



SPACETM
EMPOWERING LIFE

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Galactica

Astronomy and Space Science Magazine



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Train Your Brain

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

Team

Editor in Chief
Sachin Bahmba

Managing Editor

Shivam Gupta

Section Editors

Altamas Ali

Sanjana Nayak

Arun Yadav

Mallika Tarannum

Ravina Tandon

Yogesh Joshi

Editor

Ranjith Kumar E

Assistant Editors

Sruthi Suresh

Priyadharshini D

Contributors

iAstronomers

Space Students

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ABOUT SPACE



Legacy of 22 years



Pioneer Organization



10000+ Activities Developed



1000+ Schools Associated



1M+ Students Engaged



10K+ Outreach Events



10+ Cities Presence

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

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

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

CMD's Message



Dr. Sachin Bahmba,
CMD, SPACE

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

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

CEO's Message



Mr. Shivam Gupta,
CEO & MD, SPACE

Education is integral to humankind growth and it strongly contributes towards innovation and developments. Space is transforming India to provide better learning opportunities through Experiential and Hands-

on learning in the very niche field of Astronomy and Space Science. Our mission to build from the grassroots level is what drives us stronger and to impart scientific temperament so the next generation can be entrepreneurs, scientists & astronauts!

SPACE INSIGHTS

CBSE EXHIBITION AT DLDAV, PITAMPURA



On May 2023, CBSE Exhibition, organized by DLDAV, Pitampura, in collaboration with Space India, was a tremendous success, leaving a lasting impression on the guests, teachers, and students. Events like this foster scientific curiosity and promote a deeper understanding of our universe.

The event was honored by one of the leading journalists, Mr. Rajat Sharma, Chairman, and Editor-in-chief of India TV, and Dr. Harsh Mahajan, Chairman of DAV Society.

Space India has been constantly working to make people more scientifically aware through its different Astronomy and space science programs. Space India conducted a series of activities, including Comet Making, Spectroscopy, Virtual Reality (VR), Hydrobot, a Model of the Curiosity rover, Rocketry, a 50mm Refractor Telescope and a 75mm Reflecting Telescope. It was a wonderful opportunity for students as they could showcase their skills by demonstrating and explaining the activities to the guests.

Students were trained in these activities by Space India. They made the comet in front of the Guests and explained the working of the Curiosity Rover on Mars. Secondary students were enthusiastic to demonstrate and launch the Pop Rocket. The event's highlight, Mr. Rajat Sharma and Dr. Harsh Mahajan engaged in the spacewalk VR activity and observed through telescopes. This inspired young minds and ignited their interest in space exploration and science.



CELESTIAL JOURNEY WITH ASTRO NIGHT SKY TOURISM: JANTAR MANTAR

Space India group has formed a collaboration with the esteemed National Science Centre and Nehru Planetarium in Delhi for a remarkable event known as "Astro Night Sky Tourism." This captivating event takes place on a monthly basis at various enchanting locations. And this time it happened in Jantar Mantar on 5th and 6th of May 2023.

Jantar Mantar is an observatory located in Delhi, India. It is one of several such observatories constructed by Maharaja Jai Singh II, the ruler of Jaipur, in the early 18th century. Jantar Mantar in Delhi is the largest among the five observatories built by Jai Singh II. It features various instruments, including the Samrat Yantra (the world's largest sundial), the Jayaprakash Yantra (a hemisphere used for observing the positions of celestial bodies), the Misra Yantra (a combination of five instruments), and more. The observatory consists of a collection of architectural instruments used to measure time, track celestial bodies, and study astronomical phenomena. So, the location has its own astronomical importance in itself.

Astro Night Sky Tourism has swiftly emerged as a beloved monthly affair among the residents of Delhi, captivating the hearts of both astronomy enthusiasts and the general public. The night of May 5th and 6th witnessed a remarkable gathering of approximately 4500+ individuals, brimming with anticipation to explore the celestial wonders up close.

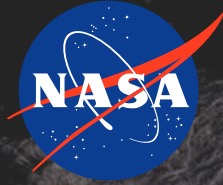


From engaging activities like crafting Solar System models to creating Comets, students and other attendees embarked on a journey of discovery. They delved into the fascinating realm of our celestial neighborhood, astounded by the enlightening size comparisons between the radiant Sun and the majestic planets that reside within our solar system. Moreover, the exploration of the various components comprising a comet left the audience spellbound, as they unveiled the enigmatic secrets concealed within the vast expanse of our galaxy.



The Moon, our closest celestial companion, graced us with a mesmerizing penumbral eclipse on the enchanting night of May 5th. The mere thought of witnessing the moon's majestic craters stirred such fervent excitement among the people that they eagerly formed a serpentine queue, eagerly awaiting their turn. As the moon began its celestial dance, a collective gasp of awe swept through the crowd, adorning their faces with expressions of pure wonder. Departing from this celestial spectacle, the eager observers were inspired and carried with them a renewed determination to experience the celestial ballet of a lunar eclipse.





All India Asteroid Search Campaign (AIASC)

'All India Asteroid Search Campaign (AIASC)' - an international science project for schools in India. This prestigious international science program is conducted exclusively for school students and amateur astronomers. The participants get an exciting opportunity to be involved in real science and to be at the forefront of research at a global level. They are given exclusive access to datasets of the night sky provided by the Pan-STARRS observatory in the USA to hunt for asteroids.

About the program

SPACE India conducts the All India Asteroid Search Campaign with the International Astronomy Search Collaboration (IASC), a consortium of reputed international labs and research centers. This project ensures that the participating teams are given exclusive access to images of the sky for 29 days during the campaign.

Over 500 teams from schools, institutes, colleges, universities, and amateur astronomy organizations from different parts of India participate in the All India Asteroid Search Campaign 2023. Participating students worked for the entire campaign to search for asteroids. All observations of Near-Earth Objects (NEO objects during this program, including asteroids and comets) contribute to NASA Jet Propulsion Laboratory's NEO tracking programs, which continuously track these objects as they can pose a hazard to the Earth if their orbits are disturbed.

SPACE India has coordinated this highly recognized campaign in India for the last 14 years. SPACE India allows working at the forefront of real science to students. This program shows that with proper opportunities and guidance, Indian students can achieve scientific heights at a very early age.



The All India Asteroid Search Training Workshop, Organized by SPACE India, took place at Bharatiya Vidya Bhavan Vidyashram (Jaipur), Doon International School (Mohali), on 15th May, and at Sri Venkateshwar International School (Delhi) on 16th May 2023. Over 350 students from multiple schools and I-astronomers participated in the event.

The workshop's primary objective was to educate and train students in the fascinating asteroid search and analysis field. By providing hands-on experience and expert guidance, the workshop aimed to inspire young minds to explore the wonders of space and foster a passion for scientific discovery.

This five-hour training workshop included the following:

- A Welcome speech by SPACE India for all the students and their Coordinators.
- Felicitation of Chief Guest Prof. Kulinder Pal Singh, INSA Senior Scientist at IISER Mohali, Dr. Joy Gardner, Chairman Hope and Beyond (Jaipur), Director Ms. Nita Arora and Officiating Principal Ms. Malini Gujral (Delhi).
- Eminent educators from SPACE India delivered engaging lectures on various topics related to the science behind asteroids. These lectures gave students valuable insights into the subject matter and helped broaden their knowledge base.
- Students participated in practical sessions using Astrometrica software for asteroid search and analysis. Under the guidance of SPACE India's well-trained educators, the participants learned how to process astronomical data, identify potential asteroids and contribute to real-world research efforts. Participants also observed sun and enjoyed watching the Hydrorocket launches by Space team.



MONTHLY TELESCOPIC OBSERVATION

SPACE ARCADE team conducted their 5th Monthly Telescopic Experience session on the 24th of May in Chennai.

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

Everyone had their hands-on telescopic experience and enjoyed the view of the moon and its craters through the 8" Dobsonian telescope setup by the SPACE team.



SPACE IN A DOME

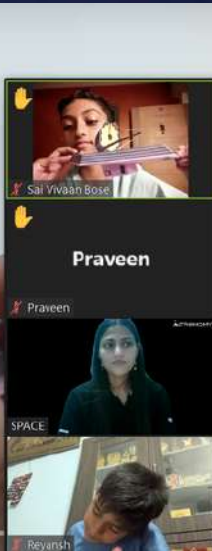
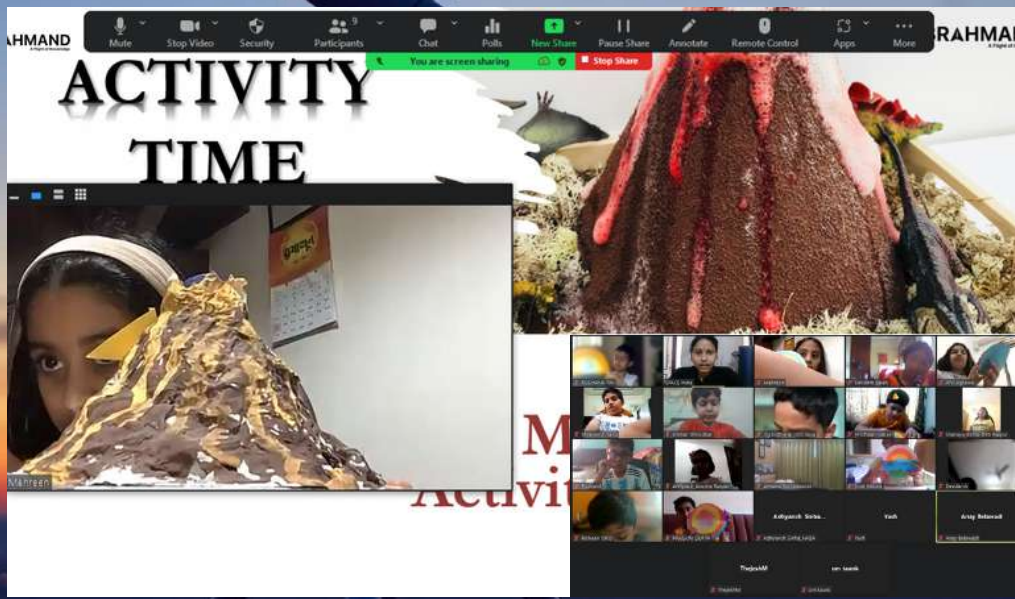
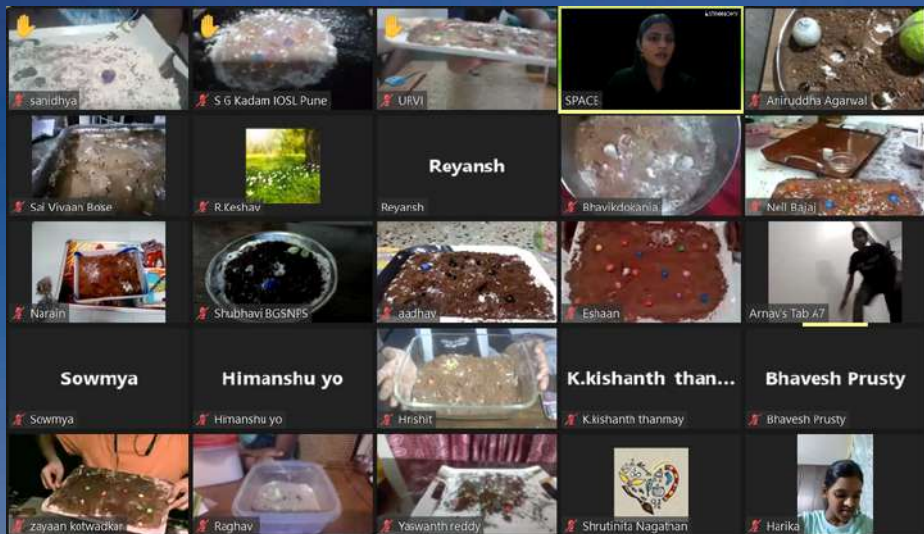
A three days event was organized at Pacific Mall, Netaji Subhash Place, Delhi, from 26-28th May 2023, where Space India reinstated its yearning with an avid Planetarium show. Once again, Space India is back with the Planetarium Show. Two shows- 'Back to The Moon for Good' and 'Deep Sky'- were run for 30 minutes at successive intervals. The former show is about the Present and future missions on the moon along with the different research programs undertaken for human settlements on the moon in the near future. Deep-sky mesmerizing objects were revealed in the latter show. These include galaxies, nebulas, star clusters, and supernova remnants.

The planetarium shows attracted around 300 people in these three days and addressed all age groups, right from toddlers to senior citizens. It mainly captivated the school students as they got the opportunity to learn about Astronomy through enthralling visuals. People were super engrossed in the show details, and their curiosities came out in different queries. This showed their contentment with these types of shows and events. They also found these events informative and were a Magnum Opus of Space India.



Online Astronomy CAMP 2023

Space conducted a ten-day online Astronomy workshop for school students of different age groups. It includes 10 days of interactive sessions where the kid learned various concepts of Astronomy and Space science. To understand the concepts better kids have done different activities and models. Some of the works done by our young Astrokids are,



A STARGAZER'S PARADISE

In the foothills of the majestic Himalayas, where the untamed wilderness meets the endless expanse of the night sky, lies a unique destination that blends natural beauty and celestial wonders. SPACE organized a trip to Jim Corbett National Park and the nearby ARIES Observatory from 26th to 28th May for Jaypee Public School, Noida students.

The journey from Jim Corbett National Park to ARIES Observatory takes you through breathtaking landscapes. As you ascend to the observatory, the anticipation builds, knowing that you are about to embark on a celestial exploration. Upon reaching ARIES Observatory, you are welcomed into a world of scientific inquiry and astronomical wonders. Established in 1954, the observatory boasts state-of-the-art telescopes and equipment, which allow researchers and visitors to observe and study celestial phenomena with precision. The observatory conducts cutting-edge research on various aspects of astrophysics, including solar physics, stellar evolution, and the study of galaxies and cosmology. ARIES also plays a vital role in promoting public awareness and education in astronomy. Visitors can interact with scientists and astronomers, attend informative workshops and lectures, and even participate in stargazing sessions.

The pristine mountain air and minimal light pollution create ideal conditions for stargazing. As you peer through the eyepiece, the universe unfolds before your eyes, revealing distant galaxies, sparkling star clusters, and even planets within our solar system. It's a humbling and awe-inspiring experience that connects you to the vastness of the cosmos.



Teachers Training Program



In the heart of the majestic Tijara Fort Palace, Rajasthan, a group of passionate teachers from DPS Sector 19 Faridabad gathered for a unique and enlightening experience for two nights, on May 5th and 6th.

Nestled amidst the historical grandeur of Tijara Fort Palace, the teachers found themselves in the perfect setting to explore the mysteries of the universe. The breathtaking Antriksh Mahal, a dedicated stargazing spot, offered unobstructed views of the night sky, with a clear horizon and an abundance of stars. From stargazing to witnessing celestial beauties, this immersive program provided a remarkable blend of learning and awe-inspiring experiences.



Guided by experienced astronomers from SPACE India, the teachers delved into the basics of stargazing. They learned about the various constellations that adorn the night sky and how to identify them. The teachers were introduced to the concept of finding the pole star, an essential tool for determining directions. In the later part of the program, participants had the privilege of observing the Moon and Venus through telescopes. The teachers were captivated by the detailed surface of the moon and the brightness of Venus, gaining a newfound appreciation for these celestial neighbors.



As fate would have it, the teachers were treated to a rare celestial event during their time at Tijara Fort Palace. The night sky unfolded its magic as they witnessed a penumbral lunar eclipse. They watched in awe as the moon passed through Earth's shadow, its luminosity subtly dimming. It was a sight that left a lasting impression on the teachers, deepening their connection with the celestial realm.



HIGHLIGHTS OF MAY 2023

A 'NOVEL' DISCOVERY BY CURIOSITY ROVER

NASA's Curiosity Mars Rover was able to take a close-up picture of a rock that resembled a book on April 15, 2023, which helped scientists learn more about the atmosphere and ecosystem on Mars.

"Terra Firme" is the nickname given to the rock, which resembles a book's open pages. Using the Mars Hand Lens Imager (MAHLI) on the end of its robotic arm, the rover discovered it on the 3,800th day of its mission on Mars. The rock measures roughly 2.5 cm across.

Rocks with unusual shapes are common on Mars and often were formed by water seeping through cracks in a rock in the ancient past, bringing harder minerals along with them. After eons of being sand-blasted by the wind, softer rock is carved away and the harder materials are all that's left. (Image Credit: NASA/JPL-Caltech/MSSS)

NASA's Curiosity Mars rover is a car-sized, mobile laboratory that was launched in November 2011 and successfully landed on Mars in August 2012. It is part of NASA's Mars Science Laboratory (MSL) mission, designed to explore the Gale Crater on Mars and analyze its climate, geology, and potential for past and present habitability. Equipped with state-of-the-art scientific instruments, including cameras, spectrometers, and sensors, Curiosity has been conducting experiments and collecting data to help scientists understand the planet's history and evolution. Its most significant discoveries include evidence of ancient riverbeds and the presence of organic molecules, which suggest the possibility that Mars once harbored microbial life.



A NEW SUPERNOVA IN PINWHEEL GALAXY

A new supernova in the Pinwheel Galaxy is the closest to Earth in a decade. Amateur astronomer Koichi Itagaki discovered it on May 19, 2023. The supernova remained visible to amateur astronomers with backyard telescopes for months. The supernova - named 2023ixf - lies in the direction of the constellation Ursa Major, near the end of the handle of the Big Dipper.

It's a popular galaxy for photographs because it's oriented to us face-on. This means you can see the bright whorled spirals and dark cloud regions, even in amateur photographs. Since it's relatively close and bright, you can get a good view of it, even with a small telescope. It also happens to have a supernova at the moment.

The last time the Pinwheel Galaxy had a visible supernova was in 2011. That one was a Type Ia supernova, the kind used to measure cosmic distances. This new one appeared in May and is a Type II supernova. These are also known as core-collapse supernovae since they occur when a massive star runs out of elements to fuse and its core collapses under its own weight to become a neutron star.

