Elongation, and thus are highest above the horizon before sunrise or after sunset.



### Opposition

When a planet or asteroid is opposite the Sun in the sky. At such times, the object is visible all night – rising at sunset and setting at sunrise.



### Equinox

The two times each year, near March 20th and September 22nd, when the Sun is directly overhead at noon as seen from Earth's equator. On an equinox date, day and night are of equal length.



### Meteor Shower

An increase in meteor activity at certain times of the year due to Earth passing through a stream of particles along a comet's orbit around the Sun.



### Occultation

When the Moon or a planet passes directly in front of a more distant planet or star.



### Solstice

The two times each year, around June 20th and December 21st, when the Sun is farthest north or south in the sky. At the summer solstice, the day is longest and the night is shortest, and vice versa at the winter solstice.

\*Definitions are taken from Sky & Telescope for easier understanding



# GALACTIC GAZETTE - 2024

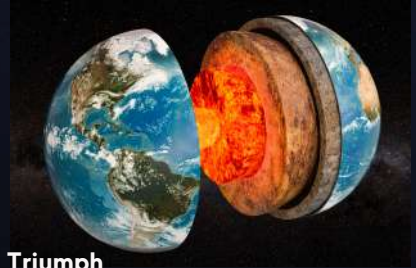
<b>3<sup>rd</sup> JAN</b> Earth at Perihelion	<b>4<sup>th</sup> JAN</b> Quadrantids Meteor Shower	<b>8<sup>th</sup> JAN</b> Planetary alignment of Mars, Mercury, Venus and Moon	<b>20<sup>th</sup> JAN</b> Conjunction of Moon and Piliades	<b>25<sup>th</sup> JAN</b> Full Moon	<b>5<sup>th</sup> FEB</b> Moon Occultation of Antares	<b>7<sup>th</sup> FEB</b> Planetary alignment of Mars, Mercury, Venus and Moon	<b>15<sup>th</sup> FEB</b> Conjunction of Moon and Jupiter	<b>23<sup>rd</sup> FEB</b> Conjunction of Venus and Mars	<b>24<sup>th</sup> FEB</b> Full Moon
<b>20<sup>th</sup> MAR</b> March Equinox	<b>22<sup>nd</sup> MAR</b> Conjunction of Venus and Saturn	<b>25<sup>th</sup> MAR</b> Full Moon	<b>11<sup>th</sup> APR</b> Conjunction of Mars and Saturn	<b>20<sup>th</sup> APR</b> Conjunction of Jupiter and Uranus	<b>22<sup>nd</sup> APR</b> Lyrids Meteor Shower	<b>24<sup>th</sup> APR</b> Full Moon	<b>3<sup>rd</sup> MAY</b> Planetary alignment of Mars, Mercury, Saturn and Moon	<b>5<sup>th</sup> MAY</b> Eta Aquarids Meteor Shower	<b>5<sup>th</sup> MAY</b> Conjunction of Moon and Mars
<b>23<sup>rd</sup> MAY</b> Full Moon	<b>3<sup>rd</sup> JUNE</b> Conjunction of Moon and Mars	<b>21<sup>st</sup> JUNE</b> June Solstice	<b>22<sup>nd</sup> JUNE</b> Full Moon	<b>5<sup>th</sup> JULY</b> Earth at Aphelion	<b>16<sup>th</sup> JULY</b> Conjunction of Uranus and Mars	<b>21<sup>st</sup> JULY</b> Full Moon	<b>29<sup>th</sup> JULY</b> Celestial alignment of Moon, Mars, Jupiter and Pleiades	<b>12<sup>th</sup> AUG</b> Perseids Meteor Shower	<b>15<sup>th</sup> AUG</b> Conjunction of Jupiter and Mars
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# RECAP OF 2023

## Earth's Core Spin Reversal

- Recent studies suggest Earth's core may exhibit a reverse spin, challenging conventional theories about its rotational dynamics. This discovery could reshape our understanding of the Earth's internal processes and magnetic field generation.



## Jupiter's Moon Triumph

- Jupiter has reclaimed its status as the planet with the most moons in our solar system. The recent identification of additional moons around Jupiter showcases the planet's gravitational dominance and its continual role in shaping the cosmic neighborhood.



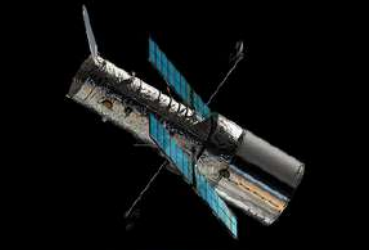
## Gaganyaan Spacecraft Recovery Test

- India has achieved a crucial milestone in its Gaganyaan mission by successfully testing the recovery system for the spacecraft. This achievement brings India closer to realizing its ambitions for crewed space exploration and human spaceflight missions.



## Hubble Observes Giant Planets

- The Hubble Space Telescope is actively monitoring and studying the dynamic weather patterns of gas giants Jupiter and Uranus. These observations provide valuable insights into the atmospheric processes and long-term changes occurring on these distant planets.



## China's Rocket Debris Solution

- China is planning to employ parachutes to control the descent of its rocket debris, addressing concerns about space debris management. This innovative approach demonstrates efforts to mitigate the environmental impact of space activities.



## ESA's Juice Mission to Jupiter's Moons

- The European Space Agency (ESA) has successfully launched the Juice mission, aiming to explore Jupiter's moons. This mission promises to unravel mysteries surrounding the largest planet in our solar system and its diverse set of natural satellites.



## Lucy Mission Captures Trojan Asteroids

- NASA's Lucy Mission has achieved a significant milestone by capturing its first images of Trojan asteroids, providing valuable data for understanding the early solar system's formation and dynamics.



## India Joins Artemis Accords

- India has officially signed the Artemis Accords, a global initiative supporting peaceful and cooperative exploration of the Moon and beyond. This collaboration marks a step forward in international efforts to expand human presence in space.







**Virgin Galactic's Commercial Spaceflight**

- Virgin Galactic has made history by completing its first commercial flight into space, marking a major achievement in the commercial space tourism industry and paving the way for future civilian space travel.

**JWST Illuminates Saturn's Rings**

- The James Webb Space Telescope (JWST) has captured stunning images showcasing the brilliance of Saturn's rings in the infrared spectrum. These observations provide a unique perspective on the composition and structure of the iconic planetary rings.



**Luna-25 Mission Setback**

- Russia's Luna-25 Spacecraft unfortunately experienced a crash on the moon during its mission, highlighting the challenges and risks associated with lunar exploration.

**Chang'e-5 Mission Misinformation**

- The Chang'e-5 Moon mission faced challenges related to misinformation concerning its sample return. This incident underscores the importance of accurate reporting and communication in the context of space exploration.

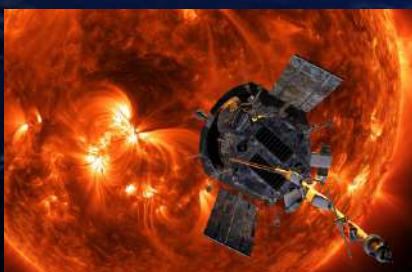
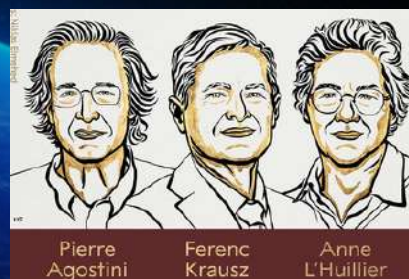


**OSIRIS-REx Triumph**

- The OSIRIS-REx mission is celebrated as a triumph of human ingenuity for successfully collecting samples from the asteroid Bennu, providing valuable insights into the early solar system's formation.

**Nobel Prize for Atom Manipulation**

- The Nobel Prize in Physics was awarded to three scientists for their groundbreaking work on manipulating atoms with tiny light pulses, showcasing the advancements in precision control at the atomic level.

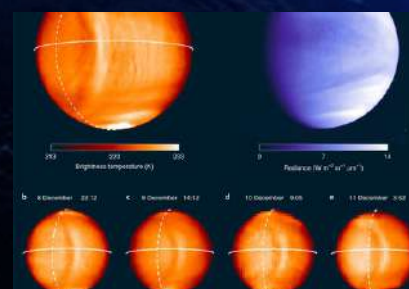


**Parker Solar Probe's Record**

- NASA's Parker Solar Probe holds the title of the fastest man-made object, providing unprecedented close-up observations of the Sun's outer atmosphere and contributing to our understanding of solar dynamics.

**Venus' Atmospheric Dynamics Unveiled**

- Scientists are making strides in unraveling the mystery of Venus' Atmospheric Dynamics, particularly focusing on the Reactive Oxygen Layer. These studies aim to enhance our understanding of the complex and dynamic atmosphere of Earth's neighboring planet.





# SUCCESSFUL MISSIONS BY ISRO IN 2023



## SSLV-D2/EOS-07

The Small Satellite Launch Vehicle's (SSLV) second developmental flight, SSLV-D2, was successfully launched on February 10, 2023, at 09:18 hours IST from the SDSC SHAR launch pad in Sriharikota. In a brief 15-minute flight, SSLV-D2 achieved its goal of injecting three satellites—EOS-07, Janus-1, and AzaadiSAT-2—into a 450 km circular orbit. SSLV is dedicated to launching satellites weighing up to 500 kg to Low Earth Orbits (LEO) on a "launch-on-demand" basis. It stands out for its low-cost access to space, minimal turnaround time, flexibility for accommodating multiple satellites, and the need for minimal launch infrastructure. Configured with three solid propulsion stages and a velocity terminal module, SSLV is a 34 m tall, 2 m diameter vehicle with a lift-off mass of 120 tons.

## THE REUSABLE LAUNCH VEHICLE MISSION (RLV LEX)

ISRO accomplished the Reusable Launch Vehicle Autonomous Landing Mission (RLV LEX) with success. The test, which took place at the Aeronautical Test Range (ATR) in Chitradurga, Karnataka on April 2, 2023, involved the RLV taking off at 7:10 am IST from a Chinook Helicopter of the Indian Air Force as an underslung load. It ascended to a height of 4.5 km (above Mean Sea Level). Upon reaching predetermined pillbox parameters, the RLV was autonomously released mid-air at a down range of 4.6 km, adhering to 10 release conditions covering position, velocity, altitude, and body rates.

The release of the RLV was autonomous, and it executed approach and landing maneuvers using the Integrated Navigation, Guidance & Control system. The RLV successfully achieved an autonomous landing on the ATR air strip at 7:40 AM IST, marking ISRO's successful demonstration of autonomous landing capabilities for a space vehicle.

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## LVM3 M3/ ONEWEB INDIA-2

The LVM3 M3/OneWeb India-2 Mission achieved success with its sixth consecutive flight, successfully placing 36 OneWeb Group Company satellites into their intended 450 km circular orbit with an inclination of 87.4 degrees. Taking off from the second launch pad at SDSC-SHAR, Sriharikota, at 09:00:20 hours IST with a total payload of 5,805 kg, the vehicle accomplished satellite injection conditions in about 17 minutes. During the mission, a sophisticated maneuver was executed, orienting the vehicle in orthogonal directions and injecting the satellites into precise orbits with defined time-gaps to prevent collisions.

## THE REUSABLE LAUNCH VEHICLE MISSION (RLV LEX)

PSLV-C55/TeLEOS-2 is launched successfully on April 22, 2023 at 14:19 hours IST from SDSC-SHAR, Sriharikota. This is a dedicated commercial mission through NSIL with TeLEOS-2 as primary satellite and Lumelite-4 as a co-passenger satellite.

The TeLEOS-2 satellite is developed under a partnership between DSTA (representing the Government of Singapore) and ST Engineering. TeLEOS-2 carries a Synthetic Aperture Radar (SAR) payload. TeLEOS-2 will be able to provide all-weather day and night coverage, and capable of imaging at 1m full-polarimetric resolution.

LUMELITE4 is an advanced 12U satellite developed for the technological demonstration of the High-Performance Space-borne VHF Data Exchange System (VDES). Using the VDES communication payload developed by I 2 R and STAR's scalable satellite bus platform, it aims to augment Singapore's e-navigation maritime safety and benefit the global shipping community.



## GSLV-F12/NVS-01

The GSLV-F12/NVS-01 mission achieved success on Monday, May 29, 2023. This mission of the Geosynchronous Satellite Launch Vehicle (GSLV) successfully placed the NVS-01 navigation satellite, weighing approximately 2232 kg, into a Geosynchronous Transfer Orbit. The launch occurred at 10:42 hours IST from the second launch pad at SDSC-SHAR, Sriharikota, and the satellite was injected into orbit after about 19 minutes of flight.

NVS-01 represents the initial satellite in the second-generation series intended for the Navigation with Indian Constellation (NavIC) services. The NVS series aims to enhance and sustain NavIC with improved features, including the incorporation of L1 band signals to expand services. Notably, NVS-01 features the first deployment of an indigenous atomic clock, marking a significant milestone in satellite technology.

## PSLV-C56/DS-SAR

The successful launch of PSLV-C56 carrying the DS-SAR satellite, along with six co-passengers, occurred on July 30, 2023, at 06:30 hrs IST from the first launch-pad of SDSC-SHAR, Sriharikota. PSLV-C56, configured in its core-alone mode, deployed the 360 kg DS-SAR satellite into a Near-equatorial Orbit (NEO) at 5 degrees inclination and 535 km altitude.

DS-SAR, developed through a partnership between DSTA (representing the Government of Singapore) and ST Engineering, serves the satellite imagery needs of various Singaporean government agencies. ST Engineering utilizes it for multi-modal and highly responsive imagery and geospatial services for commercial customers. The DS-SAR satellite is equipped with a Synthetic Aperture Radar (SAR) payload developed by Israel Aerospace Industries (IAI), enabling all-weather, day and night coverage with a 1m-resolution at full polarimetry.

## LVM3-M4-CHANDRAYAAN-3

Chandrayaan-3, launched on July 14, 2023, is a continuation of India's lunar exploration program, following Chandrayaan-2. The mission aims to showcase complete capabilities in safe lunar landing and surface roving. Launched from the Satish Dhawan Space Centre, the spacecraft consists of a propulsion module, lander, and rover. The propulsion module, equipped with the Spectro-polarimetry of Habitable Planet Earth (SHAPE) payload, carried the lander and rover to a 100-kilometer lunar orbit. The lander then soft-landed on the lunar surface, accompanied by the rover named Pragyan, designed to deploy a smaller 26-kg lunar rover.

