



**SPACE™**  
EMPOWERING LIFE

AUGUST 2022  
ISSUE VII

# Galactica

Astronomy and Space Science Magazine

## **What's Inside?**

Highlights From July  
Moon Phases And Planet Visibility  
What's Awaiting in August  
Student's Corner  
Historical Events Happened In August  
Events By SPACE  
Train Your Brain.

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Galactica is a monthly magazine about astronomy & space science published by SPACEIndia 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 general audience, and the article about historical missions & events of astronomy and more. All of this comes in an easy-to-understand user-friendly style that's perfect for astronomers at any level.

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# ABOUT SPACE

**SPACE** is the pioneer organization working towards 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, 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 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, professional organisations, government agencies and space observatories.

## #SpaceForAll

We have reused more than 40,000 Plastic Bottles ♻️ for carrying rocketry sessions at schools Engaged more than 1M+ Students & 1,000+ Schools in our 22 years of journey towards excellence and in an effort to imbibe scientific Temperament.

Contact us to know about hosting Astronomy and Space Science activities at schools.



**Mr. Sachin Bahmba**  
CMD, Space.

## CMD'S MESSAGE:

Space and Astronomy is 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 to students wherein they explore the real world of science. I wish for the young students to let their ambitions soar and think big as they are the future of our country.



# HIGHLIGHTS OF JULY 2022

## FIRST IMAGES FROM THE JAMES WEBB SPACE TELESCOPE REVEAL AN UNSEEN UNIVERSE

The dawn of a new era in astronomy has begun as the world gets its first look at the full capabilities of NASA's James Webb Space Telescope, a partnership with European Space Agency and Canadian Space Agency. The telescope's first full-color images and spectroscopic data were released during a televised broadcast on Tuesday, July 12, 2022, from NASA's Goddard Space Flight Center in Greenbelt, Maryland.

Scientists have released the first highly-anticipated, full-color, scientific images captured by the James Webb Space Telescope, the most powerful such instrument ever built. The colossal telescope orbits around 1 million miles from Earth and is positioned to peer at some of the earliest galaxies and stars ever born. Looking at these objects means looking back in time billions of years because it takes that long for this ancient light to reach us (or more precisely, reach the \$10 billion Webb telescope).

This first batch of unprecedented images includes views of some of the most distant galaxies, a giant star nursery, and colossal cosmic clouds. It also gives unparalleled insight into a giant planet beyond our solar system.



(Image credit: Webbtelescope.org)

**Webb's first observations were selected by a group of representatives from NASA, ESA, CSA, and the Space Telescope Science Institute, here are the pictures:**

### **SMACS 0723**

Webb spied an "extremely distant" population of galaxies in this image. Galaxies in the foreground distort light and help magnify these faraway objects.

The light from those galaxies has been traveling for billions of years, NASA administrator Bill Nelson explained. Specifically, you're looking at the galaxy cluster SMACS 0723 as it appeared some 4.6 billion years ago. Behind it, however, are more ancient galaxies.

"This first image from NASA's James Webb Space Telescope is the deepest and sharpest infrared image of the distant universe to date. Known as Webb's First Deep Field, this image of galaxy cluster SMACS 0723 is overflowing with detail," NASA explained in a statement. "Thousands of galaxies – including the faintest objects ever observed in the infrared – have appeared in Webb's view for the first time. This slice of the vast universe covers a patch of sky approximately the size of a grain of sand held at arm's length by someone on the ground."

## **GALACTICA**

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President Joe Biden unveiled this image during a White House event Monday, July 11.



(NASA calls this image "Webb's First Deep Field." It's an image of the galaxy cluster "SMACS 0723." The mass of the galaxies distorts, and magnifies, more distant galaxies in the background.  
Image credit: Webbtelescope.org)

## **Exoplanet spectrum from WASP-96 b**

Using instruments called spectrometers, Webb can sleuth out what the atmosphere's of distant, alien worlds are composed of. Some planets, for example, might contain water, methane, and carbon dioxide, which could potentially mean they're habitable worlds.