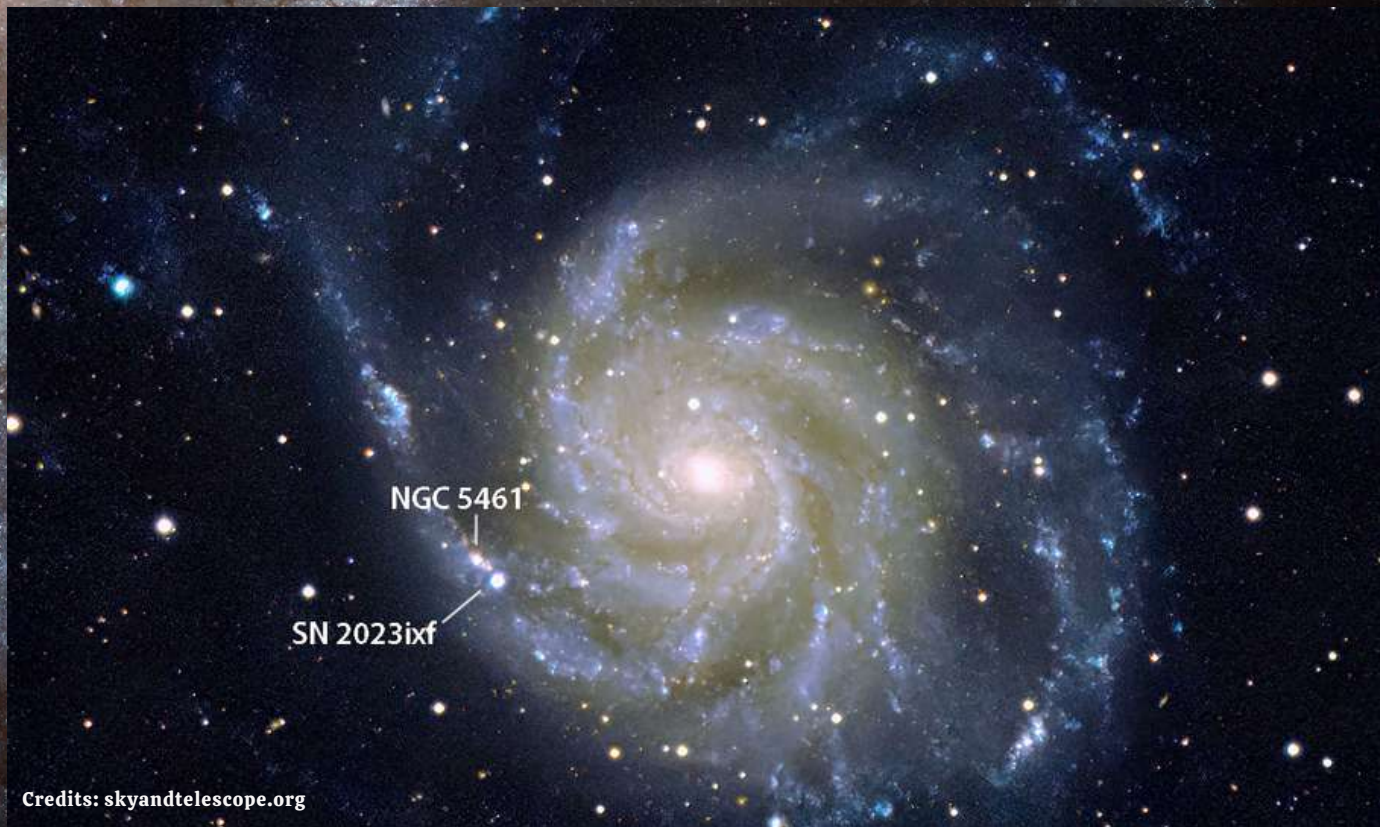
The supernova is currently at about a magnitude 11, meaning that if you have dark skies and at least a 4-inch telescope, you can see it with your own eyes. The supernova, named SN 2023ixf, is expected to brighten a bit more over the next couple of months before gradually fading.





David Hoskin in Halifax, Nova Scotia, Canada, took these images in 2022 and 2023 and wrote: "Supernova 2023ixf in the Pinwheel Galaxy (Messier 101) was discovered on May 19 by amateur astronomer Koichi Itagaki. Last night (May 22) I imaged the Pinwheel Galaxy and Supernova 2023ixf. Although transparency was poor, the supernova is obvious when compared to an image of the Pinwheel Galaxy that I captured in March 2022."

Paul Macklin in Bloomington, Indiana, made this comparison of Supernova 2023ixf before its discovery and after. Paul wrote: "On May 16, 2023, the supernova was not visible in a 5 hour integrated exposure. On May 20th, it was clear as a brilliant white star even in 3-minute exposures. I tried to process and crop both 'before' and 'after' as similarly as possible. The left image is 5 hours of 3-min exposures; the right is 6 hours of 3-min exposures."



Credits: skyandtelescope.org

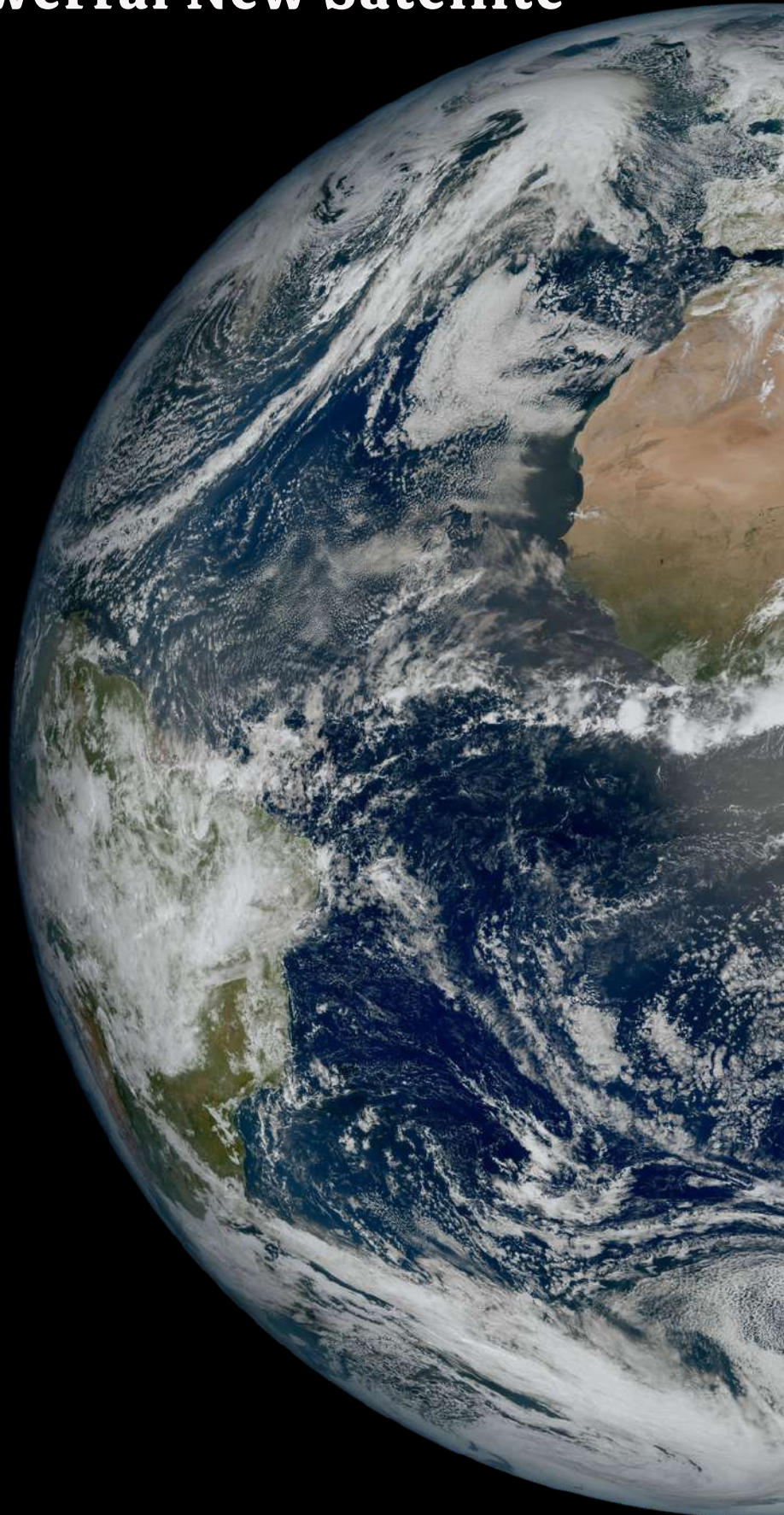
Stunning Photo of Earth Taken by Europe's Powerful New Satellite

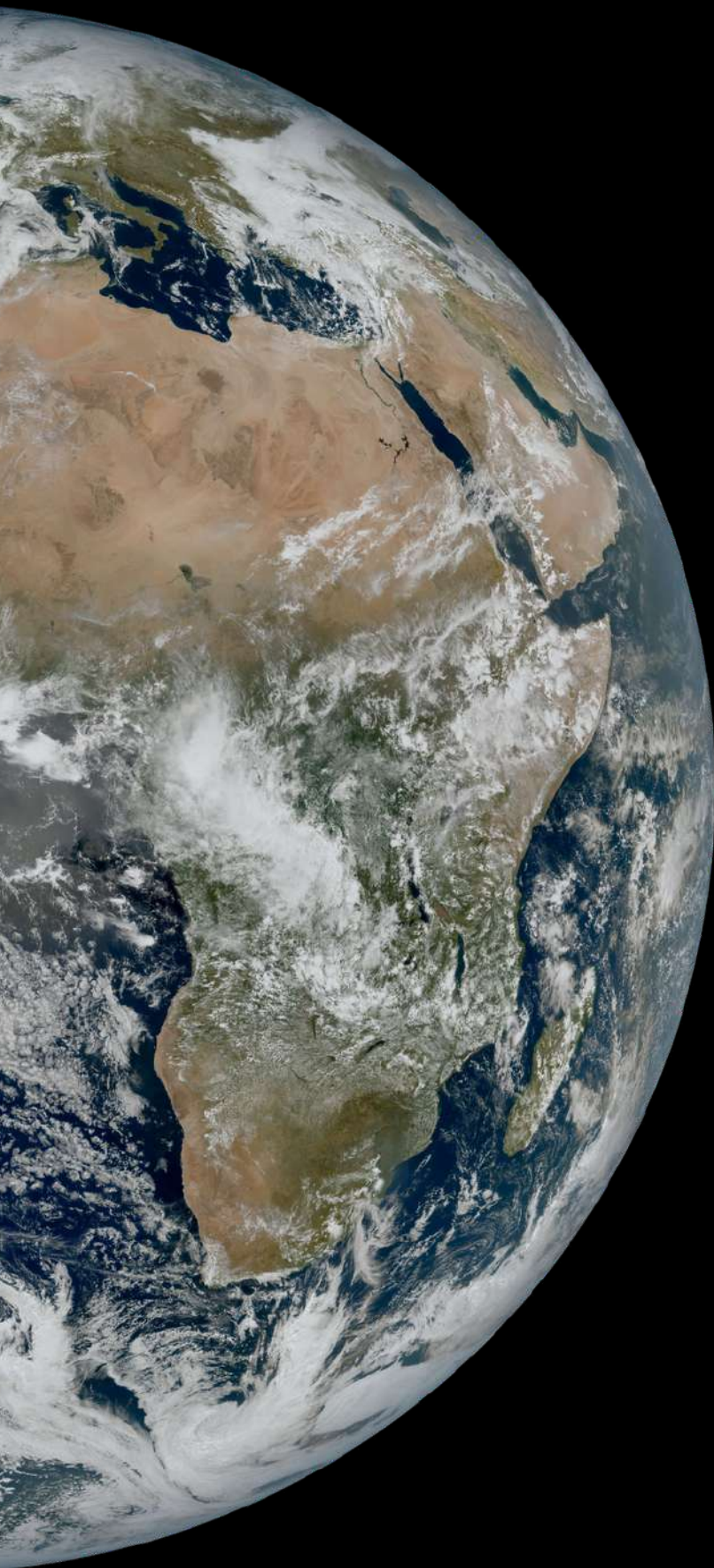
Europe's meteorological satellite agency, EUMETSAT, and the European Space Agency (ESA) jointly released the image from the first satellite in the new generation of European weather satellites, Meteosat Third Generation – Imager 1 (MTG-I1). MTG-I1 was launched on 13 December 2022. The image, captured by the satellite's imager at 11:50 UTC on 18 March 2023, shows much of Northern and Western Europe and Scandinavia cloaked in clouds, with relatively clear skies over Italy and the Western Balkans.

Details it contains, such as cloud vortices over the Canary Islands, snow cover on the Alps and sediment in the water along the coast of Italy, are not as clearly visible, or not visible at all, in imagery from the instruments on the current Meteosat Second Generation satellites.

Crucially for Nordic countries, the image reveals a greater level of detail of cloud structures at high latitudes. This will enable weather forecasters to more accurately monitor the evolution of rapidly developing severe weather in that region. "This remarkable image gives us great confidence in our expectation that the MTG system will herald a new era in the forecasting of severe weather events," EUMETSAT Director-General Phil Evans said.

"It might sound odd to be so excited about a cloudy day in most of Europe. But the level of detail seen for the clouds in this image is extraordinarily important to weather forecasters. That additional detail from the higher resolution imagery, coupled with the fact that images will be produced more frequently, means forecasters will be able to more accurately and rapidly detect and predict severe weather events."





Director of Earth Observation at the European Space Agency (ESA), Simonetta Cheli, said seeing MTG-I1's first image was a moment of great pride for the organisation and all those who have contributed to the Meteosat Third Generation programme.

"This image is a great example of what European cooperation in space can achieve," Cheli said. "The level of detail MTG-I1's image reveals, unachievable over Europe and Africa from a geostationary orbit until now, will give us a greater understanding of our planet and the weather systems that shape it. "This image represents not just what can be achieved through European expertise but our determination to ensure the benefits of new technology are felt by communities in Europe and beyond."

The instruments on the third generation of Meteosat meteorological satellites produce imagery of much higher resolution more frequently than is possible from those on the second-generation spacecraft.

Thales Alenia Space, MTG prime contractor, built the imaging instrument, the Flexible Combined Imager, and integrated the MTG-I1 satellite.

The satellite is currently undergoing a 12-month commissioning phase, in which its instruments are switched on and the data they produce are calibrated. The data from MTG-I1 will be disseminated to meteorological services in Europe and beyond at the end of 2023, for operational use in weather forecasts.

The ground segment infrastructure required to routinely process images was used to produce the first image, as a preview of things to come at the end of the year.

Images of the full Earth disc will be produced every 10 minutes when the system is operational.

MTG-I1 is operated by EUMETSAT from its headquarters in Darmstadt, Germany. The satellite was procured by ESA, fulfilling the requirements established by EUMETSAT in consultation with the meteorological services in its member states.

CRAZY MYSTERY BEHIND THE JUPITER'S STRIPES

Researchers have used NASA's Juno mission data to suggest that Jupiter's changing stripes could be caused by torsional oscillations in the planet's magnetic field. These wave-like motions may bridge the understanding gap between Jupiter's surface phenomena and its deep interior, but further research is needed.

Pictures of the planet are characterized by bands of color, as well as the famous Great Red Spot, but these bands are often seen to move and change – something which scientists have until now not been able to explain.

Now thanks to a new discovery – made possible by NASA's Juno mission providing incredible new information about Jupiter's magnetic field – Dr. Kumiko Hori and Professor Chris Jones from the University's School of Maths believe they could have found the answer.

Professor Jones said: "If you look at Jupiter through a telescope, you see the stripes, which go round the equator along lines of latitude. There are dark and light belts that occur, and if you look a little bit more closely, you can see clouds zipping around carried by extraordinarily strong easterly and westerly winds. Near the equator, the wind blows eastward but as you change latitude a bit, either north or south, it goes westward. And then if you move a little bit further away it goes eastward again. This alternating pattern of eastward and westward winds is quite different from weather on Earth."

"Every four or five years, things change. The colors of the belts can change and sometimes you see global upheavals when the whole weather pattern goes slightly crazy for a bit, and it has been a mystery as to why that happens."

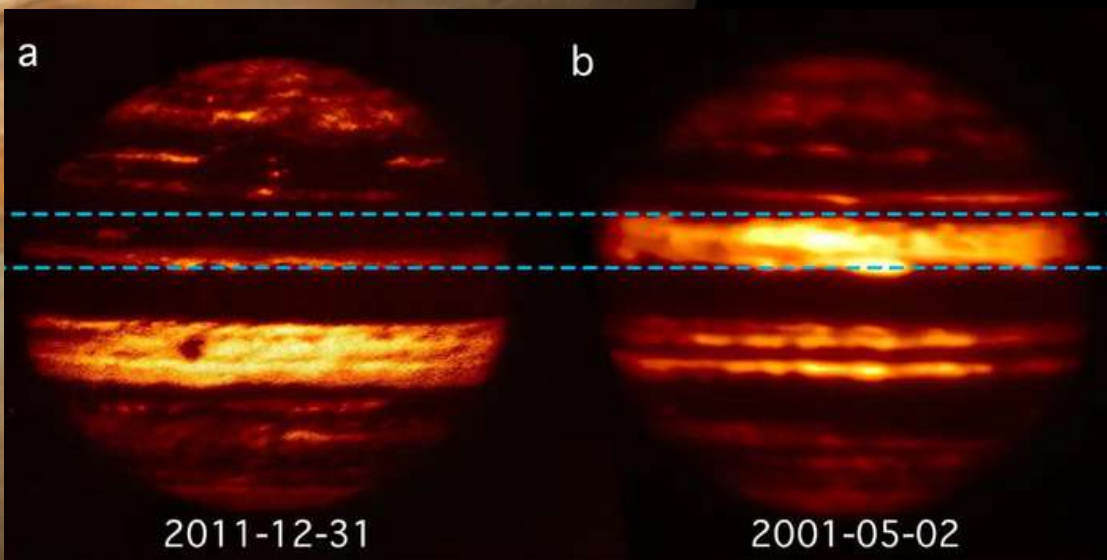
There is already evidence that points to this change in appearance being linked to infrared variations about 50 kilometers below Jupiter's surface. But the new research by Jones and others shows that these variations could be caused by waves produced by the gas giant's magnetic field, deep within the planet's interior.



Using data gathered by NASA's Juno mission to Jupiter, which has been orbiting the planet since 2016, their research team was able to monitor and calculate changes in its magnetic field.

Professor Jones added: "It is possible to get wavelike motions in a planetary magnetic field which are called torsional oscillations. The exciting thing is that when we calculated the periods of these torsional oscillations, they corresponded to the periods that you see in the infrared radiation on Jupiter."