Key objectives of Chandrayaan-3 include demonstrating advanced technologies in Earth conditions, conducting scientific experiments such as Chandra's Surface Thermophysical Experiment (ChaSTE) and the Instrument for Lunar Seismic Activity (ILSA), and observing the rover's driving capabilities on the Moon. This mission marks a significant step in India's lunar exploration endeavors

## PSLV-C57/ADITYA-L1

The Aditya-L1 mission is India's first dedicated mission to study the Sun, launched on September 2, 2023, via the PSLV C57 rocket

. The mission's key objectives include:

Studying solar upper atmospheric dynamics (chromosphere and corona)

Investigating coronal heating, coronal mass ejection, pre-flare, and flare activities, and their characteristics

Examining the dynamics of space weather and the propagation of particles and fields

Aditya-L1 is equipped with seven distinct payloads, all developed indigenously, including five by ISRO and two by Indian academic institutes in collaboration with ISRO. The satellite is designed to orbit around the Lagrange point 1 (L1) of the Sun-Earth system, which is approximately 1.5 million km from Earth

This strategic placement ensures a constant, uninterrupted view of the Sun and allows the satellite to access solar radiation and magnetic storms before they reach Earth

The mission is expected to operate for 5.2 years, studying the Sun and solar phenomena around Earth



# SPACE INSIGHTS

## KALPANA CHAWLA DEBATE COMPETITION 2023

The Kalpana Chawla Debate Competition, hosted by Space India on December 16, 2023, was an inspiring display of intellect and eloquence. Drawing 114 students from 57 esteemed schools across the region, the event sparked intellectual discourse on pressing matters concerning space exploration and beyond.

### Round 1: Unveiling Diverse Perspectives

In the initial round, 114 students showcased their passion and knowledge, engaging in debates that encapsulated myriad viewpoints. Their articulation and depth of understanding regarding the motion were commendable. The topic for the debate was "Space Colonization vs. Earth Sustainability: Should we focus on making Earth more sustainable or establishing colonies on other planets?" However, only 50 students, evenly divided between those for and against the motion, progressed to the next stage.

### Round 2: Refinement of Arguments

The subsequent round witnessed an intense clash of ideologies as 25 students from each side of the argument delved deeper into their positions. The topic for round 2 was "The Militarisation and Weaponization of Space: Should these be a part of Modern Warfare?" Their thorough research and persuasive abilities elevated the discourse, leaving the audience in awe of their conviction and proficiency in rhetoric.

### Round 3: Raising the Bar

As the competition narrowed down to the top contenders, 20 finalists faced rigorous scrutiny through probing questions relating to their debate content. This round was a testament to their comprehensive understanding of the subject matter, exhibiting not only their debating skills but also their grasp of nuanced concepts.

Ultimately, three exceptional debaters emerged victorious. Yash Swami and Arnav Vashisht from SVIS, Dwarka, claimed the top two positions, showcasing unparalleled eloquence and depth of knowledge. Saesha Mishra from Amity International School, Noida, secured the third position, adding a distinct perspective to the riveting discussions.



The dedication and hard work of these students have set a benchmark for aspiring debaters, inspiring a new generation of intellectuals. The Kalpana Chawla Debate Competition stands as a beacon of intellectual exchange and scholarly pursuit, echoing the legacy of the esteemed astronaut it honors. It has not only celebrated the art of debating but also heralded the spirit of inquiry and critical thinking amongst the youth. As these young minds continue to soar intellectually, one can only anticipate the transformative impact they will have on shaping future dialogues and decisions, not just within the realm of space exploration but across multifaceted global challenges.





# VIRTUAL REALITY EXTRAVAGANZA

Bal Bharati Public School, Pitampura renowned for its commitment to holistic education, recently set a new benchmark in innovative learning experiences during its Annual Carnival held from December 5th to 10th. The school, in a pioneering collaboration with Space India, introduced a groundbreaking Virtual Reality (VR) activity that transported parents, students, and teachers into the vast expanse of space, offering a mesmerizing glimpse into the International Space Station (ISS) and a lifelike Space Walk. The collaboration with Space India showcased the school's dedication to pushing the boundaries of conventional education. By leveraging cutting-edge VR technology, Bal Bharati Public School successfully blended entertainment with education, making the Annual Carnival a memorable and enriching event for all attendees. The meticulously crafted VR tour of the International Space Station allowed participants to explore the intricacies of life in space, fostering a deeper understanding of science and technology. The Annual Carnival, traditionally a celebration of the school community, took on a new dimension with the inclusion of the VR space adventure. Parents and teachers witnessed the enthusiasm and curiosity sparked in students as they delved into the mysteries of the cosmos. The event served as a reminder that education is not confined to textbooks and classrooms but can be a dynamic and immersive journey that leaves a lasting impact on young minds.



# ASTRAL ALLIANCE

On the 1st of December, the students enrolled in the UITS program of SPACE organized a special assembly in the school. The K.R. Mangalam Astronomy Assembly was organized entirely by passionate students. The event aimed to foster a love for astronomy, share knowledge, and create a platform for collaborative learning.

The assembly featured diverse sessions, including keynote addresses, interactive presentations, and students' self-composed poems. Noteworthy presentations covered topics such as "How do Scientists Study Space," "Exploring the Stars," and "Astronomy Facts." These talks were informative and showcased the depth of knowledge and research undertaken by the students.

Ishaan Singhal of class VIII-B presented his self-composed poem on chandrayaan-3 and Tvishi Bajaj conducted a small quiz for the students. The coordinator, Ms. Lekha felicitated a student of class VIII-A for his great performance in the Kalam Quiz Competition. Many students of class VI showcased their rocket and satellite models during the assembly.

The assembly showcased the talent and enthusiasm of students, who actively participated in organizing, presenting, and facilitating various event segments. Student-led discussions, poster presentations, and collaborative projects demonstrated the younger generation's depth of interest and dedication.





## ASTRO-TOURISM TO 'JIM CORBETT WITH NAINITAL'

DPSG School students embarked on a captivating 3-night, 2-day excursion to Jim Corbett and Nainital, designed to offer a harmonious blend of adventure, education, and recreational activities.

The journey commenced with students leaving the school premises, relishing delectable enroute meals at Moga hotel. Upon arrival at the hotel, they freshened up before venturing to Dev Bhoomi Outdoor Adventure for an exhilarating array of outdoor activities. As night fell, an enthralling astronomy session captivated the students, followed by a delightful dinner and an overnight stay at the hotel.

The following morning, students awoke to another day brimming with exploration. The schedule included a visit to Nainital, where they explored the Eco Cave Garden and leisurely strolled along the renowned Mall Road. In the evening, students were treated to additional astronomy sessions complemented by a lively DJ Night. The day concluded with a serene night's rest at the hotel.

The ultimate day kicked off with a thrilling jungle safari, offering students the chance to encounter the diverse wildlife in Jim Corbett. Following a return to the hotel for breakfast, an educational rocketry session was incorporated into the adventure. A ceremony was held to acknowledge outstanding performances, culminating in a group photograph that captured enduring memories. Satisfying enroute meals at Mc'D provided a welcomed break before students were safely transported back to school.

The DPSG School's excursion to Jim Corbett and Nainital proved to be a remarkable success, affording students a comprehensive experience encompassing adventure, education, and cultural discovery. The memories forged during this journey are bound to resonate in the hearts and minds of the students, nurturing a sense of camaraderie and adventure.



**CONTACT INFO@SPACE-GLOBAL.COM TO TRAVEL WITH US**



## DEHRADUN WITH DHANAULTI

The students from DPSG School embarked on a captivating and educational journey spanning 3 days and 2 nights, exploring the scenic landscapes of Dehradun and Dhanaulti, crafting cherished memories that are bound to endure for a lifetime. The expedition commenced with the excitement of leaving the familiar school grounds, marked by delightful pit stops for scrumptious meals at Bikanerwala. The meticulously planned itinerary unfolded with an enriching educational tour of the Forest Research Institute (FRI), offering students valuable insights into the world of forestry and research. Subsequently, the adventurers retreated to their accommodations at the hotel for a well-deserved period of rest, preparing for the exciting days ahead.

The thrill continued as the group ventured to Robbers Cave, where the students actively engaged in a series of captivating team-building activities. The camaraderie reached new heights as the evening unfolded with the beats of a DJ, providing a lively backdrop for more team-building camaraderie. The day reached its zenith with a delectable dinner, fostering connections among the students, and culminated in a peaceful overnight stay at the hotel.

As the sun cast its first rays on the following day, the students greeted a new morning, commencing their day with a nourishing breakfast in the inviting ambiance of the hotel. The expedition continued as they made their way to the Dhanaulti camp, a haven of adventure nestled amid nature's beauty, offering a plethora of exhilarating activities. After completing the check-in process and savoring a fulfilling lunch, the group experienced a peaceful interlude, allowing them to connect with the serene surroundings.

The day's exploration extended to the eco garden, where the students immersed themselves in the wonders of nature. The lush greenery, vibrant flora, and the harmonious balance of the ecosystem provided a backdrop for both relaxation and appreciation of the environment. Additionally, the students engaged in an enlightening astronomy session, deepening their understanding of the celestial wonders that grace the night sky. The day concluded with a flavorful dinner at the camp, providing a perfect balance of adventure, stargazing expedition and relaxation.

On the third and final day, the students commenced their morning with a captivating rocketry session, crafting and launching their own hydrorockets—a hands-on experience that added an extra layer of excitement to their journey. The session was punctuated with a lively prize distribution ceremony, acknowledging the efforts and achievements of the students. A group photo served as a snapshot of the shared experiences and bonds formed during the trip. The school bid a fond farewell to Dhanaulti, making a poignant stop at the Mind Rolling Monastery in Dehradun. The journey back included an en-route lunch, and as the students were dropped off at the school, they carried with them not only sweet memories but also a sense of accomplishment and camaraderie forged through this unforgettable expedition.





## *In the Shadows of Science: Project Paridhi's Solar Odyssey*

Since its inauguration in 2010, Space India's flagship initiative, Project Paridhi, has been illuminating the minds of students and the public alike. The primary objective of this program is to enhance public understanding and passion for astronomy and space exploration. The term "Paridhi," translating to "circumference," succinctly captures the project's distinctive goal—calculating the Earth's circumference using sunlight, shadows, and everyday objects.

This groundbreaking experiment draws inspiration from the work of the ancient Greek mathematician, geographer, and astronomer Eratosthenes, who, over 2300 years ago, made history by calculating the Earth's circumference. Eratosthenes, based in Alexandria, Egypt, observed an intriguing phenomenon during the summer solstice: no shadow was cast by a well in the nearby village of Syene, while a shadow was evident in Alexandria. His deduction that the Earth must be curved due to this discrepancy laid the foundation for the Sun's angle, a crucial element in estimating the Earth's circumference.

Project Paridhi meticulously recreates Eratosthenes' historic experiment using simple items like towers, twigs, and rods. By measuring the Sun's angle at two distinct points and knowing the distance between them, students can calculate the Earth's circumference using a straightforward formula. The project goes beyond mere calculations; it serves as an educational tool, imparting knowledge about Earth's rotation, solstices, equinoxes, and their connection to shadows. For instance, students discover that equinoxes witness no shadows when the Sun is directly overhead at the equator, while solstices exhibit shadowless latitudes when the Sun is above the Tropic of Cancer or Capricorn.

What sets Project Paridhi apart is its versatility. It transcends seasonal restrictions, allowing students to experiment at any time. By incorporating the latitude of a location and the Sun's declination for a specific date, students can compute distances with remarkable precision.

This project has left its scientific mark at various historical sites in India, including the iconic Qutub Minar. Serving as the experiment's "gnomon," Qutub Minar adds historical significance to this educational endeavor.

Project Paridhi is a testament to the significance of hands-on science education. It not only sparks interest in our planet and the cosmos but also pays homage to brilliant minds like Eratosthenes. Through this project, students embark on a scientific journey, unraveling the mysteries of the world one shadow at a time.





Highlighting the recent conduction of Project Paridhi on December 22nd, UITS (Universe in the School) and the following schools—JBM Global School, Noida; KRM Vaishali School; and DPS Greater Faridabad—played host to students from different classes. Their enthusiastic participation in the project added another dimension to their learning experience, underscoring the project's impact on practical science education.

### Highlights of the Event in UITS Schools

#### 1. JBM Global School, Noida

In this engaging experiment designed for 7th-grade students, a group of 20 participants embarked on a journey to explore cardinal directions and the Earth's circumference. By measuring the shortest shadow at different times of the day, these young scientists honed their observation and measurement skills. The hands-on nature of the activity not only made learning enjoyable but also laid the foundation for understanding basic concepts in geography and astronomy.

#### 2. K. R. Mangalam World School, Vaishali

The shortest shadow experiment took on a larger scale in the 8th-grade classroom, where 50 students enthusiastically participated in this multidisciplinary exploration. Armed with a solid foundation in mathematics and science, these students delved into the complexities of cardinal directions and the Earth's circumference.

#### 3. DPS, Sec. 81, Greater Faridabad

In the 9th-grade classroom, 45 students took on the challenge of the shortest shadow experiment, demonstrating a more advanced understanding of geography and astronomy. Building on their previous knowledge, these students applied sophisticated measurement techniques and analytical skills to calculate cardinal directions and the Earth's circumference.

## iASTRONOMER

Ed-tech team, a unit of SPACE India, embraced the winter solstice by orchestrating Project Paridhi online. This educational and entertaining event guided students in discovering how to calculate the Earth's circumference, mirroring the methods employed by the renowned astronomer Eratosthenes over 3,000 years ago. On December 21st, in a captivating live session, a training for Project Paridhi was hosted. The Zoom meeting witnessed an enthusiastic participation of members of iAstronomer club, making it an engaging experience. It was fascinating to observe students sharing their insights on the shortest shadow experiment and their calculations of the Earth's circumference. The event turned out to be a resounding success, leaving a lasting impact on all the attendees. Following the successful demonstration, students calculated 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.





# UNIVERSE FOR ALL

## IGNITING COSMIC CURIOSITY IN THE CLASSROOM

In a dazzling display of curiosity and wonder, the young minds of Class 2 and 3 of Sri Venkateshwar International School, Dwarka recently embarked on an astronomical odyssey that transcended the confines of their classrooms. The Astronomy event, unfolded as a celestial tapestry, weaving together education and excitement in a manner that left an indelible mark on our budding astronomers.

Different activities enjoyed by students were solar observation through solar view glasses and with 200mm Dobsonian telescope, Ring the Planets, Weigh yourself on different planets, Stomp rocketry, POP rocketry, MOON walk activity, Astronomy Tattoo station, Astronaut cut out, Satellite models, and many more.

One of the highlights of the event was the engaging activity "Ring the Planets," where students eagerly participated in a hands-on experience that brought our solar system to life. With planets placed on the ground, students took turns tossing rings, aiming to encircle these celestial bodies. Laughter and cheers filled the air as they celebrated their successful attempts, all the while absorbing fundamental facts about the order of planets in our cosmic neighborhood.

Hydro Rocketry took the excitement to new heights – quite literally! Eyes widened in awe as these make shift spacecraft defied gravity, inspiring dreams of interstellar exploration among our young enthusiasts.