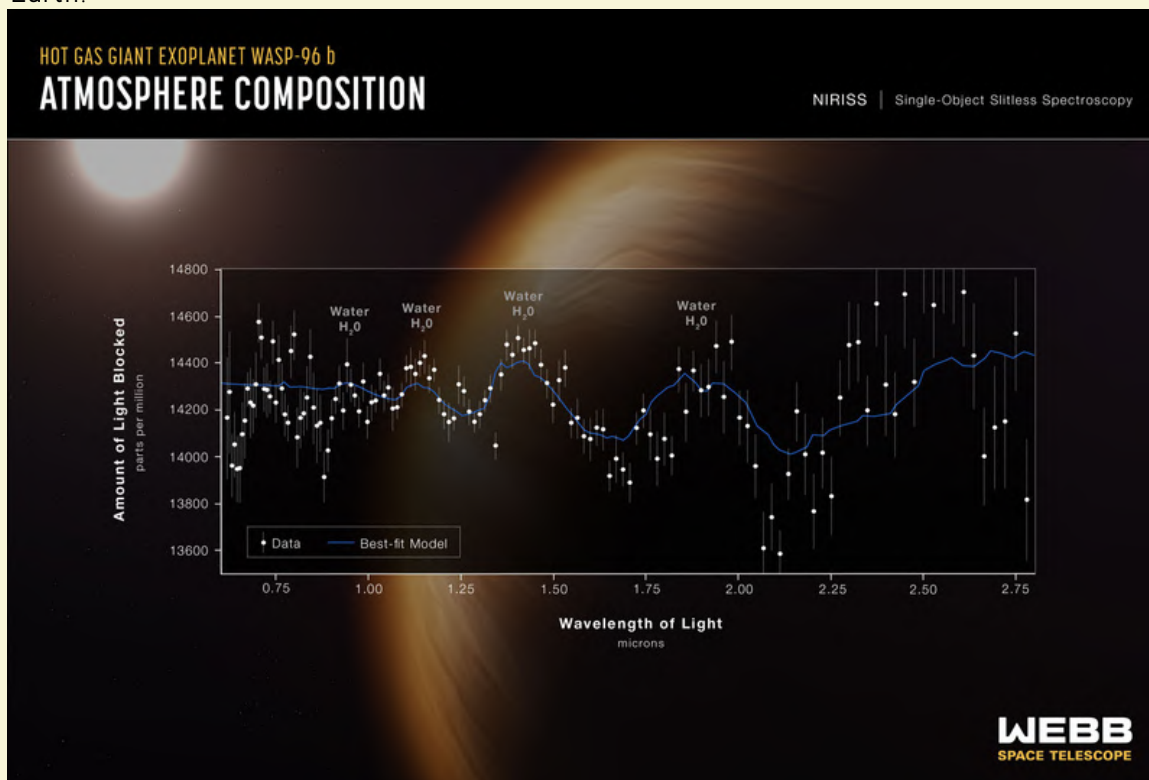
Webb's first spectrum of the gases on an exoplanet comes from WASP-96 b, known as a "hot Jupiter." It's a high-temperature gas giant that zooms around its star at tremendous speeds, taking just 3.4 days for a single orbit.

"NASA's James Webb Space Telescope has captured the distinct signature of water, along with evidence for clouds and haze, in the atmosphere surrounding a hot, puffy gas giant planet orbiting a distant Sun-like star," NASA explained. "The observation, which reveals the presence of specific gas molecules based on tiny decreases in the brightness of precise colors of light, is the most detailed of its kind to date, demonstrating Webb's unprecedented ability to analyze atmospheres hundreds of light-years away."



## GALACTICA

While the Hubble Space Telescope has analyzed numerous exoplanet atmospheres over the past two decades, capturing the first clear detection of water in 2013, Webb's immediate and more detailed observation marks a giant leap forward in the quest to characterize potentially habitable planets beyond Earth.