Dr. Hori said: "There remain uncertainties and questions, particularly how exactly the torsional oscillation produces the observed infrared variation, which likely reflects the complex dynamics and cloud/aerosol reactions. Those need more research. Nonetheless, I hope our paper could also open a window to probe the hidden deep interior of Jupiter, just like seismology does for the Earth and helioseismology does for the Sun."



Images from a ground-based infra-red telescope, showing Jupiter at 5-micron wavelength radiation. The remarkable change between May 2001 and December 2011 in the North Equatorial Belt (highlighted between the dashed blue lines) can be seen.

Credit: Arrate Antuñano/NASA/IRTF/NSFCam/Spex

PRIVATE JAPANESE MOON LANDER CRASHED AFTER BEING CONFUSED BY A CRATER

The highly anticipated moon landing attempt by the private Japanese moon lander Hakuto-R failed as the spacecraft crashed due to its onboard altitude sensor misinterpreting the rim of a lunar crater.

Despite completing eight out of nine mission milestones, the lander's unfortunate landing became a setback for the Tokyo-based company iSpace. The spacecraft's onboard computer, relying on the altitude sensor, erroneously determined that its altitude measurement was incorrect when confronted with the unexpected terrain feature.

The spacecraft belonging to the company iSpace was originally supposed to land on a flat plain. But the target was changed to a crater before December's launch. The crater's steep sides apparently confused the onboard software, and the 7-foot (2-meter) spacecraft went into a free-fall from less than 3 miles (5 kilometers) up, slamming into the lunar surface.

The estimated speed at impact was more than 300 feet (100 meters) per second, said the company's chief technology officer, Ryo Ujiie. NASA's Lunar Reconnaissance Orbiter photographed the crash site the next day as it flew overhead, revealing a field of debris as well as lunar soil hurled aside by the impact.

Computer simulations done in advance of the landing attempt did not incorporate the terrain of the new landing site, Ujiie said.

If successful, iSpace would have been the first private company to land a spacecraft on the moon. Only three governments have achieved that: Russia, the United States, and China. An Israeli nonprofit tried in 2019, but its attempt also ended in a crash landing.

Named Hakuto, Japanese for a white rabbit, the spacecraft and its experiments were insured, according to Hakamada. The United Arab Emirates had a mini lunar rover on board that was lost in the crash.

Two U.S. companies have lunar landers awaiting launch later this year from Cape Canaveral, in partnership with NASA.





In this photo provided by ispace, engineers and affiliates work on the flight model of the HAKUTO-R Mission 1 Lunar Lander at the IABG Space Test Centre in Ottobrunn, Germany, in August 2022. A Tokyo company whose lunar lander slammed into the moon last month says inadequate software and a last-minute switch in the touchdown location led to the crash. Officials for the company ispace said Friday, May 26, 2023, that its spacecraft was originally supposed to land in a flat plain. Credit: ispace Via AP

Founder & CEO Takeshi Hakamada said - "Mission 1 demonstrated a great deal of technical reliability, as our lander reached the lunar surface just prior to landing. Now, we have been able to identify the issue during the landing and have a very clear picture of how to improve our future missions. We have already begun work on Mission 2 & 3.. We will ensure that the valuable knowledge gained from Mission 1 will lead us to the next stage of evolution."



Credits: ispace

ALIEN SIGNAL BEAMED TO EARTH FROM MARS FOR THE FIRST TIME

As the search for another lifeform beyond Earth continues, an alien signal has been beamed to the planet from Mars for the first time. The European Space Agency's ExoMars Trace Gas Orbiter (TGO) flashed an encoded message to Earth from its orbit around Mars on Wednesday at 9:00 PM to simulate a situation when a real signal from another civilization is received by us. The signal hit Earth 16 minutes later.

"Throughout history, humanity has searched for meaning in powerful and transformative phenomena. Receiving a message from an extraterrestrial civilization would be a profoundly transformational experience for all humankind," said Daniela de Paulis, the artist behind the 'A Sign in Space' project.

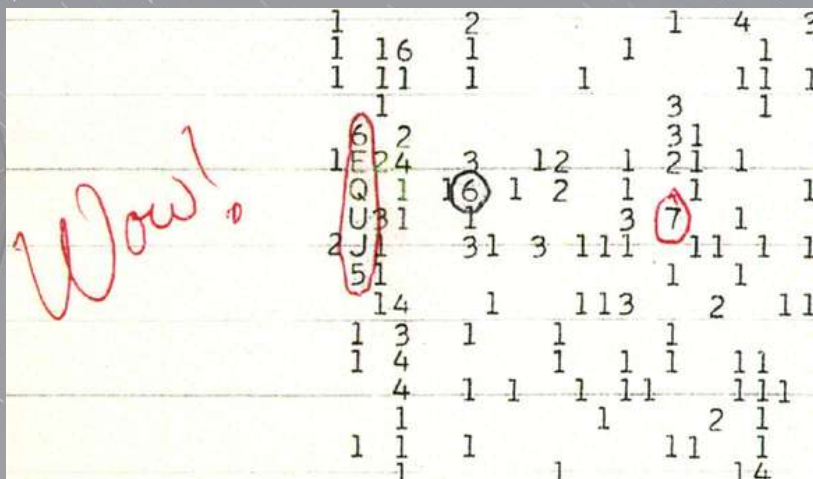
Paulis, who is an Artist in Residence at the Search for Extraterrestrial Intelligence (SETI) Institute has brought together a team of international experts, space scientists, and artists to create a project to explore the process of decoding and interpreting an extraterrestrial message.

The signal was beamed by the European probe, as part of the project, and was received by the Green Bank Telescope (West Virginia), the Medicina Radio Astronomical Station (Italy), the Allen Telescope Array (California), and the Very Large Array (New Mexico).

"We're asking individuals and groups to take part in decoding and interpreting the content of the message. The decoding and interpretation process will determine both the technical and cultural content of the message," the project website read.

It is to be noted that the message has been designed and encoded by de Paulis and her team, and is currently undisclosed. The project has now requested people to send in their interpretation of the message.

"This experiment is an opportunity for the world to learn how the SETI community, in all its diversity, will work together to receive, process, analyze, and understand the meaning of a potential extraterrestrial signal," said ATA Project Scientist Dr. Wael Farah.



The image above is from a scan of a color copy of the original computer printout taken several years after the 1977 arrival of the "Wow!" signal. (Photo: Jerry R. Ehman) Astronomers have now scanned the region in the constellation Sagittarius nearly 1800 light-years away from Earth, but they have not been able to find any concrete evidence.

NASA SUCCESSFULLY EXTRACTS OXYGEN FROM LUNAR SOIL SIMULANT



NASA scientists at Johnson Space Center in Houston have successfully extracted oxygen from simulated lunar soil in a vacuum environment, which could pave the way for establishing a long-term presence of humans on the lunar surface, and even for the future colonization of the Moon.

The ability to extract oxygen from lunar soil is not only crucial for providing breathable air for astronauts on the moon but can also be used as propellant for transportation and venture further space exploration. Aaron Paz, NASA senior scientist at Johnson Space Center, said this technology has the potential to produce several times its own weight in oxygen per year on the lunar surface, which will enable a sustained human presence and lunar economy.

During a recent test, Nasa's Carbothermal Reduction Demonstration (CaRD) team conducted a test in a special spherical chamber with a 15-foot diameter called the Dirty Thermal Vacuum Chamber. The conditions inside the Vacuum Chamber were similar to those found on the Moon.

Inside the Dirty Thermal Vacuum Chamber, the scientists used a carbothermal reactor heat the lunar soil simulant and to extract the oxygen. For decades, scientists have been using the Carbothermal reduction to produce items like solar panels and steel by producing carbon monoxide or dioxide using high temperatures.

To extract the oxygen, the Nasa team used a high-powered laser to simulate heat from a solar energy concentrator and melted the lunar soil simulant within a carbothermal reactor. After the soil was heated, the team was able to detect carbon monoxide using a device called the Mass Spectrometer Observing Lunar Operations (MSolo).

To apply this process to oxygen production on the Moon, a carbothermal reactor needs to be able to hold pressure to keep gases from escaping to space, while still allowing lunar material to travel in and out of the reaction zone.

By operating the reactor in a vacuum environment with simulated conditions at the lunar surface, the CaRD team demonstrated the carbothermal reactor was able to hold pressure to keep gases from escaping, while allowing lunar material to travel in and out of the reaction zone.

Anastasia Ford, NASA engineer and CaRD test director at Johnson Space Center said, "the scientists proved that the CaRD reactor would survive the lunar surface and successfully extract oxygen." "This is a big step for developing the architecture to build sustainable human bases on other planets", Ford added.

CHINESE ASTRONAUT LAUNCH BREAKS RECORD FOR MOST PEOPLE IN ORBIT

The Shenzhou-16 was launched by the Long March 2F rocket from the Jiuquan Cosmodrome. The crew included Jing Haipeng, Zhu Yangzhu and Gui Haichao. The last one became the first civilian taikonaut in history. Previously, the Celestial Empire sent only army officers into space.

The purpose of Shenzhou-16 is to rotate the crew of the Tiangong orbital station. The expedition members will spend about 180 days in space. Their main tasks will be to maintain the station and conduct scientific experiments.

Record for the number of people in orbit

The launch of Shenzhou-16 made it possible to update the record for the number of people in orbit at the same time. At the moment there are 17 people there, while the previous achievement was 14 people. They are distributed as follows: six Chinese, five Americans, three Russians, two astronauts from Saudi Arabia and one from the UAE.

However, in the near future the number of people in space will decrease to ten people. The Crew Dragon spacecraft with four members of the Ax-2 private expedition is scheduled to return to Earth on May 30. Shortly after that, the Shenzhou-15 will also return to Earth with three Taikonauts.

It is also worth noting that in addition to the record for the number of people in orbit, there is also a record for the number of people who are in space at the same time. The achievement was set in December 2021. Then there were 19 people in space for a few minutes. 10 of them were on board the ISS, 3 on board the Tiangong station and another six inside the New Shepard spacecraft, which was making a suborbital tourist flight.

FROM THE EYES OF WEBB - APRIL 2023**JWST DETECTED WATER VAPOR,
SCIENTISTS UNSURE ABOUT ITS SOURCE**

The most common stars in the universe are red dwarf stars, which means that rocky exoplanets are most likely to be found orbiting such a star. Red dwarf stars are cool, so a planet has to hug it in a tight orbit to stay warm enough to potentially host liquid water (meaning it lies in the habitable zone). Such stars are also active, particularly when they are young, releasing ultraviolet and X-ray radiation that could destroy planetary atmospheres. As a result, one important open question in astronomy is whether a rocky planet could maintain, or reestablish, an atmosphere in such a harsh environment.

To help answer that question, astronomers used NASA's James Webb Space Telescope to study a rocky exoplanet known as GJ 486 b. It is too close to its star to be within the habitable zone, with a surface temperature of about 800 degrees Fahrenheit (430 degrees Celsius). And yet, their observations using Webb's Near-Infrared Spectrograph (NIRSpec) show hints of water vapor. If the water vapor is associated with the planet, that would indicate that it has an atmosphere despite its scorching temperature and close proximity to its star. Water vapor has been seen on gaseous exoplanets before, but to date no atmosphere has been definitely detected around a rocky exoplanet. However, the team cautions that the water vapor could be on the star itself – specifically, in cool starspots – and not from the planet at all.

"We see a signal, and it's almost certainly due to water. But we can't tell yet if that water is part of the planet's atmosphere, meaning the planet has an atmosphere, or if we're just seeing a water signature coming from the star," said Sarah Moran of the University of Arizona in Tucson, lead author of the study.

"Water vapor in an atmosphere on a hot rocky planet would represent a major breakthrough for exoplanet science. But we must be careful and make sure that the star is not the culprit," added Kevin Stevenson of the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, principal investigator on the program.

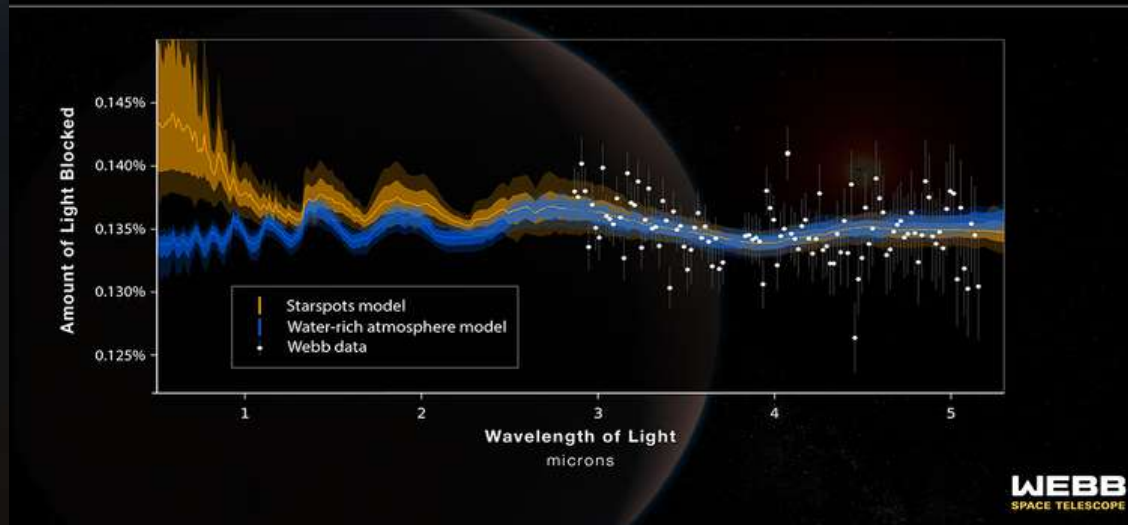
GJ 486 b is about 30% larger than Earth and three times as massive, which means it is a rocky world with stronger gravity than Earth. It orbits a red dwarf star in just under 1.5 Earth days. It is expected to be tidally locked, with a permanent day side and a permanent night side.

GJ 486 b transits its star, crossing in front of the star from our point of view. If it has an atmosphere, then when it transits starlight would filter through those gasses, imprinting fingerprints in the light that allow astronomers to decode its composition through a technique called transmission spectroscopy.

EXOPLANET GJ 486 b

TRANSMISSION SPECTRUM

NIRSpec Bright Object Time Series Spectroscopy



This graphic shows the transmission spectrum obtained by Webb observations of rocky exoplanet GJ 486 b. The science team's analysis shows hints of water vapor; however, computer models show that the signal could be from a water-rich planetary atmosphere (indicated by the blue line) or from starspots from the red dwarf host star (indicated by the yellow line). The two models diverge noticeably at shorter infrared wavelengths, indicating that additional observations with other Webb instruments will be needed to constrain the source of the water signal.

Credits: NASA, ESA, CSA, Joseph Olmsted (STScI)

The team observed two transits, each lasting about an hour. They then used three different methods to analyze the resulting data. The results from all three are consistent in that they show a mostly flat spectrum with an intriguing rise at the shortest infrared wavelengths. The team ran computer models considering a number of different molecules, and concluded that the most likely source of the signal was water vapor.

While the water vapor could potentially indicate the presence of an atmosphere on GJ 486 b, an equally plausible explanation is water vapor from the star. Surprisingly, even in our own Sun, water vapor can sometimes exist in sunspots because these spots are very cool compared to the surrounding surface of the star. GJ 486 b's host star is much cooler than the Sun, so even more water vapor would concentrate within its starspots. As a result, it could create a signal that mimics a planetary atmosphere.

"We didn't observe evidence of the planet crossing any starspots during the transits. But that doesn't mean that there aren't spots elsewhere on the star. And that's exactly the physical scenario that would imprint this water signal into the data and could wind up looking like a planetary atmosphere," explained Ryan MacDonald of the University of Michigan in Ann Arbor, one of the study's co-authors.

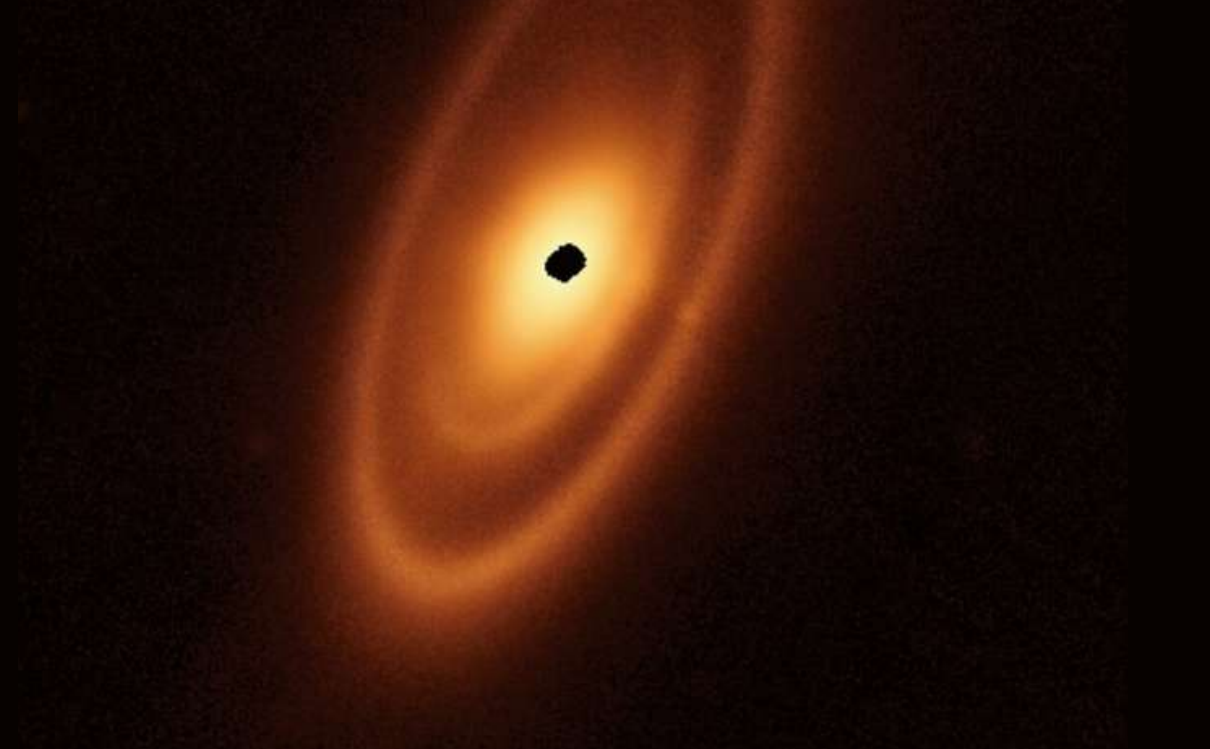
A water vapor atmosphere would be expected to gradually erode due to stellar heating and irradiation. As a result, if an atmosphere is present, it would likely have to be constantly replenished by volcanoes ejecting steam from the planet's interior. If the water is indeed in the planet's atmosphere, additional observations are needed to narrow down how much water is present.