The "Moon Walk" transported the participants to the lunar surface, complete with simulated low-gravity environments. Clad in space-themed costumes, the students delighted in taking lunar strides, mirroring the iconic moments of human exploration on Earth's celestial companion.

The event reached its zenith with the Solar Observation through 200mm Dobsonian Telescope. Under the guidance, students peered through telescopic lenses, witnessing the dance of sunspots and solar flares on the surface of our life-giving star. The sheer amazement on their faces as they glimpsed the intricacies of the sun underscored the transformative power of experiential learning.

As the day unfolded, the atmosphere buzzed with an infectious enthusiasm that radiated from each participant. The event not only fostered a love for astronomy but also ignited a passion for scientific inquiry. Our classrooms were transformed into cosmic playgrounds, where learning became an adventure and curiosity became the compass guiding these young minds through the vast expanse of the universe.

In conclusion, the Astronomy event for Class 2 and 3 was a resounding success, leaving an indelible impression on both students and teachers. Through such engaging events, we nurture the next generation of astronomers, igniting a spark that will continue to illuminate their academic paths for years to come.





# Stepping stone for exploring the cosmos in the heart of pink city

The enchanting city of Jaipur, known for its rich history, vibrant culture, and architectural marvels, is now set to embark on a new journey beyond the earthly realms. Imagine delving into the mysteries of the cosmos, unravelling the secrets of distant galaxies, and understanding the wonders of space right in the heart of the Pink City. This dream has become a reality with the launch of a groundbreaking Space Explorers Workshop at Cambridge court group of School in Jaipur.

## Why Space Workshop in Jaipur?

Jaipur, with its burgeoning academic community, inquisitive minds, and a growing interest in science and technology, is the perfect canvas for a venture into the captivating world of space science. By introducing a Space Workshop, we aim to nurture a spirit of curiosity and scientific exploration among the students of Jaipur, inspiring the next generation of space enthusiasts and scientists.

## Workshop Highlights:

### Hands-On Learning:

The workshop features a hands-on approach to learning, allowing participants to engage in exciting experiments and activities. From building model rockets to making celestial bodies such as the comets, learning about the magic of light to understanding the science of light **LIGHT-O-LOGY...!**

### Virtual Sessions:

Renowned space scientists, astronomers, and researchers were invited to conduct exclusive virtual sessions, sharing their insights and experiences. These experts will cover a wide range of topics, including the history of space exploration, current advancements in astrophysics, and the possibilities of future space missions.

### Community Engagement:

The workshop will not only cater to individuals but also extend its reach to educational institutions, fostering collaborations with schools and colleges in Jaipur. This initiative aims to integrate space science into the local educational curriculum, creating a lasting impact on student's academic journeys.

### Conclusion:

The launch of a Space Science Workshop at Cambridge Court group of Schools in Jaipur marks a significant stride towards cultivating a scientific mindset and fostering a passion for space exploration in the Pink City. By providing a platform for hands-on learning, expert insights, and community engagement, this workshop aims to ignite the flames of curiosity and inspire a new generation of space enthusiasts in Jaipur. Let's embark on this celestial journey together, as we reach for the stars from the heart of Rajasthan.





# Voyaging through the cosmos with Sam Gibbs

On December 5th 2023, the American Center hosted the masterclass 'Voyage to the Cosmos' between 3.30 and 5.30 pm. Mr Sam Gibbs conducted the session, aiming to examine recent explorations that took place using remote-sensing spacecraft and rovers. He also shared unseen aspects of the solar system through striking images and high-definition videos.

Shortly before the start of the session, Space India employees descended on the venue with smatterings of interest and excitement. After all, this is not the first Space Science event from the American Center that the team has attended, so we knew it would be enlightening. Additionally, Mr Gibbs is an amateur astronomer who has dedicated the past 20 years to developing public outreach programs and courses based on STEM and conducted several observations of the night sky from the Himalayas.

Throughout the masterclass, Mr Gibbs captured the audience with humorous actions, fun demonstrations, fascinating videos, and interesting insights. An example of an insight is when he showed the live landing of the Perseverance Rover on the Martian soil. In this live video, we, the audience, could see Perseverance's view of the descent and landing alongside the live reaction of NASA engineers. Unfortunately, we did not see the full video, but Mr Gibbs did not allow that to detract from his point. He highlighted how we, the audience, had no personal stakes in the success or failure of the descent, but for NASA engineers, it is different. They were watching the work they dedicated years of their lives descend into another world. If something went wrong, the years of work are gone.

Mr. Gibbs also conducted demonstrations to aid in the audience's visualisation of specific points. With one of these demonstrations, he explained why the James Webb Space Telescope (JWST) captures the electromagnetic (EM) waves in the infrared (IR) wavelength. Instead of giving a long-winded explanation, a volunteer got invited onto the stage. Then, with a black bin bag covering the volunteer, his phone, and an IR camera, he showed how, even though we could not see what the volunteer was doing under the bin bag with our eyes, we still knew what he was doing as through the IR camera we could see his actions. He compounded his point by showing the stars previously hidden from the Hubble Space Telescope but were revealed by JWST.





The demonstrations and insights were a supplemental part of the session. The actual part of the event was travelling through the Solar System before venturing into the universe. The sights of the Solar System were jaw-dropping. For example, we got to see the sun and its features in different parts of the electromagnetic (EM) spectrum as well as the solar magnetic field through a live capture of the sun. Additionally, we got to see the granulations of the sun due to the convection zone that lies under the photosphere. Mr Gibbs also highlighted the size of the sun by pointing out that a tiny spot on the screen was equivalent to the Earth... the full Sun was not on the screen. Mr Gibbs also utilized an interesting software known as Space Engine to show off the features of the planets in the solar system as we visited them and divulging a little fact. A notable stop was Mars, where he shared the insight I had written earlier. While visiting the red planet he showed the Martian polar caps, which has enough water to cover the planet in 1 m of water, as well as Valles Marineris (or Mariner Valley) which looks like a giant scar on the planet's surface. The valley system is so long that India, a country that is notable for its length is shorter than it.

Treating the audience to the features of the planets aren't the only thing that Mr. Gibbs did. After showing off the polar hexagons on Saturn, he fiddled with the software to get the audience to stand with the icy particles of Saturn's rings before transporting us lakeside on Titan. Being lakeside on Titan was fascinating, but it did not hold a candle to being inside the ring and looking up at the gas giant. The emotion it inspired is akin to awe, but awe does not encapsulate it well.

The audience and Mr Gibbs enjoyed themselves immensely, and no one realized that time was flying past. When accepting questions, he did not make the person feel silly and gave an explanation that was easy to understand. Unfortunately, the session eventually concluded. Afterwards, the audience descended onto Mr Gibbs to ask him more questions and take photos. The team enjoyed themselves immensely and look forward to the next space science event that the American Center will host.





# Celestial Crescendo: The Platerium Showcase

A planetarium show is like a mind-blowing journey through the universe without even leaving your seat! It's this incredible experience where students get to sit back and watch a stunning projection of stars, planets, and galaxies on a dome-shaped screen. It's like being transported to outer space!

These shows are super important because they help us understand and appreciate the vastness and beauty of our universe. They give us a chance to learn about different celestial objects, their movements, and their significance. It's like having a front-row seat to the wonders of space!

Planetarium shows also play a crucial role in education. They make complex astronomical concepts more accessible and engaging for people of all ages. Whether you're a curious kid or a seasoned space enthusiast, these shows can teach you so much about our solar system, the Milky Way, and even distant galaxies.

Furthermore, planetarium presentations have the power to arouse awe and interest in the universe. They spark our curiosity and compel us to ponder the mysteries around space. Perhaps a planetarium display can serve as an inspiration for the upcoming generation of space explorers, astronomers, or astronauts!



"One day, I will go to space." I'll be an astronaut like this. After watching these, students' opinions of space science underwent a substantial shift, and their level of curiosity about the field increased dramatically.

The planetarium was installed at JBM Global School, Noida on December 6 and 7. These two days of programs in the planetarium were attended by students from classes I to IX. Shows about the moon landing and deep space objects were aired throughout these two days. Students had a great time seeing the planetarium displays, and their knowledge of astronomy increased dramatically when an astronomer from Space India explained the science behind them. Watching the space-related shows within the dome piqued the interest of the students. It was the first time the majority of the students had ever seen a planetarium display. Their opinions about space changed quickly after they saw programs about moon landings and deep space objects. Their enthusiasm for space exploration also significantly rose, and the majority of them began shouting,



# Celestial Marvel Day

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# MONTHLY TELESCOPIC OBSERVATION

SPACE ARCADE team conducted their 12th Monthly Telescopic Experience session on the 23rd of December in Chennai and Delhi.

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

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





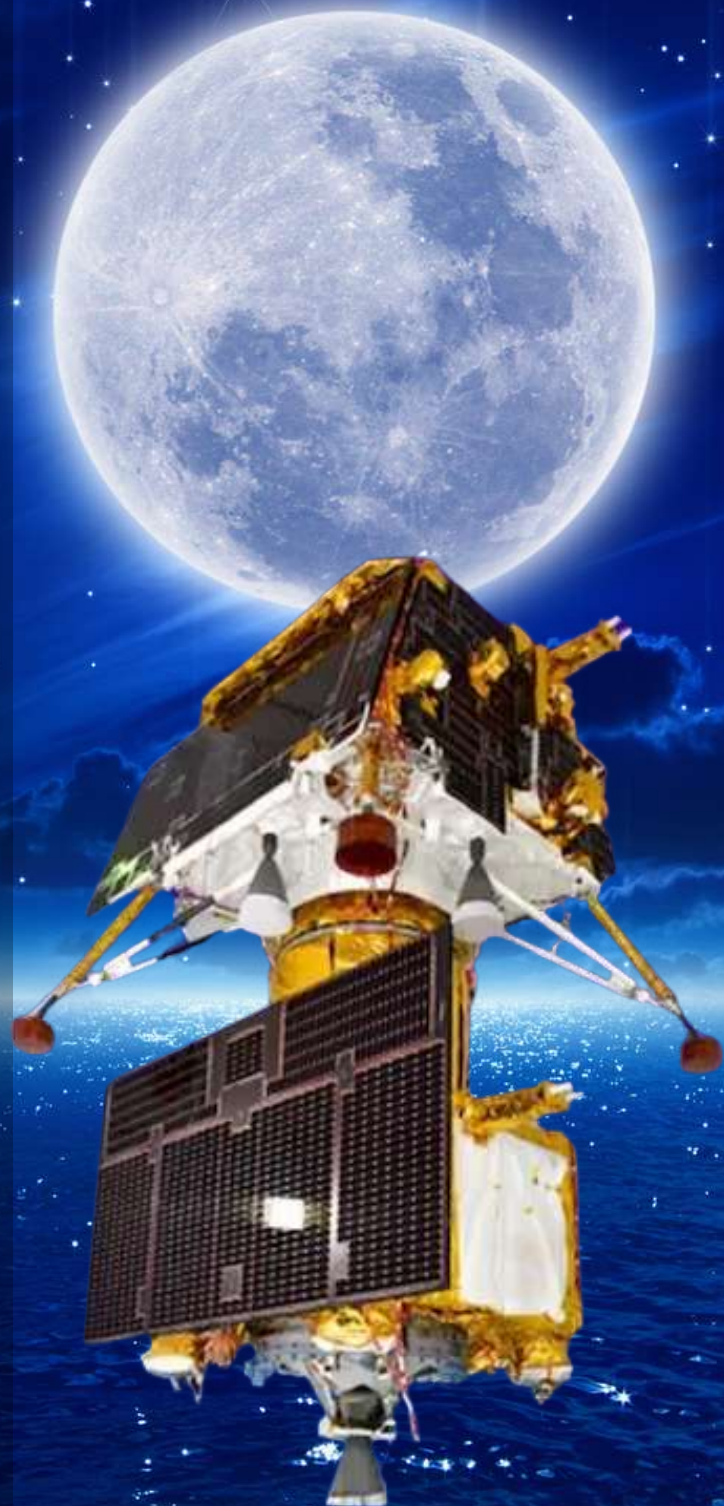
## India returns Chandrayaan-3 moon mission's propulsion module to Earth orbit

The Indian Space Research Organisation (ISRO) has repurposed the propulsion module of Chandrayaan-3, the spacecraft that carried India's lunar lander-rover duo to the moon. In a surprising move, ISRO shifted the module out of lunar orbit and positioned it high above Earth for an additional mission. The module, powered by solar panels, is now circling Earth every two weeks on leftover fuel. This bonus mission aims to demonstrate technologies for bringing lunar samples to Earth in the future.

Having completed its primary task of placing the robotic lander and rover on the moon in August, the propulsion module transitioned to a higher lunar orbit for a scientific experiment related to the search for Earth-like exoplanets. With 220 pounds of fuel remaining after its primary operations, ISRO decided to bring the module back to Earth.

In early October, the module was boosted from a low lunar orbit to over 3,100 miles above the moon's surface. After whirling around the moon four times to gain momentum, it embarked on its return journey to Earth. On November 22, the module reached its closest point to Earth, safely away from other satellites.

Chandrayaan-3's robotic explorers, Pragyan and Vikram, achieved significant milestones on the moon, including the detection of sulfur in lunar soil by Pragyan and Vikram's groundbreaking in-situ measurement of the moon's soil temperature. Despite going silent in late September, the mission was deemed successful, with ISRO stating that all objectives had been met. The unexpected bonus mission involving the propulsion module is aimed at advancing lunar sample return technologies. ISRO has not disclosed plans for the module once it exhausts its remaining fuel.





# Betelgeuse Nearly Disappeared

The bright star Betelgeuse did become fainter – and, for experienced observers using the right equipment, nearly disappeared on December 12, 2023. The event occurred as asteroid Leona passed in front of the star. But the event was quick! And it was subtle: a momentary dimming of the star.

This occultation provided an extraordinary opportunity for astronomers to study Betelgeuse's photosphere, the visible layer from which the star emits most of its energy. The Asteroid, **319 Leona**, is a main belt object located between Mars and Jupiter, with a roughly egg-shaped profile measuring around 50 by 34 miles (80 x 55 kilometers).

## Asteroid Leona

Asteroid Leona, officially designated as 2022 LL, is a small celestial object that was discovered on June 11, 2022, by astronomers. It belongs to the Apollo group of asteroids and has an estimated diameter of approximately 1.3 kilometers. Leona's orbit intersects with the Earth's, making it a potentially hazardous asteroid. However, it poses no threat during its upcoming passage in front of Betelgeuse.

## Betelgeuse

Betelgeuse is one of the most recognizable stars in the constellation Orion. As a red supergiant, it holds great significance in the field of astronomy. Located approximately 700 light-years away from Earth, Betelgeuse marks the shoulder of Orion and is known for its distinctive red color. It is expected to undergo a supernova explosion within the next million years, making it a subject of immense interest among astronomers.