(Exoplanet WASP-96 b – transit light curve. Image credit: Webptelescope.org)

## The Southern Ring Nebula

The Southern Ring Nebula is a type of object called a "planetary nebula." These are vivid shells of gas and dust expelled into space by a dying star. This well-known planetary nebula is some 2,000 light-years from us.

"Some stars save the best for last," NASA wrote. "The dimmer star at the center of this scene has been sending out rings of gas and dust for thousands of years in all directions, and NASA's James Webb Space Telescope has revealed for the first time that this star is cloaked in dust."



(Southern Ring Nebula - NIRCам and MIRI Images Side by Side. Image credit: Webptelescope.org)

## **GALACTICA**

### **Stephan's Quintet**

Stephan's quintet is a well-known group of galaxies some 290 million light-years away. Four of them are relatively close to one another, "locked in a cosmic dance of repeated close encounters," said NASA.

"With its powerful, infrared vision and extremely high spatial resolution, Webb shows never-before-seen details in this galaxy group," NASA explained. "Sparkling clusters of millions of young stars and starburst regions of fresh star birth grace the image. Sweeping tails of gas, dust, and stars are being pulled from several of the galaxies due to gravitational interactions."



(Stephan's Quintet - NIRCам and MIRI Composite Image. Image credit: Webbtelescope.org)

### **The Carina Nebula**

Nebulae are some of the most dazzling regions of space. They're giant clouds of dust and gas, like those formed after a giant star's explosion. They're fertile grounds for new stars to form. Webb captured a view of the colossal Carina Nebula, located some 7,600 light-years away, a place where large stars have already formed.

"This landscape of 'mountains' and 'valleys' speckled with glittering stars is actually the edge of a nearby, young, star-forming region called NGC 3324 in the Carina Nebula," wrote NASA. "Captured in infrared light by NASA's new James Webb Space Telescope, this image reveals for the first time previously invisible areas of star birth." The tallest 'peaks' you see here are some seven light-years high, the space agency added.



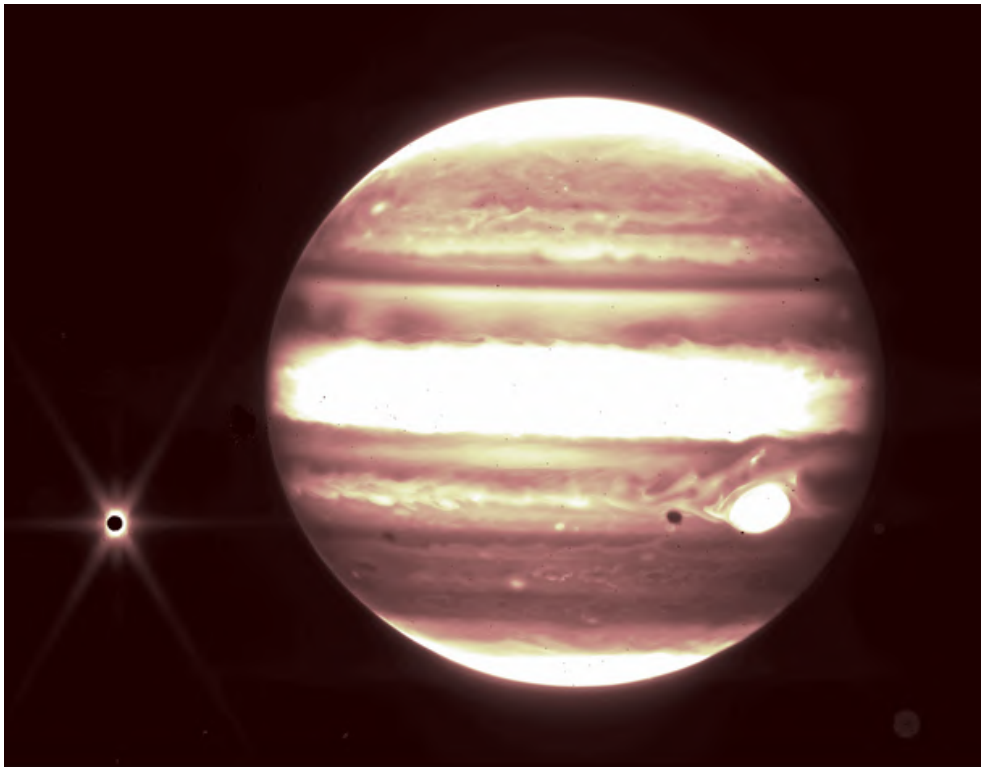


("Cosmic Cliffs" in the Carina Nebula -NIRCam Image. Image credit: Webbtelescope.org)