Future Webb observations may shed more light on this system. An upcoming Webb program will use the Mid-Infrared Instrument (MIRI) to observe the planet's day side. If the planet has no atmosphere, or only a thin atmosphere, then the hottest part of the day side is expected to be directly under the star. However, if the hottest point is shifted, that would indicate an atmosphere that can circulate heat.

Ultimately, observations at shorter infrared wavelengths by another Webb instrument, the Near-Infrared Imager and Slitless Spectrograph (NIRISS), will be needed to differentiate between the planetary atmosphere and starspot scenarios.

"It's joining multiple instruments together that will really pin down whether or not this planet has an atmosphere," said Stevenson.

Webb Looks for Fomalhaut's Asteroid Belt and Finds Much More



Astronomers used NASA's James Webb Space Telescope to image the warm dust around a nearby young star, Fomalhaut, in order to study the first asteroid belt ever seen outside of our solar system in infrared light. But to their surprise, the dusty structures are much more complex than the asteroid and Kuiper dust belts of our solar system. Overall, there are three nested belts extending out to 14 billion miles (23 billion kilometers) from the star; that's 150 times the distance of Earth from the Sun. The scale of the outermost belt is roughly twice the scale of our solar system's Kuiper Belt of small bodies and cold dust beyond Neptune. The inner belts - which had never been seen before - were revealed by Webb for the first time.

The belts encircle the young hot star, which can be seen with the naked eye as the brightest star in the southern constellation Piscis Austrinus. The dusty belts are the debris from collisions of larger bodies, analogous to asteroids and comets, and are frequently described as 'debris disks.'

"I would describe Fomalhaut as the archetype of debris disks found elsewhere in our galaxy, because it has components similar to those we have in our own planetary system," said András Gáspár of the University of Arizona in Tucson and lead author of a new paper describing these results. "By looking at the patterns in these rings, we can actually start to make a little sketch of what a planetary system ought to look like - If we could actually take a deep enough picture to see the suspected planets."

The Hubble Space Telescope and Herschel Space Observatory, as well as the Atacama Large Millimeter/submillimeter Array (ALMA), have previously taken sharp images of the outermost belt. However, none of them found any structure interior to it. The inner belts have been resolved for the first time by Webb in infrared light. "Where Webb really excels is that we're able to physically resolve the thermal glow from dust in those inner regions. So you can see inner belts that we could never see before," said Schuyler Wolff, another member of the team at the University of Arizona.

GALACTICA

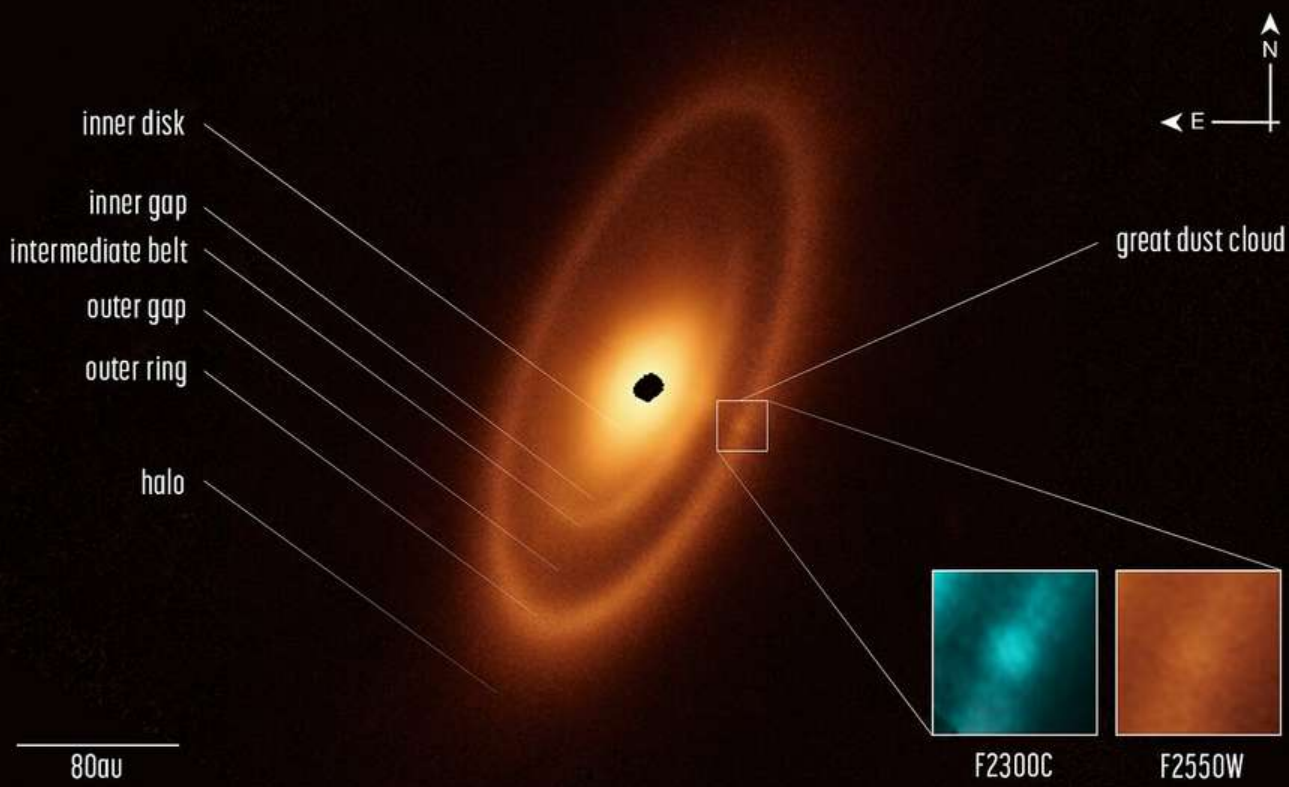
Hubble, ALMA, and Webb are tag-teaming to assemble a holistic view of the debris disks around a number of stars. "With Hubble and ALMA, we were able to image a bunch of Kuiper Belt analogs, and we've learned loads about how outer disks form and evolve," said Wolff. "But we need Webb to allow us to image a dozen or so asteroid belts elsewhere. We can learn just as much about the inner warm regions of these disks as Hubble and ALMA taught us about the colder outer regions."

These belts most likely are carved by the gravitational forces produced by unseen planets. Similarly, inside our solar system Jupiter corrals the asteroid belt, the inner edge of the Kuiper Belt is sculpted by Neptune, and the outer edge could be shepherded by as-yet-unseen bodies beyond it. As Webb images more systems, we will learn about the configurations of their planets. Fomalhaut's dust ring was discovered in 1983 in observations made by NASA's Infrared Astronomical Satellite (IRAS). The existence of the ring has also been inferred from previous and longer-wavelength observations using submillimeter telescopes on Mauna Kea, Hawaii, NASA's Spitzer Space Telescope, and Caltech's Submillimeter Observatory.

"The belts around Fomalhaut are kind of a mystery novel: Where are the planets?" said George Rieke, another team member and U.S. science lead for Webb's Mid-Infrared Instrument (MIRI), which made these observations. "I think it's not a very big leap to say there's probably a really interesting planetary system around the star."

"We definitely didn't expect the more complex structure with the second intermediate belt and then the broader asteroid belt," added Wolff. "That structure is very exciting because any time an astronomer sees a gap and rings in a disk, they say, 'There could be an embedded planet shaping the rings!'"

Webb also imaged what Gáspár dubs "the great dust cloud," which may be evidence for a collision occurring in the outer ring between two protoplanetary bodies.



This image of the dusty debris disk surrounding the young star Fomalhaut is from Webb's Mid-Infrared Instrument (MIRI). It reveals three nested belts extending out to 14 billion miles (23 billion kilometers) from the star. The inner belts – which had never been seen before – were revealed by Webb for the first time. Labels at left indicate the individual features. At right, a great dust cloud is highlighted and pullouts show it in two infrared wavelengths: 23 and 25.5 microns.

Credits: NASA, ESA, CSA, A. Gáspár (University of Arizona). Image processing: A. Pagan (STScI)

NASA'S WEBB TAKES CLOSEST LOOK OF A MYSTERIOUS PLANET



NASA's James Webb Space Telescope has observed a distant planet outside our solar system – and unlike anything in it – to reveal what is likely a highly reflective world with a steamy atmosphere. It's the closest look yet at the mysterious world, a "mini-Neptune" that was largely impenetrable to previous observations.

And while the planet, called GJ 1214 b, is too hot to harbor liquid-water oceans, water in vaporized form still could be a major part of its atmosphere.

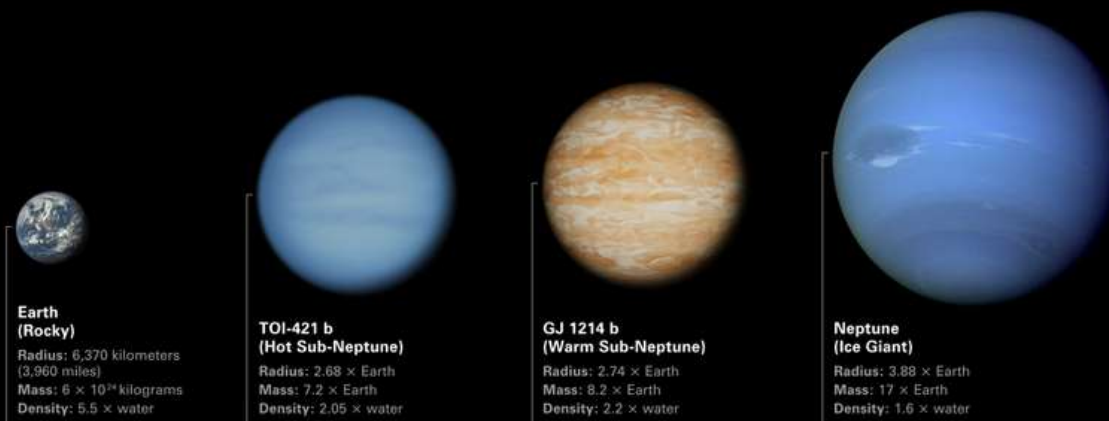
"The planet is totally blanketed by some sort of haze or cloud layer," said Eliza Kempton, a researcher at the University of Maryland and lead author of a new paper, published in *Nature*, on the planet. "The atmosphere just remained totally hidden from us until this observation." She noted that, if indeed water-rich, the planet could have been a "water world," with large amounts of watery and icy material at the time of its formation.

To penetrate such a thick barrier, the research team took a chance on a novel approach: In addition to making the standard observation – capturing the host star's light that has filtered through the planet's atmosphere – they tracked GJ 1214 b through nearly its entire orbit around the star.

The observation demonstrates the power of Webb's Mid-Infrared Instrument (MIRI), which views wavelengths of light outside the part of the electromagnetic spectrum that human eyes can see. Using MIRI, the research team was able to create a kind of "heat map" of the planet as it orbited the star. The heat map revealed – just before the planet's orbit carried it behind the star, and as it emerged on the other side – both its day and night sides, unveiling details of the atmosphere's composition.

"The ability to get a full orbit was really critical to understand how the planet distributes heat from the day side to the night side," Kempton said. "There's a lot of contrast between day and night. The night side is colder than the day side." In fact, the temperatures shifted from 535 to 326 degrees Fahrenheit (from 279 to 165 degrees Celsius).

Comparison of TOI-421 b and GJ 1214 b to Earth and Neptune



Such a big shift is only possible in an atmosphere made up of heavier molecules, such as water or methane, which appear similar when observed by MIRI. That means the atmosphere of GJ 1214 b is not composed mainly of lighter hydrogen molecules, Kempton said, which is a potentially important clue to the planet's history and formation – and perhaps its watery start. This is not a primordial atmosphere," she said. "It does not reflect the composition of the host star it formed around. Instead, it either lost a lot of hydrogen, if it started with a hydrogen-rich atmosphere, or it was formed from heavier elements to begin with – more icy, water-rich material."

Cooler Than Expected

And while the planet is hot by human standards, it is much cooler than expected, Kempton noted. That's because its unusually shiny atmosphere, which came as a surprise to the researchers, reflects a large fraction of the light from its parent star rather than absorbing it and growing hotter.

The new observations could open the door to deeper knowledge of a planet type shrouded in uncertainty. Mini-Neptunes – or sub-Neptunes as they're called in the paper – are the most common type of planet in the galaxy, but mysterious to us because they don't occur in our solar system. Measurements so far show they are broadly similar to, say, a downsized version of our own Neptune. Beyond that, little is known.

"For the last almost decade, the only thing we really knew about this planet was that the atmosphere was cloudy or hazy," said Rob Zellem, an exoplanet researcher who works with co-author and fellow exoplanet researcher Tiffany Kataria at NASA's Jet Propulsion Laboratory in Southern California. "This paper has really cool implications for additional detailed climate interpretations – to look at the detailed physics happening inside this planet's atmosphere."

The new work suggests the planet might have formed farther from its star, a type known as a red dwarf, then spiraled gradually inward to its present, close orbit. The planet's year – one orbit around the star – takes only 1.6 Earth days.

"The simplest explanation, if you find a very water-rich planet, is that it formed farther away from the host star," Kempton said.

Further observations will be needed to pin down more details about GJ 1214 b as well as the formation histories of other planets in the mini-Neptune class. While a watery atmosphere seems likely for this planet, a significant methane component also is possible. And drawing broader conclusions about how mini-Neptunes form will require more of them to be observed in depth.

"By observing a whole population of objects like this, hopefully we can build up a consistent story," Kempton said.

NASA'S WEBB FINDS WATER, AND A NEW MYSTERY, IN RARE MAIN BELT COMET

NASA's James Webb Space Telescope has enabled another long-sought scientific breakthrough, this time for solar system scientists studying the origins of Earth's abundant water. Using Webb's NIRSpec (Near-Infrared Spectrograph) instrument, astronomers have confirmed gas – specifically water vapor – around a comet in the main asteroid belt for the first time, indicating that water ice from the primordial solar system can be preserved in that region. However, the successful detection of water comes with a new puzzle: unlike other comets, Comet 238P/Read had no detectable carbon dioxide.

"Our water-soaked world, teeming with life and unique in the universe as far as we know, is something of a mystery – we're not sure how all this water got here," said Stefanie Milam, Webb deputy project scientist for planetary science and a co-author on the study reporting the finding.

"Understanding the history of water distribution in the solar system will help us to understand other planetary systems, and if they could be on their way to hosting an Earth-like planet," she added.

Comet Read is a main belt comet – an object that resides in the main asteroid belt but which periodically displays a halo, or coma, and tail like a comet. Main belt comets themselves are a fairly new classification, and Comet Read was one of the original three comets used to establish the category. Before that, comets were understood to reside in the Kuiper Belt and Oort Cloud, beyond the orbit of Neptune, where their ices could be preserved farther from the Sun.

This image of Comet 238P/Read was captured by the NIRCam (Near-Infrared Camera) instrument on NASA's James Webb Space Telescope on September 8 2022. It displays the hazy halo called the coma and tail that are characteristic of comets as opposed to asteroids. The dusty coma and tail result from the vaporization of ices as the Sun warms the main body of the comet.

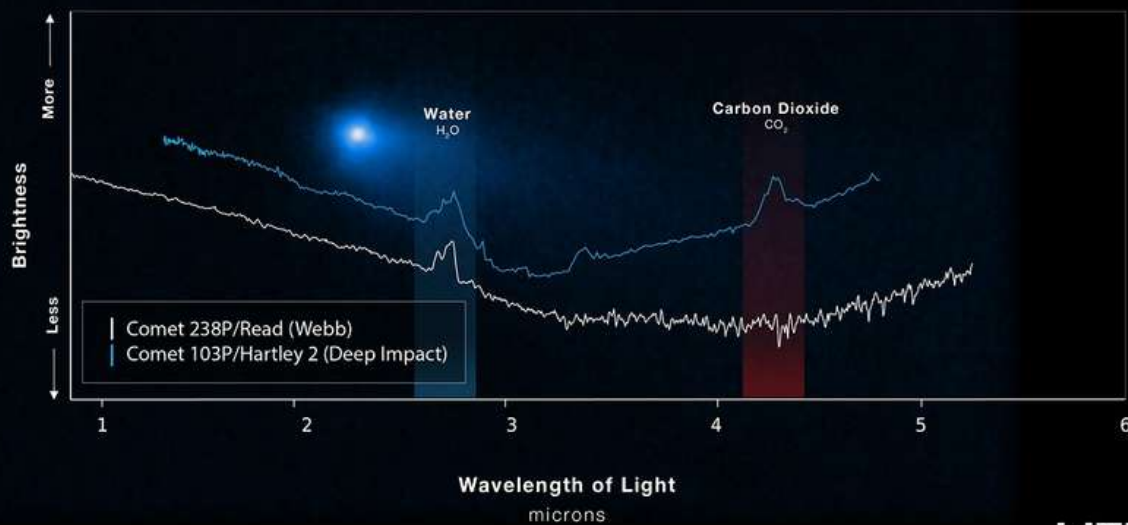
Credits: NASA ESA CSA M. Kelley (University of Maryland). Image processing: H. Hsieh (Planetary Science Institute) A. Pagan (STScI)

Frozen material that vaporizes as they approach the Sun is what gives comets their distinctive coma and streaming tail, differentiating them from asteroids. Scientists have long speculated that water ice could be preserved in the warmer asteroid belt, inside the orbit of Jupiter, but definitive proof was elusive – until Webb.

MAIN BELT COMET 238P/READ

EMISSION SPECTRUM

NIRSpec | IFU Medium-Resolution Spectroscopy


WEBB
 SPACE TELESCOPE

This graphic presentation of spectral data highlights a key similarity and difference between observations of Comet 238P/Read by the NIRSpec (Near-Infrared Spectrograph) instrument on NASA's James Webb Space Telescope in 2022 and observations of Comet 103P/Hartley 2 by NASA's Deep Impact mission in 2010. Both show a distinct peak in the region of the spectrum associated with water. Finding this in Comet Read was a significant accomplishment for Webb, as it is in a different class of comets than Jupiter-family comets like Hartley 2, and this marks the first time that a gas has been confirmed in such a main belt comet. However, Comet Read did not show the characteristic, expected bump indicating the presence of carbon dioxide.