Betelgeuse has garnered attention in recent years due to its significant brightness fluctuations. Some astronomers speculate that the star may go supernova and explode in the foreseeable future, while others estimate that Betelgeuse is still tens of thousands to hundreds of thousands of years away from reaching that stage.





# New Hubble Telescope image shows mysterious spokes on Saturn's rings

The Hubble Space Telescope has captured mysterious features on Saturn's rings, marking the onset of the planet's "spoke season." Saturn, like Earth, experiences seasons due to its axial tilt, but its extended orbit results in each season lasting approximately seven Earth years. During an equinox, when the rings tilt edge-on toward the sun, spokes—mysterious lines—appear on Saturn's rings. These spokes are believed to be influenced by the planet's variable magnetic field, interacting with the solar wind and creating an electrically charged environment.

The upcoming fall equinox on May 6, 2025, will make these spokes more prominent in Saturn's northern hemisphere. NASA's Hubble Space Telescope, as part of the Outer Planet Atmospheres Legacy (OPAL) program, is closely monitoring Saturn's spokes. The OPAL program aims to build an archive of outer solar system planets' data, providing an extended opportunity to study the spoke phenomenon.

Saturn's spokes were first observed by NASA's Voyager mission in the 1980s, and the Cassini spacecraft observed the planet's last equinox in 2009. Hubble's observations, combined with archived Cassini data, offer a comprehensive exploration of the spoke phenomenon, shedding light on ring physics. The spokes may appear dark or light, depending on illumination and viewing angles, and they vanish during the planet's summer or winter solstice.

Saturn remains the only known ringed planet in our solar system where such spokes have been observed, making it a unique and captivating natural occurrence. The study aims to unravel the intricacies of Saturn's spokes and their implications for our understanding of ring physics.



(Image credit: NASA, ESA, STScI, Amy Simon (NASA-GSFC))



# INDIA'S ADITYA-L1 SOLAR OBSERVATORY CAPTURES 1ST GORGEOUS VIEWS OF THE SUN

India's Aditya-L1 solar observatory, equipped with the Solar Ultraviolet Imaging Telescope (SUIT), has unveiled stunning images of the sun, marking its initial foray into solar observation. The spacecraft, launched on September 2 from Sriharikota, embarked on a four-month journey to the L1 orbit, positioned approximately 1 million miles from Earth, providing a strategic vantage point for continuous solar monitoring.

SUIT, the instrument responsible for capturing the captivating images, showcased various features on the sun's surface, such as sunspots, a solar "plage," and inactive regions. The principal investigator of SUIT, Durgesh Tripathi, expressed enthusiasm, calling it a "lifetime opportunity to conceive a space telescope and get to see its first light observations."

The observatory, Aditya-L1, is operated by the Indian Space Research Organisation (ISRO) in collaboration with institutions in Ahmedabad, Pune, and Kerala. Scientists initiated SUIT on November 20, capturing clear images of four sunspots, one of which was situated close to the sun's equator. The sun's visible "surface," known as the photosphere, is a thin layer of hydrogen and helium, approximately 62 miles thick, housing sunspots—dark, planet-sized areas with intense magnetic fields.

The images also revealed a "quiet sun" to the left of the sunspots, indicating a calmer region. Below the equator, the images displayed a "plage," a hot region typically found in the chromosphere, the sun's atmospheric layer above the photosphere but beneath the corona.

Aditya-L1's strategic position in the L1 orbit allows for continuous solar observation with minimal fuel usage and limited orbital maneuvers. The spacecraft passed Earth's gravitational influence in late September and is anticipated to reach its final orbit later in the month or early next year.

The observatory carries seven scientific instruments, including the Aditya Solar Wind Particle Experiment (ASPEX), designed for in-situ observations to study the composition of solar wind. ISRO reported that ASPEX was performing as expected. Additionally, another payload aimed at monitoring solar wind was activated and declared in good health.

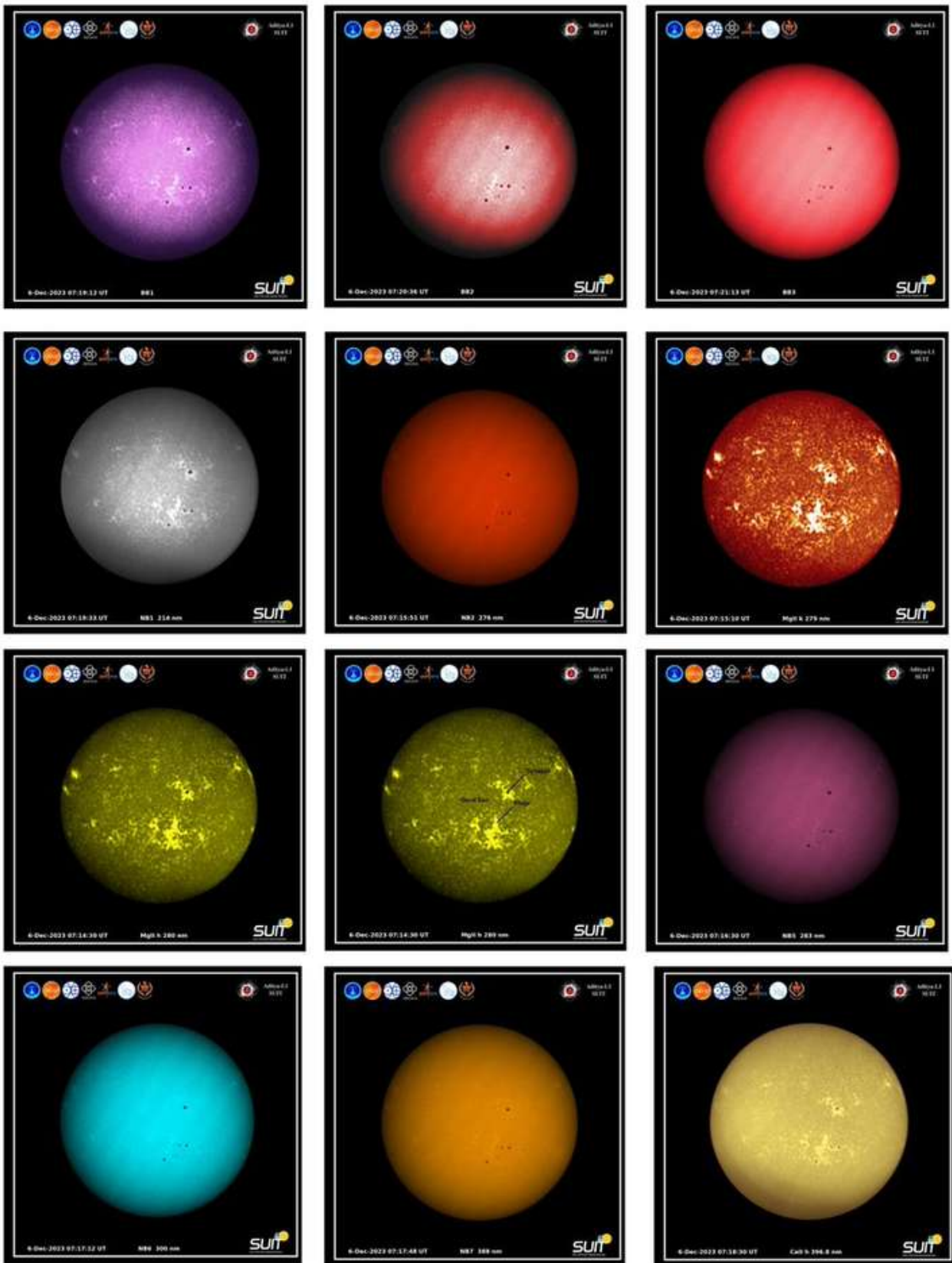
The mission's overarching goals include studying the behavior of solar wind particles after being emitted by the sun and monitoring the sun for upcoming solar flares. Scientists hope to leverage data from the Aditya-L1 mission to predict solar flare activity and associated phenomena like coronal mass ejections.

This mission signifies a significant step in India's space exploration endeavors, contributing valuable insights into solar dynamics and advancing our understanding of the sun's behavior. As Aditya-L1 continues its mission, it is poised to provide crucial data that may aid in space weather predictions and enhance our comprehension of solar phenomena.



# Aditya-L1's SUIT captures full-disk images of the Sun in near ultraviolet wavelengths

December 2023





# Perseverance rover celebrates 1,000 Mars days on the Red Planet

NASA's Perseverance rover has achieved a significant milestone by completing 1,000 Martian days, or sols, on the Red Planet. The car-sized rover, along with its robotic companion, the Ingenuity helicopter, landed on Mars' Jezero Crater on February 18, 2021. Perseverance's primary goal is to search for signs of ancient life on Mars by exploring the floor of the 28-mile-wide Jezero Crater, chosen for its past indication of a large lake.

The rover's mission team celebrated the 1,000-sol mark on Tuesday, December 12, even though Sol 1,000 extended into Wednesday, December 13. JPL (NASA's Jet Propulsion Laboratory) manages the Perseverance mission.

Jezero Crater's geological history, dating back approximately four billion years, reveals that the crater was formed by an asteroid impact. Perseverance has found that the crater's floor is composed of volcanic rock, with sandstones and mudstones indicating the presence of a river that flowed into Jezero, forming a large lake.

Perseverance has played a crucial role in piecing together the crater's history by exploring its lake and river phases. The rover is also engaged in collecting and caching samples, a total of 23 so far, which are intended for future return to Earth as part of a joint NASA-European Space Agency campaign in the 2030s.

The samples include intriguing specimens like "Lefroy Bay," which contains a substantial amount of fine-grained silica, known for preserving ancient fossils on Earth. Another sample, "Otis Peak," holds a significant amount of phosphate, often associated with life as we know it, and both samples are rich in carbonate, capable of preserving environmental conditions from the rock's formation period.

Ingenuity, the 4-pound helicopter, is also marking the 1,000-sol milestone. Originally designed as a technology demonstrator for a five-flight campaign, Ingenuity exceeded expectations and has completed 62 flights during its extended mission. The helicopter continues to operate as a scout for Perseverance.

Perseverance's mission on Mars remains ongoing, and the rover is expected to provide valuable insights into the Red Planet's geological history and the potential for past habitability. Additionally, the data collected and samples cached by Perseverance will contribute to our understanding of Mars and may play a crucial role in future missions to the planet.



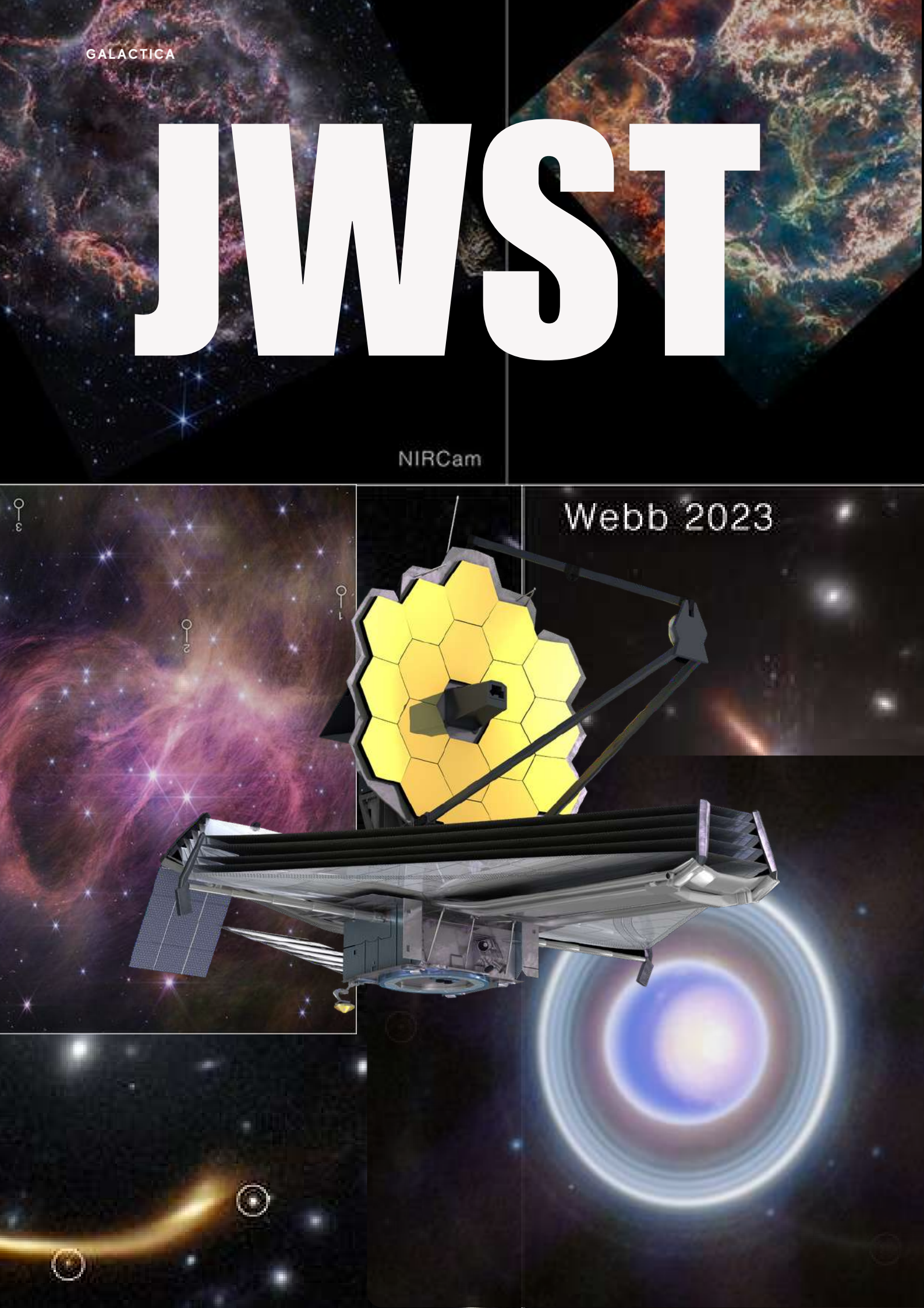


GALACTICA

# JWST

NIRCam

Webb 2023





# ABOUT JAMES WEBB SPACE TELESCOPE (JWST)

The James Webb Space Telescope (JWST) is an infrared astronomy space telescope. Its high-resolution and high-sensitivity instruments allow it to witness objects that the Hubble Space Telescope cannot because they are too old, distant, or faint.

The Webb was launched on an Ariane 5 rocket from Kourou, French Guiana, on December 25, 2021. It reached at its goal in January 2022, a solar orbit at the Sun-Earth L2 Lagrange point, roughly 1.5 million kilometers (930,000 miles) from Earth. On July 11, 2022, the first image from the telescope was made public.