**Webb's View of Something Closer to Home: Jupiter**

The new James Webb Space Telescope can capture photographs not only of galaxies across the universe but also of objects in our celestial backyard.

NASA released images of Jupiter, the largest planet in our solar system, which is currently just 430 million miles away from Earth. The Jupiter photos were captured during Webb's commissioning period when mission team members were calibrating and vetting the observatory's four science instruments and other systems.



(Jupiter, and its moon Europa, left, seen through the James Webb Space Telescope's NIRCam instrument 2.12-micron filter. Image credit: Webbtelescope.org)

# CHINA'S TIANWEN-1 ORBITER HAS MAPPED THE ENTIRE SURFACE OF MARS

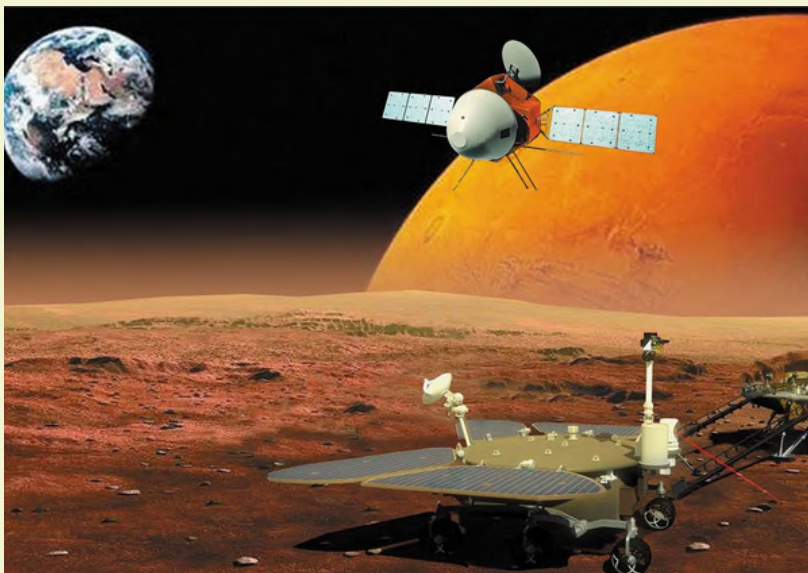
**China's Tianwen-1 Mars probe consists of an orbiter, a lander and a rover named Zhurong.**

China National Space Administration (CNSA) announced on 4th July 2022 that the orbiter and rover of the country's Tianwen-1 probe have both completed their targeted scientific exploration missions. After operating for 706 days and circling the red planet over 1,344 times, the orbiter of Tianwen-1 has acquired medium-resolution image data that covers the whole globe of Mars.