Credits: NASA, ESA, CSA, and J. Olmsted (STScI)

"In the past, we've seen objects in the main belt with all the characteristics of comets, but only with this precise spectral data from Webb can we say yes, it's definitely water ice that is creating that effect," explained astronomer Michael Kelley of the University of Maryland, lead author of the study.

"With Webb's observations of Comet Read, we can now demonstrate that water ice from the early solar system can be preserved in the asteroid belt," Kelley said.

The missing carbon dioxide was a bigger surprise. Typically, carbon dioxide makes up about 10 percent of the volatile material in a comet that can be easily vaporized by the Sun's heat. The science team presents two possible explanations for the lack of carbon dioxide. One possibility is that Comet Read had carbon dioxide when it formed but has lost that because of warm temperatures.

"Being in the asteroid belt for a long time could do it – carbon dioxide vaporizes more easily than water ice, and could percolate out over billions of years," Kelley said. Alternatively, he said, Comet Read may have formed in a particularly warm pocket of the solar system, where no carbon dioxide was available.

The next step is taking the research beyond Comet Read to see how other main belt comets compare, says astronomer Heidi Hammel of the Association of Universities for Research in Astronomy (AURA), lead for Webb's Guaranteed Time Observations for solar system objects and co-author of the study. "These objects in the asteroid belt are small and faint, and with Webb we can finally see what is going on with them and draw some conclusions. Do other main belt comets also lack carbon dioxide? Either way it will be exciting to find out," Hammel said.

NASA'S CHANDRA, WEBB COMBINE FOR ARRESTING VIEWS

Four composite images deliver dazzling views from NASA's Chandra X-ray Observatory and James Webb Space Telescope of two galaxies, a nebula, and a star cluster. Each image combines Chandra's X-rays – a form of high-energy light – with infrared data from previously released Webb images, both of which are invisible to the unaided eye. Data from NASA's Hubble Space Telescope (optical light) and retired Spitzer Space Telescope (infrared), plus the European Space Agency's XMM-Newton (X-ray) and the European Southern Observatory's New Technology Telescope (optical) is also used. These cosmic wonders and details are made available by mapping the data to colors that humans can perceive.

Credits: X-ray: Chandra: NASA/CXC/SAO, XMM: ESA/XMM-Newton; IR: JWST: NASA/ESA/CSA/STScI, Spitzer: NASA/JPL/CalTech; Optical: Hubble: NASA/ESA/STScI, ESO



NGC 346:

NGC 346 is a star cluster in a nearby galaxy, the Small Magellanic Cloud, about 200,000 light-years from Earth. Webb shows plumes and arcs of gas and dust that stars and planets use as source material during their formation. The purple cloud on the left seen with Chandra is the remains of a supernova explosion from a massive star. The Chandra data also reveals young, hot, and massive stars that send powerful winds outward from their surfaces. Additional data from Hubble and Spitzer is included, along with supporting data from XMM-Newton and ESO's New Technology Telescope. (X-ray: purple and blue; infrared/optical: red, green, blue)

M16 (Eagle Nebula):

Messier 16, also known as the Eagle Nebula, is a famous region of the sky often referred to as the "Pillars of Creation." The Webb image shows the dark columns of gas and dust shrouding the few remaining fledgling stars just being formed. The Chandra sources, which look like dots, are young stars that give off copious amounts of X-rays. (X-ray: red, blue; infrared: red, green, blue)



M74:

Messier 74 is also a spiral galaxy – like our Milky Way – that we see face-on from our vantage point on Earth. It is about 32 million light-years away. Messier 74 is nicknamed the Phantom Galaxy because it is relatively dim, making it harder to spot with small telescopes than other galaxies in Charles Messier's famous catalog from the 18th century. Webb outlines gas and dust in the infrared while Chandra data spotlights high-energy activity from stars at X-ray wavelengths. Hubble optical data showcases additional stars and dust along the dust lanes. (X-ray: purple; optical: orange, cyan, blue, infrared: green, yellow, red, magenta)

NGC 1672:

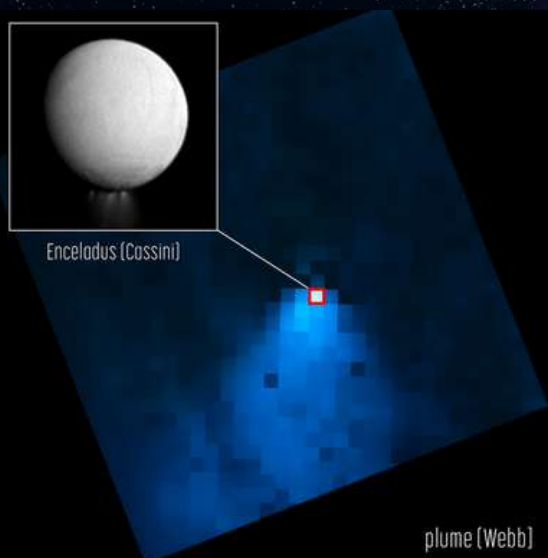
NGC 1672 is a spiral galaxy, but one that astronomers categorize as a "barred" spiral. In regions close to their centers, the arms of barred spiral galaxies are mostly in a straight band of stars across the center that encloses the core, as opposed to other spirals that have arms that twist all the way to their core. The Chandra data reveals compact objects like neutron stars or black holes pulling material from companion stars as well as the remnants of exploded stars. Additional data from Hubble (optical light) helps fill out the spiral arms with dust and gas, while Webb data shows dust and gas in the galaxy's spiral arms. (X-ray: purple; optical: red, green, blue; infrared: red, green, blue)



JWST Maps Surprisingly Large Plume Jetting From Saturn's Moon Enceladus

A water vapor plume from Saturn's moon Enceladus spanning more than 6,000 miles – nearly the distance from Los Angeles, California to Buenos Aires, Argentina – has been detected by researchers using NASA's James Webb Space Telescope. Not only is this the first time such a water emission has been seen over such an expansive distance, but Webb is also giving scientists a direct look, for the first time, at how this emission feeds the water supply for the entire system of Saturn and its rings.

Enceladus, an ocean world about four percent the size of Earth, just 313 miles across, is one of the most exciting scientific targets in our solar system in the search for life beyond Earth. Sandwiched between the moon's icy outer crust and its rocky core is a global reservoir of salty water. Geyser-like volcanos spew jets of ice particles, water vapor, and organic chemicals out of crevices in the moon's surface informally called 'tiger stripes.'



NASA's James Webb Space Telescope shows a water vapor plume jetting from the southern pole of Saturn's moon Enceladus

"When I was looking at the data, at first, I was thinking I had to be wrong. It was just so shocking to detect a water plume more than 20 times the size of the moon," said lead author Geronimo Villanueva of NASA's Goddard Space Flight Center in Greenbelt, Maryland. "The water plume extends far beyond its release region at the southern pole."

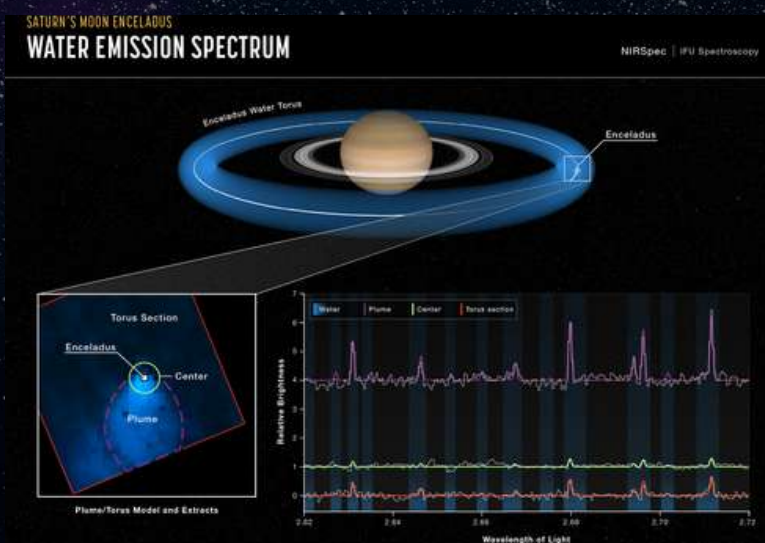
The length of the plume was not the only characteristic that intrigued researchers. The rate at which the water vapor is gushing out, about 79 gallons per second, is also particularly impressive. At this rate, you could fill an Olympic-sized swimming pool in just a couple of hours. In comparison, doing so with a garden hose on Earth would take more than 2 weeks.

The Cassini orbiter spent over a decade exploring the Saturnian system, and not only imaged the plumes of Enceladus for the first time but flew directly through them and sampled what they were made of. While Cassini's position within the Saturnian system provided invaluable insights into this distant moon, Webb's unique view from the Sun-Earth Lagrange Point 2 one million miles from Earth, along with the remarkable sensitivity of its Integral Field Unit aboard the NIRSpec (Near-Infrared Spectrograph) Instrument, is offering new context.

"The orbit of Enceladus around Saturn is relatively quick, just 33 hours. As it whips around Saturn, the moon and its jets are basically spitting off water, leaving a halo, almost like a donut, in its wake," said Villanueva. "In the Webb observations, not only was the plume huge, but there was just water absolutely everywhere."

This 'fuzzy donut' of water that appeared 'everywhere,' described as a torus, is co-located with Saturn's outermost and widest ring – the dense "E-ring."

The Webb observations directly demonstrate how the moon's water vapor plumes feed the torus. By analyzing the Webb data, astronomers have determined roughly 30 percent of the water stays within this torus, and the other 70 percent escapes to supply the rest of the Saturnian system of water.



Credits: NASA, ESA, CSA, STScI, Leah Hustak (STScI)

WEBB

New images from Webb's NIRSpec (Near-Infrared Spectrograph) have revealed a water vapor plume jetting from the southern pole of Enceladus, extending out more than 20 times the size of the moon itself.

Webb Maps and Finds Traces of Water in an Ultra-hot Gas Giant's Atmosphere

There's an intriguing exoplanet out there - 400 light years out there - that is so tantalizing that astronomers have been studying it since its discovery in 2009. A year for WASP-18 b, one orbit around its star (slightly larger than our Sun), takes just 23 hours. There's nothing like it in our solar system. In addition to observatories on the ground, NASA's Hubble, Chandra, TESS, and Spitzer space telescopes have all observed WASP-18 b, an ultra-hot gas giant 10 times more massive than Jupiter. Now astronomers have taken a look with NASA's James Webb Space Telescope and the "firsts" keep coming.

The Discovery:

Scientists identified water vapor in the atmosphere of WASP-18 b, and made a temperature map of the planet as it slipped behind, and reappeared from, its star. This event is known as a secondary eclipse. Scientists can read the combined light from star and planet, then refine the measurements from just the star as the planet moves behind it.

The same side, known as the dayside, of WASP-18 b always faces the star, just as the same side of the Moon always faces Earth. The temperature, or brightness, map shows a huge change in temperature - up to 1,000 degrees - from the hottest point facing the star to the terminator, where day and night sides of the tidally-locked planet meet in permanent twilight.

"JWST is giving us the sensitivity to make much more detailed maps of hot giant planets like WASP-18 b than ever before. This is the first time a planet has been mapped with JWST, and it's really exciting to see that some of what our models predicted, such as a sharp drop in temperature away from the point on the planet directly facing the star, is actually seen in the data!" said Megan Mansfield, a Sagan Fellow at the University of Arizona, and one of the authors of the paper describing the results.

The team mapped temperature gradients across the day side of the planet. Given how much cooler the planet is at the terminator, there is likely something hindering winds from efficiently redistributing heat to the night side. But what is affecting the winds is still a mystery.

"The brightness map of WASP-18 b shows a lack of east-west winds that is best matched by models with atmospheric drag. One possible explanation is that this planet has a strong magnetic field, which would be an exciting discovery!" said co-author Ryan Challener, of the University of Michigan.

GALACTICA

One interpretation of the eclipse map is that magnetic effects force the winds to blow from the planet's equator up over the North pole and down over the South pole, instead of East-West, as we would otherwise expect.

Researchers recorded temperature changes at different elevations of the gas giant planet's layers of atmosphere. They saw temperatures increase with elevation, varying by hundreds of degrees.

The spectrum of the planet's atmosphere clearly shows multiple small but precisely measured water features, present despite the extreme temperatures of almost 5,000 degrees Fahrenheit (2,700 C). It's so hot that it would tear most water molecules apart, so still seeing its presence speaks to Webb's extraordinary sensitivity to detect remaining water. The amounts recorded in WASP-18 b's atmosphere indicate water vapor is present at various elevations.

"It was a great feeling to look at WASP-18 b's JWST spectrum for the first time and see the subtle but precisely measured signature of water," said Louis-Philippe Coulombe, a graduate student at the University of Montreal and lead author of the WASP-18 b paper. "Using such measurements, we will be able to detect such molecules for a wide range of planets in the years to come!"

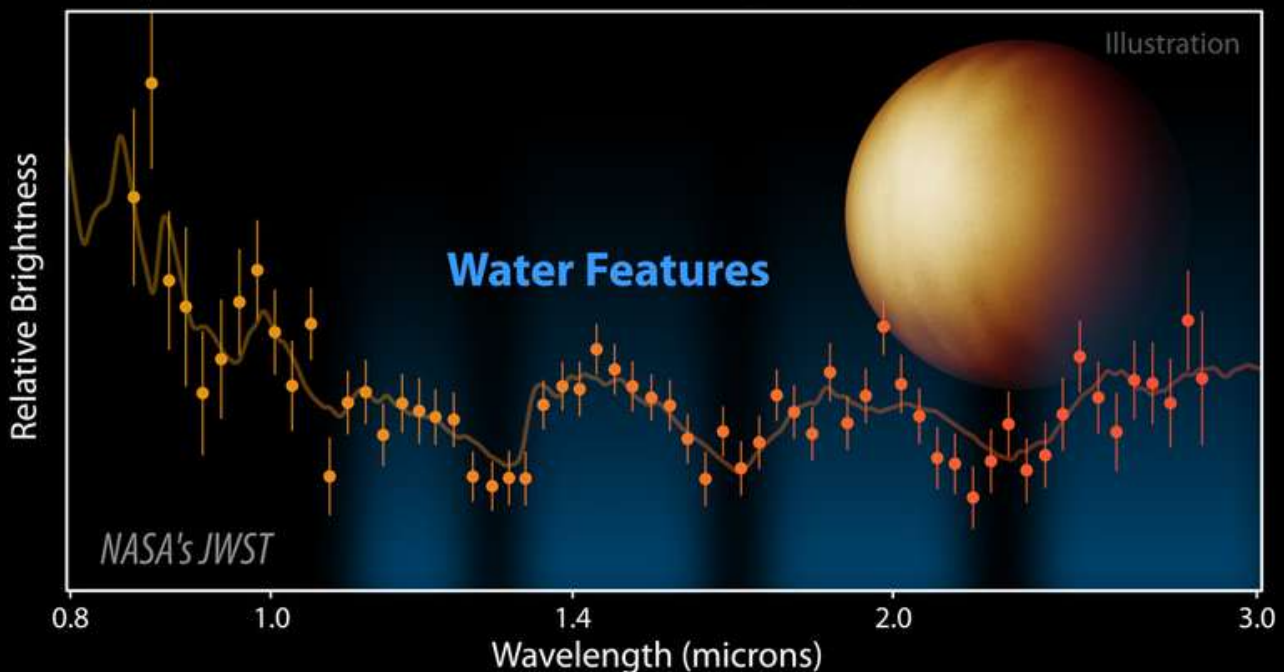
Researchers looked at WASP-18 b for about six hours with one of Webb's instruments, the Near-Infrared Imager and Slitless Spectrograph (NIRISS), contributed by the Canadian Space Agency.

"Because the water features in this spectrum are so subtle, they were difficult to identify in previous observations. That made it really exciting to finally see water features with these JWST observations," said Anjali Piette, a postdoctoral fellow at the Carnegie Institution for Science and one of the authors of the new research.

"By analyzing WASP-18b's spectrum, we not only learn about the various molecules that can be found in its atmosphere but also about the way it formed. We find from our observations that WASP-18 b's composition is very similar to that of its star, meaning it most likely formed from the leftover gas that was present just after the star was born," Coulombe said. "Those results are very valuable to get a clear picture of how strange planets like WASP-18 b, which have no counterpart in our solar system, come to exist."

Exoplanet WASP-18 b

Atmospheric Spectrum & Detection of Water



The team obtained the thermal emission spectrum of WASP-18 b by measuring the amount of light it emits over NASA's James Webb Space Telescope's NIRISS SOSS 0.85-2.8 um wavelength range, capturing 65% of the total energy emitted by the planet. WASP-18 b is so hot on the day side of this tidally-locked planet (the same side always faces its star, as the Moon to Earth) that water vapor molecules would break apart. The Webb Telescope directly observed water vapor on the planet in even relatively small amounts, indicating the sensitivity of the observatory. Credit: NASA/JPL-Caltech (R. Hurt/IPAC).

WHAT'S UP IN THE SKY - JUNE 2023

LUNAR CALENDAR

IMPORTANCE OF MOON PHASES FOR STARGAZERS

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

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



PLANETS VISIBILITY

Mercury

The planet makes a disappointing morning appearance but is best mid to late June. The Moon is nearby on 16 June.



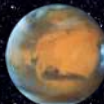
Venus

Spectacular evening planet. The greatest eastern elongation is on 4 June. Visibility deteriorating. Moon nearby on 21 June.



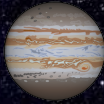
Mars

Low evening planet, which is best at the start of June when crossing M44, the Beehive Cluster.



Jupiter

Low morning planet. Waning crescent Moon to the north of Jupiter on 14 June.



Saturn

Poorly placed morning planet. Moon close on 10 June.



Uranus

Uranus is closer to the sun so not visible this month.



Neptune

Neptune is a morning object but lost in the dawn twilight, so tricky to view.



BRIGHT DEEP SKY OBJECTS

Messier 6 (M6), also known as the Butterfly Cluster, is a bright open cluster located in the southern constellation Scorpius. Messier 6 was named the Butterfly Cluster by the American astronomer Robert Burnham, who described it as a "charming group whose arrangement suggests the outline of a butterfly with open wings."