The Integrated Science Instrument Module (ISIM) is a framework that supplies the Webb telescope with electrical power, computational resources, cooling capability, and structural stability. It is constructed from bonded graphite-epoxy composite that is affixed to the underside of Webb's telescope construction. The ISIM houses four scientific instruments as well as a guide camera as follows:

- [NIRCam](#) (Near Infrared Camera)
- [NIRSpec](#) (Near Infrared Spectrograph)
- [MIRI](#) (Mid-Infrared Instrument)
- [FGS/NIRISS](#) (Fine Guidance Sensor and Near Infrared Imager and Slitless Spectrograph)

## NASA'S WEBB STUNS WITH NEW HIGH-DEFINITION LOOK AT EXPLODED STAR

In a stunning image released by NASA's James Webb Space Telescope, supernova remnant Cassiopeia A (Cas A) gleams like a brilliant, round ornament waiting to be placed in the ideal location on a holiday tree.

This star explosion is seen at a resolution previously unattainable at these wavelengths according to Webb's NIRCam (Near-Infrared Camera) image of Cas A.

This high-resolution image reveals minute features of the material's expanding shell slamming into the star's gas shed just before it erupted. The big, striated blob is known as Baby Cas A because it resembles a progeny of the primary supernova.

This is a light echo—distant dust is glowing as it cools down—that light from the star's long-ago outburst has reached. The Cas A in the Cassiopeia constellation, 11,000 light-years away, is a supernova remnant. From our perspective, it is thought to have exploded approximately 340 years ago.





## NASA'S WEBB IDENTIFIES TINIEST FREE-FLOATING BROWN DWARF



Objects that lie in between stars and planets are known as brown dwarfs. They grow thick enough to collapse under their own gravity, much like stars do, but they never get hot enough or dense enough to start fusing hydrogen and transform into stars.

The tiniest thing that can form in a way similar to a star is what astronomers are attempting to figure out.

A team using NASA's James Webb Space Telescope has identified the new record-holder: a tiny, free-floating brown dwarf with only three to four times the mass of Jupiter.

Tiny brown dwarfs can provide astronomers with insights not only into the star-formation process but also into exoplanets. Since the largest exoplanets and the least massive brown dwarfs overlap, certain similarities between them might be predicted. But studying a free-floating brown dwarf is less complicated than studying a massive exoplanet.

The question of whether the objects are rogue planets that were expelled from planetary systems or brown dwarfs arises since they fall well inside the mass range of giant planets. More of these things will be found, which will assist elucidate their status. Extending the search region may find rogue planets within IC 348 if theories are correct and they are more likely to be found on the periphery of a star cluster.

## NASA'S WEBB RINGS IN THE HOLIDAYS WITH THE RINGED PLANET URANUS

Uranus, an ice giant that spins on its side. NASA's James Webb Space Telescope just set its sights on this peculiar and mysterious planet. With its rings, moons, storms, and other atmospheric phenomena, such as a seasonal polar cap, Webb was able to depict this dynamic environment.

The image adds more wavelength coverage for a more detailed appearance, building on a two-color version that was published earlier this year. The weak inner and outer rings of Uranus, including the elusive Zeta ring—the incredibly faint and diffuse ring closest to the planet—were recorded by Webb's extraordinary sensitivity.

In addition, it captured images of many of the planet's 27 known moons, even seeing a few tiny moons inside the rings. Of these, the planet's seasonal north polar cloud cap is one of the most remarkable. When the planet's pole starts to point toward the Sun as it gets closer to solstice and receives more sunlight, it appears that the polar cap will become more noticeable.

In the solar system, Uranus experiences the most harsh seasons due to its 98 degree tilt caused by spinning on its side. The Sun shines over one pole for over a quarter of the Uranian year, causing the other half of the planet to enter a gloomy, 21-year winter.





# ROCKET LAUNCHES IN JANUARY 2024

## Peregrine Lunar Lander (Vulcan VC25)

- Date: January 8, 2024
- Rocket: Vulcan VC25
- Agency: ULA (United Launch Alliance)
- Country: USA
- Launch Site: Space Launch Complex 41, Cape Canaveral, FL, USA
- Purpose: Maiden flight of ULA's Vulcan launch vehicle carrying the Peregrine lunar lander developed by Astrobotic Technology. Astrobotic was selected by NASA's Commercial Lunar Payload Services (CLPS) program to deliver up to 14 NASA payloads to the Moon on its Peregrine lunar lander in 2022.



## XpoSat (PSLV-DL)

- Date: January 1, 2024
- Time: 7:30 AM - 11:30 AM GMT+5:30
- Rocket: PSLV-DL
- Agency: ISRO (Indian Space Research Organisation)
- Country: India
- Launch Site: Satish Dhawan Space Centre First Launch Pad
- Purpose: At Satish Dhawan Space Centre, India's PSLV-DL will launch XPoSat (X-ray Polarimeter Satellite), marking India's first dedicated polarimetry mission. Studying bright astronomical X-ray sources in extreme conditions, XPoSat carries scientific payloads, including POLIX for measuring polarimetry parameters and X-SPECT for providing spectroscopic information in specific energy ranges.

## Kuaizhou-1A

- Date: January 5, 2024
- Time: 3:30 PM - 8:30 PM GMT+5:30
- Rocket: Kuaizhou-1A
- Agency: ExPace (Commercial rocket division of China Aerospace Science and Industry Corporation - CASIC)
- Country: China
- Launch Site: Jiuquan Satellite Launch Centre

Purpose: China's ExPace will launch the Kuaizhou-1A rocket from Jiuquan Satellite Launch Centre. Specializing in small satellite launchers, this mission contributes to ExPace's focus on providing commercial rocket services and highlights China's capabilities in the space industry.







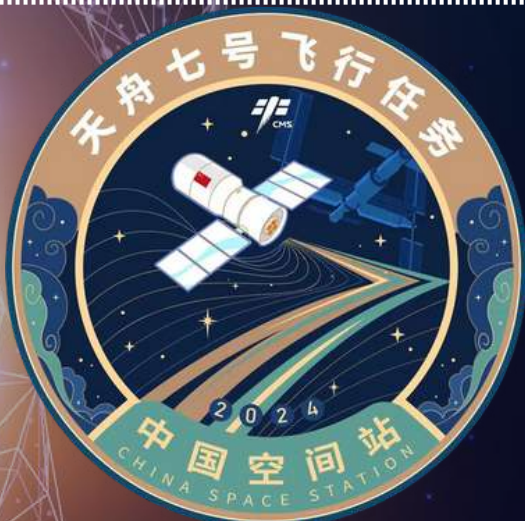
### INSAT-3DS

- Date: January 12, 2024
- Time: 5:00 PM - 9:00 PM GMT+5:30
- Rocket: GSLV Mk II
- Agency: ISRO (Indian Space Research Organisation)
- Country: India
- Launch Site: Satish Dhawan Space Centre Second Launch Pad
- Purpose: GSLV Mk II will launch INSAT-3DS, an Indian weather satellite, from Satish Dhawan Space Centre. As part of the Indian National Satellite System, INSAT-3DS provides meteorological services, search and rescue information, and message relay for terrestrial data collection platforms.

### Galactic 06

- Date: January 26, 2024
- Location: Spaceport America
- Rocket: SpaceShipTwo
- Agency: Virgin Galactic
- Country: USA

**Purpose:** Virgin Galactic's SpaceShipTwo will embark on its sixth commercial mission from Spaceport America. This mission signifies Virgin Galactic's ongoing efforts to make commercial space travel a reality for private individuals.



### Tianzhou 7

- Date: January 15, 2024
- Time: 1:00 PM UTC
- Rocket: Long March 7
- Agency: China Aerospace Science and Technology Corporation (CASC)
- Country: China
- Launch Site: Wencheng Space Launch
- Purpose: China Aerospace Science and Technology Corporation's Long March 7 will launch Tianzhou 7. Serving as a critical component of China's space program, this mission contributes to the country's advancements in spacecraft, launch vehicles, and strategic capabilities.



# SPACE X LAUNCHES IN JANUARY 2023

## Axiom Space Mission 3

- Date: January 10, 2024
- Time: 6:48 AM GMT+5:30
- Rocket: Falcon 9 Block 5
- Agency: SpaceX
- Country: USA
- Launch Site: Unknown Launching Pad, Cape Canaveral, FL, USA
- Purpose: Crew Dragon flight for Axiom Space. The mission will carry a professionally trained commander alongside three private astronauts to and from the International Space Station. This crew will stay aboard the space station for at least eight days.



## Ovzon-3

- Date: January 3, 2024
- Time: 3:16 AM - 5:16 AM GMT+5:30
- Rocket: Falcon 9 Block 5
- Agency: SpaceX
- Country: USA
- Launch Site: Cape Canaveral, FL, USA
- Purpose: The missions involve deploying the Ovzon-3 satellite, with the Falcon 9 first stage landing back at the launch site after the flights, demonstrating SpaceX's reusable rocket technology.

## Ax-3 (Axiom Space's 3rd private astronaut crew)

- Date: January 9, 2024 (Expected)
- Rocket: Falcon 9
- Agency: SpaceX
- Country: USA
- Purpose: SpaceX's Falcon 9 Block 5 will launch Axiom Space Mission 3, representing the first all-European commercial astronaut mission to the International Space Station. The diverse crew, including members from the U.S., Italy, Türkiye, and Sweden, highlights the international collaboration in space exploration.







**Cygnus CRS-2 NG-20 (S.S. Patricia "Patty" Hilliard Robertson)**

- Date: January 29, 2024
- Location: Cape Canaveral, FL, USA
- Rocket: Falcon 9 Block 5
- Agency: SpaceX
- Country: USA
- Purpose: 20th flight of Orbital ATK's uncrewed resupply spacecraft Cygnus, 19th flight to the International Space Station under the Commercial Resupply Services contract with NASA.

**Starlink Group 6-35**

- Date: Expected in January 2024
- Location: Cape Canaveral, FL, USA
- Rocket: Falcon 9 Block 5
- Agency: SpaceX
- Country: USA
- Purpose: Batch of satellites for the Starlink mega-constellation - SpaceX's project for a space-based Internet communication system.



**Starlink Group 6-37**

- Date: January 31 (Expected)
- Time: 6:02 AM (Expected)
- Location: Cape Canaveral, FL, USA
- Rocket: Falcon 9 Block 5
- Agency: SpaceX
- Country: USA
- Purpose: Batch of satellites for the Starlink mega-constellation - SpaceX's project for a space-based Internet communication system.



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



# WHAT'S UP IN THE SKY - JANUARY 2024

## LUNAR CALENDAR

### IMPORTANCE OF MOON PHASES FOR STARGAZERS

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

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

### Monthly Lunar Calendar JANUARY 2024

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

### PLANETS VISIBILITY

#### Mercury

Morning planet, best early January. Close encounter with Mars on 27 January.



#### Venus

Morning planet, slips closer to the Sun this month.



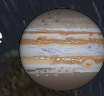
#### Mars

Morning planet, hard to see well. Near Mercury on 27 January.



#### Jupiter

Evening planet edging into twilight by the end of January.



#### Saturn

The Ringed Planet loses ground to the evening twilight during January.



#### Uranus

This ice giant planet is currently well placed in the evening sky, making it one of the best planets to spot tonight.



#### Neptune

The position of this planet deteriorates in the evening sky over the month.



### BRIGHT DEEP SKY OBJECTS

The Orion Nebula, designated as Messier 42, is a diffuse nebula situated south of Orion's Belt in the constellation of Orion. It is one of the brightest nebulae visible to the naked eye in the night sky with an apparent magnitude of 4.0. It is 1,344 light-years away and is the closest region of massive star formation to Earth.



M34 is a fine large open cluster located in the constellation of Perseus. At magnitude +5.5, it's visible as a faint smudge to the naked eye and is easily identifiable with binoculars, where the brightest members are resolvable. A small telescope reveals up to 20 bright stars embedded in nebulosity with about 80 members visible in large scope.



M52 is also one of the very richest open clusters in the Messier catalog, with a star density near the center of 1.5 stars per cubic light-year. The cluster itself is 22 light-years across. M52 lies within the circumpolar constellation of Cassiopeia. The Milky Way passes through here and the region is especially rich in open clusters.



The Triangulum galaxy, also known as Messier 33, is sometimes said to be the farthest object visible with the unaided eye (Mag 5.7). The Triangulum galaxy, named for its location in the constellation Triangulum, is the 2nd-nearest spiral galaxy to our Milky Way, after the Andromeda galaxy. It's about 2.7 million light-years from Earth.





## ASTRONOMICAL EVENTS - JANUARY 2024

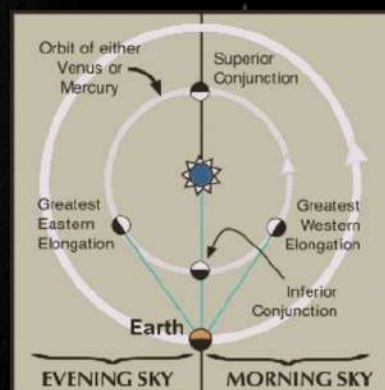
### MERCURY AT GREATEST ELONGATION WEST

Mercury's orbit is closer to the Sun than Earth's, therefore it constantly looks near to the Sun and is often obscured by the Sun's glare. It is only visible for a few weeks at a time when it is at its greatest separation from the Sun, which is referred to as the greatest elongation. These apparitions occur around once every 3-4 months, alternating in the morning and evening skies, depending on whether Mercury is to the east or west of the Sun. It rises and sets shortly after the Sun in the east and is noticeable in the early evening twilight. It rises and sets a little time before the Sun and is visible immediately before sunrise when it is to the west of the Sun.

Mercury is always near a line in the sky known as the ecliptic, which is the sun's apparent path on the celestial sphere during the year. This line depicts the plane of the Earth's orbit around the Sun as well as the route that the Sun follows through the zodiacal constellations each year. Because all planets orbit the Sun in almost the same plane, it also closely follows the planes of the other planets' orbits. When Mercury is far distanced from the Sun, it is separated along the ecliptic line. At sunset, however, the ecliptic intersects the horizon at varied angles depending on the time of year. This implies that Mercury appears at varying elevations above the horizon at different times of the year, even if its distance from the Sun remains constant.

At greatest western elongation, Mercury or Venus is visible as a morning object that rises in the east before the sun. At greatest eastern elongation, Mercury or Venus is visible as an evening object that sets in the west after the sun. In between these times, Mercury's swift orbit carries it either directly behind the Sun as seen from Earth (superior conjunction), or in front of it (inferior conjunction). Mercury's separation from the Sun varies between 18 and 28 degrees with each apparition.

## BEST DAY TO OBSERVE MERCURY



(Image Credit & Copyright: Earthsky.org)

**Where to look:** Look in the sunrise direction, as the sky gets lighter.

**Greatest elongation:** At 6:40 a.m. IST on January 13, 2024. It's 24 degrees from the sun with a magnitude of -0.6.

**Through a telescope:** Mercury will appear about 64% illuminated, at greatest elongation. It'll measure 6.8 arcseconds across.

