



SPACE™
EMPOWERING LIFE

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Galactica

Astronomy and Space Science Magazine

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Highlights From April

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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.

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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

SPACE FOUNDATION DAY

On 15th April 2023, the SPACE group celebrated its 23rd Foundation Day in Delhi and Chennai. We were reminded of the core values that our Founder & CMD, Dr. Sachin Bahmba, and CEO & MD, Mr. Shivam Gupta, instilled in us - integrity, accountability, teamwork, and excellence. We took the opportunity to acknowledge the hard work and dedication of our team members by giving out awards to those who went above and beyond their call of duty. This was followed by the most awaited moment with the special mention of "Spacian of the Year 2022", awarded to Mr. Ranjith Kumar E.

A company's foundation day celebration is an excellent opportunity to acknowledge the vision and hard work of the people who established the organization. We celebrated the occasion with a range of team bonding activities and fun-filled games, including music and dance. To add to the festive atmosphere, we organized a delicious pizza party that our team members thoroughly enjoyed. It was heartening to see our employees come together and make memories that will be cherished for a long time. Together, we remain committed to building a brighter future for the Space community.



LUNAR OBSERVATION AT QUTUB MINAR "AN ASTRO NIGHT SKY TOURISM EVENT"

On the 5th and 6th of April, the stargazing event was held at Qutub Minar organized by SPACE India. The Qutub Minar, a UNESCO world heritage site, located in Delhi, India, is a towering Minaret that has stood for 800 years. While it is known for its historical and architectural significance, it is also famous for its fascinating location for astronomers and stargazers.

SPACE India collaborated with the National Science Centre and Nehru Planetarium, Delhi for its event "Astro Night Sky Tourism" - which is organized every month at different locations. On the day of the event, the Moon and the other three planets Mercury, Venus, and Mars were visible, and people getting a view up so close were fascinated. We had five different telescopes aligned for different planets. In addition, there was a long queue of people waiting to catch the beauty of the moon through the telescope. Visitors were also able to observe the Orion Nebula and the Pleiades star cluster.

The equipment used in the event were Telescopes and binoculars while we displayed the weighing on different planets activity. Stellarium software was introduced to the public, which is a software for beginners who are trying to get familiar with the night sky. Even before the event started people were curious about what was happening and when the whole procedure would begin. We noticed many people giggling and enjoying themselves while measuring their weight on different planets. "Age is just a number" This quote is as true as it sounds, as a woman of or around the age of 55 waiting for the event to get started so that she could participate in the event. She enjoyed it and gave wonderful feedback.

This "two-day" event caught the attention of around 800 people on the first day and more than 1200 people on the second day. It was free, allowing every visitor to explore and learn about Astronomy. Various activities were organized under the "Astro Night Sky Tourism" for the visitors including comet making, quizzes, Astro poetry, and Crater making, which was educational but also fun, and engaging. Our educators, on the other hand, spread awareness among the audience about the different terms of Astronomy. This event gave a "Goosebumps" moment to everyone present at the spot when the ISS (International Space Station) came into view. It was like watching a moving star, twinkling over everyone.

Different media channels such as ANI, Doordarshan, and PIB were there to cover our event. Nearly 2,000 visitors were inspired by the Astronomy session and Space activities, which helped us to propagate further scientific temperament and love for science in the general public.



MONTHLY TELESCOPIC OBSERVATION

SPACE ARCADE team conducted their 4th Monthly Telescopic Experience session on the 29th of April 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.





GLOBAL ASTRONOMY MONTH

Global Astronomy Month (GAM), is organized every year in April by SPACE India in collaboration with the International Organization Astronomers Without Borders (AWB), intending to unite enthusiasts worldwide in celebrating Astronomy following the motto - "One People, One Sky". Throughout this month, SPACE offered a range of astronomy programs to the general public and students to promote astronomy worldwide.

This year, SPACE India conducted various events in the client schools like JBM Global, K. R. Mangalam World School, Delhi Public School, etc. Here are the event snippets and snaps.

K R MANGALAM WORLD SCHOOL, VAISHALI

Students of K R Mangalam World School enthusiastically participated in several events like Hubble Space Telescope Model, Astro Doodle, Quiz on Aryabhata- India's first Satellite, Astro Bookmark, and Astro Riddle.

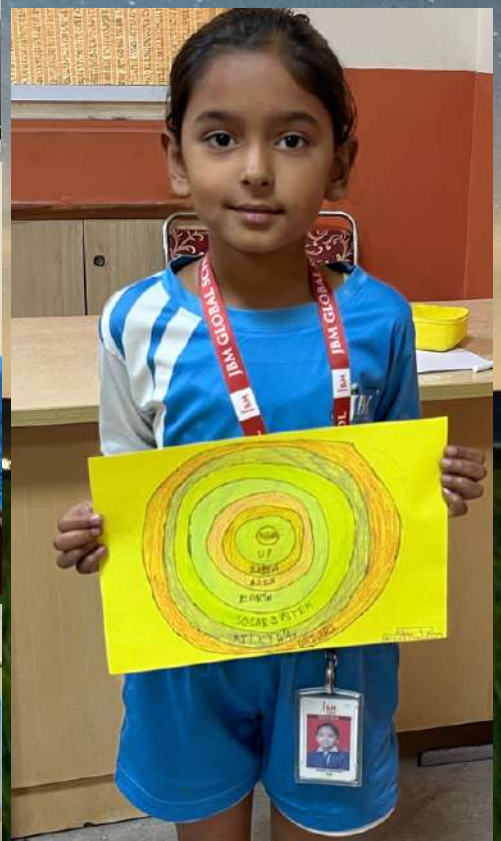
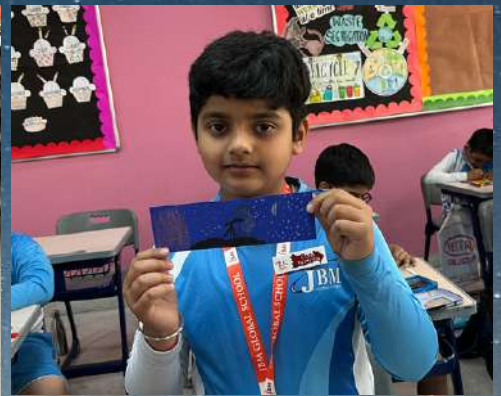


JBM GLOBAL SCHOOL, NOIDA

Students of JBM Global School participated in a number of events like Astro Crossword search, Phases of Moon with Oreo, Astro Bookmark, Let's race rockets, etc. Class I and II students learned about the Rocket and participated in Straw Rocket Race. The students were introduced to the space class for the first time in their First standard. They were encouraged to map their position and location in the country and compare it to the location and distance from outer space.

All age groups of students participated in the Astro art Competition where a myriad of students, excited about the global platform they'd get exposed to, submitted beautiful artworks expressing their love towards Astronomy and space through colors and brushes. Out of the participants received 5 best entries from allotted categories were selected for global exposure.

Earth Day was celebrated big by the students. The poster-making event was organized for the students in which they exhibited an amalgamation of their creativity and sensitivity toward the global concern of climate change. JBM Global School also took the initiative and switched off the lights for 15 minutes to save energy to teach the lesson to the students that every individual can take part to save energy and create awareness towards climate change.



K R MANGALAM, VIKASPURI

Students of K R Mangalam Vikaspuri participated in many events like the Star decoration activity, Let's Paint the Planet, Galaxy making, etc. Students of all classes participated in 16 activities conducted in the School. Class II students made space bands using sparkles and colors and tied them on their hands. A group of enthusiastic students made models of the galaxy using cotton and sparkles and black ivory sheets. Students displayed them to their teachers.



DELHI PUBLIC SCHOOL, GREATER FARIDABAD



Students of Delhi Public School, Greater Faridabad participated in many events like Astro Crossword search, Phases of Moon with Oreo, Astro Bookmark, Let's Race rockets, etc. Class I and II students learned about the Rocket and participated in Straw Rocket Race. Mass Solar Observation as SunDay was conducted during Global Astronomy Month, where 1200 students, teachers, and other supporting staff observed the Sun through Dobsonian telescopes. Everyone was mesmerized to see the Sun. It was a fascinating and educational experience and it's a great way for students to learn about our nearest star.

SALLY RIDE EARTHKAM

Sally Ride EarthKAM is a NASA-sponsored project. EarthKAM means **Earth Knowledge Acquired by Middle school students**. It is an educational program that enables students to take pictures of their own planet from a digital camera on board the International Space Station (ISS) via a web interface. International Space Station is an artificial satellite where astronauts reside for various experiments based on micro-gravity. EarthKAM camera is to date a permanent payload on board the ISS and supports approximately four missions annually, one for each season. The recent mission was opened from the 11th to the 14th of April.

About this year:

This is the second mission cycle of 2023, which is actually the 83rd Mission. A Three hour Sally Ride EarthKAM workshop was conducted in the schools. Students from Class 6 to 8 standard were selected to participate in this workshop. The workshop started with students using Google Earth to find a few locations of interest followed by a presentation about EarthKAM. Students have then demonstrated the use of the EarthKAM interface to request Earth's images by keeping various aspects such as orbital path, weather, location, and day/night preference in mind. After this, the students had an exciting time locating regions of their interest and putting up their requests. The workshop ended with the students writing Messages to Astronauts.



5 schools participated in this program with around 120 students. We also conducted this program online where more than 90 students who participated. 43 students from K. R. Mangalam World School, Vaishali, 48 students from JBM Global School, Sec-132, Noida, 40 students from St. Martin Diocesan School, Delhi Cantt., and 29 students from Bal Bharti Public School, Pitampura energetically participated in the program and captured incredible photographs of our Earth. In Chennai, 32 students of the Bhavans Rajaji Vidyashram, Kilpauk enthusiastically took part in the program and captured amazing photos of our Earth.



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Message for Astronauts:

- How does it feel like to walk on Earth after being in zero gravity? Also, how do you eat? -**Jiyaa**.
- Dear Astronauts, Keep doing your work and be healthy for strong I wish you all good luck. -**Manomay**.
- Hello Astronaut, How are you? Thank you for going there, wish you good luck astronaut. - **K. R. Mangalam World School, Vaishali**
- Hello! My name is Nibhit. How are you? I also want to be an astronaut. Wish you good luck on your next mission. - **JBM Global School, Sec - 132, Noida**
- My message is that you people the astronauts are working so hard to discover facts about the universe. I just want to say thank you all with heart. - **Bal Bharti Public School, Pitampura**
- Can you explore Pluto? I want to see pictures of Pluto. - **St. Martin Diocesan School, Delhi Cantt.**

Workshop Feed Back:

- I love being in the team and learning more about space, thankyou space team to teach us. -**Yash**.
- Everyone should come to Space India love you space India I am lucky to have a space team. -**Jashn Jain P.**
- Really interesting works shop. I am very excited to see my captures. -**Jiyaa**.

◆.....◆
Images requested by Students of various locations through Sally Ride EarthKAM
 ◆.....◆



Manchester, US, Captured by Rishit



New York captured by Tanya Garg



California captured by R Devasshri



Iran Captured by Deepak Kumaran



Morocco captured by Diya Singh



Kargil Ladakh captured by Vansh Shrama

HIGHLIGHTS OF APRIL 2023

FOUR FOR THE MOON! NASA ANNOUNCED ARTEMIS 2 ASTRONAUT CREW

The Artemis 2 quartet will become the first people to travel to lunar realms in more than 50 years.

NASA's plan to land the first woman and first person of color on the Moon during the the first crewed lunar flyby of the 21st century took one giant leap this week with the unveiling of four astronauts for the Artemis II mission.

In a news conference Monday at Ellington Field near NASA's Johnson Space Center in Houston the space agency announced the first black man, the first woman and the first Canadian on any crewed Moon mission—the agency's first since Apollo 17 in 1972.

The selected astronauts for Artemis II—a critical test flight around the Moon are:

- **Reid Wiseman (Commander, NASA).**
- **Victor Glover (pilot, NASA).**
- **Christina Hammock Koch (mission specialist, NASA).**
- **Jeremy Hansen (mission specialist, Canadian Space Agency).**



The crew of NASA's Artemis II mission (left to right): NASA astronauts Christina Hammock Koch, Reid Wiseman (seated), Victor Glover, and Canadian Space Agency astronaut Jeremy Hansen. Credits: NASA

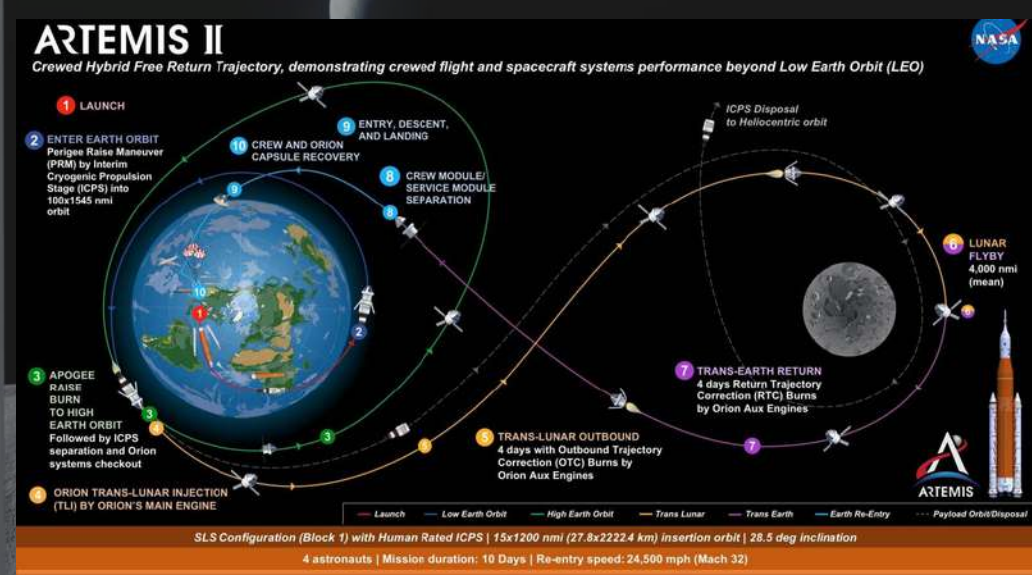
Meet Artemis II Astronauts

This will be Wiseman's second trip into space, serving previously as a flight engineer aboard the International Station for Expedition 41 from May through November 2014. Wiseman has logged more than 165 days in space, including almost 13 hours as lead spacewalker during two trips outside the orbital complex. Prior to his assignment, Wiseman served as chief of the Astronaut Office from December 2020 until November 2022.

The mission will be Glover's second spaceflight, serving previously as pilot on NASA's SpaceX Crew-1, which landed May 2, 2021, after 168 days in space. As a flight engineer aboard the space station for Expedition 64, he contributed to scientific investigations, technology demonstrations, and participated in four spacewalks.

Koch also will be making her second flight into space on the Artemis II mission. She served as flight engineer aboard the space station for Expedition 59, 60, and 61. Koch set a record for the longest single spaceflight by a woman with a total of 328 days in space and participated in the first all-female spacewalks.

Representing Canada, Hansen is making his first flight to space. A colonel in the Canadian Armed Forces and former fighter pilot, Hansen holds a Bachelor of Science in space science from Royal Military College of Canada in Kingston, Ontario, and a Master of Science in physics from the same institution in 2000, with a research focus on Wide Field of View Satellite Tracking. He was one of two recruits selected by CSA in May 2009 through the third Canadian Astronaut Recruitment Campaign and has served as Capcom in NASA's Mission Control Center at Johnson and, in 2017, became the first Canadian to be entrusted with leading a NASA astronaut class, leading the training of astronaut candidates from the United States and Canada.



What's next after Artemis II?

Artemis I and II are precursors to Artemis III, an ambitious mission to land at least two astronauts on the Moon. It will come over 50 years after Apollo 17 astronauts Jack Schmitt and Gene Cernan became the last humans to step on the lunar surface in 1972.

The exact landing sites will be chosen after NASA identifies the mission's target launch dates. "The Artemis II crew represents thousands of people working tirelessly to bring us to the stars. This is their crew, this is our crew, this is humanity's crew," said NASA Administrator Bill Nelson. "Together, we are ushering in a new era of exploration for a new generation of star sailors and dreamers—the Artemis Generation."