The M81 and M82 galaxies appear close together in our sky, and they're near the famous Big Dipper asterism, in the constellation Ursa Major, the Greater Bear. M81 (Bode's Galaxy) is a spiral galaxy that lies 11.8 million light-years away, while M82 (The Cigar Galaxy) is an irregular galaxy at roughly the same distance away from Earth.

The Hercules Cluster in the constellation Hercules also known as M13 is considered to be the finest globular cluster in the northern half of the heavens. It's found in a star pattern called the Keystone a lopsided square between the two brightest stars of northern spring and summer, Vega and Arcturus.



Messier 7 (M7), also known as Ptolemy's Cluster, is a bright open cluster in Scorpius constellation. It has the designation NGC 6475 in the New General Catalogue. With a visual magnitude of 3.3 and an apparent diameter of 80 arc minutes - more than twice the apparent size of the full Moon - Ptolemy's Cluster is an easy naked-eye target.

ROCKET LAUNCHES IN JUNE 2023

SYRACUSE 4B & HEINRICH HERTZ (H2SAT)

Syracuse 4B & Heinrich Hertz (H2Sat) is going to be launched on Sat Jun 17, 2023, 07:16 IST from Kourou, French Guiana.

It is the last flight of Ariane 5, after 117 flights. In 27 years of service, Ariane 5 has launched dozens of commercial payloads, as well as multiple major scientific missions (XMM Newton, Rosetta, Herschel, Planck, BepiColombo, JWST, and JUICE), and Europe's very first spacecraft, the ATV.

Syracuse 4B is a French military communications satellite built by Thales Alenia Space. Heinrich Hertz (H2Sat) is a small geostationary communications satellite built by OHB System and the German Aerospace Center (DLR) to explore and test new broadband communications technologies.

Heinrich Hertz

The German Heinrich Hertz or H2Sat aims to explore and test new communications technologies in space at a technical and scientific level in order to determine how broadband communications, for example, can result in high data rates for mobile final users.

Mission objectives are:

- * Scientific/technical verification of hardware and software and scientific experiments in the area of communications.
- * Preparations/testing of pre-operational Satcom services for German (public-sector) users. (Image Credits: NASA/Chris Gunn)

DELTA IV HEAVY TO LAUNCH NROL-68

A United Launch Alliance (ULA) Delta IV Heavy rocket is launching the NROL-68 mission for the National Reconnaissance Office (NRO). Liftoff will occur from Space Launch Complex-37 (SLC-37) at Cape Canaveral Space Force Station, Florida on June 21, 2023.

A United Launch Alliance (ULA) Delta IV Heavy rocket is launching the NROL-68 mission for the National Reconnaissance Office (NRO). Liftoff will occur from Space Launch Complex-37 at Cape Canaveral Space Force Station, Florida.

When the United States needs eyes and ears in critical places where no human can reach - be it over the most rugged terrain or through the most hostile territory - it turns to the NRO. The NRO is the Intelligence Community agency responsible for developing, acquiring, launching and operating America's reconnaissance satellites, as well as operating associated data processing facilities in support of national security.

The NRO uses a variety of satellites to meet mission needs—from small sats to more traditional, larger satellites. This allows the NRO to pursue a hybrid architecture designed to provide global coverage against a wide range of intelligence requirements, carry out research and development efforts, and assist emergency and disaster relief efforts in the U.S. and around the world. The NRO never loses focus on who they are working to protect: our nation and its citizens.

(Image Credits: United Launch Alliance)



SOYUZ 2.1B/FREGAT-M

METEOR-M NO.2-3



TUE, JUNE 27, 2023
17:04 IST

Meteor-M No.2-3

Type: Earth Science

Launch Cost: \$48,500,000

Meteor-M satellites are a new generation of Russian meteorological satellites to replace the Meteor-3M series.



Location

Cosmodrome Site 1S,
Vostochny Cosmodrome, Siberia, Russian Federation
Rocket
13 rockets have launched from Vostochny Cosmodrome,
Siberia, Russian Federation.



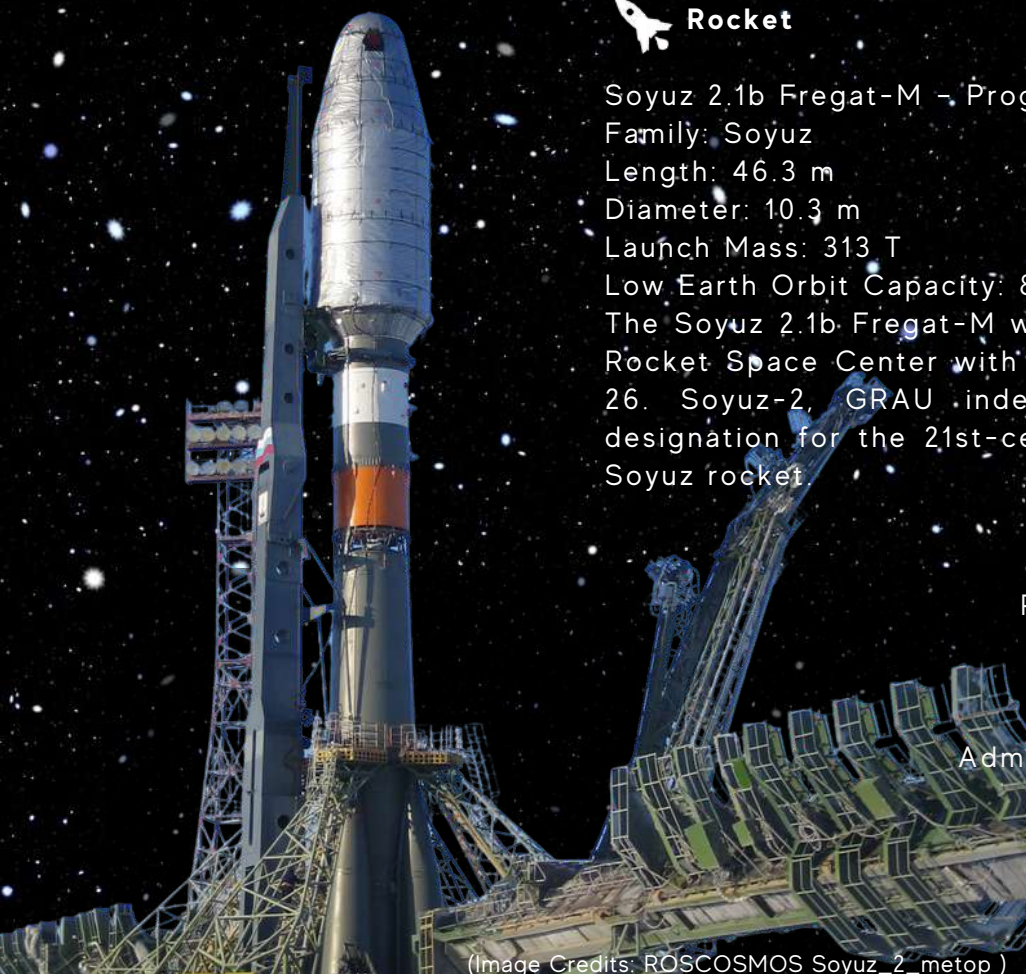
Rocket

Soyuz 2.1b Fregat-M – Progress Rocket Space Center
Family: Soyuz
Length: 46.3 m
Diameter: 10.3 m
Launch Mass: 313 T
Low Earth Orbit Capacity: 8200 kg
The Soyuz 2.1b Fregat-M was manufactured by Progress Rocket Space Center with the first launch on 2008-07-26. Soyuz-2, GRAU index 14A14, is the collective designation for the 21st-century version of the Russian Soyuz rocket.

Agency



Russian Federal Space Agency
(ROSCOSMOS) – RFSA
Type: Government
Abbreviation: RFSA
Administration: Administrator: Yuri
Borisov
Founded: 1992
Launchers: Soyuz
Spacecraft: Soyuz
Country: RUS



(Image Credits: ROSCOSMOS Soyuz_2_metop)

SpaceX Launches - June 2023

FALCON 9 STARLINK 6 -4

About:
Falcon 9 Starlink 6-4:
A batch of satellites for the Starlink mega-constellation - SpaceX's project for space-based Internet communication system.

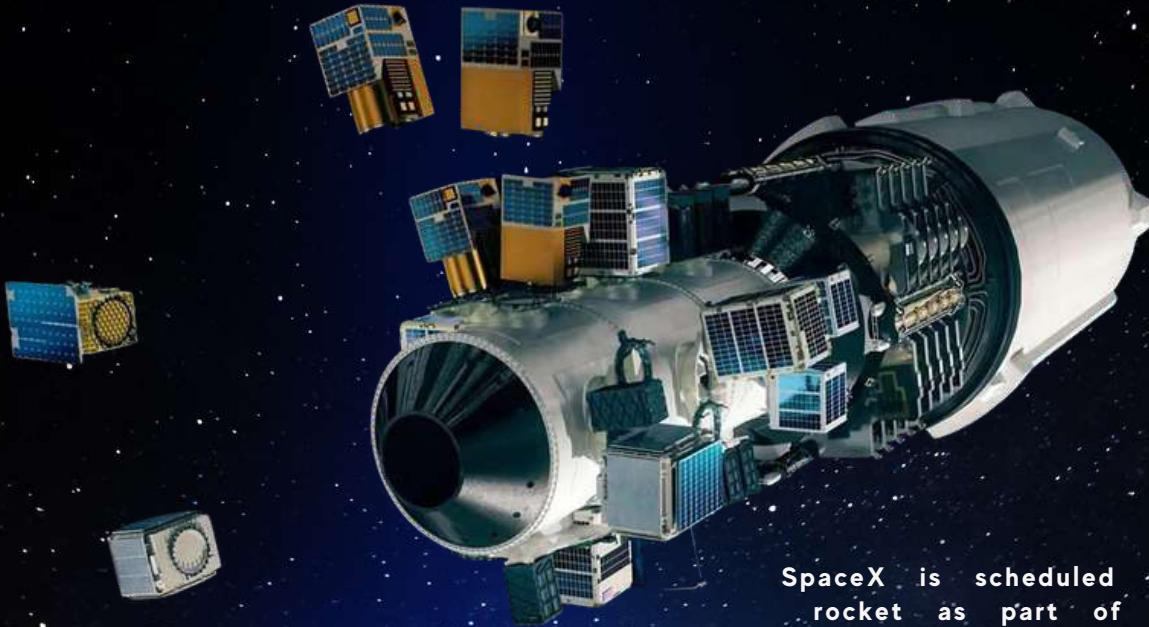
Where:
Cape Canaveral Space Force Station - SLC 40

When :
June 01, 2023
Time :
04:34 PM IST

About SpaceX:
Starlink is a satellite internet constellation operated by SpaceX, providing satellite Internet access coverage to over 53 countries. It also aims for global mobile phone service after 2023. SpaceX started launching Starlink satellites in 2019. (Image credits: SpaceX)



TRANSPORTER 8 - DEDICATED SPACE X RIDESHARE



SpaceX is scheduled to launch a rocket as part of the smallsat Rideshare. The launch is scheduled for June 8th. Transporter 8 is a dedicated rideshare mission by SpaceX.

SpaceX's SmallSat Rideshare Program provides small satellite operators with regularly scheduled, dedicated Falcon 9 rideshare missions to SSO for ESPA class payloads for as low as \$275,000 per mission, which includes up to 50kg of payload mass.

Falcon 9, the world's first orbital-class reusable rocket, is manufactured and operated by SpaceX for the reliable and safe transport of people and payloads to Earth orbit and beyond.

Smallsat Rideshare program is designed to provide low-cost access to space for smaller payloads. Here are the details:

COST AS LOW AS \$275K

\$275k for 50kg to SSO with additional mass at \$5.5k/kg. Affordable rates are also available to Mid-Inclination LEO, GTO, and TLI.



SCHEDULE CERTAINTY

SSO missions approximately every 4 months. Frequent launches to mid-inclination. Inquire for other orbits.

CONTRACT FLEXIBILITY

If your payload is delayed, apply 100% of the monies paid toward the cost of rebooking on a future mission, subject to a 10% rebooking fee.



(Image credits: SpaceX)

O3B MPOWER 5 & 6



Fifth and sixth of a constellation of eleven high-throughput communications satellites in Medium Earth Orbit (MEO) built by Boeing and operated by SES is to be launched on Fri Jun 9th, 2023 at 11:00 AM IST.

O3b mPOWER is a communications satellite system currently under construction and deployment. The first two satellites were launched on 16 December 2022 and commercial service is expected to begin in Q3 2023. It is owned and operated by SES, O3b mPOWER initially comprises 11 high-throughput and low-latency satellites in a medium Earth orbit (MEO), along with ground infrastructure and intelligent software, to provide multiple terabits of global broadband connectivity for applications including cellular backhaul to remote rural locations and simultaneous international IP trunking.

The O3b mPOWER satellites use fully shapable and steerable spot beams that can be shifted and scaled in real-time to suit individual users. The satellites will join SES' existing constellation of 20 first-generation O3b satellites in MEO and operate in conjunction with them and the SES fleet of geostationary satellites.

From MEO, the O3b mPOWER satellites can deliver high-bandwidth connectivity between latitudes 50° N and 50° S (covering 96% of the global population) to mobile and/or remote terminals of 0.3 m to 5.5 m, and is expected to find application in the following markets:

- Mobility: cruise, commercial shipping, aero
- Telecom: telco, mobile network operators, cloud providers
- Government: military, government agencies, non-governmental organizations
- Enterprise: oil and gas, mining

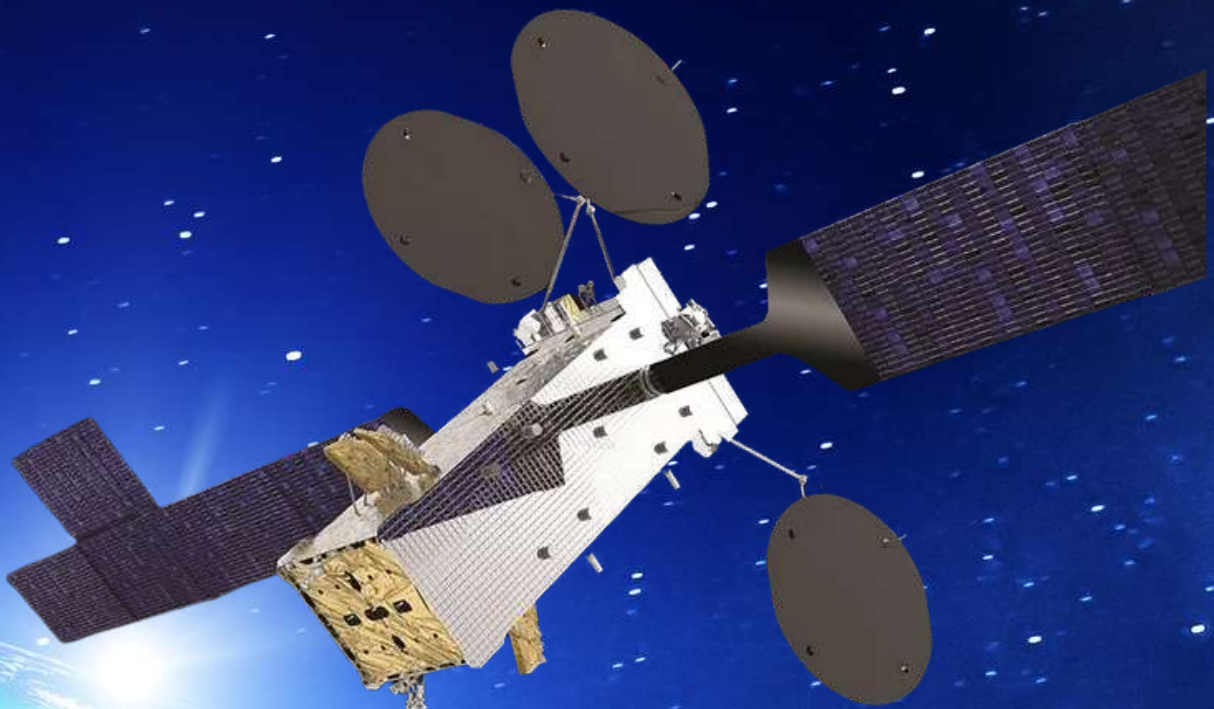
Proposed additional satellites operating in a second medium earth orbit at an inclination of 70° would give near-complete global coverage. (Image Credits: La Nacion/ZUMA Press/picture alliance)

SATRIA I

Indonesia's Pasifik Satelit Nusantara (PSN) has earlier ordered a high-throughput satellite from Boeing to launch on a SpaceX Falcon 9 on June 19, 2023, at 11:00 AM IST.

The Nusantara Lima Satellite aims to deliver 160 gigabits per second (Gbps) of capacity across the Indonesian archipelago and surrounding countries.

PSN said the satellite will augment capacity on the SATRIA-1 satellite Thales Alenia Space is building for a launch in 2023, which together would make it one of the biggest satellite capacity providers in Asia.



"This project shows that despite the pandemic situation, the acceleration of digital transformation continues to be developed in providing connectivity across the Indonesian Archipelago," said Johnny G. Plate, Indonesia's Minister of Communications and Informatics.

Plate said Nusantara Lima Satellite will provide 140 Gbps of capacity over Indonesia.

About 80 Gbps will be used by BAKTI, an Indonesian government agency, for what it calls Hot Backup Satellite (HBS) to deliver services to remote places in Indonesia where terrestrial communications are unavailable.

Plate said, "The balance of 20 Gbps will be serving Malaysia and the Philippines."