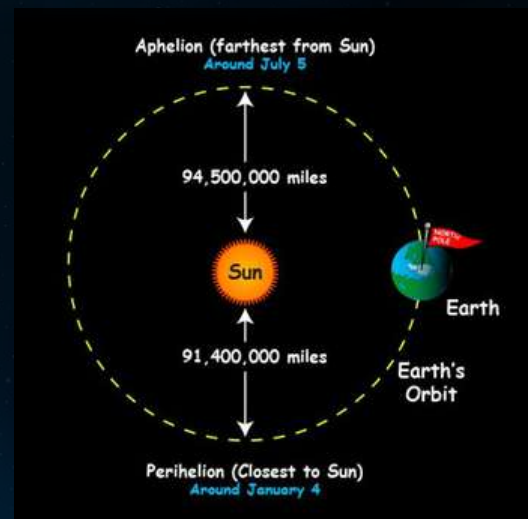
**Constellation:** Mercury will lie in front of the constellation Sagittarius: the Archer at this elongation.



# Earth at Perihelion

The word “Perihelion” comes from ancient Greek, where ‘peri’ means close and ‘helios’ means the Sun. The Earth orbits the Sun in an elliptical path, which means that there is one point on the path closest to the Sun and one point that is farthest away from the Sun. The Earth is closest to the Sun, at its perihelion, about two weeks after the December solstice, and farthest from the Sun, or at its aphelion, about two weeks after the June solstice. This variation is due to the gravitational influences of other planetary objects, particularly the Moon. Approximately every 100,000 years, the Earth's orbital path changes from being nearly circular to elliptical. The difference of the Earth's orbital shape from a perfect circle is known as its eccentricity. An eccentricity value of 0 is a circular orbit, while values between 0 and 1 describe an elliptical orbit. Due to variations in the eccentricity of the Earth's orbit, the dates when the Earth reaches its perihelion or aphelion are not fixed.

**NOTE:** Earth at Perihelion is a natural occurrence that does not result in any evident changes in the Earth's climate, it is a day to understand the planetary phenomenon and the importance of the Sun.



(Image Credit & Copyright: NASA)

- Perihelion in New Delhi, India is on Wednesday, 3 January 2024, 06:08 IST
- Distance from the Sun's center to Earth's center will be 147,100,632 km (91,404,095 mi) approx.

# Planetary Alignment



Place: New Delhi / Date: 8th January / Time: 06:25 AM

**When to look:** On January 8th, 2024 at 06:30 a.m. IST; just before the sunrise

**Where:** Constellation Scorpius (or Scorpio) which is the eighth sign of the Zodiac

**Planets aligned:** Mars, Mercury, Venus, and the Moon

**Type:** A mini morning alignment

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



# Quadrantid meteor shower

Unlike most meteor showers which originate from comets, the Quadrantids originate from an asteroid: asteroid 2003 EH1. Asteroid 2003 EH1 takes 5.52 years to orbit the Sun once. It may be a "dead comet" or a "rock comet" and was discovered on March 6, 2003, by the Lowell Observatory Near-Earth Object Search (LONEOS). 2003 EH1 is a small asteroid – its diameter measures only about two miles (three kilometers) across. It was astronomer and research scientist Peter Jenniskens who realized that 2003 EH1 was the source for the Quadrantid meteors.

Their radiant – the point in the sky from which the Quadrantids appear to come – is an obsolete constellation called "Quadrans Muralis." French astronomer Jerome Lalande created this constellation in 1795. (The constellation takes its name from an early astronomical instrument used to observe and plot star positions: a quadrant.) The Quadrantids were first seen in 1825.

When the International Astronomical Union (IAU) created a list of recognized modern constellations in 1922, Quadrans Muralis was left off the list. Quadrans Muralis is located between the constellations of Bootes and Draco (near the end of the handle of the "Big Dipper"). An alternative name for the Quadrantids is the Bootids since the meteors appear to radiate from the modern constellation of Bootes. Even though the constellation may no longer be recognized, it was considered a constellation long enough to give the meteor shower its name.

**Origin:** 2003 EH1 (an asteroid or a possible "rock comet")

**Predicted peak:** January 3-4, 2024, at 06:23 p.m. IST. Under a dark sky with no moon, the Quadrantids can (briefly) produce over 100 meteors per hour.

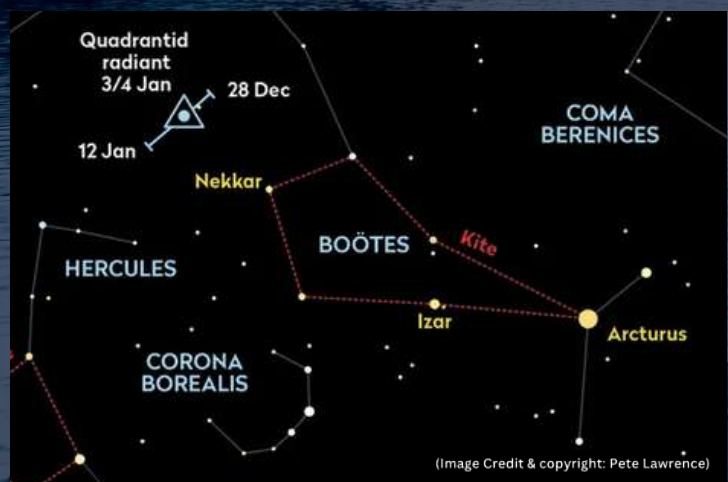
**When to watch:** Try late night January 3 to dawn January 4, in moonlight.

**Duration of the shower:** The Quadrantid meteor shower runs from mid-November through mid-January each year.

**Radiant:** Constellation Boötes

**Nearest moon phase:** The last quarter moon will come late on January 3, 2024.

**Note:** The Quadrantids are also sometimes called Bootids after the modern constellation, Boötes. The Quadrantid shower is one of four major meteor showers each year with a sharp peak (the other three are the Lyrids, Leonids, and Ursids).



Astronomer Peter Jenniskens proposed in 2003 that this object, 2003 EH1, is the parent body of the Quadrantid meteor shower.  
(Image credit & copyright: Wikimedia Commons)



# CONJUNCTIONS FOR THE MONTH

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

## Conjunction of Moon and Saturn

On January 14th, the ringed planet Saturn will meet the 3-day-old Moon in the constellation Aquarius. The apparent distance between the two objects will be  $2^{\circ}08'$  in the night. They will be in the South-western direction. Saturn is at a magnitude of 0.8 and the Moon has a magnitude of -10.5.



Place: New Delhi / Date: 14th January / Time: 06:51 PM

## Conjunction of Moon and Jupiter

On January 19th, the gaseous giant Jupiter will meet the 7-day-old Moon in the constellation Aries. The apparent distance between the two objects will be  $2^{\circ}46'$  in the night. They will be in the Western direction. Jupiter is at a magnitude of -2.5 and the Moon has a magnitude of -12.1.



Place: New Delhi / Date: 19th January / Time: 23:26 PM

## Conjunction of Moon and Pleiades

On January 20th, the Pleiades star cluster or seven sisters or Messier 45 (M45) will meet the 9-day-old Moon in the constellation Taurus. The apparent distance between the two objects will be  $0^{\circ}46'$  in the night towards the Western direction. The Pleiades is at a magnitude of 1.20 and the Moon has a magnitude of -11.39.



Place: New Delhi / Date: 20th January / Time: 11:23 PM

## Conjunction of Mercury and Mars

On January 27th, the smallest and fastest planet Mercury will meet the red planet Mars in the constellation Sagittarius. Both planets will share the same right ascension, with Mercury passing  $14'$  to the North of Mars. Mercury will be at magnitude -0.2, and Mars at magnitude 1.3.



Place: New Delhi / Date: 27th January / Time: 06:11 AM



# Introduction to

# Cultural Astronomy



The night sky has been one of humanity's longest companions. It has, to a certain extent, stayed constant: witnessing civilizations rise and fall. It is impressive, beautiful, and a source of awe and wonder. Thus, it is not surprising that people from these civilizations tracked the night sky, built monuments and planned their year around the sky. Celestial objects in the sky were utilized for cultural practices, such as seasonal calendars, predicting time, forecasting weather, informing social structure, and serving as a memory space. They potentially had elaborate rituals, festivals and precise timings for conducting crucial activities such as farming. Yet, thanks to the sands of time, the reasonings behind the practices are lost.

Cultural Astronomy, sometimes known as the study of astronomy in culture or anthropology of astronomy studies, is a field that studies the astronomy of ancient societies and cultures, focusing on their sites and structures. Cultural astronomy developed from archaeoastronomy and ethnoastronomy and is related to historical astronomy, history of astronomy and astrology and investigates the relationship between astronomy and astrology. The field is interdisciplinary, with astronomers, astrophysicists, anthropologists, archaeologists and indigenous scholars working in it. The field usually adds a great insight into what is known about early cultures, as most of these cultures used astronomy.

In this section, Galactica aims to enrich our readers with various topics from cultural astronomy. Astronomers have noticed that several people usually find this sub-field fascinating, and, at times, it inspires an understanding of the traditions and cultures of the ancient people alongside interest in other parts of astronomy. Some of the topics we aim to cover will be Stonehenge, the Sun Temple at Kornak, Nabta Plaza, and wayfinding, among others.







# Celestial Tales: The Cultural Significance of the Moon Across Millennia

## Introduction:

The Moon, Earth's only natural satellite, has captivated human imagination and culture across the globe for millennia. Its presence in the night sky has inspired diverse myths, legends, and symbolism in various cultures, reflecting a shared human fascination with this celestial body.

In many ancient cultures, the Moon was often associated with deities and considered a powerful force influencing life on Earth. In Greek mythology, the Moon was linked to the goddess Selene, while in Roman mythology, it was associated with Luna. These deities were often depicted riding a chariot across the night sky, illuminating the world below.

In **Hindu mythology**, the Moon is personified as the god Chandra. Chandra is considered a gentle and benevolent deity, associated with beauty and creativity. The phases of the Moon are symbolic in Hindu culture, representing the cyclical nature of life, death, and rebirth.

In **Chinese folklore**, the Moon is tied to the legend of Chang'e, a woman who became the Moon Goddess after consuming the Elixir of Immortality. The Mid-Autumn Festival, also known as the Moon Festival, celebrates this myth, and families gather to appreciate the full moon, exchange mooncakes, and share stories.

**Islamic cultures** also hold significant reverence for the Moon. The Islamic calendar is lunar-based, and the sighting of the new crescent moon marks the beginning of each month. The importance of the Moon in Islamic astronomy and timekeeping is reflected in religious practices and rituals.

In Native American cultures, various tribes have unique stories and beliefs about the Moon. For example, the Ojibwe people believe that Nanabozho, a cultural hero, created the Moon to provide a guiding light for nocturnal activities. Different tribes have distinct lunar calendars and ceremonies that align with the Moon's phases.



The **Japanese** have a cultural appreciation for the Moon, evident in art, literature, and festivals. Tsukimi, the Moon-viewing festival, celebrates the beauty of the full moon. People gather to appreciate the Moon while enjoying traditional foods and drinks, creating a serene atmosphere.

The Moon's influence extends into **Western literature** and folklore as well. From Shakespeare's "A Midsummer Night's Dream" to modern science fiction, the Moon has been a source of inspiration for countless stories. The concept of a "man in the moon" and lunar exploration themes have permeated popular culture.

In **Siberia**, Why is the moon scarred? They're fang marks left by Alklha, a monster with huge, impenetrably black wings. Alklha is a personification of the darkness of the sky. It feeds on the moon every month, slowly nibbling at it until it disappears. But the moon does not agree with the monster, who vomits it out into the sky, bit by bit, eventually re-creating the full moon.

**New Zealand**: In Maori myth, the moon, Marama, is male, with a wife and two daughters. The indigenous people also believe that the moon is the husband of all women, given how he affects a woman's reproductive cycle every month.

In **Serbia**, a folktale about a wolf chasing a fox contains the oldest explanation for why we say the moon is made of cheese. The fox convinces the wolf that a better snack, a block of cheese, lies at the bottom of a pond. The wolf, not realising it's just the moon's reflection, drinks and drinks from pond, eventually bursting.

In **Greenland**, The Inuit believe that Anningan, the moon god, raped his sister, the sun goddess, and that every night, he chases her to possess her again. Annigan starves as he runs, getting smaller every night, then disappears to hunt, before slowly coming back to his full self.

In **modern times**, scientific exploration has deepened our understanding of the Moon, but its cultural significance persists. The Moon continues to be a symbol of mystery, romance, and contemplation. Its cycles influence cultural practices, religious observances, and artistic expressions, connecting people across the globe through a shared fascination with Earth's celestial companion.

In conclusion, the Moon's presence in different cultures across the globe has given rise to a rich tapestry of myths, legends, and symbolic meanings. Whether as a deity, a guiding light, or a muse for art and literature, the Moon continues to inspire and evoke a sense of wonder that transcends cultural boundaries.



# Kilonovae: Cosmic Explosions Illuminating the Universe

**Nikhilesh B**  
**lastronomer**

In the vast tapestry of the cosmos, kilonovae stand out as celestial fireworks, marking the cataclysmic collision of neutron stars or a neutron star and a black hole. These awe-inspiring events, approximately a thousand times more energetic than a typical nova, have captivated the attention of astronomers and astrophysicists alike. This essay delves into the profound significance of kilonovae, their origins, and the invaluable contributions they make to our understanding of the universe.

Kilonovae are born in the cosmic dance of compact objects, particularly neutron stars and black holes. When two neutron stars spiral toward each other or when a neutron star and a black hole form a binary system, their eventual merger unleashes an astonishing release of energy. The term "kilonova" aptly reflects the event's luminosity, dwarfing even the brilliance of a supernova. Unlike conventional novae or supernovae, kilonovae are distinguished by their extreme brightness and the unique signature they leave in the electromagnetic spectrum. The aftermath of a kilonova is marked by the production of heavy elements, shedding light on the cosmic processes responsible for the creation of precious metals like gold and platinum.

The breakthrough in our ability to detect gravitational waves has revolutionized the study of kilonovae. Instruments like LIGO (Laser Interferometer Gravitational-Wave Observatory) and Virgo have enabled scientists to not only detect these elusive ripples in spacetime but also precisely locate the source of the gravitational waves. This technological marvel has ushered in a new era of multi-messenger astronomy.

Following the detection of gravitational waves, astronomers deploy an arsenal of telescopes to observe the kilonova across the electromagnetic spectrum. From radio waves to gamma rays, each wavelength provides unique insights into the different phases and components of the explosion. The coordinated efforts of astronomers worldwide have resulted in comprehensive datasets that deepen our understanding of these cosmic phenomena.

Kilonovae serve as cosmic laboratories, allowing scientists to explore extreme conditions and phenomena associated with the merger of neutron stars and black holes. The colossal energy release and subsequent ejection of matter create an environment ripe for the formation of heavy elements. Studying these elements unveils the cosmic alchemy responsible for enriching the universe with elements crucial for the formation of planets, stars, and, perhaps most intriguingly, life.