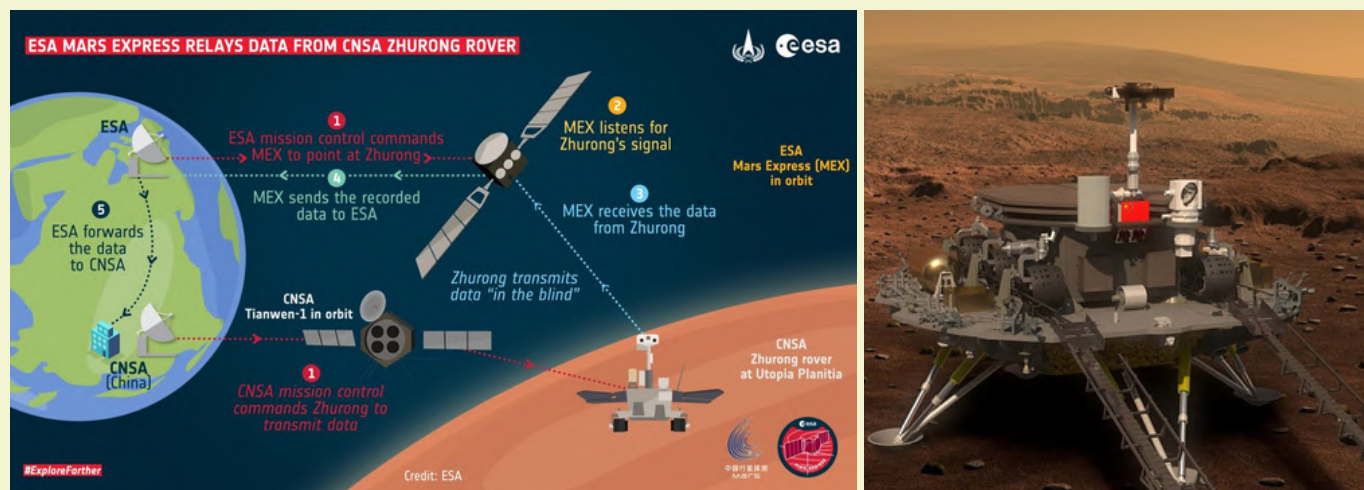
The Tianwen-1 probe consists of an orbiter, a lander and a rover named Zhurong. It touched at its landing area in the vast Martian plain of Utopia Planitia on May 15 last year, marking the first time that China landed a probe on the planet. Zhurong started patrolling the planet on May 22, 2021 and finished its 90-Martian-day mission on August 15 the same year but continue further exploration.

The rover traveled a total of 1,921.5 meters on the surface of Mars till May 18 this year, when it was switched to dormant mode due to the cold winter and dusty weather on the planet. CNSA says that it will resume operations again after sometime around December this year when working conditions get better.

The rover and the orbiter have collected over 1,040 GB of raw scientific data with their 13 onboard scientific payloads after two years of flight and exploration. After the data is completely received and processed on Earth, it will be turned into standard scientific data products and then, they will be delivered to scientists for further analysis and interpreted monthly. According to CNSA, the data will be open to scientists worldwide and "China welcomes global scientists to apply for related research and jointly push forward the exploration of the universe."



CNSA says that it has already shared the data with NASA and the European Space Agency (ESA) and that it has cooperated with them in collision forecasting. Zhurong and ESA's Mars Express spacecraft also performed an in-orbit relay communication test.





# MEGACOMET "K2" CAPTURED ON CAMERA CROSSING THE CELESTIAL EQUATOR



Comet C/2017 K2 PANSTARRS was captured on June 18, 2022 in the constellation of Ophiuchus at magnitude 9.7. (Image credit: John Chumack/galacticimages.com)

**The comet is past Earth but may grow brighter as it approaches the sun in December.**

A mega comet has just passed safely by Earth, but there's still a chance it will grow brighter through the summer as it reaches its closest approach to the sun in December.

Comet C/2017 K2 (PANSTARRS), called K2 for short, made its closest approach to our planet on Thursday (July 14). It passed 168 million miles (270 million kilometers) from Earth.

This distant approach meant that K2 had a bit of a dim showing, despite its sheer size. The mega comet was first spotted in 2017 by the Panoramic Survey Telescope and Rapid Response System (PanSTARRS) in the outer reaches of the solar system.

But there's more to come, as K2 now continues its journey to the sun and will make its closest approach to the star around which it orbits, the so-called perihelion, in December. The comet, which is visible these days by large amateur telescopes, may brighten up in the warmer environment closer to the sun and move into average binocular range if we are lucky.



(Perfect timing for a conjunction with a star cluster. Gerald Rhemann photographed the big comet passing by M10 on July 15th.)

The comet seems to be launching a jet of material in the direction of the cluster's center. Actually, no. Just one of the comet's two tails is visible there. An ion tail and a dust tail are present in all comets. The solar wind blows the gaseous ion tail directly away from the sun. The comet's orbit is more precisely traced by the heavier dust tail. The ion tail is what is pointing toward the star cluster.