STARSHIP ROCKET LAUNCH: DESPITE THE FAILURE, SPACE X DECLARES IT A SUCCESS

“With a test like this, success comes from what we learn, and we learned a tremendous amount,” reads a post about the launch on SpaceX’s website.

After the first test launch of a SpaceX Starship rocket, the most powerful launch vehicle ever constructed that ended in an eruption of flames over the Gulf of Mexico on 20th April, the company sought to frame the mission as a success.

Within the space industry, Thursday’s Starship test mission wasn’t considered an outright failure, Caleb Henry, director of research at the space research firm Quilty Analytics, said.

“The expectation was just that – a test,” Henry said. “It’s important to fail during tests so that you have a greater chance of succeeding” in the future.

Still, SpaceX enjoys a pristine reputation in the space industry. And there’s a good reason why: The reliability of SpaceX’s Falcon rockets and Dragon spacecraft which have been flying for years and even carry NASA astronauts to orbit that gives the company its vaunted status within the industry.

Money was lost in the Starship explosion, though it’s not clear how much. SpaceX remains a privately held company, and it’s not required to reveal its development expenses.

What happened on 20th April

The Starship vehicle consists of two parts: The Super Heavy rocket booster, a 230-foot-tall (69-meter-tall) cylinder that houses 33 engines and gives the first burst of power at liftoff. The Starship spacecraft, which stands at 164 feet (50 meters) tall, rides atop the rocket.

The vehicle lifted off the launch pad near Brownsville, Texas, on the state’s southernmost tip. On the ascent, some of the Super Heavy booster’s 33 engines unexpectedly shut down.

Starship is also supposed to separate from the Super Heavy booster after the rocket expends most of its fuel, but that never happened.

A few minutes after liftoff, the vehicle began tumbling, tail over head. Then, about four minutes into the flight, the vehicle flight termination system or self-destruct feature was triggered, blowing up the rocket to ensure it didn’t careen off course. (Image credits: SpaceX),



The SpaceX Starship exploded after launch for a flight test on April 20, 2023.

What happens next?

Muratore said engineers will be pouring over the data that was gathered on Thursday's flight. Many things were tested for the first time: Attempting to fire up 33 massive Raptor engines at the same time for a flight test had never been done before. Using methane for fuel is also a new approach for SpaceX. And the vehicle is made of steel while other rockets typically use lighter metals and carbon composites. Musk even suggested heading into Thursday's test that he would consider it a success if the rocket cleared the launch tower – and that did happen.

Next, SpaceX will be looking to pinpoint exactly what went wrong. Muratore said engineers will be analyzing data from the Raptor engines. Among the questions they will be asking: How did the vibrations affected the flight? What temperatures were reached inside propulsion systems? And breaking down the overall behavior of the vehicle: How did its on-board guidance perform? Why was it tumbling?

The company will also assess damage to its launch pad and surrounding infrastructure and gear up for another flight. Musk said in a tweet that could take a "few months" – though he is known to broadcast unmet deadlines.

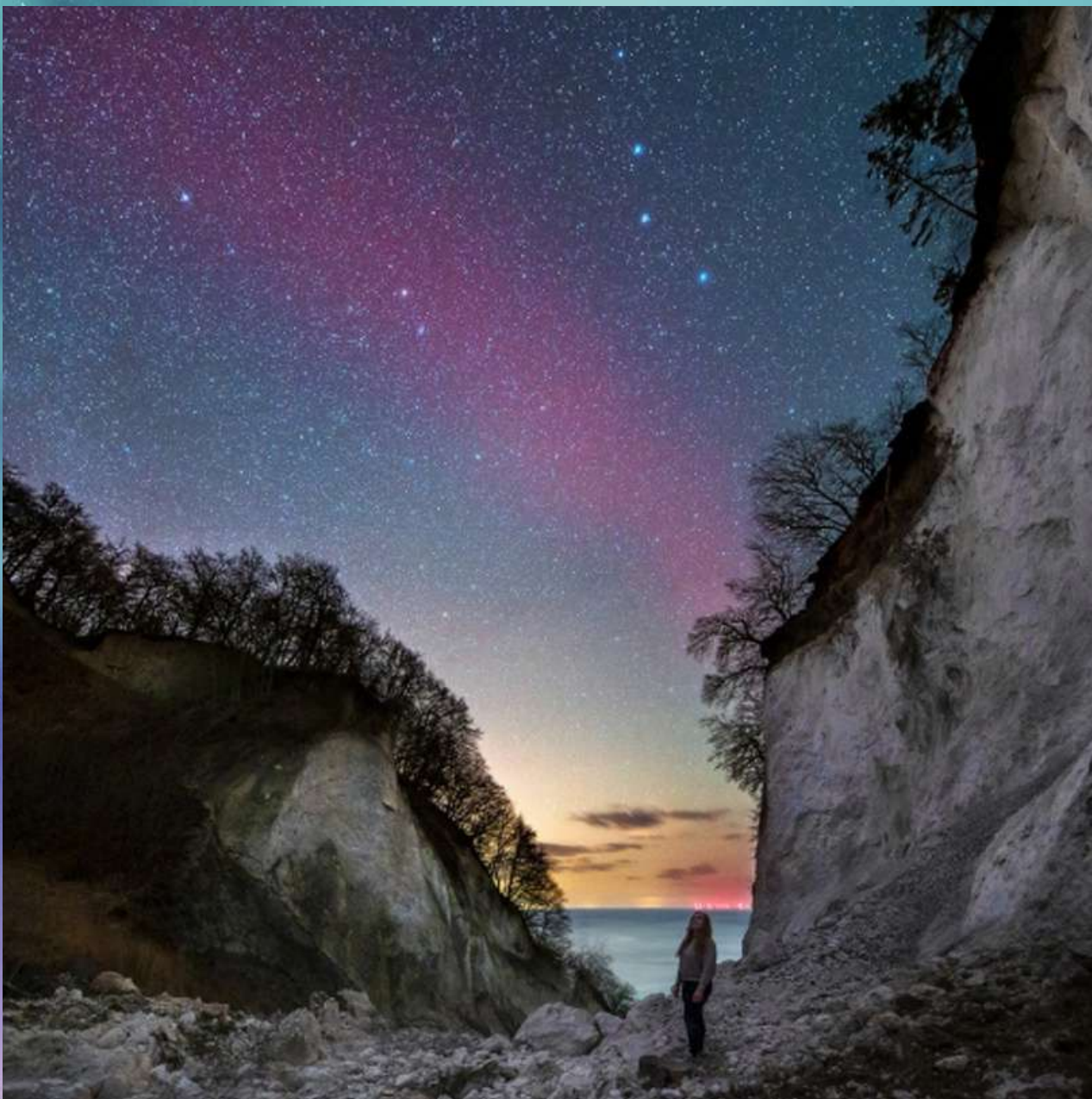
RARE BLOOD-RED ARC OF LIGHT SHINES IN THE SKY

A river of hazy red light stretched across the night sky over Denmark after the most powerful solar storm to hit Earth for six years slammed into our planet. The rare phenomenon is not an aurora.

A bright red streak of light appeared in the sky above parts of Scandinavia last week after a surprise solar storm smashed into Earth and triggered stunning auroras across the planet. But the bright red band was not an aurora – it was something much rarer.

The streak, which appeared as a river of hazy red light that stretched all the way across the night sky, was most prominently visible above Denmark. Astrophotographer Ruslan Merzlyakov snapped a spectacular shot of the peculiar light show on March 23 above Mons Klint, a set of limestone cliffs on the Danish island of Mon in the Baltic Sea.

The unusual phenomenon is known as a stable auroral red arc (SAR), but despite the name, it is not an aurora or particularly stable. Instead, the light is emitted by oxygen molecules in the upper atmosphere that have become superheated by Earth's ring current system, a massive loop of electric current that surrounds our planet.



A photograph of the SAR in the night sky above Mons Klint on March 23.
(Image credit: Ruslan Merzlyakov)

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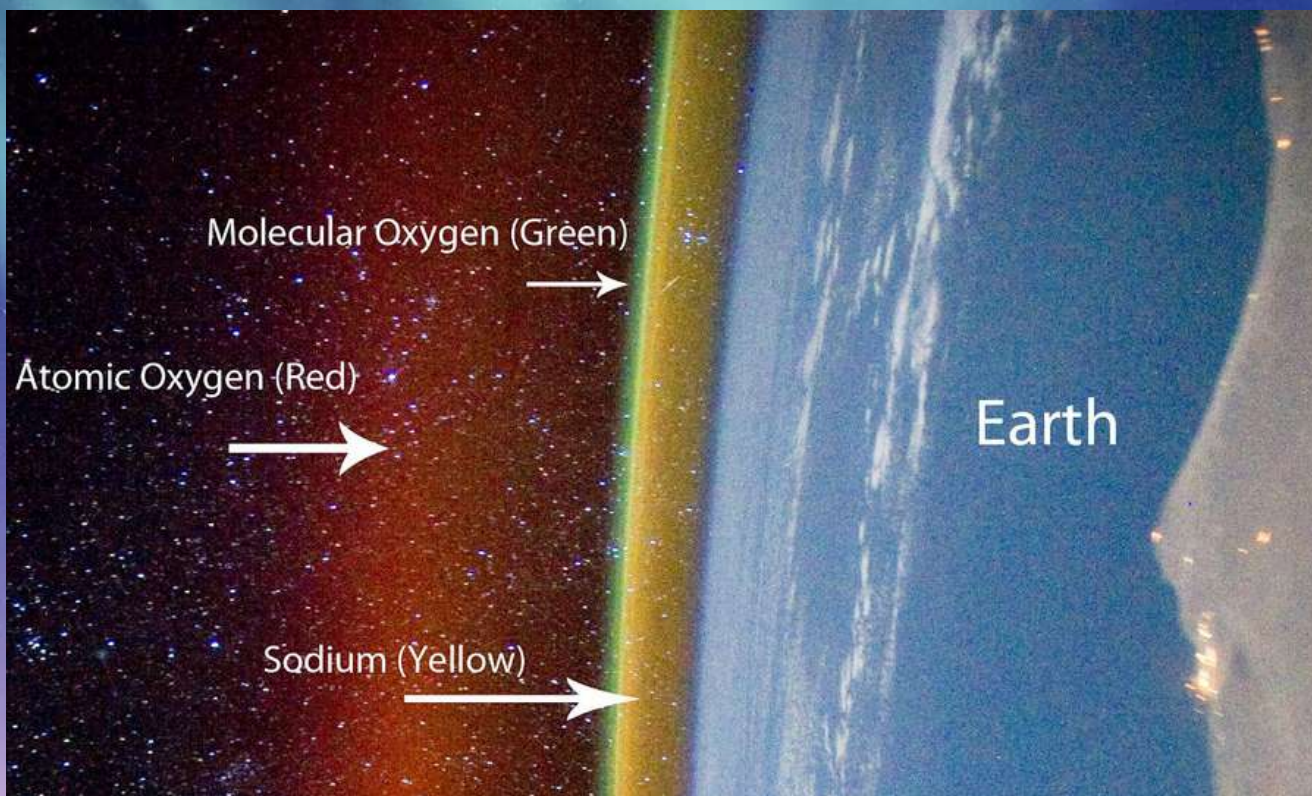
The SAR coincided with the most powerful geomagnetic storm to hit Earth for six years, which was triggered by a surprise coronal mass ejection – a gargantuan, fast-moving blob of plasma and magnetic field released from the sun that was spat out of a massive hole in the sun wider than 20 Earths.

During auroras, highly energetic particles from solar storms and solar wind bypass Earth's magnetic field, or magnetosphere, and excite molecules of gas in the upper atmosphere. This creates swirling, multicolor lights that ebb and flow over time. The various colors of light come from different atoms, which emit specific colors when excited.

During SARs, energy from the ring current system, which surrounds the magnetosphere, heats up the gas in the upper atmosphere and makes it glow like an aurora. For unknown reasons, only oxygen is heated up during a SAR, which means these phenomena always emit the exact same shade of red.

SARs actually occur quite frequently, but they are normally invisible to humans because they are too faint and our eyes are poorly attuned to the wavelength of red light emitted by SARs. Massive streaks like the one over Denmark only become visible when strong solar storms weaken the magnetosphere, which enables more heat from the ring current system to enter the upper atmosphere.

The SAR over Denmark was not the only unusual light show observed during the recent solar storm. The aurora-like phenomenon STEVE, a large ribbon of colored light that hangs in the sky for up to an hour, was also visible across the United States and parts of the United Kingdom.



There is some evidence that STEVE and SAR arcs are related phenomena. In March 2015, skywatchers in New Zealand watched as a bright red SAR slowly transformed into a STEVE event over the course of about half an hour.

ESA'S JUICE MISSION LAUNCHES TO SEARCH FOR LIFE ON JUPITER'S MOONS

The JUpiter ICy moons Explorer (JUICE) is a European Space Agency (ESA) mission to make multiple flybys of Jupiter's satellites Ganymede, Callisto, & Europa and then to go into orbit around Ganymede. The science goals focus on Jupiter and its system, with particular emphasis on Ganymede as a planetary body and potential habitat. The primary science objectives for Ganymede (most of these apply to Callisto as well) are: characterization of the ocean layers and detection of putative subsurface water reservoirs; topographical, geological and compositional mapping of the surface; study of the physical properties of the icy crusts; characterization of the internal mass distribution, dynamics and evolution of the interiors; investigation of the exosphere; and study of Ganymede's intrinsic magnetic field and its interactions with the Jovian magnetosphere. For Europa, the focus is on the chemistry essential to life, including organic molecules, and on understanding the formation of surface features and the composition of the non water-ice material.



MISSION PROFILE

JUICE launched on 14 April 2023 on an Ariane 5 from the European Spaceport in Kourou, French Guiana. Spacecraft separation took place at 12:42 UTC. After an 8 year cruise to Jupiter, utilizing Earth, Moon, and Venus gravity assists, JUICE will go into orbit around Jupiter in July 2031. The spacecraft will use flybys of Ganymede and Callisto to optimize the orbit. This will include flybys of Europa. These orbits will be used to study Jupiter and its moons, and then it will be inserted into a highly elliptical orbit around Ganymede. The orbit will evolve to a 5000 km circular orbit, and will be lowered into a 500 km circular orbit. After mapping and other investigations at this altitude, it will be lowered again to a 200 km circular orbit. The nominal mission ends after about 3 years, there is the possibility of an extension to the mission of 200 or more days. In either case the mission will end with an impact on the surface of Ganymede.

SPACECRAFT AND SUBSYSTEMS

The dry mass of 2420 kg includes the launch adapter. 3650 kg of chemical propellant will be required for orbit insertions and maneuvers. The spacecraft will be powered by a large bank (85 square meters) of ten solar arrays employing 23,560 GaAs solar cells optimized for low-intensity / low-temperature conditions. The arrays are arranged in two wings in a cross-like pattern, stretching 27 meters from tip-to-tip, and can produce about 850 W power at Jupiter. Power is stored in a 5-battery bank. Including the solar arrays, JUICE is 16.8 x 27.1 x 13.7 meters in size.

Communications will be primarily via a fixed 2.5 meter diameter high-gain antenna as well as a steerable medium-gain antenna, both X- and K-band will be used. Downlink rates of 2 Gb/day are possible with ground-based Deep Space Antennas. On-board data storage capability is 1.25 Tb. A number of booms and antennas protrude from the spacecraft for the science instruments.

The JUICE main engine is a hypergolic bi-propellant (mono-methyl hydrazine and mixed oxides of nitrogen) 425 N thruster. 100 kg of multilayer insulation provide thermal control. The spacecraft is 3-axis stabilized using momentum wheels. Radiation shielding will be used to protect onboard electronics from the Jovian environment.