In essence, kilonovae provide a unique window into the fundamental processes shaping our universe. By combining gravitational wave astronomy with traditional observations, scientists can piece together the puzzle of these extraordinary events. The knowledge gained not only expands our understanding of astrophysics but also has broader implications for our comprehension of the origins and evolution of the cosmos.

Kilonovae, with their breathtaking luminosity and scientific significance, exemplify the symbiotic relationship between technology, theoretical astrophysics, and observational astronomy. These cosmic explosions, born from the gravitational embrace of compact objects, unlock the secrets of the universe, revealing the intricate interplay of matter, energy, and the forces that govern our cosmic existence. As our instruments and understanding evolve, kilonovae will undoubtedly continue to illuminate the cosmos, guiding us toward a deeper comprehension of the marvels that unfold in the celestial tapestry above.



# Brightest object in the Universe

Sourajit Mandal  
Astronomy camp

The sun... is bright as seen from Earth. But have you wondered what is the brightest object in the entire cosmos? Let's host a universe level competition to find out! First let us set up the base for the competition! It should be fair for all the contestants participating. Brightness is usually calculated in magnitude of the object. Lower the magnitude, brighter is the object.

Apparent magnitude is commonly used in stargazing and refers to the brightness of an object that appears here on Earth. The distance of the object will not be considered in the following situation. But this is not fair! For example, if a normal 100-watt light bulb is placed closer than 8 centimeters to your eye, it will look brighter than the sun high up in the sky... but if both of them are kept at the same distance, then the light bulb would be a septillion times fainter than the sun.

That is where absolute magnitude comes into the picture. Absolute magnitude is the apparent magnitude if it were viewed from a distance of exactly 10 parsecs (32.6 light-years), without extinction (or dimming) of its light due to absorption by interstellar matter and cosmic dust. Now... we can give a fair chance to all objects equally.

Everyone is participating from every star and the biggest galaxy in the universe to huge and hungry blackholes that eat stars in one gulp (Weren't blackholes supposed to be dark and absorb all light that came their way...) and our sun is also participating.

Let the competition begin! From the stars we have a tough competition... and... R136A1 gets a spot! It has an absolute magnitude of  $-12.6$  which makes it 8 million times brighter than our sun and one of the brightest stars in the universe! It is also the most massive star out there with the mass 256 times of our sun!

So... is that all! Is that the brightest thing in the entire universe? No... The competition has just begun!

Next... comes a powerful event that sends shockwaves in all directions for lightyears and releases the energy more the sun will release in all of its lifetime in a fraction of a second! That is right, the powerful event of the supernova, which marks the end of the life of a star is also one of the brightest things in the entire universe! Supernovas can eject terrifying flashes of gamma ray bursts which are arguably the brightest electromagnetic events in the universe. But... these gamma ray bursts are events that last maximum for a few minutes. So, it is up to you to decide whether these events can get a position in our competition or not.

If you want the brightest sustained objects, then you can look at the darkest thing ever- blackholes! How is that possible? How can the darkest object in the universe be the brightest object in the universe? The intense energies created by the blackholes in the process of eating things like stars are not dark. The gas and debris from the stars the blackholes eat whirl into the blackholes from bright discs called accretion discs. In the disc, the matter moves around at nearly the speed of light. The light in the accretion discs is formed by the heat because of the friction of the matter moving around at high speeds. These glowing discs are in fact so bright that a special name has been given to them- a quasar! These quasars shine thousands of times brighter than galaxies containing billions of stars making them the brightest objects in the universe!

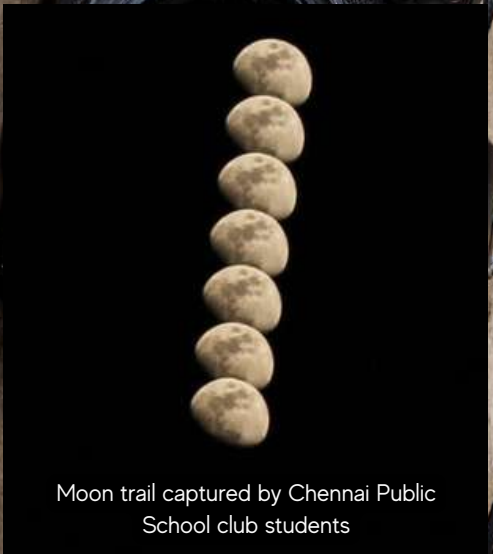
The first identified quasar- 3C273 had a magnitude of  $-26.7$  which makes it about 4 trillion times brighter than the sun. If placed 33 light years away from us, it will shine as brightly as the sun which is merely 8 light minutes away. But this too... is not the brightest thing in the universe.

Blazars... are basically quasars but in a different angle of observation. AND BLAZAR- 3C 453.3 HAS WON THIS ENTIRE COMPETITION!! It is the brightest thing ever observed in our entire history! With an absolute magnitude of  $-31.4$ . That is just too large a brightness to comprehend by the human brain.

Now we know about the brightest thing in the universe though this... is going to change. The winners of this universal competition are going to change as long as we progress and make discoveries. As we make new discoveries, we will keep finding new brighter objects that break all previous records on our scale. We do not know much about the universe yet. Most of the universe is still unseen by our human eyes. We are still stuck in our pale blue dot in one corner of our universe still fighting wars and shedding blood for unnecessary reasons such as power. If we would not waste our time and energy on fighting such wars and instead focus on advancing our civilization, we could reach great heights. Let us hope our best on progressing ourselves and our civilization in the year ahead! Happy New Year!



# VISUAL ARTS FROM SPACE ASSOCIATED ASTRONOMERS



Moon trail captured by Chennai Public School club students



Gibbous moon captured by Daksh Rathi, iAstronomer



Ganymede  
Europa  
Jupiter  
Callisto

Jupiter captured by Lakshitha, club student



Jupiter captured by Daksh Rathi, iAstronomer



Moon Craters captured by Daksh Rathi, iAstronomer



Rainbow captured by Vetrivel Thirunavukkarasu, iAstronomer



Moon captured by Aadya Ghate, Club student



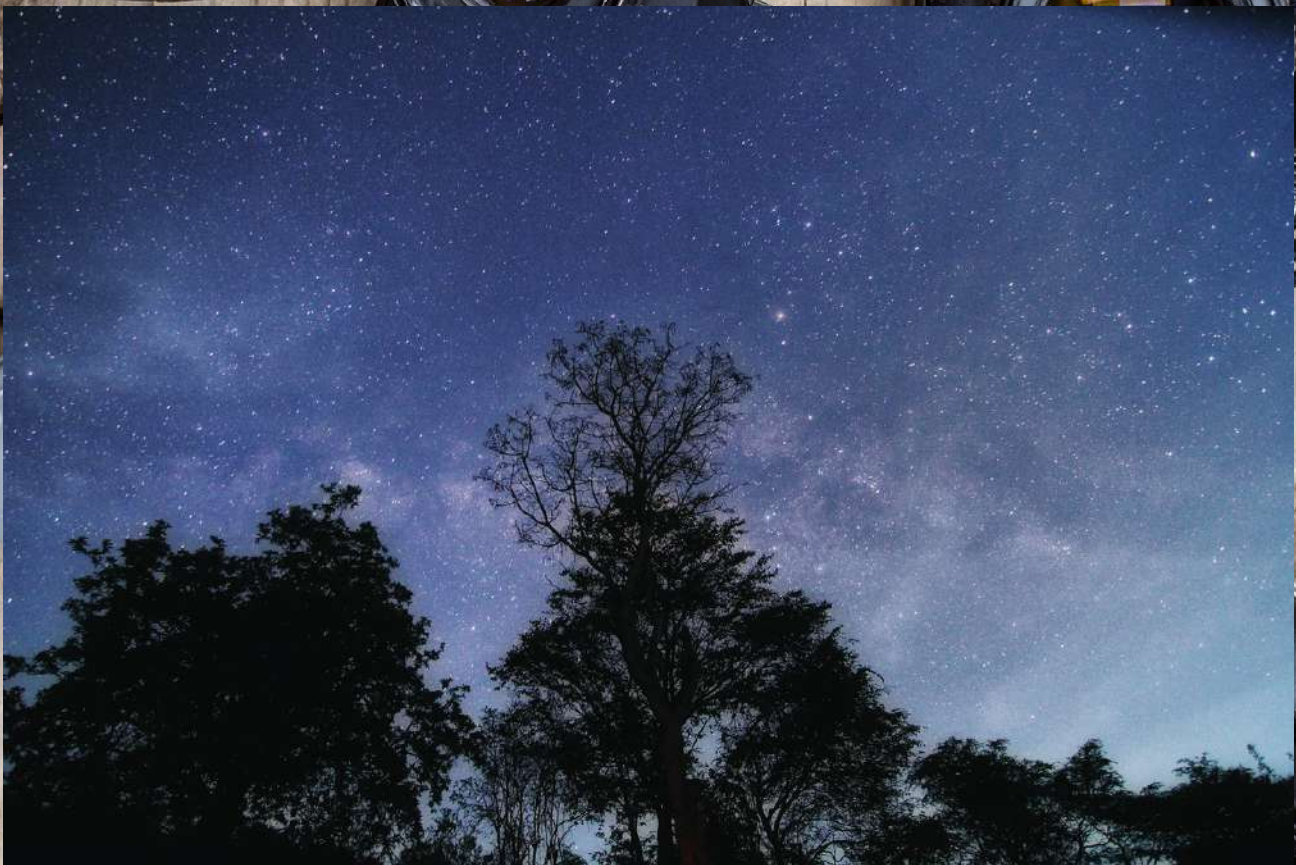
Moon captured by Lakshitha, Club Student



Sky captured by Vetrivel Thirunavukkarasu, iAstronomer



# ASTROPHOTOGRAPHS BY SPACE





## HISTORICAL EVENTS HAPPENED IN JANUARY

# DISCOVERING CERES



Giuseppe Piazzi

After William and Caroline Herschel discovered Uranus, there was a frenzy to find another planet within the solar system. In 1800, a group of astronomers called the celestial police, got together to look for a planet between Mars and Jupiter, as previously astronomers proposed the presence of an undiscovered planet sat there. The celestial police sent out invitations asking other astronomers to join them in the search.

Giuseppe Piazzi, a Catholic priest, was one of the astronomers who received an invite. However, before he received his invite, on 1st January 1801, he observed a tiny dot in the sky. Piazzi initially classified the object as a comet, even though he knew it wasn't one.

Soon, the potential planet was hidden by the Sun's glare and was not observed for the rest of the year. Near the end of the year, thanks to mathematician Carl Freidrich Gauss's new method of orbit calculations, astronomers we able to locate it again. When its orbit was better determined, it was clear that Piazzi's assumption was correct; the object was not a comet but a small planet.

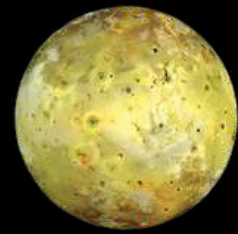
Piazzi proposed to name the planet Ceres Ferdinanda. Ceres was after the Roman goddess of agriculture, while Ferdinanda was for the current king of Sicily, Pizzazi's monarch and patron. However, the Ferdinanda part of the name was removed due to political reasons.

Ceres can be found within the main asteroid belt, present between the orbits of Mars and Jupiter. Throughout its time as a known object, Ceres' classification has changed from planet to asteroid to dwarf planet, which is its current designation. Ceres is the largest object in the asteroid belt and the smallest dwarf planet. It is also the only dwarf planet in the asteroid belt. Due to its small size, it is too dim to be seen with the naked eye.

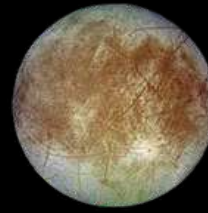
In 2015, the Dawn spacecraft arrived at Ceres. It was the first dwarf planet to be visited by a spacecraft. The mission found the planet's surface to be a mixture of water, ice, and hydrated minerals such as carbonates and clay, while data suggested that Ceres' interior has a muddy mantle/core that is encased by a crust that is less dense yet stronger than the interior. The crust is made up of ice 30% by volume. It is unknown if Ceres has an internal ocean of liquid water, but brine flows through the outer mantle and breaks on the surface, allowing cryovolcanoes to form. This makes Ceres the closest known cyrovolcanically active body to the sun.



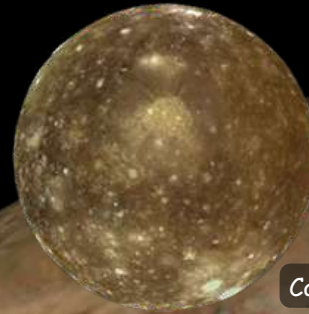
# THE MOONS THAT CHANGED OUR PERCEPTION



Io



Europa



Callisto



Ganymede

On 7th January 1610, Galileo Galileio looked through a new device. It was an eyepiece that was an improved version of Hans Lippershey's invention. On a chilly night, Galileo pointed the telescope to the king of planets, where he noticed the appearance of three small objects. Initially, he believed that the objects were stars, but after a few weeks of observation, he realized that the objects were not stars. They were orbiting Jupiter. Today, Io, Europa, Ganymede and Callisto are known as the Galilean moons after their discoverer.

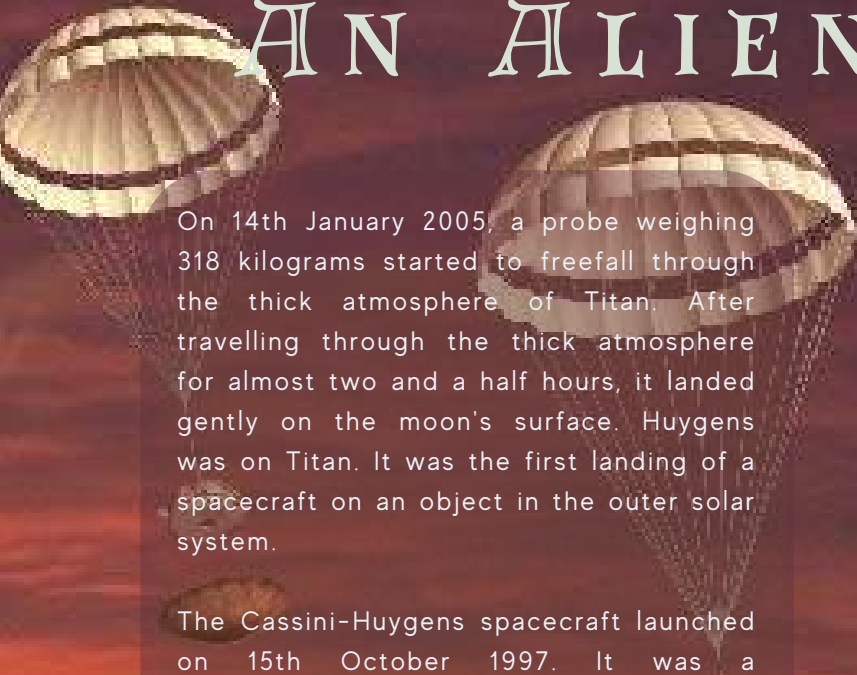
Galileo didn't name them after him or give them the names they are known today. He used a numbering scheme of I, II, III, and IV based on their position with the planet (I - Io, II - Europa, III - Ganymede, IV - Callisto). The person behind the moons' names is Simon Mauris, who independently discovered the moon around the same time. Mauris named the moons after the lovers or victims of Zeus, the Greek god equivalent of the Roman god Jupiter, the planet's namesake. Jupiter's Ganymede is the largest moon in the solar system and is larger than Mercury.