The comet seems to have originated in the Oort cloud. Unlike other comets that appear repeatedly, this was the K2 comet's first trip to our inner solar system.

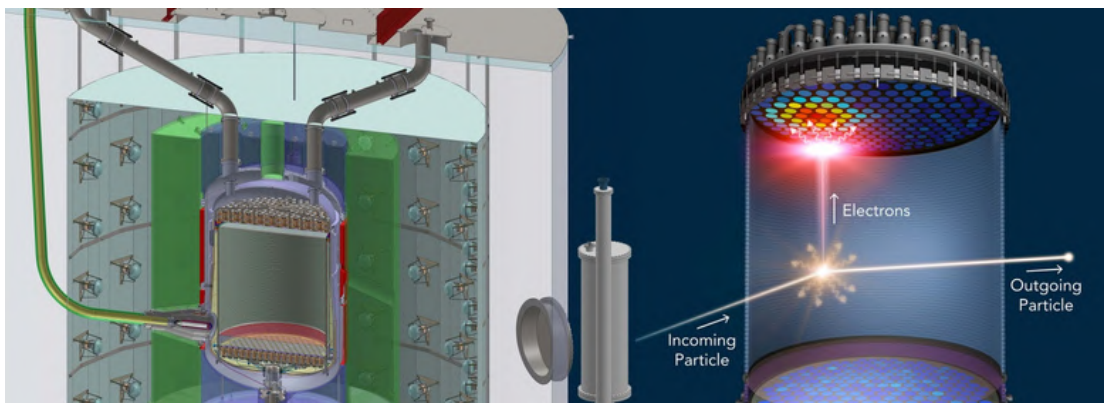
# WORLD'S MOST SENSITIVE DARK MATTER DETECTOR DELIVERS 1ST RESULTS

The world's largest and most sensitive dark matter experiment has come to life and is delivering results, moving a step closer to offering clues about one of the biggest mysteries of the Universe.

The LUX-ZEPLIN Dark Matter Experiment (LZ), based at the Sanford Underground Research Facility in South Dakota, US, has gathered its first result - showing the experiment is successfully operating as designed.

### About LUX-ZEPLIN (LZ) Dark Matter Detector

- LZ Dark Matter Detector has been installed deep down the Black Hills in South Dakota in Sanford Underground Research Facility(SURF).
- The experiment is led by DOE's Lawrence Berkeley National Laboratory (Berkeley Lab).
- It is the most sensitive dark matter detector of the world.
- Researchers had collected data for more than three-and-a-half-month in initial operations. This period was sufficient to confirm the proper functionality of all aspects of LZ detector.



In the heart of a new dark matter detector, LUX-ZEPLIN (LZ), a 5-foot-tall detector filled with 10 tons of liquid xenon, will search for hypothetical dark matter particles to produce flashes of light as they traverse the detector.

(Image credit: SLAC National Accelerator Laboratory)

### Significance of the LZ

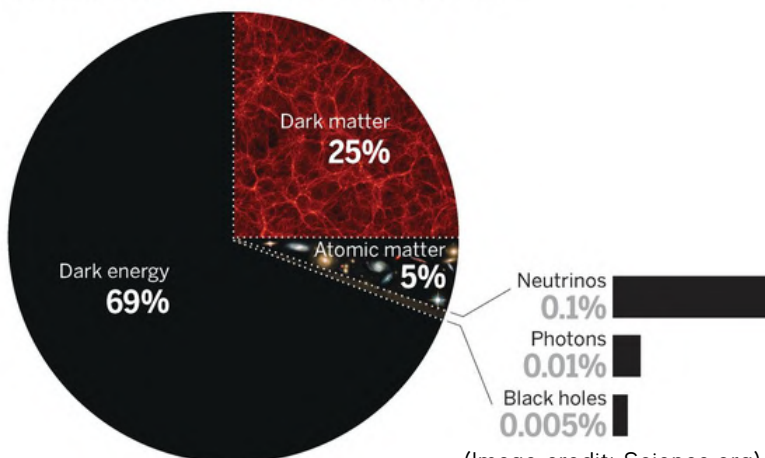
Dark matter particles have never been detected earlier. But this will not be true for longer. Initial results from the first 60 days live days testing of LZ have generated positive results.