The JUICE science payload has a mass of 280 kg and includes the JANUS camera system, the MAJIS visible and infrared imaging spectrometer, the UVS ultraviolet imaging spectrograph, RIME radar sounder, GALA laser altimeter, SWI submillimeter wave instrument, J-MAG magnetometer, PEP particle and plasma package, RPWI radio and plasma wave investigation, 3GM radio science package, the PRIDE radio science instrument, and the RADEM radiation monitor. A 10.6-meter deployable boom will hold J-MAG and RPWI, a 16-meter long deployable antenna will be used for RIME. Four 3-meter booms carry parts of the RPWI instrument. The other instruments are mounted on the spacecraft body, or for 3GM, within the spacecraft bus.

SCIENTISTS BLASTED 'BARBIES WITH LIQUID NITROGEN' FOR MOON DUST CLEANUP

Scientists blasted Barbies with liquid nitrogen to test a new method of moon dust cleanup and it worked extremely well. Researchers have developed a liquid-nitrogen spray that rids spacesuits of lunar dust.

Ever since Neil Armstrong took one small step onto the moon, lunar dust has proved to be a messy problem for astronauts, coating their spacesuits in a powdery film that's difficult to clean off and can be unhealthy if inhaled.

However, scientists have come up with a novel solution that could ultimately leave this problem in, well, the dust.

For their experiment, researchers at Washington State University (WSU) dressed Barbies in makeshift spacesuits constructed of materials similar to what NASA uses. Then, the team blasted the dolls with liquid nitrogen to test how well the cryogenic fluid could remove moon dust or, in this case, volcanic ash collected from the 1980 eruption of nearby Mount Saint Helens, which is similar in consistency to lunar dust – from the gear.



A trio of Barbie dolls wearing makeshift spacesuits. (Image credit: Ian Wells)

They found that spraying the spacesuit-clad dolls with liquid nitrogen not only removed more than 98% of the moon dust substitute but also caused little to no damage to the Kevlar-like suit material. This proved to be a better solution than older methods; Apollo program astronauts would use brushes to swipe the highly abrasive material from their suits post-moonwalk, which would ultimately degrade the material, according to the team's new study.

Not only is lunar dust annoyingly clingy – the researchers likened it to cleaning up a spilled box of static-charged packaging peanuts – but coming into contact with it can prove toxic to human cells and can lead to "lunar hay fever," an illness that causes watery eyes, a sore throat, and sneezing. That's not exactly something astronauts would want to contend with while conducting an already-risky mission to the moon.

"Moondust is abrasive, electrostatically charged and it gets everywhere," lead author Ian Wells, a mechanical engineering student at WSU, told Live Science. "It can work its way into the seals on spacesuits and make them unusable since too much dust causes them to not seal properly. It can also have a negative impact on the lungs of anyone who encounters it, since it's similar to breathing in ground-up fiberglass."

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The liquid-nitrogen experiment worked thanks to a phenomenon known as the Leidenfrost effect, which occurs when water hits a surface that's hotter than its boiling point, causing the droplet to "skitter across the surface."



A close-up image of a dropper releasing liquid nitrogen on a pile of volcanic ash.
(Image credit: Ian Wells)

"When liquid nitrogen boils, it expands 800 times, and it's almost like a little explosion when it hits the surface of a hot material," co-author Jacob Leachman, an associate professor in the WSU School of Mechanical and Materials Engineering, told Live Science. "Because it's exploding and expanding so much, it can push those particles far away from the surface." Or, in this case, the liquid nitrogen blasted the moon dust substitute almost completely off the Barbies' spacesuits.



The team presented its findings to NASA to aid the agency's Artemis moon program, winning the space agency's 2021 Breakthrough, Innovative and Game-Changing (BIG) Idea Challenge. "We used the doll primarily because it's a one-sixth-scale person," Wells said. "However, it was also chosen as the Artemis mission's aim is to send the first woman and person of color to the moon, and we wanted our project to reflect that commitment to diversity."

REDNESS OF NEPTUNIAN ASTEROIDS SHEDS LIGHT ON EARLY SOLAR SYSTEM

Asteroids sharing their orbits with the planet Neptune have been observed to exist in a broad spectrum of red color, implying the existence of two populations of asteroids in the region, according to a new study by an international team of researchers.



The team of scientists from the USA, California, France, the Netherlands, Chile, and Hawaii observed 18 asteroids sharing the orbit of Neptune, known as Neptunian Trojans. They are between 50 and 100 km in size and are located at a distance of around 4.5 billion kilometers from the Sun. Asteroids orbiting this far away are faint and so are challenging for astronomers to study. Before the new work, only about a dozen Neptunian Trojans had been studied, requiring the use of some of the largest telescopes on Earth.

The new data were gathered over the course of two years using the WASP wide field camera on the Palomar Observatory telescope in California, the GMOS cameras on the Gemini North and South telescopes in Hawaii and Chile, and the LRIS camera on the Keck Telescope in Hawaii.

GALACTICA

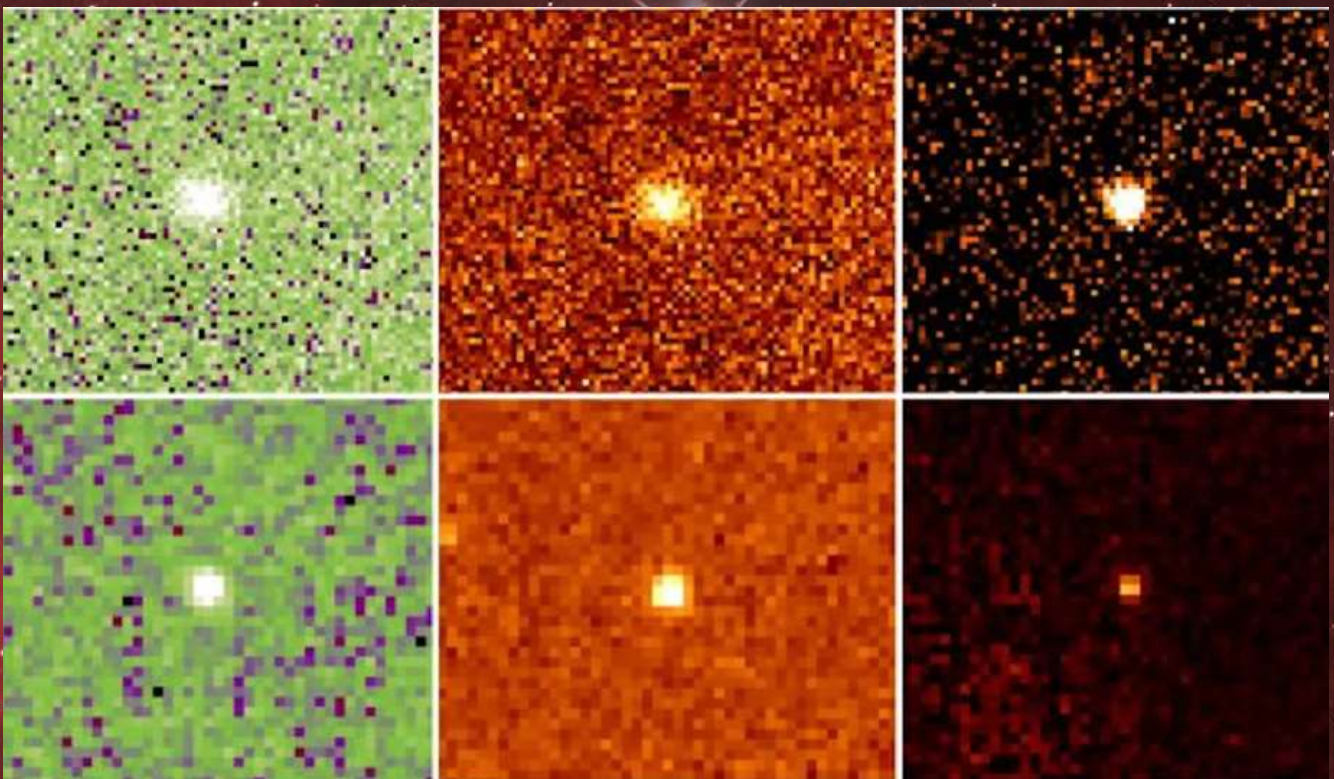
The presence of redder asteroids among the Neptunian Trojans suggests the existence of a transition zone between more neutral-colored and redder objects. The redder Neptunian asteroids may have formed beyond this transition boundary before being captured into the orbit of Neptune. The Neptunian Trojans would have been captured into the same orbit as the planet Neptune as the ice giant planet migrated from the inner solar system to where it is now, some 4.5 billion kilometers from the Sun.

Lead author Dr Bryce Bolin of the NASA Goddard Space Flight Centre said, "In our new work we have more than doubled the sample of Neptunian Trojans studied with large telescopes. It's exciting to find the first evidence of redder asteroids in this group."

"Because we have a larger sample of Neptunian Trojans with measured colors, we can now start to see major differences between asteroid groups. Our observations also show that the Neptunian Trojans are also different in color compared to asteroid groups even further from the Sun. A possible explanation may be that the processing of the surfaces of asteroids by the Sun's heat may have different effects for asteroids at varying solar distances."

Of the 18 observed Neptunian Trojans, several were much redder than most asteroids, and compared with other asteroids in this group looked at in previous studies. Redder asteroids are expected to have formed much further from the Sun; one population of these is known as the Cold Classical trans-Neptunian objects found beyond the orbit of Pluto, at around 6 billion kilometers from the Sun. The newly observed Neptunian Trojans are also unlike asteroids located in the orbit of Jupiter, which are typically more neutral in color.

The redness of the asteroids implies that they contain a higher proportion of more volatile ices such as ammonia and methanol. These are extremely sensitive to heat, and can rapidly transform into gas if the temperature rises, so are more stable at large distances from the Sun. The location of the asteroids at the same orbital distance as Neptune also implies that they are stable on timescales comparable to the age of the Solar System. They effectively act as a time capsule, recording the initial conditions of the Solar System.

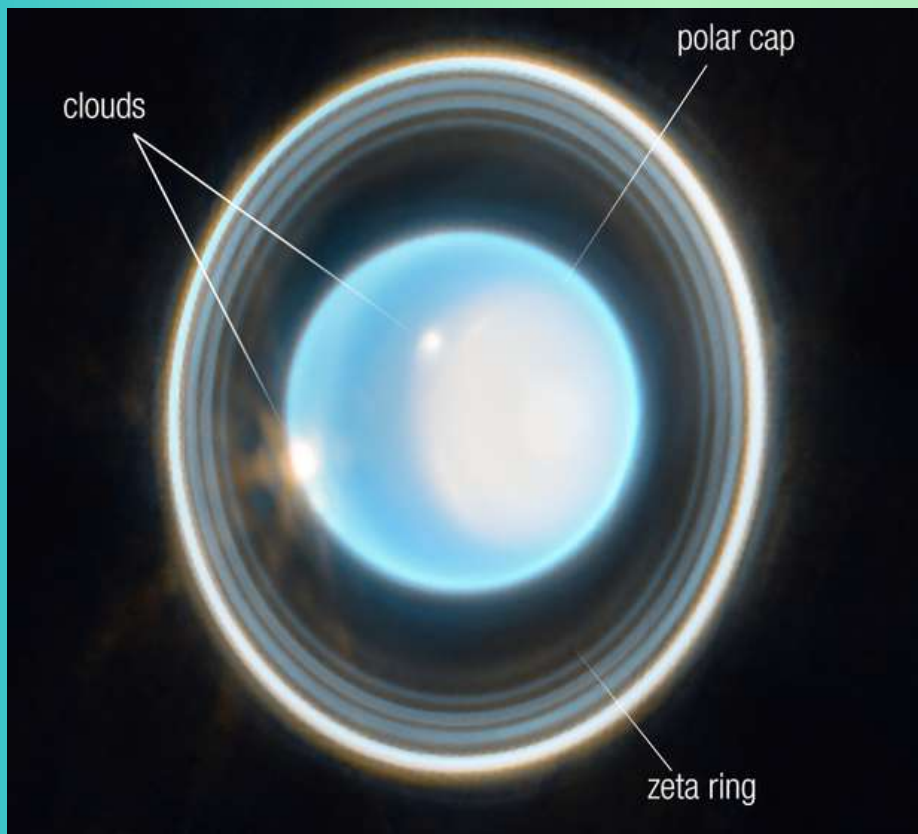


A collection of six images showing a red asteroid as a bright point in the center of a grainy image.

Telescope images of Neptune's rare red asteroids taken with taken with the Palomar 200-inch, Gemini and Keck telescopes (Image credit: Dr Bryce Bolin)

FROM THE EYES OF WEBB - APRIL 2023

NASA'S WEBB SCORES ANOTHER RINGED WORLD WITH NEW IMAGE OF URANUS



This zoomed-in image of Uranus, captured by Webb's Near-Infrared Camera (NIRCam) Feb. 6, 2023, reveals stunning views of the planet's rings. The planet displays a blue hue in this representative-color image, made by combining data from two filters (F140M, F300M) at 1.4 and 3.0 microns, which are shown here as blue and orange, respectively

Credits: NASA, ESA, CSA, STScI.

This causes extreme seasons since the planet's poles experience many years of constant sunlight followed by an equal number of years of complete darkness. (Uranus takes 84 years to orbit the Sun.) Currently, it is late spring for the northern pole, which is visible here; Uranus' northern summer will be in 2028. In contrast, when Voyager 2 visited Uranus it was summer at the south pole. The south pole is now on the 'dark side' of the planet, out of view and facing the darkness of space.

This infrared image from Webb's Near-Infrared Camera (NIRCam) combines data from two filters at 1.4 and 3.0 microns, which are shown here in blue and orange, respectively. The planet displays a blue hue in the resulting representative-color image

When Voyager 2 looked at Uranus, its camera showed an almost featureless blue-green ball in visible wavelengths. With the infrared wavelengths and extra sensitivity of Webb we see more detail, showing how dynamic the atmosphere of Uranus really is.

On the right side of the planet there's an area of brightening at the pole facing the Sun, known as a polar cap. This polar cap is unique to Uranus – it seems to appear when the pole enters direct sunlight in the summer and vanish in the fall; these Webb data will help scientists understand the currently mysterious mechanism. Webb revealed a surprising aspect of the polar cap: a subtle enhanced brightening at the center of the cap.

Following in the footsteps of the Neptune image released in 2022, NASA's James Webb Space Telescope has taken a stunning image of the solar system's other ice giant, the planet Uranus. The new image features dramatic rings as well as bright features in the planet's atmosphere. The Webb data demonstrates the observatory's unprecedented sensitivity for the faintest dusty rings, which have only ever been imaged by two other facilities: the Voyager 2 spacecraft as it flew past the planet in 1986, and the Keck Observatory with advanced adaptive optics. The seventh planet from the Sun, Uranus is unique: It rotates on its side, at roughly a 90-degree angle from the plane of its orbit.

GALACTICA

The sensitivity and longer wavelengths of Webb's NIRCам may be why we can see this enhanced Uranus polar feature when it has not been seen as clearly with other powerful telescopes like the Hubble Space Telescope and Keck Observatory.

At the edge of the polar cap lies a bright cloud as well as a few fainter extended features just beyond the cap's edge, and a second very bright cloud is seen at the planet's left limb. Such clouds are typical for Uranus in infrared wavelengths and likely are connected to storm activity.

This planet is characterized as an ice giant due to the chemical make-up of its interior. Most of its mass is thought to be a hot, dense fluid of "icy" materials – water, methane, and ammonia – above a small rocky core.

Uranus has 13 known rings and 11 of them are visible in this Webb image. Some of these rings are so bright with Webb that when they are close together, they appear to merge into a larger ring. Nine are classed as the main rings of the planet, and two are the fainter dusty rings (such as the diffuse zeta ring closest to the planet) that weren't discovered until the 1986 flyby by Voyager 2. Scientists expect that future Webb images of Uranus will reveal the two faint outer rings that were discovered with Hubble during the 2007 ring-plane crossing.

Webb also captured many of Uranus' 27 known moons (most of which are too small and faint to be seen here); the six brightest are identified in the wide-view image. This was only a short, 12-minute exposure image of Uranus with just two filters. It is just the tip of the iceberg of what Webb can do when observing this mysterious planet. In 2022, the National Academies of Sciences, Engineering, and Medicine identified Uranus science as a priority in its 2023–2033 Planetary Science and Astrobiology decadal survey. Additional studies of Uranus are happening now, and more are planned in Webb's first year of science operations.