Galileo's discovery of the moons was notable for several reasons. First, it showed the importance of the telescope as a tool for astronomers. Secondly, the discovery of objects orbiting a celestial body other than Earth dealt a blow to the popular geocentric model. Thirdly, the discovery of the Galilean moons also helped in solving the longitudinal problem, a prevalent issue at the time. This meant that cartographers could get accurate distances between cities.

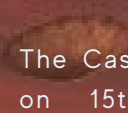
The discovery of the moons meant that they were the first objects to be discovered in the solar system since humans started tracking planets.



# LANDING ON AN ALIEN MOON



On 14th January 2005, a probe weighing 318 kilograms started to freefall through the thick atmosphere of Titan. After travelling through the thick atmosphere for almost two and a half hours, it landed gently on the moon's surface. Huygens was on Titan. It was the first landing of a spacecraft on an object in the outer solar system.



The Cassini-Huygens spacecraft launched on 15th October 1997. It was a collaboration between NASA, ESA and the Italian Space Agency, ASI. The mission aimed to study the Saturnian system, with Huygens designed to study Titan specifically.

In 1655, Christiaan Huygens, a Dutch astronomer and Huygens namesake, discovered Titan. It is Saturn's largest moon and the second-largest moon in the solar system.

For 90 minutes, the Huygens spacecraft beamed back data about Titan's surface to Earth via the Cassini Spacecraft. Huygens was designed to investigate the moon's atmosphere from around 170 km to surface level.

Early data from the mission indicated that Titan has a thin frozen crust with a less dense layer beneath, while initial images show the presence of large drainage channels crossing the land into potential hydrocarbon seas. In January 2007, further data from the Cassini Mission confirmed the existence of permanent liquid hydrocarbon lakes on Titan. These lakes are known as the Lakes of Titan.







## DEAD HOT STARS

In 1844, Friedrich Bessel, a German astronomer, noticed strange irregularities in the motion of Sirius and Procyon. The two stars were not moving in a straight line. Instead, both appeared to be orbiting around an empty point, which led Bessel to believe that the stars had a massive but unseen companion.

On 31st January 1862, after Bessel's death, the unseen object revealed itself, for Sirius at least. Procyon hid its mysterious companion until 1896 when John Martin Schaeberle observed Procyon B.

Alvan Clark and Alvan Graham Clark, a father and son from a prominent telescope-making family, were testing the lens for the, at the time, largest refracting telescope in the world when they observed Sirius' mysterious companion. They reported the observation to George Phillips Bond, who used the Harvard College Observatory's telescope and observed the star we now know as Sirius B, a white dwarf.

Yet, Sirius B was not the first white dwarf discovered. In 1783, on the same date as the discovery of Sirius B, William Herschel discovered 40 Eridani B and C, a binary pair orbiting 40 Eridani A. In 1910, 40 Eridani B was identified as a white dwarf. It is one of the easiest to observe.

White dwarfs are believed to be the final stage of small to medium-mass stars. They are the dense core-remnants after the star has expelled its gaseous outer layer. When white dwarfs first form, they are very hot, emitting faint light. However, due to no nuclear fusion taking place in the core, white dwarfs do not have an energy source to maintain the heat and will lose heat until it becomes a theoretical black dwarf.

Currently, over 25,000 white dwarfs are known.



# Happy Birthday

## STEPHEN HAWKING

Prof. Stephen Hawking (8 January 1942 to 14 March 2018) was an English theoretical astrophysicist widely regarded as 'one of the most brilliant minds of the century.' In 1970, Hawking and Roger Penrose, a fellow physicist, published a paper where they pushed the boundaries of theoretical physics. A feat repeated in 1974 when Hawking hypothesized that black holes have radiation emitting from them. Throughout his career, he was awarded several awards and was a member of several societies. Since 2017, his Ph.D. thesis, 'Properties of Expanding Universe,' is available through the University of Cambridge's Open-Access Repository. Hawking also lived with a neurodegenerative disease that affected the motor neurons in his brain and spinal cord and gradually paralyzed him.



8 January 1942



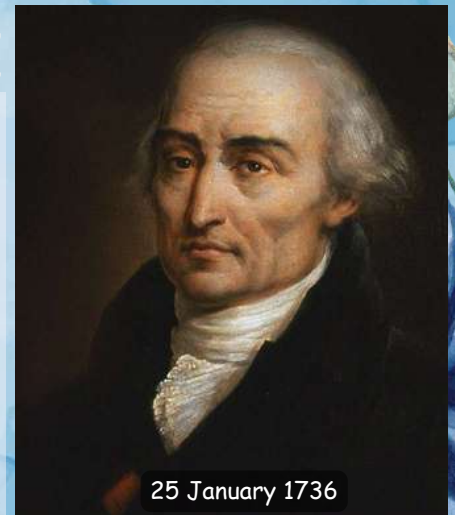
13 January 1949

## RAKESH SHARMA

Wing Commander Rakesh Sharma (13th January 1949 – present) was a squadron leader in the Indian Air Force when he was selected to become a cosmonaut. After 18 months of training, on 3rd April 1984, he, alongside two Russian cosmonauts, launched into space aboard the Soyuz T-11. The rocket docked and transferred the three crewmembers to the SALTUT - 7 Orbital Station, where they spent seven days aboard. When the crew landed, the Indian Government awarded the 'Ashoka Chakra' to them while the USSR conferred him with the honour of 'Hero of the Soviet Union.' With this, he became the 128th person in space, while India became the 14th country to have a citizen in space. Till today, he is the only Indian citizen who has gone to space.

## JOSEPH-LOUIS LAGRANGE

Joseph-Louis Lagrange (25th January 1736 - 10th April 1813) was a French-Italian mathematician born in Turin, Italy. Lagrange wasn't interested in mathematics until he was 17 years old when he came across a paper from Edmond Halley, which led him to learn the subject by himself. In astronomy, Lagrange is known for his work in planetary motion. Lagrange described the Lagrangian points in 1772. These points are in the plane of two objects that orbit around their common centre of gravity. At the Lagrangian points, the combined gravitational forces are zero, and a third particle, with negligible mass, can remain at rest. In the 1790s, Lagrange was involved in the development of a new system of measurement, where he influenced the use of the decimal subdivision. This system is the modern-day metric system.



25 January 1736



# Astroport: Your Gateway to Celestial Wonders



Sariska Astroport, Rajasthan

Space India's Astroports are celestial havens that cater to the cravings of avid stargazers and cosmic enthusiasts. These premier destinations redefine astronomical experiences with cutting-edge facilities, ensuring unparalleled observations of celestial marvels. Equipped with advanced telescopes and optimized viewing platforms, Astroport sites deliver tailor-made experiences for events like the Geminids meteor shower, guided by expert astronomers who deepen visitors' appreciation for each celestial spectacle.

Situated in remote locations far from urban sprawls, Astroports embrace dark skies that are essential for optimal visibility. Minimal light pollution allows telescopes to capture intricate details and faint celestial objects, offering an immersive experience. Carefully chosen for stable atmospheric conditions, these sites minimize air currents, turbulence, cloud cover, and humidity, ensuring clear and sharp observations.

Strategically located in areas with dry climates and low precipitation, Astroport observatories double as tourist destinations, providing an enjoyable travel experience. The commitment to turning off resort lights during observations minimizes light pollution, allowing astronomers to explore distant objects with unparalleled clarity.

Astroport Ajmer stands out with seasoned astronomers providing in-depth insights into celestial events, transforming observations into journeys of discovery. Beyond individual pursuits, Astroports foster shared experiences during events like the Geminids meteor shower, creating connections among guests as they marvel at the universe's grandeur. In essence, Astroports by Space India emerge not merely as observational sites but as gateways to profound cosmic encounters, offering an intimate connection with the beauty of the cosmos that lingers in the memories of visitors.

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## Christmas Celebration

Christmas means cold yet warm days, hunting for anything red in your closet, looking at the smiles on children's faces, and a nice cup of hot chocolate.

Christmas means different things to different people, but for Spacians, it meant walking through your office's front door and seeing the ceiling decorated with Christmas garland, sparkling balls, and the delicious smell of plum cake.

Christmas provides us with one more opportunity to join together to enjoy moments of joy, laughing, and friendship, and to enable these shared moments to linger when we return to our daily work, reminding us that the magic of Christmas extends well beyond the office.



## Birthdays of the Month

What could be possibly better than blowing candles on a cake dressed up in Christmas colors and glitters, singing carols with Spacians & Santa.

## Christmas Ritual:

Nothing beats generating and transferring your energy onto a piece of cardboard and transforming it into an ornament that might perhaps connect you to the Christmas Tree as a token of love and gratitude and for that Space, introduced a new activity "Me & my Space Tree". In which, all the Spacians Made and decorated their own ornament and brought life back on the tree.

## Online Activities

As SPACE Group is expanding its footprint across India, we had a virtual session with our Spacians who could not make it to Delhi HQ office, we played a variety of fun virtual games, danced virtually and built amazing memories with laughs & prizes.





## 23 Years of Glorious Journey of Space

A simple initiative started by our MD and CEO that takes every Spacian back to our origins, recalling the purpose why SPACE was found and celebrating SPACE achievements in the last 23 years. SPACE Group, MD, Mr. Shivam Gupta used the Space Group website ([www.space-global.com](http://www.space-global.com)) to show the timeline of achievements.



## Intern's Point of View - Mr. Yashwardhan

SPACE is an organization, which I have had a deep connect with, since I was a kid in 7th grade, I was the club head of my school's Astronomy Club for 2 straight years, (module 1 & 2), and those 2 years were incredible, the sessions were fascinating, the competitions and workshops I took part in were mesmerizing, and the Astronomy Days and the Astroport trips were some of the best highlights of my school life, my combined experience, along with my interest for Videography and Photography, pushed me to even intern with the organization, and my experience in this wonderful work environment, along with some amazing people has definitely been invaluable for me. May the echoes of our laughter and the brightness of Christmas decorations create a tapestry of happy memories that will take us into the New Year with fresh energy and a sense of unity. Here's to a wonderful Christmas season and the promise of brighter tomorrow!

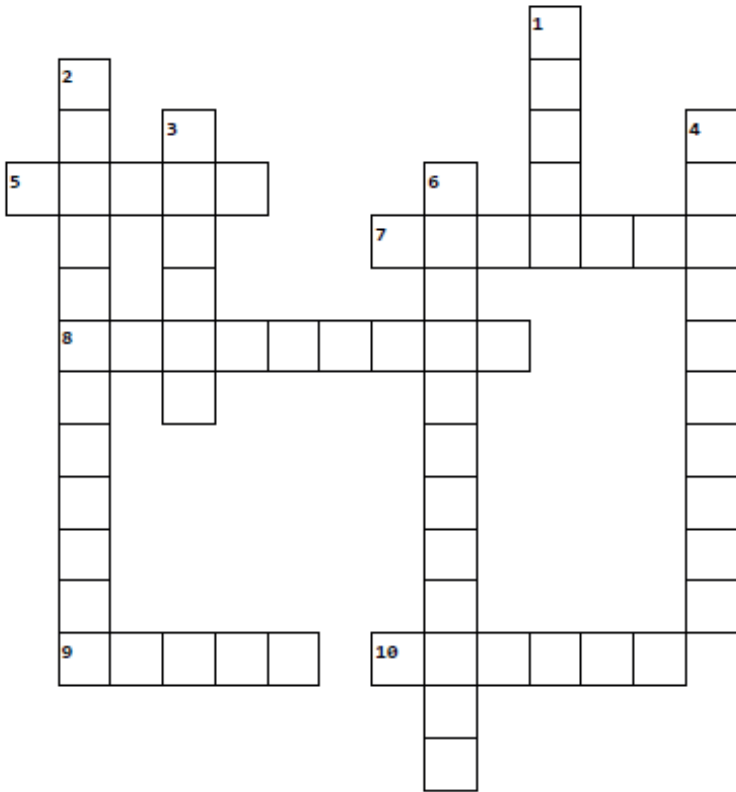
## Spacian of the month - Mohammed H Aibani & Ms. Sanjana Nayak (Nov - Dec'23)

Their dedication and contributions to the progress of the business and the opening of one of the major territory - Ahmedabad has commenced. Your devotion and positive attitude toward work are an example to all of us!



# TRAIN YOUR BRAIN

## CROSSWORD



### ACROSS

5. What instrument was used for recent research on Venus' atmosphere containing atomic oxygen?
7. What was grown in the treated simulated lunar soil?
8. What process causes certain exoplanets to lose their atmospheres and shrink in size?
9. Which experiment, led by the Royal Belgian Institute for Space Aeronomy, studied the martian atmosphere for nightglows?
10. Which NASA mission data did the astronomers analyze for the Exoplanet study?

### DOWN

1. What is the name of the object whose collision formed the moon?
2. What is the layer observed between two atmospheric currents on Venus?
3. What unexpected feature did Lucy discover about the asteroid Dinkinesh during its flyby?
4. Which essential elements are often locked within insoluble compounds in lunar soil?
6. What is the fifth state of matter achieved by the Cold Atom Lab?

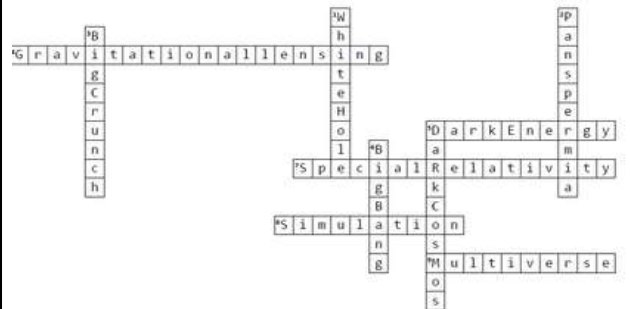
## ASTRONOMY WORD PUZZLE

Find the names of the Comet from the mixed letters and mark them.



- JOHANNENCKE
- HALLEY
- PHILAE
- BORISOV
- ARENDROLAND
- SWIFTTUTTLE
- SHOEMAKERLEVY
- THATCHER
- GREATCOMET
- HYAKUTAKE
- EUGENIA
- TEMPEL
- DONATI
- IKEYASEKI
- HALEBOPP

Answers for last month puzzles.



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



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