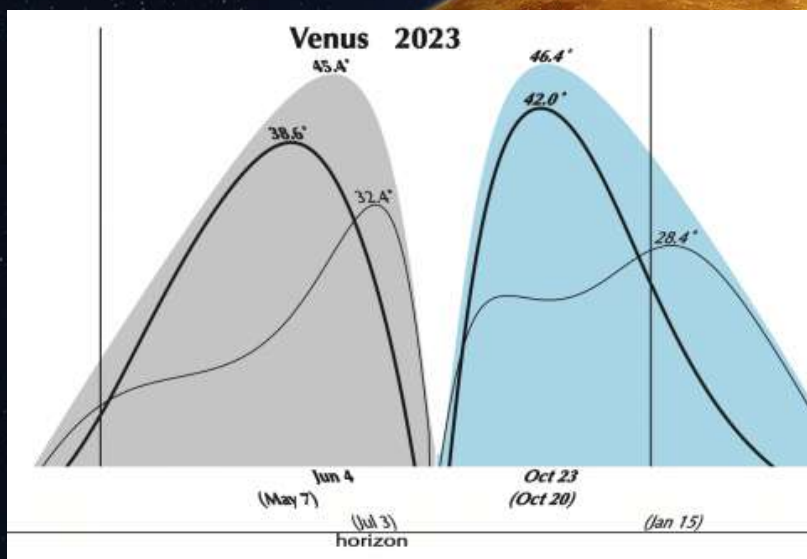
Boeing, which delivered Indonesia's first telecoms satellite Palapa A1 in 1976, said the satellite will be based on its 702MP platform. (Credits: Space news, Image credits: Thales Alenia Space)

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

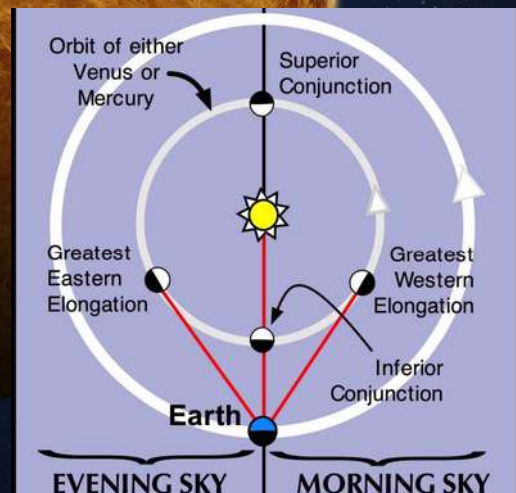
ASTRONOMICAL EVENTS - JUNE 2023

VENUS AT GREATEST ELONGATION EAST

Venus will be at its greatest elongation - farthest from the sunset - on June 4, 2023. Look for Venus in the sunset direction as evening twilight falls. Also, if you have a dark sky, look for Mars in the constellation Cancer.



Venus came into view after sunset in December 2022 and will be visible in the evening sky throughout the early months of 2023. The greatest elongation - when Venus will be farthest from the sunset - will happen in early June. Afterward, Venus will quickly sink toward the sunset as it races toward its sweep between the Earth and sun around mid-August 2023.



Venus's orbit lies closer to the Sun than the Earth's, meaning it always appears close to the Sun and is lost in the Sun's glare much of the time.

It is observable for a few months each time it reaches the greatest separation from the Sun - moments referred to as greatest elongation.

On these occasions, Venus is so bright and conspicuous that it becomes the third brightest object in the sky after the Sun and Moon. It is often called the morning star or the evening star.

These apparitions repeat roughly once every 1.6 years, taking place alternately in the morning and evening skies, depending on whether Venus lies to the east of the Sun or to the west. (Image credits: Earthsky)

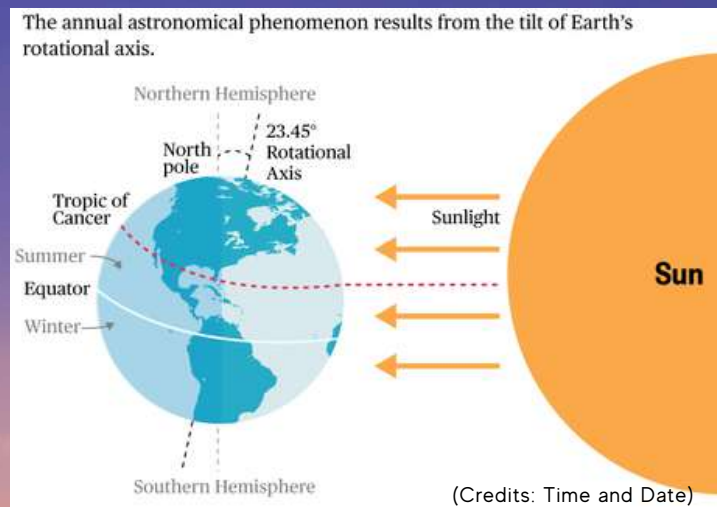
JUNE SOLSTICE 2023

The June solstice is when the Sun is directly above the Tropic of Cancer in the Northern Hemisphere. This is the northernmost latitude it reaches during the year. After the solstice, it begins moving south again. This year, it occurs on Wed, Jun 21, 2023, at 8:27 PM.

Longest Day in the North

Since the Northern Hemisphere is tilted toward the Sun in June, it receives more sunlight during the day. The North Pole's tilt toward the Sun is greatest at the solstice, so this event marks the longest day of the year north of the equator.

This effect is most significant in locations that are farther away from the equator. In tropical areas, the longest day is just a little longer than 12 hours. In the temperate zone, it is significantly longer; and places within the Arctic Circle experience Midnight Sun or polar day, when the Sun does not set at night.



Shortest Day in the South

Conversely, the day of the June solstice is the shortest day of the year in the Southern Hemisphere. Here, too, the effect is greater the farther a location is away from the equator.

Why Is It Called a "Solstice?"

During a year, the subsolar point—the spot on the Earth's surface directly beneath the Sun—slowly moves along a north-south axis. Having reached its southernmost point at the December solstice, it stops and starts moving northward until it crosses the equator on the day of the March equinox.

At the June solstice, which marks the northernmost point of its journey, it stops again to start its journey back toward the south.

This is how the solstices got their name: the term comes from the Latin words *sol* and *sistere*, meaning "Sun" and "to stand still".

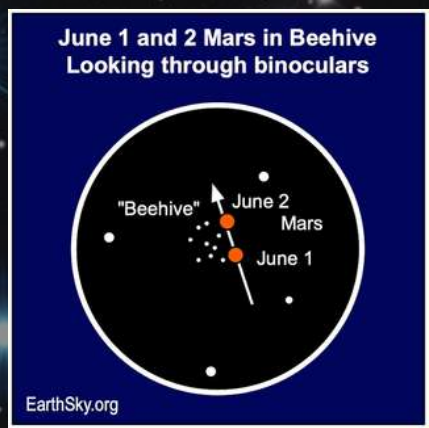
Initially, the naming arose from observations of how the Sun's apparent path across the sky changes slightly from one day to the next, which is caused by the same process as the subsolar point's movement described above.

In the months leading up to the June solstice, the position of sunrise and sunset creeps northward. On the day of the solstice, it reaches its northernmost point. After that, the daily path of the Sun across the sky begins to creep southward again.

RED PLANET TRANSITING BEEHIVE CLUSTER

From 1st of June to 4th of June, the red planet, Mars, will be transiting through the Beehive cluster (M44). The spectacular sight will be visible during the evenings, right after the sunset. To find Mars, look for brilliant Venus in the west, which is at magnitude -4.3; Mars will be right above it at magnitude 1.52.

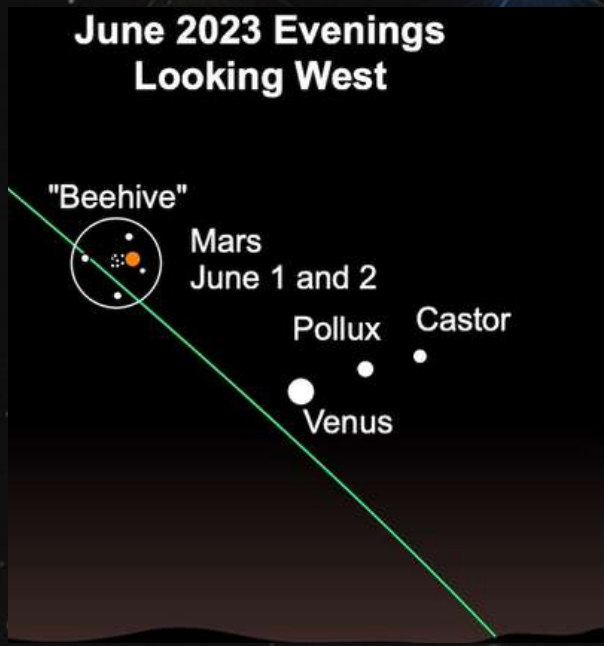
On the evenings of June 1 and 2, 2023, you can spot Mars as it passes through a background Beehive star cluster in Cancer. Mars appears as a big, bright ruby surrounded by tiny diamonds of distant stars. Aim your binoculars at the red planet to see the sparkling background star cluster. While you can spot the cluster with your eyes alone, they will appear as a misty patch. However, with optical aid, the true nature of this star cluster comes alive.



About the Beehive cluster:

A mere 600 light-years away, the Beehive cluster or M44 is one of the closest star clusters to our solar system. Also known as the Praesepe its stars are young though, about 600 million years old compared to our Sun's 4.5 billion years. Based on similar ages and motion through space, M44 and the even closer Hyades star cluster in Taurus are thought to have been born together in the same large molecular cloud. (Image credits: Stellarium and Earthsky.org)

June 2023 Evenings Looking West



An open cluster spanning some 15 light-years, M44 holds 1,000 stars or so and covers about 3 full moons (1.5 degrees) in the sky in the constellation Cancer. Visible to the unaided eye, M44 has been recognized since antiquity.

It is described as a faint cloud or celestial mist long before being included as the 44th entry in Charles Messier's 18th-century catalog, the cluster was not resolved into its individual stars until telescopes were available. It is a popular target for modern, binocular-equipped sky gazers, the cluster's few yellowish-tinted, cool, red giants are scattered through the field of its brighter hot blue main sequence stars in this telescopic group snapshot.

CONJUNCTIONS FOR THE MONTH

Conjunction - Occasionally two or more objects meet up with each other in our sky. Astronomers use the word conjunction to describe these meetings. 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.

The word conjunction comes from Latin, meaning to join together. Maybe you remember the old Conjunction Junction cartoons from the 1970s. In language, conjunctions relate to clauses brought together in sentences with words like and. In astronomy, conjunctions relate to two or more objects brought together in the sky.

An astronomical conjunction describes a few different types of meetings. The first two types we're describing here - inferior and superior conjunctions - involve the sun and thus can't be seen.

CONJUNCTION OF MOON AND SATURN

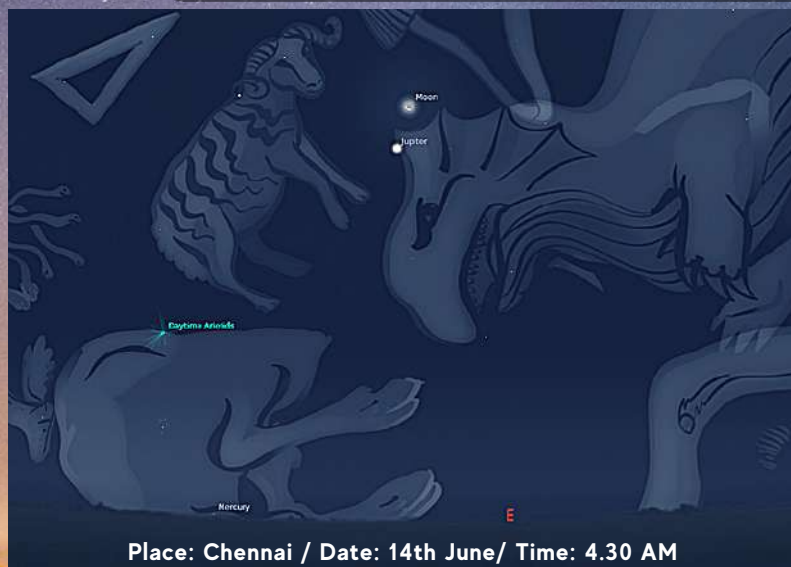
On June 10, 2023, the planet Saturn will appear very close to the Moon. The pair will be seen together at night right after it rises. They will be in the eastern direction. Moon is at a magnitude of -10.77 and Saturn has a magnitude of -0.8.

The Moon and Saturn will share the same right ascension, with the Moon passing $2^{\circ}58'$ to the south of Saturn. The Moon will be 21 days old.



Place: Chennai / Date: 10th June/ Time:12.30 AM

CONJUNCTION OF MOON AND JUPITER



Place: Chennai / Date: 14th June/ Time: 4.30 AM

On June 14, 2023, Moon and the planet Jupiter will appear very close to each other in the early morning. They will be in the eastern direction. Moon is at a magnitude of -8.53, and the planet Jupiter is at a magnitude of -2.14.

The Moon and Jupiter will share the same right ascension, with the Moon passing $1^{\circ}30'$ to the north of Jupiter. The Moon will be 26 days old.

CONJUNCTION OF VENUS AND BEEHIVE CLUSTER

In the evenings of June 13, Venus buzzes by the beehive star cluster.

Venus – our sky’s brightest planet – will take on the role of ‘queen bee’ when it passes by the Beehive star(M44) cluster on June 12 and 13, 2023. Look west shortly after darkness falls for this exciting and beautiful sight.

M44 is one of the closest star clusters to our solar system. An open cluster spanning some 15 light-years holds 1,000 stars and covers about 3 full moons (1.5 degrees) in the sky in the constellation Cancer. Visible to the unaided eye, M44 has been recognized since antiquity.

Thus, Venus will be at a magnitude of -4.49, and the Beehive cluster will be at a magnitude of 3.10. The pair will be visible right after sunset until soon it sets at 21:30.



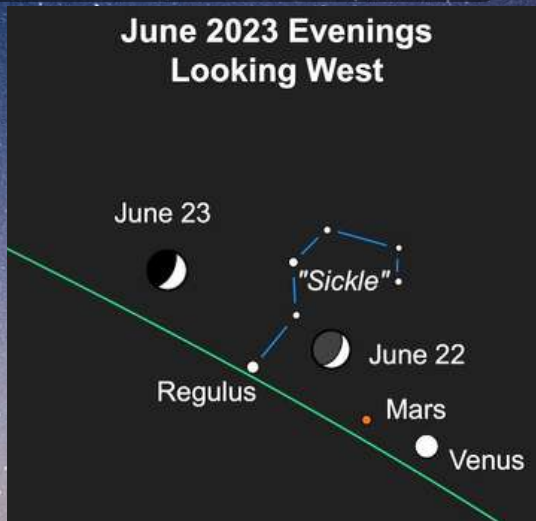
Place: Chennai / Date: 13th June / Time:8.30PM



CONJUNCTION OF MOON, VENUS AND MARS



Place: Chennai / Date: 22nd June / Time: 8.00PM



The waxing crescent moon will glow near the planets Venus and Mars, plus the bright star Regulus in Leo the Lion, on the evenings of June 22 and 23, 2023. It will also lie near the dim star pattern – or asterism – known as the Sickle.

Moon will be four days old at a magnitude of -8.20, while Venus and Mars will be at -4.58 and 1.71.

The conjunction will be visible right after sunset until they set around 21:30.

(Image credits Earthsky.org)

STUDENT'S CORNER

CAN SPACE BE OWNED?

Nikhilesh B
IAstronomer Member

With our current rate of progress in space missions, it is reasonable to say that we are going to colonize other parts of the solar system faster than previously expected. In March 2019, Elon Musk said that we could make a self-sustaining city on Mars by 2050 if we start by 2024 and take 10 orbital synchronizations. In 2022, Elon Musk said that he predicts a mission to Mars by 2029. So, it can be expected that we will have a city on Mars by 2060 (keeping 5 years more in hand). After that, we would be an interstellar species! Our civilization would get a second chance to fix the mass extinction that might take place due to global warming! It would all be amazing! Right now, it is hard to imagine getting a phone call from any place outside of the Earth. Then, it would be the reality!

President of the lunar embassy, Chris Lamar has already claimed the moon! And he has been selling land on the moon for 42 years! Basically, Chris's father wanted to own real estate. But, real estate on Earth was way too expensive! So one night, when he looked up at the sky, he didn't only see the moon, he saw a Real Estate opportunity! He studied the Outer Space Treaty of 1967 and saw that it had no mention of individual property owners! That, was when he wrote a letter to the UN claiming the Moon as his own! He never got a reply to that letter, so he took it as a yes! And that's how Chris and his father became real estate agents.

They did not stop after selling the moon! They started to sell the rest of the solar system in the same way! Currently, they sell land on Mercury, Venus, Mars, Moon, and Io. They also have future plans of expanding it!

Now there are two possibilities about what is going to happen in the future to this extraordinary business. One- UN is going to announce this business as fraud and all their hard work will be a gimmick. Second- the UN is going to approve this business and Chris and his father will be rich. Maybe the richest people on the planet!

But this could also lead to other problems... if the UN approves this business it would mean anyone could own anything in space! We also would not have laws to control them. It would be easier to control 199 countries than treat 8 billion people, each one like a separate nation. It would also be a hard time knowing which property is owned by whom. It would be like a civil war between everyone!

All of this is dependent on the decision of the UN. We can just hope that no war starts due to this advancement of humanity. Any global war now, with our weapons of mass destruction is the extinction of humanity. So... just hope for the good.

THE LORD OF THE RINGS J1407B

Sourajit Mandal
IAstronomer Member

J1407b is the first brown dwarf or an exoplanet discovered by the transit method, the transit method is the method of finding planets, stars, or moons, by waiting until they pass by something. Astronomers found that J1407b has 30 ring systems and since the light has been bent by the rings we can estimate that the diameter is approximately 120 million kilometers and 200 times bigger than Saturn's rings, J1407B revolves around the star V1400 Centauri, which is an oval looking star, it is also called 1SWASP J140747. The distance from Earth to J1407B is 433.8 light years. One light year is the distance traveled by light in 1 year.

As there are small ring gaps in between each ring system astronomers have predicted the existence of a couple of moons at least one moon the size of Earth or Mars. The mass of J1407B is difficult to determine but it is estimated to be around 10 to 40 Jupiter masses. The one and only way we have to observe J1407B is during its eclipse which let us study its physical-chemical properties. Some studies prove that J1407B has 2 more ring systems when it was discovered in the year 2012. In a couple of days, we can see this planet transit in front of its star, the star can be visible through small amateur telescopes,

J1407B is a young planet well 16 million years old which is actually not young for us, the Earth and the sun are 4.5 billion years old which is sure a long time, but is young compared to the other exoplanets, if the sun was replaced by J1407B the rings would nearly reach earth! Its orbital period is 3.5 to 13.8 years and its surface temperature is around 5483.85 degree Celsius, its parent star is a G-type star, and the distance between the star and Earth is 434 light years. J1407B was discovered in a 56-day eclipse. If it had ever replaced Saturn the rings can be seen brighter than the moon.