This wider view of the Uranian system with Webb's NIRCам instrument features the planet Uranus as well as six of its 27 known moons (most of which are too small and faint to be seen in this short exposure). A handful of background objects, including many galaxies, are also seen. Credits: NASA, ESA, CSA, STScI. Image processing: J. DePasquale (STScI)

Webb Reveals Never Before Seen Details in Cassiopeia A

The explosion of a star is a dramatic event, but the remains the star leaves behind can be even more dramatic. A new mid-infrared image from NASA's James Webb Space Telescope provides one stunning example. It shows the supernova remnant Cassiopeia A (Cas A), created by a stellar explosion 340 years ago from Earth's perspective. Cas A is the youngest known remnant from an exploding, massive star in our galaxy, which makes it a unique opportunity to learn more about how such supernovae occur.

"Cas A represents our best opportunity to look at the debris field of an exploded star and run a kind of stellar autopsy to understand what type of star was there beforehand and how that star exploded," said Danny Milisavljevic of Purdue University in West Lafayette, Indiana, principal investigator of the Webb program that captured these observations.

"Compared to previous infrared images, we see incredible detail that we haven't been able to access before," added Tea Temim of Princeton University in Princeton, New Jersey, a co-investigator on the program.

Cassiopeia A is a prototypical supernova remnant that has been widely studied by a number of ground-based and space-based observatories, including NASA's Chandra X-ray Observatory. The multi-wavelength observations can be combined to provide scientists with a more comprehensive understanding of the remnant.

Dissecting the Image

The striking colors of the new Cas A image, in which infrared light is translated into visible-light wavelengths, hold a wealth of scientific information the team is just beginning to tease out. On the bubble's exterior, particularly at the top and left, lie curtains of material appearing orange and red due to emission from warm dust. This marks where ejected material from the exploded star is ramming into surrounding circumstellar gas and dust.

Interior to this outer shell lie mottled filaments of bright pink studded with clumps and knots. This represents material from the star itself, which is shining due to a mix of various heavy elements, such as oxygen, argon, and neon, as well as dust emission.

"We're still trying to disentangle all these sources of emission," said Ilse De Looze of Ghent University in Belgium, another co-investigator on the program.

The stellar material can also be seen as fainter wisps near the cavity's interior.

Perhaps most prominently, a loop represented in green extends across the right side of the central cavity. "We've nicknamed it the Green Monster in honor of Fenway Park in Boston. If you look closely, you'll notice that it's pockmarked with what look like mini-bubbles," said Milisavljevic. "The shape and complexity are unexpected and challenging to understand."

Origins of Cosmic Dust - and Us

Among the science questions that Cas A may help answer is: Where does cosmic dust come from? Observations have found that even very young galaxies in the early universe are suffused with massive quantities of dust. It's difficult to explain the origins of this dust without invoking supernovae, which spew large quantities of heavy elements (the building blocks of dust) across space.

However, existing observations of supernovae have been unable to conclusively explain the amount of dust we see in those early galaxies. By studying Cas A with Webb, astronomers hope to gain a better understanding of its dust content, which can help inform our understanding of where the building blocks of planets and ourselves are created.

"In Cas A, we can spatially resolve regions that have different gas compositions and look at what types of dust were formed in those regions," explained Temim.

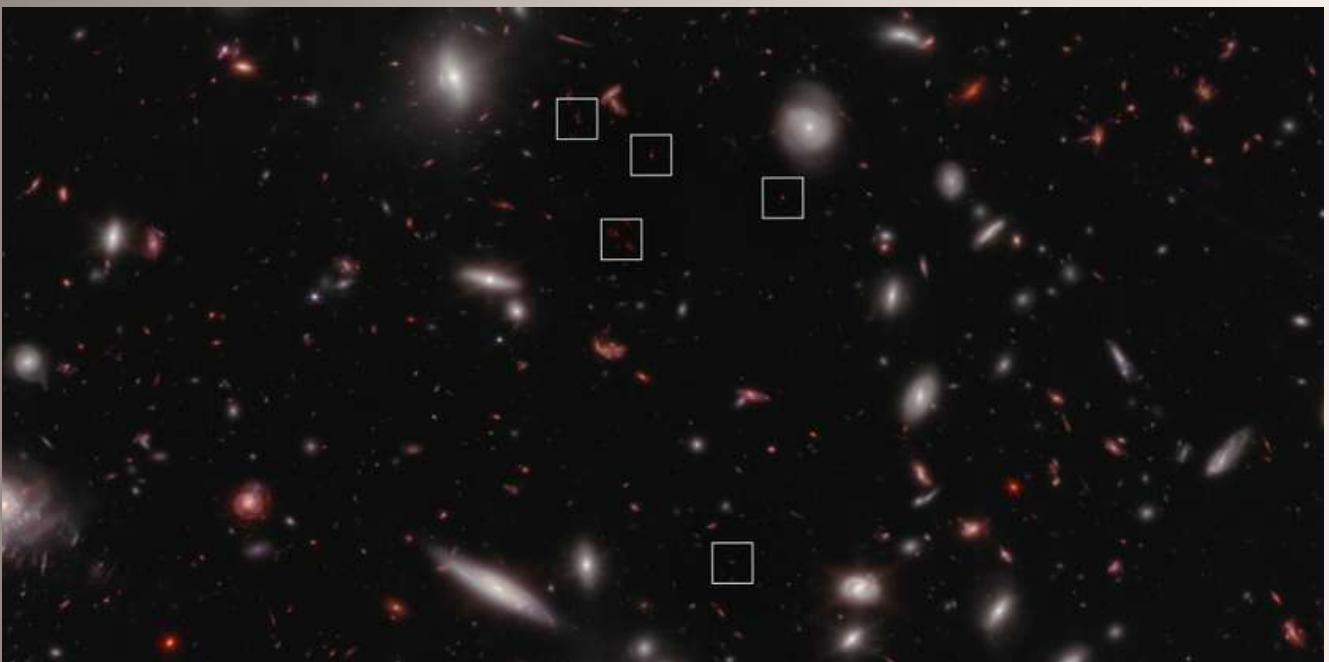
Supernovae like the one that formed Cas A are crucial for life as we know it. They spread elements like the calcium we find in our bones and the iron in our blood across interstellar space, seeding new generations of stars and planets.

"By understanding the process of exploding stars, we're reading our own origin story," said Milisavljevic. "I'm going to spend the rest of my career trying to understand what's in this data set."

The Cas A remnant spans about 10 light-years and is located 11,000 light-years away in the constellation Cassiopeia.

WEBB REVEALS EARLY-UNIVERSE PREQUEL TO HUGE GALAXY CLUSTER

Every giant was once a baby, though you may never have seen them at that stage of their development. NASA's James Webb Space Telescope has begun to shed light on formative years in the history of the universe that have thus far been beyond reach: the formation and assembly of galaxies. For the first time, a protocluster of seven galaxies has been confirmed at a distance that astronomers refer to as redshift 7.9, or a mere 650 million years after the big bang. Based on the data collected, astronomers calculated the nascent cluster's future development, finding that it will likely grow in size and mass to resemble the Coma Cluster, a monster of the modern universe. "This is a very special, unique site of accelerated galaxy evolution, and Webb gave us the unprecedented ability to measure the velocities of these seven galaxies and confidently confirm that they are bound together in a protocluster," said Takahiro Morishita of IPAC-California Institute of Technology, the lead author of the study published in the *Astrophysical Journal Letters*.



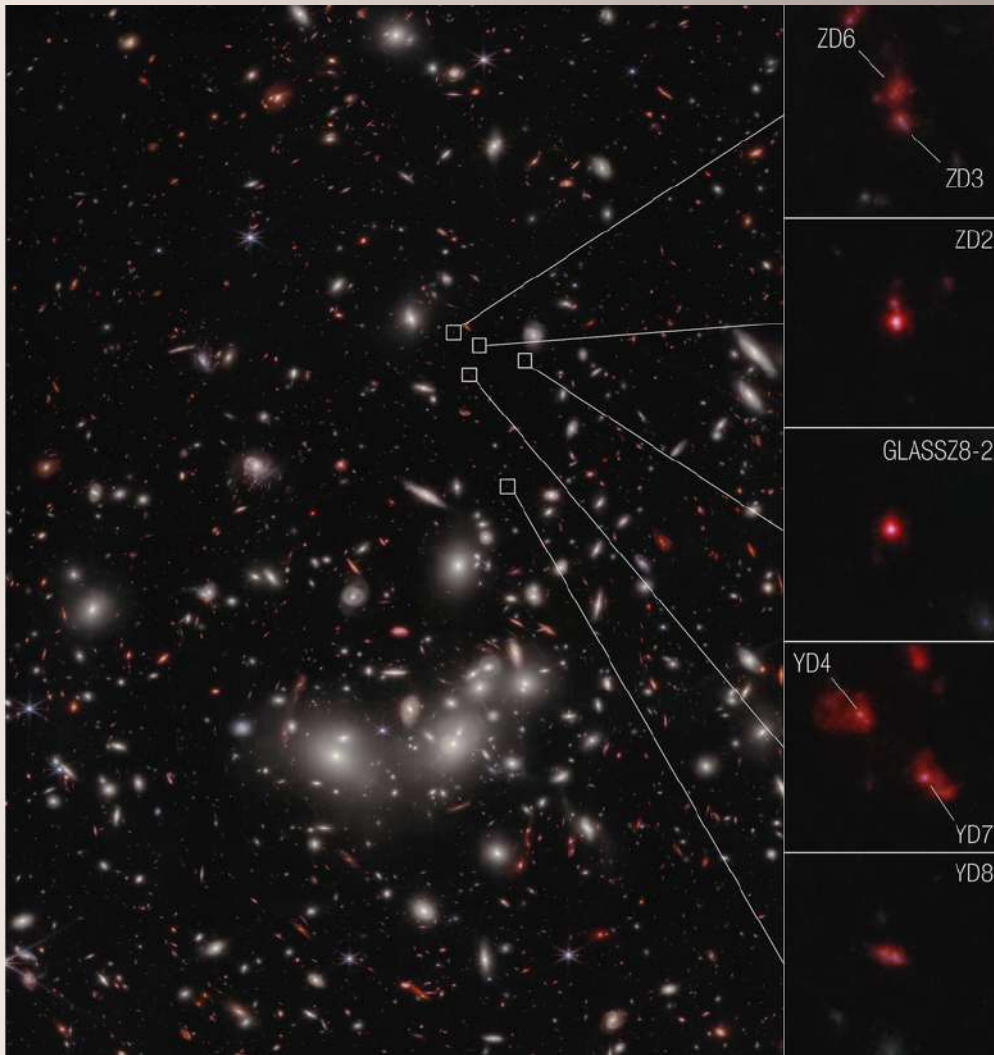
**The seven galaxies highlighted in this James Webb Space Telescope image
Credits: NASA, ESA, CSA, T. Morishita (IPAC).**

The precise measurements captured by Webb's Near-Infrared Spectrograph (NIRSpec) were key to confirming the galaxies' collective distance and the high velocities at which they are moving within a halo of dark matter more than two million miles per hour (about one thousand kilometers per second).

The spectral data allowed astronomers to model and map the future development of the gathering group, all the way to our time in the modern universe. The prediction that the protocluster will eventually resemble the Coma Cluster means that it could eventually be among the densest known galaxy collections, with thousands of members.

"We can see these distant galaxies like small drops of water in different rivers, and we can see that eventually, they will all become part of one big, mighty river," said Benedetta Vulcani of the National Institute of Astrophysics in Italy, another member of the research team.

Galaxy clusters are the greatest concentrations of mass in the known universe, which can dramatically warp the fabric of spacetime itself. This warping, called gravitational lensing, can have a magnifying effect on objects beyond the cluster, allowing astronomers to look through the cluster like a giant magnifying glass. The research team was able to utilize this effect, looking through Pandora's Cluster to view the protocluster; even Webb's powerful instruments need an assist from nature to see so far.



The seven galaxies highlighted in this James Webb Space Telescope image have been confirmed to be at a distance that astronomers refer to as redshift 7.9, which correlates to 650 million years after the big bang. This makes them the earliest galaxies yet to be spectroscopically confirmed as part of a developing cluster. Credits: NASA, ESA, CSA, T. Morishita (IPAC).

Exploring how large clusters like Pandora and Coma first came together has been difficult, due to the expansion of the universe stretching light beyond visible wavelengths into the infrared, where astronomers lacked high-resolution data before Webb. Webb's infrared instruments were developed specifically to fill in these gaps at the beginning of the universe's story.

The seven galaxies confirmed by Webb were first established as candidates for observation using data from the Hubble Space Telescope's Frontier Fields program. The program dedicated Hubble time to observations using gravitational lensing, to observe very distant galaxies in detail. However, because Hubble cannot detect light beyond near-infrared, there is only so much detail it can see. Webb picked up the investigation, focusing on the galaxies scouted by Hubble and gathering detailed spectroscopic data in addition to imagery.

The research team anticipates that future collaboration between Webb and NASA's Nancy Grace Roman Space Telescope, a high-resolution, wide-field survey mission, will yield even more results on early galaxy clusters. With 200 times Hubble's infrared field of view in a single shot, Roman will be able to identify more protocluster galaxy candidates, which Webb can follow up to confirm with its spectroscopic instruments. The Roman mission is currently targeted for launch by May 2027.

"It is amazing the science we can now dream of doing, now that we have Webb," said Tommaso Treu of the University of California, Los Angeles, a member of the protocluster research team. "With this small protocluster of seven galaxies, at this great distance, we had a one hundred percent spectroscopic confirmation rate, demonstrating the future potential for mapping dark matter and filling in the timeline of the universe's early development."

WEBB CAPTURES THE SPECTACULAR GALACTIC MERGER ARP 220

"Shining like a brilliant beacon amidst a sea of galaxies, Arp 220 lights up the night sky in this view from NASA's James Webb Space Telescope. Actually two spiral galaxies in the process of merging, Arp 220 glows brightest in infrared light, making it an ideal target for Webb. It is an ultra-luminous infrared galaxy (ULIRG) with a luminosity of more than a trillion suns. In comparison, our Milky Way galaxy has a much more modest luminosity of about ten billion suns. Located 250 million light-years away in the constellation of Serpens, the Serpent, Arp 220 is the 220th object in Halton Arp's Atlas of Peculiar Galaxies. It is the nearest ULIRG and the brightest of the three galactic mergers closest to Earth.

The collision of the two spiral galaxies began about 700 million years ago. It sparked an enormous burst of star formation. About 200 huge star clusters reside in a packed, dusty region about 5,000 light-years across (about 5 percent of the Milky Way's diameter). The amount of gas in this tiny region is equal to all of the gas in the entire Milky Way galaxy.

Previous radio telescope observations revealed about 100 supernova remnants in an area of less than 500 light-years. NASA's Hubble Space Telescope uncovered the cores of the parent galaxies 1,200 light-years apart. Each of the cores has a rotating, star-forming ring blasting out the dazzling infrared light so apparent in this Webb view. This glaring light creates diffraction spikes – the starburst feature that dominates this image.

On the outskirts of this merger, Webb reveals faint tidal tails, or material drawn off the galaxies by gravity, represented in blue – evidence of the galactic dance that is occurring. Organic material represented in reddish-orange appears in streams and filaments across Arp 220.

Webb viewed Arp 220 with its Near-Infrared Camera (NIRCam) and Mid-Infrared Instrument (MIRI).

INDIA SUCCESSFULLY LANDS REUSABLE SPACE PLANE PROTOTYPE FOR THE 1ST TIME

India is working to become a member of the space plane club.

On Sunday (April 2), the Indian Space Research Organization (ISRO), India's national space agency, announced that it had completed the second of four experiments designed to get its robotic Reusable Launch Vehicle (RLV) space-ready.

India, for the first time autonomously landed its reusable space plane prototype, marking a major milestone in the country's pursuit of low-cost access to space.

The latest experiment – Reusable Launch Vehicle Autonomous Landing Mission (RLV LEX) was carried out in a test facility owned by the country's Defence Research and Development Organisation (DRDO) in Karnataka, a state in southern India. As part of the mission, the 21-foot-long (6.5 meters) space plane was airlifted by a Chinook helicopter, flown by the Indian Air Force, to an altitude of 2.8 miles (4.5 kilometers) and released mid-air at 7:10 am local Indian time.

"With LEX, the dream of an Indian Reusable Launch Vehicle arrives one step closer to reality," the agency said in a statement, adding that it set a record by using a helicopter to lift a winged body 2.8 miles high.

The conditions assessed in this test, like the space plane's high landing speed of 217 mph (350 kph), are similar to what a launch vehicle re-entering Earth's atmosphere from outer space would experience, ISRO said in the same statement.



India's reusable space plane prototype comes in for a landing on April 2, 2023 after a drop test.

(Image credit: ISRO)

This test is the second of four experiments dedicated to honing various aspects of the reusable launch vehicle. The first test, the Hypersonic Flight Experiment (HEX), was performed in May 2016. At the time, ISRO had tested the space plane prototype by launching it atop an HS9 rocket, which deposited the 1.5-ton plane into Earth's lower atmosphere. ISRO declared that short mission a success when the plane splashed into its predetermined spot in the Bay of Bengal.

The first experiment did not test the launch vehicle's ability to land on a runway, which became the focus of this latest mission, nearly seven years later.

With the success of the second of four tests, the agency has taken another step toward realizing this goal.

NASA'S LUCY MISSION SNAPS ITS FIRST VIEWS OF TROJAN ASTEROID TARGETS

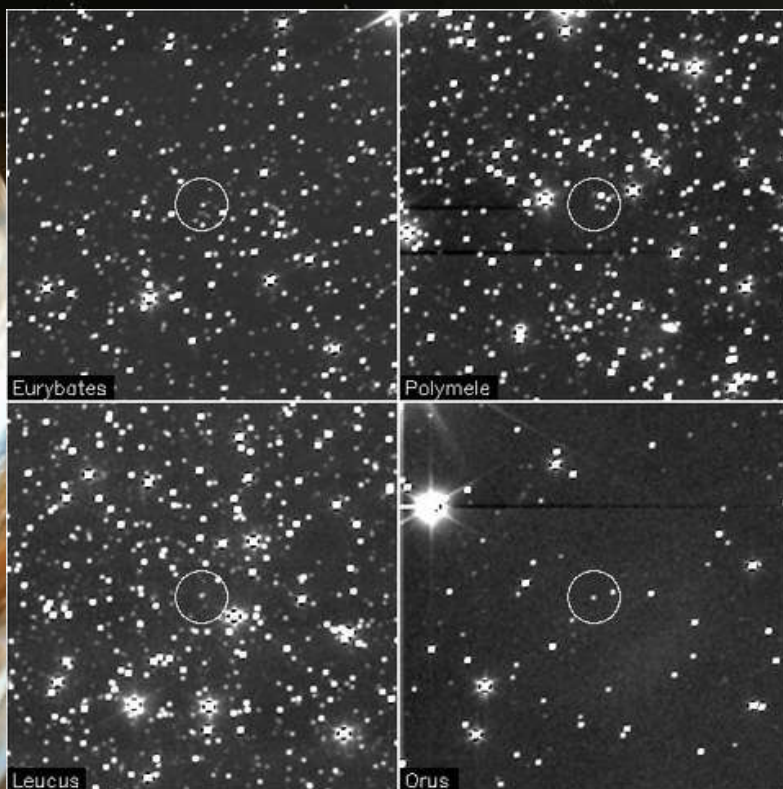
From March 25 to 27, 2023, NASA's Lucy used its highest resolution imager, L'LORRI, to capture its first views of four Jupiter Trojan asteroids. From left to right in the above image: Eurybates, Polymele, Leucus, and Orus.

Some of the asteroids Lucy's mission will visit are still more than 330 million miles (530 million kilometers) away from the spacecraft, which is more than three times the average distance between Earth and the Sun. But despite the great distance and the comparatively small sizes of these asteroids, Lucy caught views of four of them recently.

Although the four images are all at the same scale, the orientation of each is different, reflecting the different orientations of the L'LORRI camera as it turned to capture each target.

The targets were also observed for different time periods based on their rotation periods:

- Eurybates images were taken over a span of 6.5 hours.
- Polymele, about 2.5 hours.
- Leucus, 2 hours.
- Orus, 10 hours.



These images are the first in a series of planned observations designed to measure how the Trojan asteroids reflect light at higher angles than is observable from Earth. Though the asteroids are still just single points of light in these images, seen against a background of distant stars, the data will help the team choose exposure times for Lucy's close-up observations of its targets. Lucy will fly by these asteroids in 2027 and 2028 as the spacecraft travels through a swarm of small asteroids that lead Jupiter in its orbit around the Sun. Lucy is just more than a year into a 12-year voyage that entails close observation of nine of Jupiter's Trojans – the first space mission ever to visit them – and two main belt asteroids.

Japanese lunar lander loses contact moments before touchdown

The Tokyo-based company that developed the lander, ispace, still hopes to eventually provide commercial services to both private companies and space agencies alike.

The Japanese start-up ispace attempted to become the first private company to successfully soft-land a commercial spacecraft on the Moon on April 25, 2023. However, it now appears that the landing attempt – like several other such attempts in recent years – has failed.

The company's car-sized lander, called M1, first set forth for the Moon late last year, launching aboard a SpaceX Falcon 9 rocket from Cape Canaveral in Florida on Dec. 11. After a multi-month trip to lunar orbit, the spacecraft fired its main thrusters to carry out a pre-programmed series of commands aimed at gently lowering the lander to the lunar surface.

But when the craft got within just a few dozen meters of the Moon's surface, ispace lost contact with the lander. Attempts to reestablish contact have so far failed, suggesting ispace's M1 lander did not touch down softly and safely as intended, but instead likely crashed into the Moon's surface.

"We have to assume that we did not complete the landing on the lunar surface," said ispace founder Takeshi Hakamada during the company's webcast. **"We will keep going, never quit in our quest."**

Ispace currently plans to attempt at least two more lunar landings over the next few years, applying lessons learned during today's landing attempt to increase their odds of success.



A potentially lucrative moonshot

The overarching goal of ispace's so-called Hakuto-R mission – Hakuto means "white rabbit," a reference to Japanese folklore that says a white rabbit lives on the Moon – was to set the stage for future commercial operations on the Moon. According to ispace, these money-making operations include "providing high-frequency, low-cost transportation services to the Moon," as well as harvesting and selling lunar resources to commercial companies and national space agencies alike.

The Hakuto-R mission was expected to last about 10 days after reaching the lunar surface. And during that time, ispace's M1 lander planned to release a rover built by the United Arab Emirates named Rashid, as well as a two-wheeled, transformable lunar robot built by the Japanese space agency JAXA.

Not the first, not the last

In 2019, another privately funded lunar lander, the Israeli Beresheet spacecraft, attempted to touch down on the Moon. However, a failure of the craft's main engine during the landing sequence resulted in Beresheet instead slamming into the lunar surface, destroying the craft. That same year, the Indian Space Research Organization (ISRO) also lost a lunar lander, Virkam, that was attempting to make a soft landing but instead crashed into the Moon's south polar region.

Ispace may not have secured the title of the first private company to land on the Moon. However, two U.S.-based companies – Astrobotic and Intuitive Machines – are both aiming to land on the lunar surface sometime later this summer.

Astrobotic says its lander is ready now, but the company is currently waiting on the United Launch Alliance to finish the development of the Vulcan rocket that will send the lander to the Moon. Meanwhile, Intuitive Machines is still working to complete its lander, but the company has already booked a flight on one of SpaceX's reliable Falcon 9 rockets.

Both of these companies are sponsored in part by NASA's Commercial Lunar Payload Services (CLPS) program, which aims to spur the development of technology needed to carry out science, exploration, and commercial development of the Moon.

THE CLEAREST PICTURE OF DEIMOS EVER TAKEN!

Deimos, a moon of Mars, is seen in front of the red planet in a high-resolution image from the United Arab Emirates' Emirates Mars Mission spacecraft. (Image credit: Emirates Mars Mission)

The UAE's Hope Probe, which was launched as part of the Emirates Mars Mission, has captured the clearest-ever image of Mars' moon Deimos. The image has not only provided scientists with new insights about the moon but also challenges existing theories about its origin.

At the red planet since 2021, in late January and early February 2023, EMM's Hope probe got to within just 62 miles of Deimos—the closest any spacecraft has ever been to the eight miles diameter moon—and even managed to record images of its far side. During the 25-minute flyby, it took 27 images of Deimos.

"These images and observations represent a significant step forward in our knowledge of Deimos, its atmosphere, composition, origins, and what this means for our understanding of Mars more broadly," the United Arab Emirates Space Agency said in a statement.



For example, researchers suggest the new observations appear to challenge the long-standing theory that Mars' moons are captured asteroids and instead point to a planetary origin. The findings will be presented at the European Geosciences Union (EGU) General Assembly. As a result of the observations, the Hope Probe's activity will be extended by another year.

Hessa Al Matroushi, EMM science lead, said: 'We are unsure of the origins of both Phobos and Deimos. One long-standing theory is that they are captured asteroids, but there are unresolved questions about their composition.'

'How exactly they came to be in their current orbits is also an active area of study, and so any new information we can gain on the two moons, especially the more rarely observed Deimos, has the potential to unlock new understanding of Mars' satellites.'

'It came from Mars'

"Much like data acquired of Phobos indicate its composition is not consistent with a captured D-type asteroid, early results from EMIRS observations of Deimos tell a similar story. Both of these bodies have infrared properties more akin to a basaltic Mars than a D-type asteroid such as the Taggish Lake meteorite that is often used as an analog for the spectral properties of Phobos and Deimos," said EMIRS Instrument Scientist Christopher Edwards.

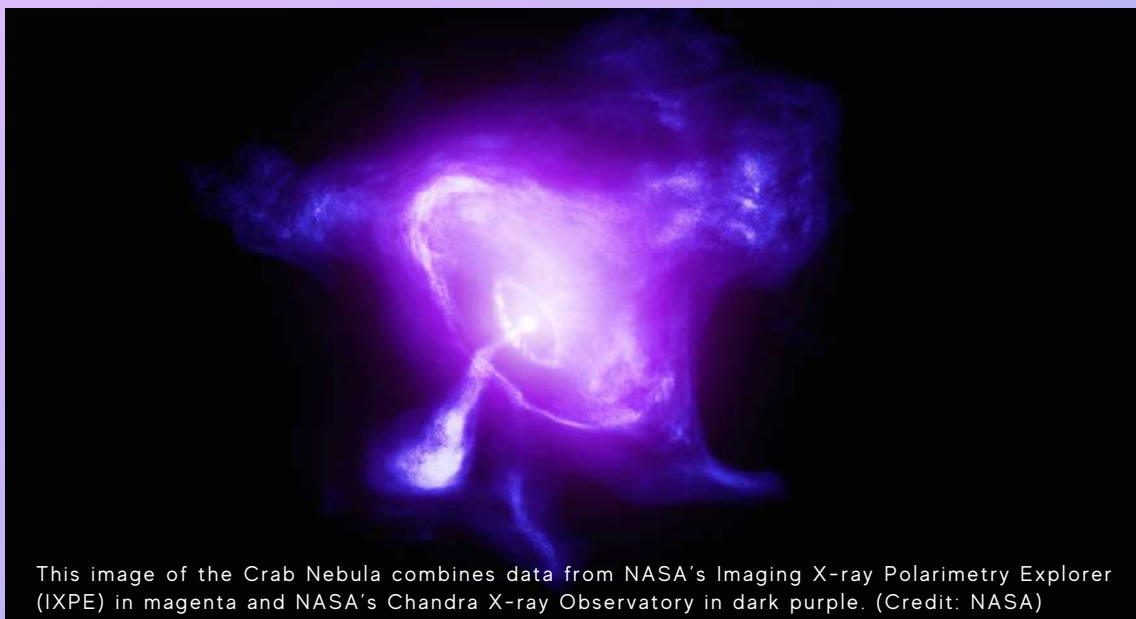
NEW X-RAY PHOTO SHOWS FAMOUS CRAB NEBULA LIKE NEVER BEFORE

Scientists have mapped the iconic Crab Nebula's magnetic field in greater detail than ever before using NASA's latest X-ray telescope.

Located 6,500 light-years from Earth, the Crab Nebula is the remnant of a massive stellar explosion, or supernova, that occurred in the year 1054 and left behind a dense object called the Crab Pulsar with a mass about twice that of Earth's sun. This nebula is one of the most thoroughly studied cosmic objects, but new observations suggest that it's far more complex than scientists had thought.

Using NASA's Imaging X-ray Polarimetry Explorer (IXPE) spacecraft, Niccolò Bucciantini at the INAF Arcetri Observatory in Italy and his colleagues were able to trace the Crab Nebula's magnetic field, revealing unexpected patches and asymmetrical areas of turbulence, according to NASA.

The Crab Pulsar, a spinning neutron star with jets of radiation spewing from its poles – lies at the nebula's center, surrounded by gas, shock waves, powerful magnetic fields and high energy light and particles, collectively known as the pulsar wind nebula. NASA's Earth orbiting IXPE satellite, which launched on Dec. 9, 2021, has helped to unravel the pulsar's chaotic surroundings, which were previously not well understood.



This image of the Crab Nebula combines data from NASA's Imaging X-ray Polarimetry Explorer (IXPE) in magenta and NASA's Chandra X-ray Observatory in dark purple. (Credit: NASA)

The IXPE space telescope is designed to examine the polarization of cosmic X-rays. Polarization measures the direction in which light waves oscillate, which is largely influenced by an object's magnetic field. Therefore, by measuring the polarization of X-rays from the Crab Nebula, the researchers were able to map the direction of the magnetic field in different parts of the nebula, as well as how ordered the magnetic field is, according to the space agency.

Data collected by IXPE shows X-rays originate in the outer magnetic field region, called the "wind" region, and within the magnetic field around the pulsar, from which shocks accelerate particles to near the speed of light. However, further observation is needed to fully understand the origin of these X-rays.

"The Crab is one of the most-studied high-energy astrophysical objects in the sky. So it is extremely exciting that we could learn something new about this system by looking through IXPE's 'polarized lenses,'" Michela Negro, co-author of the study and a research scientist at NASA Goddard Space Flight Center, said in the statement.

WHAT'S UP IN THE SKY - MAY 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

Inferior conjunction 1 May, Mercury is poorly placed in the morning sky thereafter, so it is unlikely to be seen.



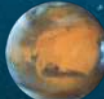
Venus

This spectacular evening planet has a crescent phase at the end of the month. Close to the Moon on 22 and 23 May.



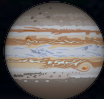
Mars

Evening planet, now very small telescopically. Close to M44 at the end of the month.



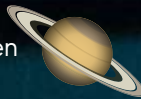
Jupiter

Morning planet, not well-placed and is unlikely to be seen.



Saturn

Saturn is a morning object, Can be seen before Sunrise.



Uranus

Uranus is in conjunction with the Sun on 9 May and so not currently visible.



Neptune

Neptune is a morning object but lost in the dawn twilight.



BRIGHT DEEP SKY OBJECTS

The lenticular galaxy, Messier 104, is called the Sombrero Galaxy because it features a prominent dust lane in its inclined disk, and an unusually large central bulge, which gives this galaxy the appearance of a sombrero hat. One can find M104 near the border of the constellations Virgo and Corvus.



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.



The Whirlpool Galaxy, also known as Messier 51 & NGC 5194, is an interacting grand-design spiral galaxy with a Seyfert 2 active galactic nucleus. It lies in the constellation Canes Venatici, and was the first galaxy to be classified as a spiral galaxy. Its distance is 31 million light-years away from Earth.

ROCKET LAUNCHES IN MAY 2023

ROCKET LIKE A HURRICANE



Rocket Lab will launch NASA's Time-Resolved Observations of Precipitation Structure and Storm Intensity with a Constellation of Smallsats (TROPICS) mission across two separate Electron launches.