It was discovered by astronomer Eric Mamajek at the University of Rochester and his co-author from the Leiden Observatory, Netherlands, discovered that the ring system is much larger and heavier than the ring system of Saturn. The ring system – the first of its kind to be found outside our solar system was discovered in 2012 by a team led by Rochester's Eric Mamajek. In the most recent study also led by Kenworthy, adaptive optics and Doppler spectroscopy were used to estimate the mass of the ringed object.

Their conclusions based on these and previous papers on the intriguing system J1407 is that the companion is likely to be a giant planet – not yet seen – with a gigantic ring system responsible for the repeated dimming of J1407's light.

ASTROPHOTOGRAPHY FROM SPACE ASSOCIATED ASTRONOMERS



Sun captured by Kalkin Bansal, Club student



Daksh Rathi, lastronomer



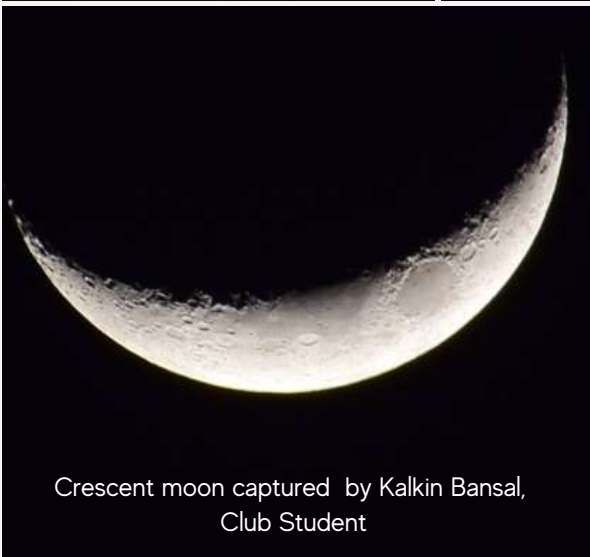
Nikhilesh B, lastronomer



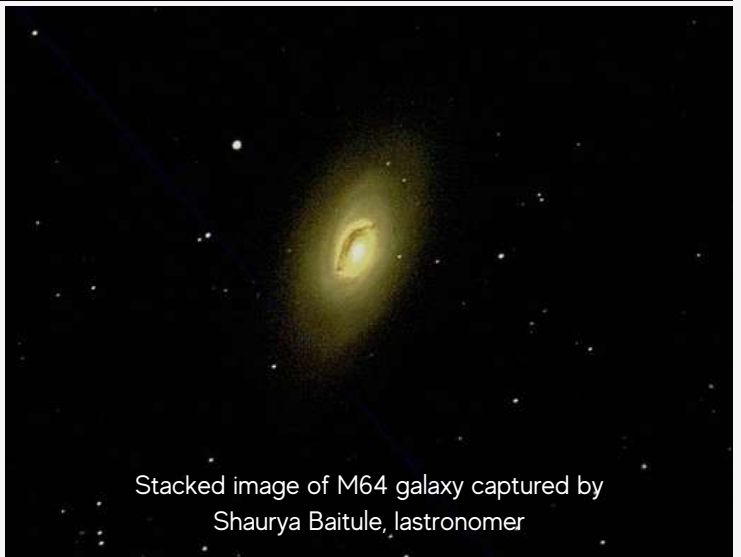
Star Trail by Daksh Rathi,
lastronomer



Penumbra Eclipse captured by Kalkin Bansal, Club Student



Crescent moon captured by Kalkin Bansal,
Club Student



Stacked image of M64 galaxy captured by
Shaurya Baitule, lastronomer

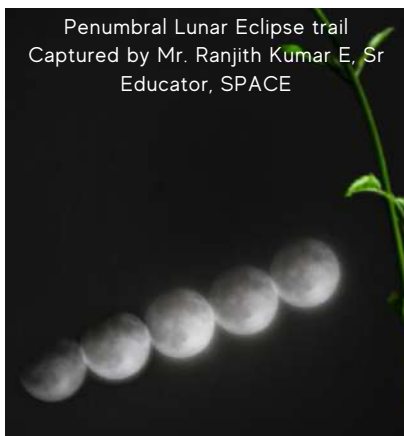
ASTROPHOTOGRAPHS BY SPACE



Star trail captured by Ms. Sakshi Sheoran, Educator, SPACE



Moon, Venus and Mars trail captured by Mr. Ranjith Kumar E, Sr Educator, SPACE



Penumbral Lunar Eclipse trail
Captured by Mr. Ranjith Kumar E, Sr
Educator, SPACE



Milkyway captured by Mr. Ankur Chhabra,
Educator, SPACE



Moon trail captured by
Ms. Priyadharshini, Educator, SPACE



Star trail captured by Mr. Ankur Chhabra, Educator, SPACE



Penumbral Lunar Eclipse Captured by Mr. Yogesh Joshi, Program Incharge, Astro
Tourism India Pvt. Ltd



Venus and Moon trail captured by Ms. Sruthi Suresh, Educator, SPACE

Happy Birthday

Charles Messier

Charles Messier (26 June 1730 – 12 April 1817) was a French astronomer. He witnessed the spectacular Comet Klinkenberg-Chéseaux, which ignited his passion for astronomy. He learned to use astronomical tools and became a skilled observer. He discovered over a dozen comets, earning him the nickname “Comet Ferret” from King Louis XV. Messier had compiled a list of 103 objects in the night sky using his observations with various telescopes and the discoveries of other astronomers. The catalog was revised in the 20th century and now contains 110 objects. Amateur astronomers today use Messier’s catalog as a guide to some of the most exciting and detailed cosmic sights that can be viewed from the Northern Hemisphere.



Eugene Parker

Eugene Newman Parker (June 10, 1927 – March 15, 2022) was an American solar and plasma physicist. In the 1950s he proposed the existence of the solar wind and that the magnetic field in the outer Solar System would be in the shape of a Parker spiral, predictions that were later confirmed by spacecraft measurements. In May 2017, NASA renamed the spacecraft from the Solar Probe Plus to the Parker Solar Probe in honor of astrophysicist Eugene Parker. This was the first time NASA named a spacecraft for a living individual. The spacecraft was launched on 12 August 2018.



HISTORICAL EVENTS HAPPENED IN JUNE

BHASKARA I

On June 7th, 1979, India launched their First Experimental Remote Sensing Satellite built-in full in India. The onboard TV camera imageries were used in the field of Hydrology and Forestry. Rich scientific data sent by SAMIR was used for oceanographic studies.



The satellite is named after the famous 7th Century mathematician Bhaskara I. He was the first scholar to write numbers in the decimal number system. The weight of the satellite was 442 Kg at launch and was launched by the Intercosmos launch vehicle, C-1 Intercosmos from Volgograd Launch Station, Russia. The satellite was placed at an Apogee of 399 km and a Perigee of 394 km, with an inclination of 50.6°.

Onboard the satellite were two television cameras that operated in the visible and near-infrared spectrum. SAMIR, which stands for Satellite microwave radiometer was another payload that studied the water vapor, ocean state, the liquid water content in the atmosphere, and so on. It operated at 19 and 22 GHz. The satellite sent many extensive data that was used for studies including oceanographic studies. The nominal mission life was one year. The satellite's orbital life was about ten years. It re-entered in 1989. The second similar satellite, the Bhaskara-II was launched in November 1981. (Image credits: jagran.com)

PIONEER 10 SPACECRAFT

On June 13, 1983, Pioneer 10 became the first human-made object to pass outside Pluto's orbit and leave the central solar system.

Pioneer 10 is considered one of the most successful spacecraft of all time. The spacecraft was designed for deep-space exploration when it was launched in 1972, which was anything beyond the moon.

During its lifetime, the spacecraft sent back numerous data along the way. It achieved a breakaway speed of 32,400 mph as soon as it was launched, being the fastest man-made object to leave the Earth. It shot past the moon in a mere 11 hours and crossed Mars' orbit in just 12 weeks. It was moving at the speed of 82,000 mph when it passed Jupiter on Dec 3, 1973. Upon reaching Jupiter, Pioneer 10 sent back the first direct observations and close-up images of the solar system's largest planet. It was data from Pioneer 10 that confirmed that Jupiter is mostly a liquid planet.



Pioneer 10 kept on sending the data as it reached the end of the Solar system, which was considered anything after Pluto's orbit. The scientific mission ended in the year 1997. But all the contacts were terminated when the spacecraft sent its last transmission of telemetry data on April 27, 2002.

To everyone's surprise, NASA's Deep Space Network received a final, faint signal on January 22, 2003, and it's been silent ever since. Even though we lost contact forever, the spacecraft is continuing its journey through interstellar space. Right now, it is headed toward the brightest star of the Taurus constellation, Aldebaran, which forms the Bull's eye. As per NASA scientists, it is expected to take about 2 million years.

Originally, Pioneer 10's mission was intended to go for only 21 months, but it has lasted 25 years. As project manager Larry Lasher said, "I guess you could say we got our money's worth. (Image credits: National Air and Space Museum)

THE FIRST WOMAN TO SPACE!



In an era where women were struggling to get proper education, Valentina Tereshkova became the First Woman to go to Space. The Russian space agency, ROSCOSMOS, was not only successful in sending the First Man to space in 1961 but also succeeded in sending the Woman.



After Yuri Gagarin became the first man in space in 1961, Tereshkova volunteered for the Soviet space program. Although she did not have any experience as a pilot, she was accepted into the program because of her 126 parachute jumps. At the time, cosmonauts had to parachute from their capsules seconds before they hit the ground on returning to Earth.

On 16 February 1962, out of more than 400 applicants, five women were selected to join the cosmonaut corps: Tatyana Kuznetsova, Irina Solovyova, Zhanna Yorkina, Valentina Ponomaryova, and Valentina Tereshkova. The group spent several months in training, which included weightless flights, isolation tests, centrifuge tests, 120 parachute jumps, and pilot training in jet aircraft. After a two-hour countdown, Vostok 6 lifted off without fault and, within hours, she was in communication with Bykovsky in Vostok 5, marking the second time that two manned spacecraft were in space at the same time. With the radio call sign 'Chaika' ('seagull'), Tereshkova had become the first woman in space at the age of 26.

Her mission lasted just under three days (two days, 23 hours, and 12 minutes). With a single flight, she had logged more flight time than all the US Mercury astronauts who had flown to that date combined.



THE FIRST AMERICAN WOMEN TO SPACE

On June 18, 1983, NASA Astronaut Sally K. Ride became the first American woman in space, when she launched with her four crewmates aboard the Space Shuttle Challenger on mission STS-7. Ride and five other women had been selected in 1978 for NASA Astronaut Group 8, the first American selection class to include females. With the advent of the space shuttle, NASA expanded astronaut selection from only pilots to scientists and engineers, and women became eligible for selection. NASA announced Ride and her classmates to the public on Jan. 16, 1978.



During the six-day mission, the most complex in the shuttle program to date, the crew launched two commercial communications satellites, Anik C3 for Canada's Telesat and Palapa B2 for Indonesia. Ride used the Shuttle's robotic arm to deploy the first Shuttle Pallet Satellite (SPAS-01) and retrieve it two days later, the first time the Shuttle was used to return a spacecraft to Earth. The SPAS-01 satellite took some amazing photographs of Challenger as the two spacecraft flew in formation. Although originally planned to conduct the first shuttle landing at Kennedy Space Center, inclement weather in Florida forced a diversion to Edwards Air Force Base in California. Touchdown occurred June 24.

Ride's launch on STS-7 occurred almost to the day of the 20th anniversary of the launch of the first woman in space, Soviet cosmonaut Valentina V. Tereshkova. Sally Ride and Valentina Tereshkova made their marks in history. In their own ways, the two were trailblazers for women who followed in their footsteps in the conquest of space.



THE TUNGUSKA EVENT

On the morning of 30 June 1908 (N.S.) enormous explosion that is estimated to have occurred at 7:14 AM plus or minus one minute, at an altitude of 5-10 km (15,000-30,000 feet), flattening some 2,000 square km (500,000 acres) and charring more than 100 square km of pine forest near the Podkamennaya Tunguska River in central Siberia (60°55' N 101°57' E), Russia. The energy of the explosion is estimated to have been equivalent to the explosive force of as much as 15 megatons of TNT—a thousand times more powerful than the atomic bomb dropped on Hiroshima, Japan, on August 6, 1945.

The explosion is generally attributed to the air burst of a meteoroid or asteroid. It is classified as an impact event, even though no impact crater has been found; the object is thought to have disintegrated at an altitude of 5 to 10 kilometers (3 to 6 miles) rather than to have hit the surface of the earth.

EFFECT OF THE IMPACT



The Tunguska event is the largest impact event on Earth in recorded history. Studies have yielded different estimates of the meteoroid's size, on the order of 60 to 190 meters (200 to 620 feet), depending on whether the body was a comet or a denser asteroid.

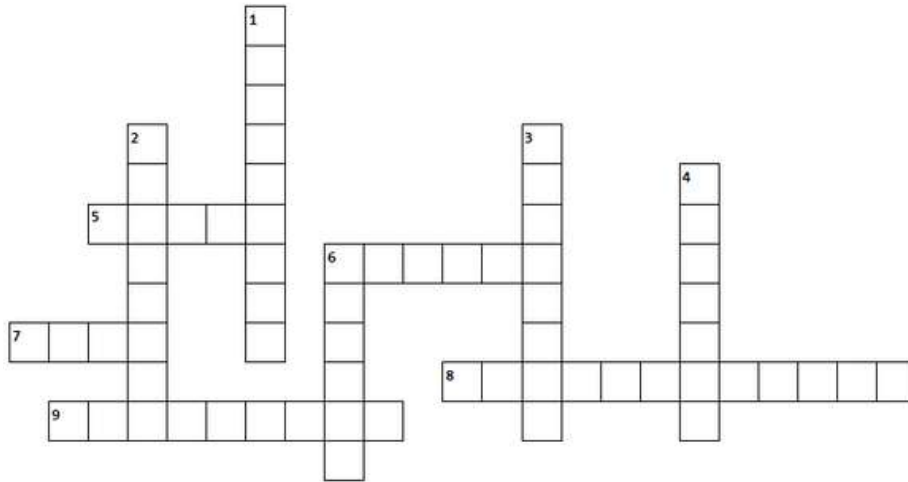
It is estimated that the Tunguska explosion knocked down some 80 million trees over an area of 2,150 km² (830 sq mi) and that the shock wave from the blast would have measured 5.0 on the Richter magnitude scale. An explosion of this magnitude would be capable of destroying a large metropolitan area, but, due to the remoteness of the location, no human fatalities were officially documented. Several reports have indicated that two people may have died in the event; however, these deaths remain unofficial. This event has helped to spark discussion of asteroid impact avoidance.



(Image credits: NASA)

TRAIN YOUR BRAIN

CROSSWORD



ACROSS

- 5. The first module of the ISS _____?
- 6. Which was the first space station?
- 7. What was the name of the Japanese Space station?
- 8. Who was the first astronaut in the space station?
- 9. India's future space station named as _____?

DOWN

- 1. Who has been on the ISS the longest?
- 2. What was the name of the Chinese space station?
- 3. The ISS was the size of a _____ field?
- 4. How many times does ISS revolve around the Earth in a day?
- 6. Which was the first space station launched by NASA?

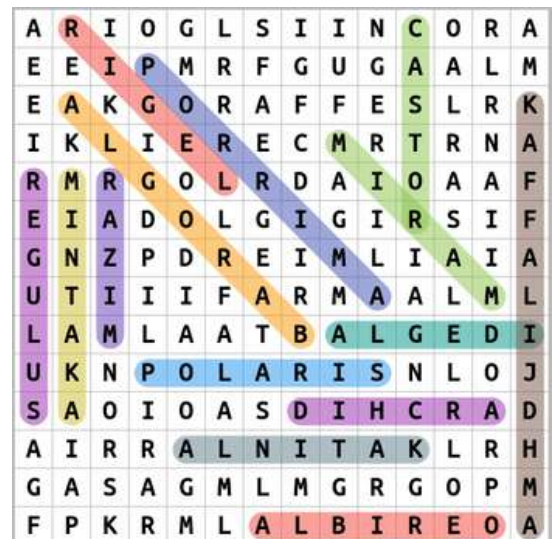
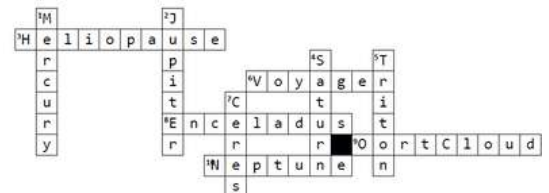
ASTRONOMY WORD PUZZLE

Find the names of the famous Asteroids from the mixed letters and mark them.



- IRIS
- NUWA
- HARMONIA
- CERES
- PARTHENOPE
- LAETITIA
- VESTA
- PALLAS
- ATALANTE
- ASTRAEA
- JUNO
- LEDA
- PSYCHE
- HEBE
- GALLIA

Answers for last month puzzles.



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

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PRISM GLASS: BAK-4
APERTURE: 70MM
EXIT PUPIL: 9.7MM
MAGNIFICATION: 15X
ANGULAR FOV: 6.4 Deg
- CELESTRON SKYMASTER 20X80**
PRISM SYSTEM: ROVED PRISM
PRISM GLASS: BAK-4
APERTURE: 80MM
EXIT PUPIL: 40MM
MAGNIFICATION: 20X
ANGULAR FOV: 3.7 Deg
- CELESTRON SKYMASTER 25X100**
PRISM SYSTEM: ROVED PRISM
PRISM GLASS: BAK-4
APERTURE: 100MM
EXIT PUPIL: 40MM
MAGNIFICATION: 25X
ANGULAR FOV: 3.0 Deg

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MOUNT: ALT-AZ
APERTURE: 60MM
FOCAL LENGTH: 700MM
- CELESTRON POWERSEEKER 80EQ**
TYPE: REFRACTOR
MOUNT: EQ
APERTURE: 80MM
FOCAL LENGTH: 800MM
- SPACE PROBE 80EQ**
TYPE: REFRACTOR
MOUNT: EQ
APERTURE: 80MM
FOCAL LENGTH: 600MM

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APERTURE: 70MM
FOCAL LENGTH: 700MM
- KSON 80MM NEWTONIAN**
TYPE: REFLECTOR
MOUNT: ALT-AZ
APERTURE: 80MM
FOCAL LENGTH: 800MM
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