The first mission - Rocket Like A Hurricane - will be Rocket Lab's 36th Electron launch and is scheduled to lift-off from Rocket Lab Launch Complex 1 in Mahia, New Zealand no earlier than May 1, 2023. The second mission - Coming To A Storm Near You - is scheduled to launch from the same location no earlier than May 16, 2023.

NASA's TROPICS constellation will monitor the formation and evolution of tropical cyclones, including hurricanes, and will provide rapidly updating observations of storm intensity. This data will help scientists better understand the processes that effect these high-impact storms, ultimately leading to improved modelling and prediction.

The constellation, which is part of NASA's Earth System Science Pathfinder Program, consists of four CubeSats that require launch to a specific orbit at an altitude of 550 kilometers and inclination of about 30 degrees. All four satellites need to be deployed into their operational orbit within a 60-day period, making Electron the ideal launch vehicle as it enables dedicated launch to unique orbits on highly responsive timelines. The two missions were initially scheduled to lift-off from Launch Complex 2 at the Mid-Atlantic Regional Spaceport within NASA's Wallops Flight Facility in Virginia but will now take place at Launch Complex 1 in New Zealand to support a Q2 launch window that will see the satellites reach orbit in time for the North American 2023 hurricane season.

Rocket Lab will not be attempting to recover Electron's first stage for either of these missions.

COMING TO STORM NEAR YOU

A Rocket Lab Electron rocket will launch the "Coming to a Storm Near You" mission. The launch date is currently targeted for May 16, 2023.

On April 10th, Rocket Lab announced the preliminary launch timeline for the two dedicated launches of four NASA's TROPICS satellites. The two launches are expected to be on May 1st and May 16th 2023, launching from Rocket Lab's LC-1B in New Zealand.

Last two operational (TROPICS-06 & TROPICS-07) satellites for NASA's Time-Resolved Observations of Precipitation Structure and Storm Intensity with a Constellation of SmallSats (TROPICS) mission. The CubeSats are designed to provide rapid-refresh microwave measurements that can be used to determine temperature, pressure, and humidity inside hurricanes as they form and evolve. (Image credits: Rocket Lab)

Electron is a two-stage orbital expendable launch vehicle (with an optional third stage) developed by the American aerospace company Rocket Lab. Electron is a small-lift launch vehicle designed to launch small satellites and CubeSats to sun-synchronous orbit and low earth orbit. The Electron is the first orbital class rocket to use electric-pump-fed engines, powered by the 9 Rutherford engines on the first stage. Rocket Lab is an American aerospace manufacturer with a wholly owned New Zealand subsidiary. The company develops lightweight, cost-effective commercial rocket launch services. (Image credits: Blue Canyon technologies.)



NEXTSAT-2 & SNIPE-NURI

KOREA AEROSPACE RESEARCH INSTITUTE



WED • MAY 24TH, 2023
2:54 PM - 3:24 PM GMT+5:30

Mission

NEXTSat-2 & SNIPE
Type: Earth Science
Third flight of the KSLV-II "Nuri" launch vehicle, carrying NEXTSat-2 as well as SNIPE A through D.



Location

LC-2
Naro Space Center, South Korea
5 rockets have launched from Naro Space Center, South Korea.



Rocket

KSLV-2 Nuri – Korea Aerospace Research Institute
Family: KSLV
Length: 47.2 m
Diameter: 3.5 m
Launch Mass: 200 T
Low Earth Orbit Capacity: 2600 kg
The KSLV-2 Nuri was manufactured by Korea Aerospace Research Institute with the first launch on 2021-10-21. KSLV-2 Nuri has 1 successful launches and 1 failed launches with a total of 2 launches. Nuri, also known as KSLV-II, is South Korea's second carrier rocket and the successor to KSLV-1.



Agency

Korea Aerospace Research Institute – KARI

- Type: Government
- Abbreviation: KARI
- Administration: Cho Gwang-rae
- Founded: 1989

The Korea Aerospace Research Institute (KARI) established in 1989, is the aeronautics and space agency of Republic of Korea. Its main laboratories are located in Daejeon, in the Daedeok Science Town.

SHENZHOU 16 LONG MARCH 2F/G

Shenzhou 16 is a planned Chinese spaceflight to the Tiangong space station, expected to launch on May 25, 2023, on board a Shenzhou spacecraft. It will carry three People's Liberation Army Astronaut Corps (PLAAC) taikonauts. The mission will be the eleventh crewed and sixteenth flight overall of the Shenzhou program.

Shenzhou 16 will be the fifth long-duration spaceflight to the Tiangong space station and will last about six months.

The Long March 2F/G was manufactured by China Aerospace Science and Technology Corporation with the first launch on 2011-10-31. Long March 2F/G has 10 successful launches. The Long March 2F is a Chinese orbital carrier rocket, part of the Long March 2 rocket family.

Designed to launch the crewed Shenzhou spacecraft, the Long March 2F is a human-rated two-stage version of the Long March 2E rocket, which in turn was based on the Long March 2C launch vehicle. It is launched from complex SLS at the Jiuquan Satellite Launch Center.

The flight will launch in May 2023, following the launch of Tianzhou 6 and near the end of the Shenzhou 15 mission. The two crews will perform a handover in space prior to the departure of the Shenzhou 15 crew in May 2023



SpaceX Launches - May 2023

AXIOM SPACE MISSION 2



Axiom Mission 2 (Ax-2) is Axiom Space's second all-private astronaut mission to the International Space Station (ISS) and is targeting on May 8, 2023, 10:43 PM CT for launch, i.e., May 9 2023, 8:13 am IST.

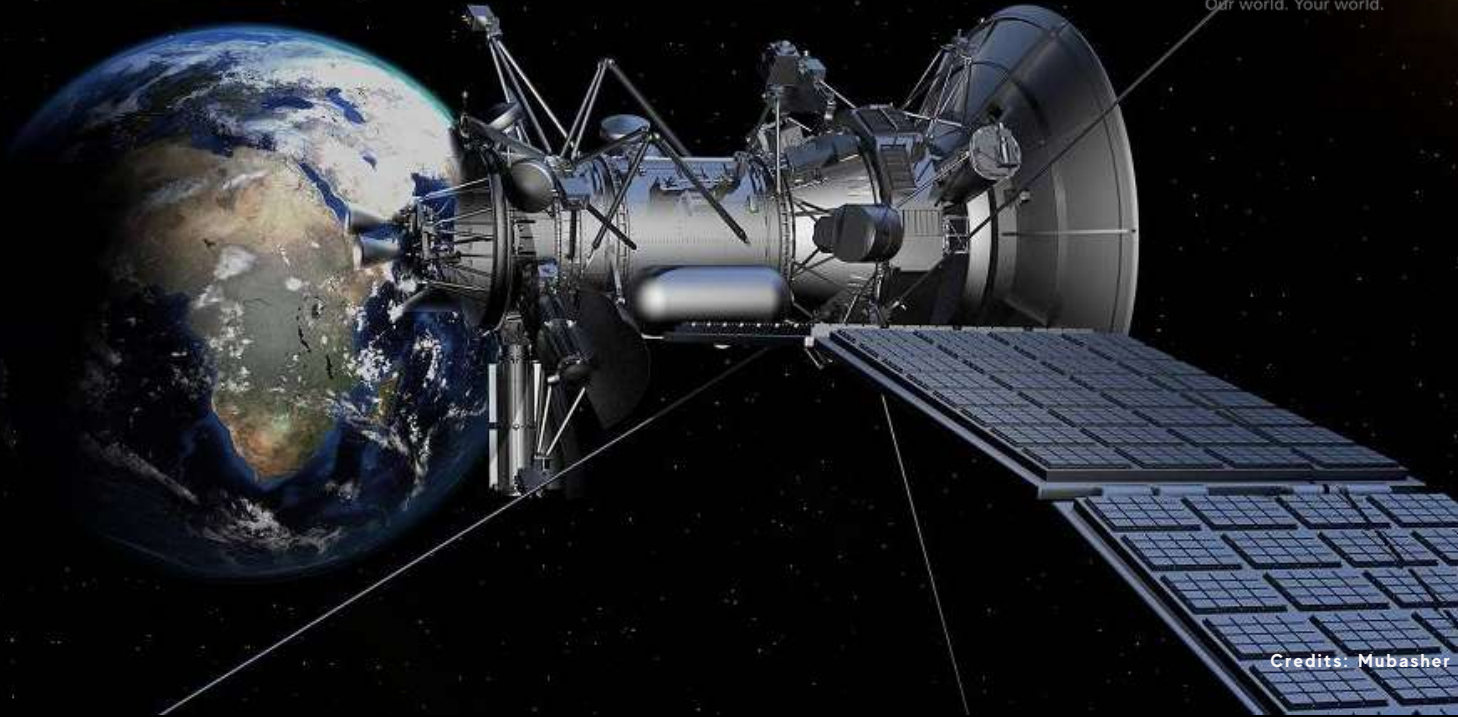
Axiom Mission 2 (Ax-2) will be Axiom Space's second all-private astronaut mission to the International Space Station (ISS), marking another pivotal step toward Axiom Station, the world's first commercial space station and successor to the ISS.

The Ax-2 crew is currently scheduled to launch in the spring of 2023. The four-person Axiom Space crew will fly to space in SpaceX's Dragon spacecraft atop its Falcon 9 rocket to participate in a 12-day mission, including 10 days working and living on the orbiting laboratory to implement a full mission manifest of science, outreach, and commercial activities.

Axiom Space's Director of Human Spaceflight Peggy Whitson, a former NASA astronaut and ISS commander, will lead the privately funded mission. Aviator John Shoffner of Knoxville, Tennessee, will serve as pilot. The two mission specialists are Ali Alqarni and Rayyanah Barnawi from the Kingdom of Saudi Arabia (KSA).

Axiom Space's Ax-2 mission continues progress toward the Axiom Station and a sustainable low-Earth orbit economy as humans venture farther for longer duration in space.

FALCON 9 BLOCK 5 ARABSAT-7B (BADR-8)



Credits: Mubasher

SpaceX is scheduled to launch a Falcon 9 rocket as part of the BADR-8 mission. The launch is scheduled on May 22nd at 8:50 am IST for the Communications mission launching from Cape Canaveral, FL, USA.

The Arabsat 7B (Badr 8) satellite is a new generation telecommunications satellite manufactured by Airbus Defence and Space for Arabsat that will replace and augment Arabsat's capabilities, the satellite will be based on the state-of-the-art Airbus Eurostar Neo electric orbit raising platform. BADR-8 will also include the innovative Airbus developed TELEO optical communications payload demonstrator. This payload will enable very high capacity analogue optical feeder link communications, as part of the development by Airbus of a new generation of optical communications technology in space to be integrated in its future commercial products, which is highly robust against jamming.



STARLINK GROUP 5-6

A SpaceX Falcon 9 rocket will launch the Starlink-81 (5-6) mission on Thursday, May 4, 2023, at 7:29 AM (UTC). SpaceX will launch a batch of Starlink v1.5 satellites for their second-generation high-speed low earth orbit internet satellite constellation.

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. As of February 2023, Starlink consists of over 3,580 mass-produced small satellites in low Earth orbit (LEO), which communicate with designated ground transceivers. In total, nearly 12,000 satellites are planned to be deployed, with a possible later extension to 42,000. SpaceX announced reaching more than one million subscribers in December 2022.

The SpaceX satellite development facility in Redmond, Washington houses the Starlink research, development, manufacturing, and orbit control teams. The cost of the decade-long project to design, build, and deploy the constellation was estimated by SpaceX in May 2018 to be at least US\$10 billion. SpaceX expects more than \$30 billion in revenue by 2025 from its satellite constellation, while revenues from its launch business were expected to reach \$5 billion in the same year.

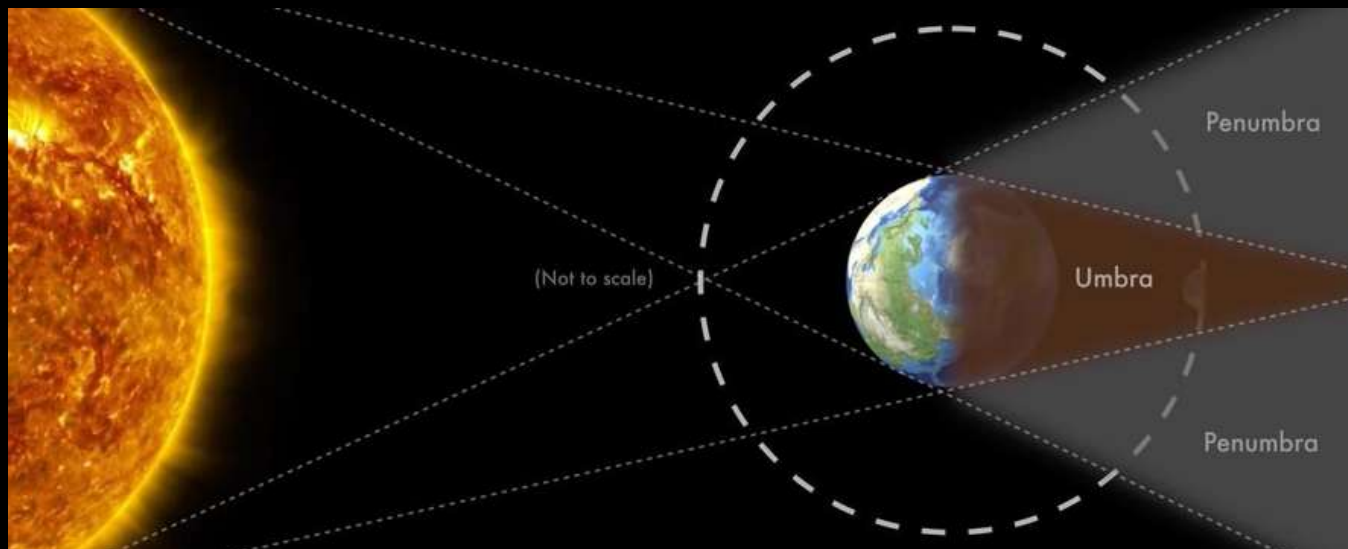
The Internet communication satellites were expected to be in the smallsat class of 100 to 500 kg (220 to 1,100 lb)-mass and were intended to be in low Earth orbit (LEO) at an altitude of approximately 1,100 km (680 mi), according to early public releases of information in 2015. In the event, the first large deployment of 60 satellites in May 2019 was 227 kg (500 lb) and SpaceX decided to place the satellites at a relatively low 550 km (340 mi), due to concerns about the space environment. Initial plans as of January 2015 were for the constellation to be made up of approximately 4,000 cross-linked satellites, more than twice as many operational satellites as were in orbit in January 2015. (Image Credits: La Nacion/ZUMA Press/picture alliance)

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

ASTRONOMICAL EVENTS - MAY 2023

PENUMBRAL LUNAR ECLIPSE

On May 5, 2023, India will experience a penumbral lunar eclipse starting at 8:44 PM IST and reaching maximum visibility by 10:52 PM.



A total lunar eclipse occurs when the whole Moon passes through the umbra, the darkest part of the Earth's shadow. In that instance, the light from the sun cannot directly reach and illuminate the Moon. Some light does bounce off the Earth's atmosphere and reach the Moon, but the different colors or wavelengths that make up white light get separated: it is only the red light that reaches the Moon, the blue light gets lost en route. This is why the Moon looks red during a total eclipse, and is sometimes referred to as a Blood Moon. If Earth didn't have an atmosphere no light at all would reach the Moon during a total eclipse and it would appear completely dark.

During this penumbral eclipse, the Moon passes deep into the outer part of Earth's shadow (known as the penumbra). The umbral magnitude of this eclipse is -0.046 , which means the Moon just misses the darker, inner part of Earth's shadow (which is called the umbra). The image shows the shadow formation (Image credits: NASA)

- **Penumbral eclipse begins at 15:13 UTC on May 5 (8:43 PM IST).**
- **Greatest eclipse at 17:22 UTC on May 5 (10:52 PM IST)** with a penumbral magnitude of 0.9655. So only a small sliver of the moon will not fall inside the penumbral shadow.
- **Penumbral eclipse ends at 19:31 UTC on May 6 (1:01 AM EDT).**
- **Duration of eclipse:** This is a deep penumbral lunar eclipse with a duration of 258 minutes.



Moon at 10:37 PM
(First Contact)

Penumbral eclipse captured by Mr. Ranjith Kumar, Senior Educator, SPACE on 10 January 2020



Moon at 12:41 AM
(Maximum Eclipse)

ETA AQUARIDS METEOR SHOWER

The Eta Aquarids peak occurs during early May every year. Eta Aquarid meteors are known for their speed. These meteors are fast-traveling at about 148,000 mph (66 km/s) into Earth's atmosphere. Fast meteors can leave glowing "trains" (incandescent bits of debris in the wake of the meteor) which last for several seconds to minutes. At peak, giving sky gazers the opportunity to see up to 40 shooting stars every hour. This year is set to be even more stunning than usual, with experts predicting an "outburst" that could double the number of meteors in the sky. The meteor shower is active this year from April 15 to May 27, but it is expected to peak on May 6.

Where Do Meteors Come From?

Meteors come from leftover comet particles and bits from broken asteroids. When comets come around the sun, they leave a dusty trail behind them. Every year the Earth passes through these debris trails, which allows the bits to collide with our atmosphere where they disintegrate to create fiery and colorful streaks in the sky.

The Comet

The pieces of space debris that interact with our atmosphere to create the Eta Aquarids originate from comet 1P/Halley. Each time that Halley returns to the inner solar system its nucleus sheds a layer of ice and rock into space. The dust grains eventually become the Eta Aquarids in May and the Orionids in October if they collide with Earth's atmosphere.

Comet Halley takes about 76 years to orbit the sun once. The last time Comet Halley was seen by casual observers was in 1986. Comet Halley will not enter the inner solar system again until 2061. Comet Halley was discovered in 1705 by Edmund Halley. Edmund Halley predicted the orbit of the comet through past observations of comets, suggesting that these sightings were in fact all the same comet. Halley is perhaps the most famous comet—it has been sighted for millennia. This comet is even featured in the Bayeux tapestry, which chronicles the Battle of Hastings in 1066.

The Radiant

Their radiant—the point in the sky from which the Eta Aquarids appear to come—is the constellation Aquarius, the water bearer. One of the brightest stars within Aquarius is called Eta Aquarii, and these meteors appear from this area of the constellation. (Eta Aquarii is one of the four stars that make up the top of the "water jar.") This star and the constellation is where we get the name for this shower: Eta Aquarids.

Viewing Tips

The Eta Aquarids are viewable in both the Northern and Southern hemispheres during the pre-dawn hours. The Southern Hemisphere is preferable for viewing the Eta Aquarids. The Northern Hemisphere has an hourly rate of only about 10 meteors. This is due to the viewing location of the radiant from different latitudes. The constellation of Aquarius—home to the radiant of the Eta Aquarids—is higher up in the sky in the Southern Hemisphere than it is in the Northern Hemisphere. In the Northern Hemisphere, Eta Aquarid meteors can more often be seen as "earth grazers." Earthgrazers are long meteors that appear to skim the surface of the Earth at the horizon.

To view the Eta Aquarids find an area well away from city or street lights. Come prepared with a sleeping bag, blanket, or lawn chair. Lie flat on your back with your feet facing east and look up, taking in as much of the sky as possible. After about 30 minutes in the dark, your eyes will adapt and you will begin to see meteors. Be patient—the show will last until dawn, so you have plenty of time to catch a glimpse.

South, May Before Dawn Eta Aquariid Meteor Shower



Credit: Earthsky.org



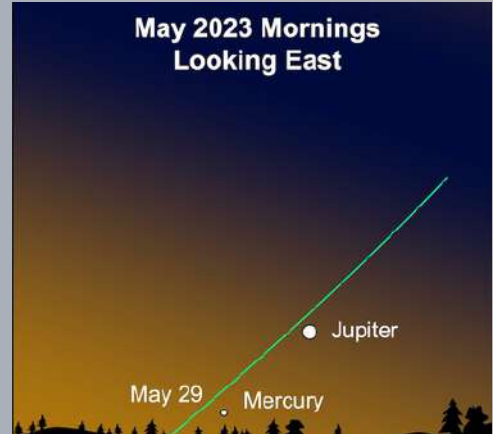
Halley's comet, the parent of the May Eta Aquariid and October Orionid meteor showers. Dust from this comet will light the night as Eta Aquariid meteors on the morning of May 5. (Credit: NASA)

MERCURY AT GREATEST WESTERN ELONGATION

On May 1, 2023, Mercury passes very close to the sun. In fact, its inferior conjunction was about a week later, it would transit the sun. Even though a transit doesn't happen, Mercury is heading for its greatest morning elongation on May 29, 2023. This elongation is best viewed from the Southern Hemisphere where it rises about two hours before sunrise and will be visible until around mid-June.

Mercury will brighten rapidly at the start of its morning apparition as it emerges from inferior conjunction. Prior to its apparition, it passed between the Earth and Sun, at which time it had its unilluminated side turned towards the Earth and so appeared as a thin, barely illuminated crescent. As the apparition proceeds, this crescent waxes and becomes gibbous.

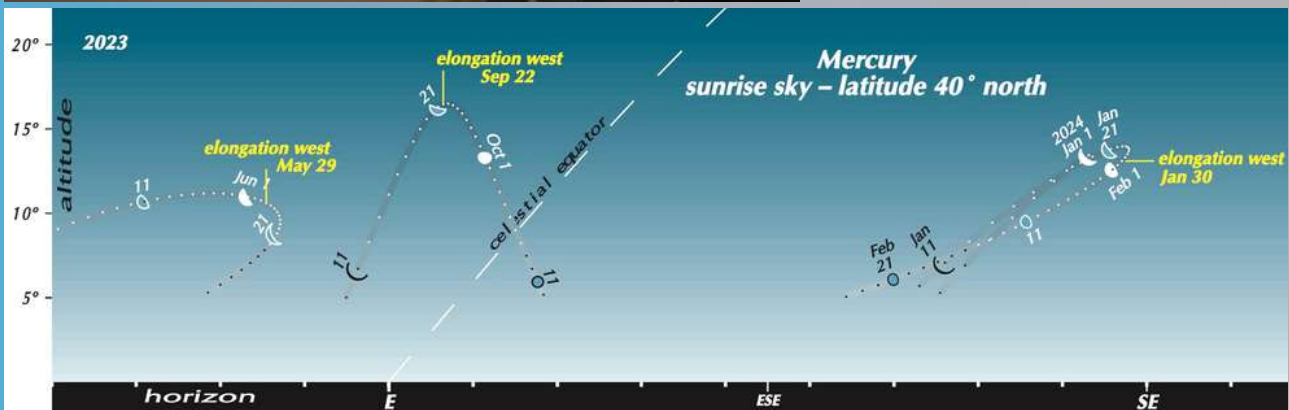
Since Mercury can only ever be observed in twilight, it is particularly difficult to find when it is in a thin crescent phase. Thus, it will be significantly easier to see in the days after it reaches its highest point in the sky – when it will show a gibbous phase than in the days beforehand. (Chart via John Jardine Goss)



Where to look: Look in the sunrise direction, as the sky is getting lighter.

Greatest elongation is on May 29 where Mercury will be shining at +0.6 magnitude that morning. And it'll be 24.9 degrees from the sun.

Through a telescope on and around May 29, Mercury will appear 38% illuminated, in a crescent phase, and 8.2 arcseconds across. By the way, in mid-June it'll be almost 75% illuminated by the time it slips out of view for Southern Hemisphere observers.



(Mercury's greatest morning elongations in 2023 from the Northern Hemisphere as viewed through a powerful telescope. The planet images are at the 1st, 11th and 21st of each month. Here, dots show the actual positions of the planet for every day. Chart via Guy Ottewell.)

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 May 14, 2023, the planet Saturn will appear very close to the Moon. The pair will be seen together in the early morning. They will be in the eastern direction. Moon is at a magnitude of -11.58 and Saturn has a magnitude of -1.0.



Place: Chennai / Date: 14th May / Time: 3.30 AM

Conjunction of Moon, and Jupiter.

On May 18, 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 -8.84, and the planet Jupiter is at a magnitude of -1.92.



Place: Chennai / Date: 18th May / Time: 4.30 AM

Conjunction of Moon and Venus.

On May 23, 2023, Moon and the planet Venus appear very close to each other in the early evening, right after sunset. They will be in the Western direction. Moon is at a magnitude of -10.48, Venus will be at a magnitude of -4.12.



Place: Chennai / Date: 23rd May / Time: 7.30 PM

Conjunction of Moon with Mars.

On May 24, 2023, Moon and the planet Mars will appear very close to each other in the evening. They will be in the Western direction. Moon is at a magnitude of -10.92, Mars is at a magnitude of 1.5.



Place: Chennai / Date: 24th May / Time: 7.30 PM

STUDENT'S CORNER

FATE OF OUR UNIVERSE

Shaurya Baitule
IAstronomer Member

This involves 3 hypotheses. The first one is 'The Big Crunch' which says that if the universe keeps on expanding and expanding its mass will gradually increase and we all know that the higher the Mass the GREATER THE GRAVITY hence, the gravity will become so powerful that the balance between Dark energy or matter will become imbalanced and the universe will collapse to a singularity. Again starting the cycle of BIG BANG.

The second hypothesis is 'BIG FREEZE' which states if the universe will expand then all the stars, galaxies and everything will go far and far. If this happens then nebula clouds will also go far from each other, resulting in thwarting the formation of stars therefore leaving no thermodynamic energy in the universe. The stars would go supernovae and only black holes would remain in the universe. Black wouldn't last long because after all Hawking radiation will evaporate them, leaving the universe cold and lonely.

The third theory suggests the Universe will end with a 'Big Rip', as the pull of the Universe's expansion gets stronger than the gravity it contains. This would tear apart galaxies, followed by black holes, stars, and even our own planet.

Earth, and humanity with it, could slowly decay into radiation, collapse in on itself, or be ripped apart as the Universe's expansion ramps up. This would leave the Universe full of single, disconnected particles.

◆.....◆

ORION NEBULA: A COSMIC MASTERPIECE UNVEILED

Nikhilesh B
iAstronomer member

The Orion Nebula, also known as Messier 42 or NGC 1976, is one of the most well-known and captivating astronomical objects in the night sky. Located in the constellation of Orion, which is easily visible in the winter months in the northern hemisphere, the Orion Nebula is a celestial wonder that has fascinated astronomers and stargazers alike for centuries.

The Orion Nebula is a giant cloud of gas and dust, stretching approximately 24 light-years across and located about 1,344 light-years away from Earth. It is a stellar nursery, where new stars are born from the remnants of older stars. At the heart of the nebula, there is a cluster of young stars known as the Trapezium Cluster, which is a group of hot, young stars that emit intense ultraviolet radiation. The energy from these stars causes the surrounding gas and dust to glow brightly, creating the stunning visual spectacle that we see as the Orion Nebula.

One of the most striking features of the Orion Nebula is its beautiful and intricate structure. The nebula is composed of a combination of glowing gas and dark dust. The gas appears in shades of red, green, and blue, indicating the presence of hydrogen, oxygen, and other elements. The dark dust lanes create intriguing patterns, resembling billowing clouds or tendrils of smoke, adding to the nebula's ethereal beauty.

The Orion Nebula has been extensively studied by astronomers, providing invaluable insights into the process of star formation. Observations have revealed that stars are formed in dense regions within the nebula, where the gas and dust are gravitationally pulled together to create protostellar cores.

GALACTICA

These cores then collapse under their own gravity, triggering the birth of a new star. As the protostar continues to gather material from its surroundings, it grows in size and temperature until nuclear fusion ignites in its core, marking the birth of a fully-fledged star.

The Orion Nebula also contains numerous proplyds, which are protoplanetary disks surrounding young stars. These disks are thought to be the birthplaces of planets, as they are composed of gas and dust that can eventually coalesce into planetesimals, the building blocks of planets. Studying the proplyds in the Orion Nebula provides valuable insights into the early stages of planetary formation, shedding light on the origins of our own solar system.

In conclusion, the Orion Nebula is a breathtaking and awe-inspiring celestial object that has captivated humanity for centuries. Its stunning structure, intricate patterns, and scientific significance make it a fascinating subject of study for astronomers and a source of wonder for stargazers. Through its immense beauty and profound scientific insights, the Orion Nebula continues to be a testament to the vastness and majesty of our universe, inviting us to explore and marvel at the wonders of the cosmos

SOMETHING BIG OUT THERE!

Sourajit Mandal
Astronomer Member

Do you know which is a bigger planet? Jupiter is the largest planet in the solar system. It has a radius of 69,911 km. That is nearly 10 times more than the radius of the Earth. Over 1300 Earth can fit inside Jupiter. Jupiter is about 2.5 times more massive than the other planets in our solar system combined. Jupiter also holds the first rank for the maximum number of moons, with a total of 92 confirmed moons.

But Jupiter is the largest planet in our solar system—a microscopic star system compared to the entire cosmos. There are trillions of star systems in the universe. Each with its own planet called an exoplanet. The universe is full of wonders, and the discovery of exoplanets has been one of the most significant achievements in modern science. HD 100546 b (a potential brown dwarf star) an exoplanet located approximately 316.4 light-years away from Earth, is one such wonder.

This gas giant planet's several distinctive features make it unique and worthy of study. This planet has a mass of 752 Jupiter! Its radius is around 493200 km—that is around 7 times larger than the radius of Jupiter! It would take three whole months to travel around the equator of this planet on an airplane! Roughly 955 thousand Earths can fit inside this gas giant. Imagine the gravity of this planet! Under that gravity, we would be completely crushed into a thin sheet of paper.

We still do not know why this massive celestial object is a planet and not a star. It has enough mass to start nuclear fusion and produce its own light. This planet lies about 53 AU away from its star. Studying this planet will help us know more about stars and planets and teach us about the distinction between stars and planets. Studying this planet is going to make it easier to find celestial objects and classify them correctly.

IS THE BIG BANG RIGHT?

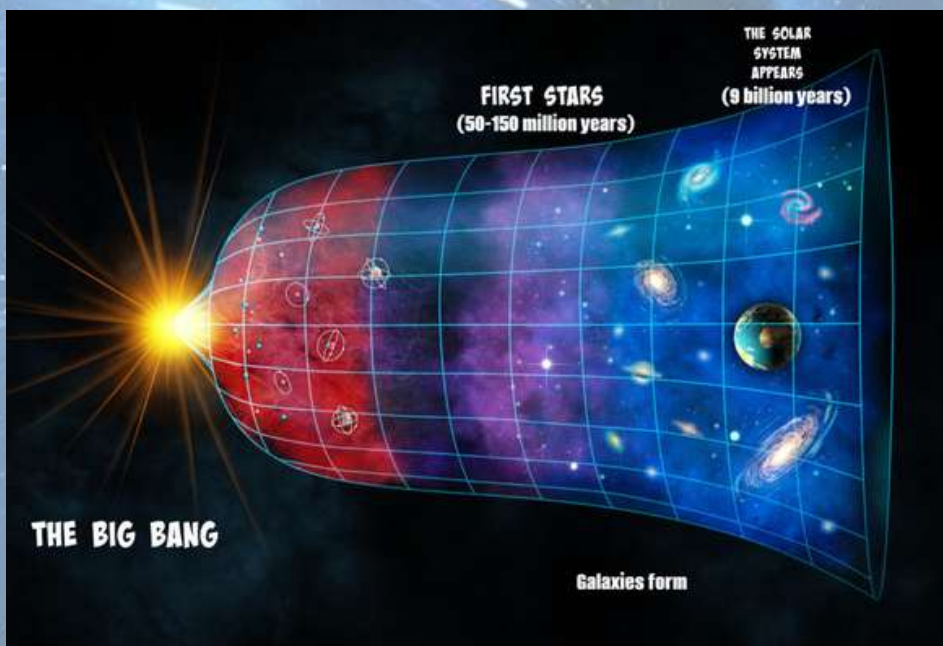
Sourajit Mandal
iAstronomer member

The entirety of the cosmos started out as small as a pinpoint. Then, something happened—something that we don't know the cause of— and an explosion took place. The biggest explosion that could ever take place in the entire realm of reality. And... It all started. The universe had begun its life. That was also the time when time started and everything began.

That is how the universe is thought to have started, also known as the Big Bang theory. We have got many proofs of this theory. For example— The dim afterglow of the big bang discovered in 1960 is known as cosmic microwave background radiation. This radiation covering about 2.5 percent of the night sky shows fluctuations in the ionized gases that later condensed to form galaxy superclusters. Edward Hubble's discovery of a connection between a galaxy's distance from Earth and its speed in the 1920s is another example of how the Big Bang theory is supported.

That's enough to prove the Big Bang theory right isn't it? Yes, it was enough till now. The Big Bang theory is one of the most followed theories in cosmology about the creation of the universe. Every book that ever tells about the creation of the universe states about the Big Bang theory so confidently that it sometimes seems like we have actually witnessed the Big Bang in our own lifetimes.

This confidence in the Big Bang theory was certainly and suddenly drained out by a new discovery by the James Webb telescope. This sudden discovery by the James Webb space telescope has started a sense of chaos among scientists and confusion among people. The media's immense enthusiasm has caused even more confusion among the common people.



But, what is this ground-breaking new discovery which is the core of this chaos? The James Webb Space Telescope— the biggest and most advanced, 10 billion dollar space telescope has found 6 new galaxies which are not supposed to exist in theory. These galaxies are around 13.75 billion light years away. This means that the images that we see today of these galaxies are those galaxies before 13.75 billion years ago.

These galaxies are massive— much bigger than our Milky Way galaxy. The problem lies here— it is not theoretically possible for galaxies to become so massive so early in the universe. This is because galaxies take a lot of time to form. Especially the bigger galaxies. These massive galaxies could not have formed only after 500– 700 million years after the Big Bang. This is the center of all our problems. Since we cannot explain how these huge galaxies have formed with the Big Bang theory, we can possibly assume that it is wrong. Or, it might also be possible that the theory is correct but just needs some modifications. It might also be possible that this new finding fits into the theory perfectly but we cannot understand how. (Image credits: Science-sparks)

We do not have enough data to understand the correct solution to this problem. We require a lot more data and research to find out exactly what might have happened at the time of the creation of these galaxies and the universe as a whole.

VISUAL ARTS FROM SPACE ASSOCIATED ASTRONOMERS



Prem Sahana A, Iastronomer



Orion Nebula Captured by Nikhilesh B, Iastronomer



Moon and Venus Conjunction captured by Ruhika S, Club Student



Orion Constellation captured by Pareesa Dudia, Club Student



Shaurya Baitule, Iastronomer

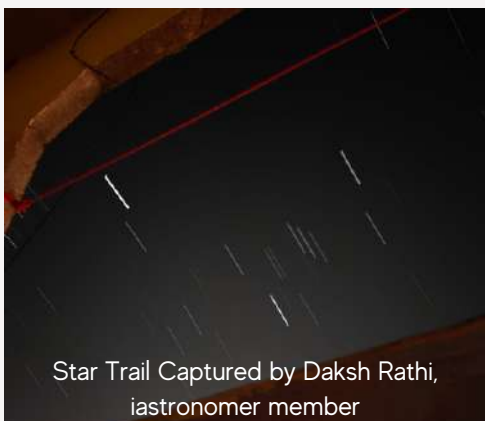


Moon and Venus Conjunction captured by Shree Vishwajith S, Club Student



Composite Image of Moon

Daksh Rathi, Iastronomer member



Star Trail Captured by Daksh Rathi, Iastronomer member

ASTROPHOTOGRAPHS BY SPACE



Star trail with Qutub Minar captured by Mr. Yogesh Joshi,
Asst. Educator incharge, SPACE



Milkyway captured by
Mr. Ankur Chabra, Educator, SPACE



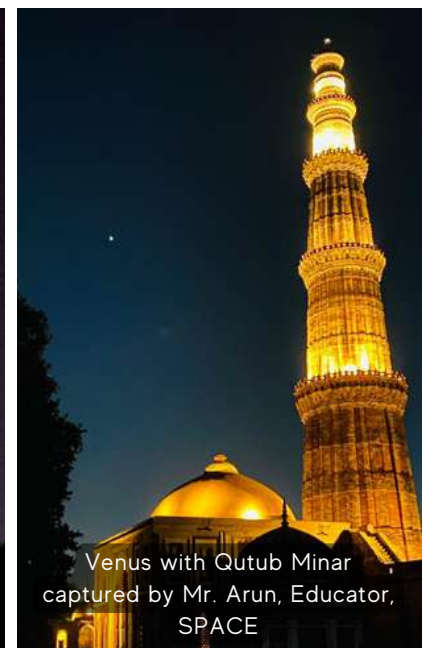
Moon trail captured by Ms. Sruthi Suresh,
Educator, SPACE



Star trail captured by Mr. Ranjith Kumar E, Senior Educator, SPACE



Venus and Pleiades Conjunction captured by Mr. Shiril, Executive, GAPL



Venus with Qutub Minar
captured by Mr. Arun, Educator,
SPACE

Happy Birthday



Cecilia Payne

Cecilia Payne-Gaposchkin, original name in full Cecilia Helena Payne, (born May 10, 1900, —died Dec. 7, 1979), was a British-born American astronomer who discovered that stars are made mainly of hydrogen and helium and established that stars could be classified according to their temperatures.



MAY 10, 1900

Nancy Roman

Nancy Grace Roman (May 16, 1925 – December 25, 2018) was an American astronomer who made important contributions to stellar classification and motions. The first female executive at NASA, Roman served as NASA's first Chief of Astronomy throughout the 1960s and 1970s. She oversaw the planning and development of programs for the Hubble Space Telescope. Thus, she was called the 'Mother of Hubble.'



MAY 16, 1925

HISTORICAL EVENTS HAPPENED IN MAY

PIONEER VENUS 1 PROBE

NASA's Pioneer Venus 1 was the first of a two-spacecraft orbiter-probe combination designed to study the atmosphere of Venus. It was the first American spacecraft to orbit Venus. The second spacecraft was launched a few months later.

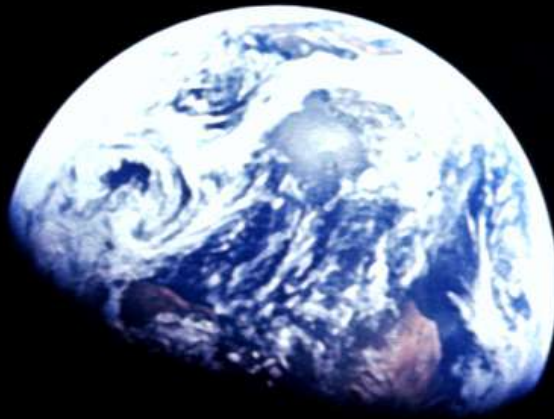
- Pioneer Venus 1 used radar to map the surface of Venus.
- The probe found Venus to be generally smoother than Earth, though with a mountain higher than Mt. Everest and a chasm deeper than the Grand Canyon.
- It confirmed that Venus has little if any, magnetic field and found the clouds to consist mainly of sulfuric acid.
- The spacecraft burned up the atmosphere of Venus, ending a successful 14-year mission that was planned to last only eight months.

Pioneer Venus 1, the orbiter, was designed to spend an extended period in orbit around Venus mapping the surface using a radar package. After a six-and-a-half-month journey, the spacecraft entered an elliptical orbit around Venus at 15:58 UT on Dec. 4, 1978.

It was the first American spacecraft to enter orbit around Venus, about three years after the Soviets accomplished the same feat.(Image credits: NASA)

APOLLO 10 MISSION

Sixty-four years ago, NASA launched Apollo 10 from Kennedy Space Center on a test mission before the historic Apollo 11 moon landing. It launched into a nominal 115-mile circular Earth-parking orbit at an inclination of 32.5 degrees. One-and-a-half orbits later, a translunar injection occurred. The S-IVB fired to increase velocity from 25,593 to 36,651 feet per second on a free-return trajectory. Twenty-five minutes later, the CSM separated for transposition and docking with the LM, similar to the maneuver performed on Apollo 9.



The orbital vehicle was comprised of the S-IVB stage, and its payload of the CSM, the LM, and the spacecraft-lunar module adapter, or SLA, shroud. The Apollo 10 crew members were Commander Thomas Stafford, Command Module Pilot John Young, and Lunar Module Pilot Eugene Cernan. The Apollo 10 mission encompassed all aspects of an actual crewed lunar landing, except the landing. It was the first flight of a complete, crewed Apollo spacecraft to operate around the Moon. Objectives included a scheduled eight-hour lunar orbit of the separated lunar module, or LM, and descent to about nine miles off the moon's surface before ascending for rendezvous and docking with the command and service module, or CSM, in about a 70-mile circular lunar orbit. Pertinent data to be gathered in this landing rehearsal dealt with the lunar potential, or gravitational effect, to refine the Earth-based crewed spaceflight network tracking techniques, and to check out LM programmed trajectories and radar, and lunar flight control systems. Twelve television transmissions to Earth were planned. All mission objectives were achieved.

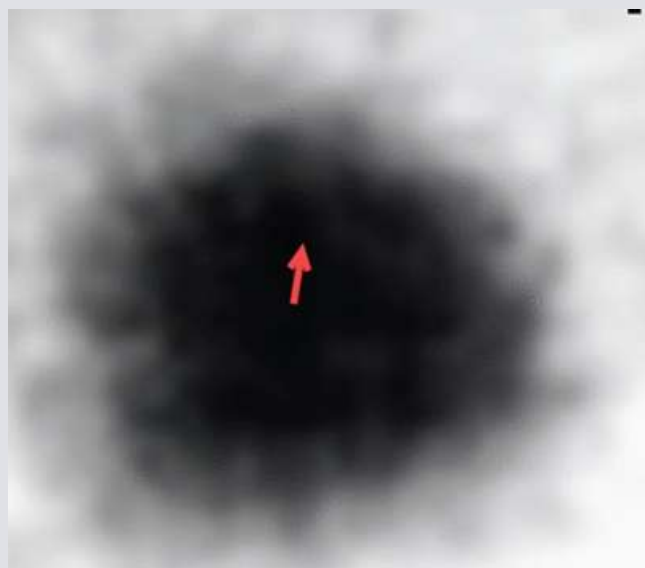
A SOLAR ECLIPSE THAT SHOWED LIGHT ON EINSTEIN'S GENIUS



Einstein became world famous on 7 November 1919, following the press publication of a meeting held in London on 6 November 1919 where the results were announced of two British expeditions led by Eddington, Dyson, and Davidson to measure how much background starlight is bent as it passes the Sun. Three data sets were obtained: two showed the measured deflection matched the theoretical prediction of Einstein's 1915 Theory of General Relativity, and became the official result; the third was discarded as defective.

6 November 2019 was the centenary of the presentation to a joint meeting of the Royal Society and the Royal Astronomical Society of the scientific results from the May 1919 solar eclipse expeditions. These determined that the reality and amplitude of gravitational light bending by the Sun were consistent with Einstein's 1915 predictions, and significantly inconsistent with the Newtonian flat-space-time prediction. This evidence, complementing the earlier (1915) evidence that the theory explained an anomaly in the orbit of the planet Mercury, established General Relativity as a valid theory of space-time and made Einstein famous.

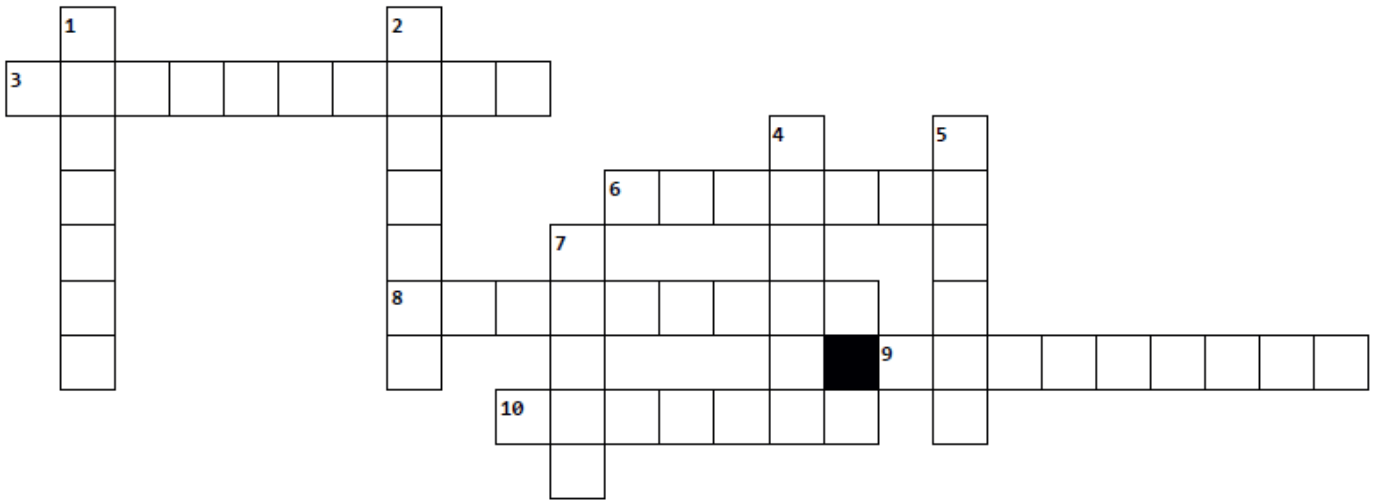
The 1915 publication of Einstein's Theory of General Relativity included three definitive and necessary observational tests for which the General Relativistic prediction differed from flat space-time 'Newtonian' values. In the order presented by Einstein, the first is the rate of precession of the orbit of the planet Mercury around the Sun (an additional 43 arcsec per century, observation at the time required 45 ± 5 arcsec per century). The second is the predicted amplitude of bending by a light ray from a background star passing the Sun (1.75 arcsecs at the Sun's limb). The third is the gravitational redshift of light for a particle moving through a gravitational potential; this last was determined unambiguously only in the 1960s.



The image is an enlargement of 'Star 4' from a Sobral 4-inch plate. The red arrow indicates the amplitude of the centroid shift due to gravitational deflection at the position of this star, which is 0.75 arcsec. (Image credits: John Pilkington at the Royal Greenwich Observatory in 1999)

TRAIN YOUR BRAIN

CROSSWORD



ACROSS

- 3. The outer edge of the Solar system is called?
- 6. Which spacecraft have visited all planets?
- 8. What is the name of the moon which shoots water jets from its ocean?
- 9. What is the region in the solar system where long-range comets originate?
- 10. Which celestial object has supersonic winds?

DOWN

- 1. _____takes roughly three Earth months to orbit the Sun.
- 2. Which planet's moon has volcanic eruptions?
- 4. I have 90% of water in my rings, who am I?
- 5. Which moon revolves in the opposite as that of the host planet?
- 7. Which is the dwarf planet in the asteroid belt?

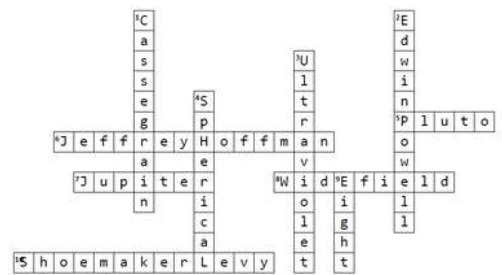
ASTRONOMY WORD PUZZLE

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

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

- MIRAM
- ARCHID
- RIGEL
- MIZAR
- POLARIS
- PORRIMA
- ALGEDI
- MINTAKA
- ALGORAB
- KAFFALIJDHMA
- ALNITAK
- CASTOR
- REGULUS
- ALBIREO

Answers for last month puzzles.



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

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

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

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MOUNT: ALT-AZ
APERTURE: 70MM
FOCAL LENGTH: 700MM
- KSON 80MM NEWTONIAN
TYPE: REFLECTOR
MOUNT: ALT-AZ
APERTURE: 80MM
FOCAL LENGTH: 800MM
- BRESSER 127EQ NEWTONIAN
TYPE: REFLECTOR
MOUNT: EQ
APERTURE: 127MM
FOCAL LENGTH: 650MM

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