### Presence of Dark Matter

Dark matter is not yet seen because it does not absorb, emit or scatter light. However, presence of dark matter and gravitational pull are fundamental to universe. Dark matter accounts for 85 percent of the total mass of universe. It is responsible for the movement of galaxies and shaping.

### The multiple components that compose our universe

Current composition (as the fractions evolve with time)



(Image credit: Science.org)

### About the LZ experiment

As a part of LZ experiment, two nested titanium tanks detected faint sources of light from the LZ dark matter detector. The two tanks were filled with ten tonnes of liquid xenon. They were seen through two arrays of photomultiplier tubes (PMTs). Particles mimicking a dark matter signal are detected using the titanium tanks.

### Who designed the detector?

LUX-ZEPLIN detector was designed, manufactured and installed by the Berkeley Lab in association with an international team of 250 scientists and engineers from more than 35 institutions in the UK, US, South Korea and Portugal.

### What's next for LZ?

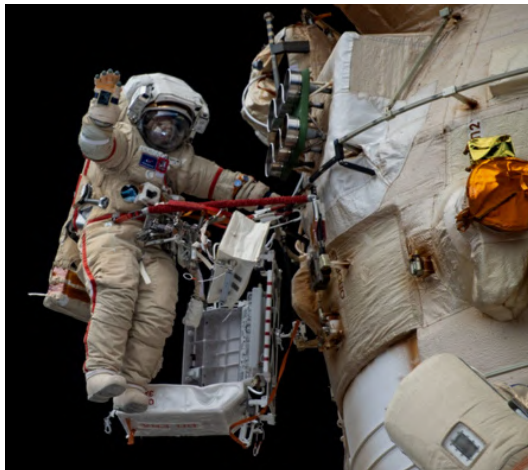
With confirmation that LZ and its systems are operating successfully, Lesko said, it is time for full-scale observations to begin in hopes that a dark matter particle will collide with a xenon atom in the LZ detector very soon.



# 1st European female spacewalker and Russian cosmonaut complete works on ISS



(The European Space Agency's Samantha Cristoforetti (left) was scheduled to embark on the first European spacewalk by a female on July 21, 2022. At right is fellow astronaut Alexander Gerst. Image credit: ESA)



22 July 2022. - ESA's Samantha Cristoforetti became the first European female spacewalker when she went outside the International Space Station (ISS) with Russian cosmonaut, Oleg Artemyev, to complete a seven-hour mission working on the space station.

Works carried out by the pair included installing platforms and workstation adapter hardware to the Nauka laboratory module. They also hand deployed 10 nanosatellites to gather radio electronics data. Cristoforetti and Artemyev prepared the 11.3-meter long European Robotic Arm (Smart spacewalker) for operational use as well.

The astronaut-cosmonaut duo completed their EVA (extravehicular activity) wearing Russian-built Orlan spacesuits. The Russian-operated spacewalk was the sixth for Artemyev and it was also the sixth EVA at the ISS this year.

The two started the mission 50 minutes late, nonetheless, they were still able to complete all but one planned activity.

The extension of the Strela telescoping boom from the Zarya service module to the Poisk research module had to be postponed. Mission termination was necessary because of spacesuit life support system constraints.

### SMART SPACEWALKER

**The European Robotic Arm**

**Tasks**

- installing, removing or replacing **experiment payloads** and large Station elements.
- transferring small payloads **in and out** of the Station through the Russian airlock.
- transporting crew members** from one external working site to another.
- freeing cosmonauts to do **other work** during spacewalks.
- using its **cameras to inspect** the outside of the Space Station.

**esa**

**Arm length:** 11.3 m

**Reach:** 9.7 m

**Tip position accuracy:** 5 mm

**Maximum speed of operations:** 10 cm/s

**Degrees of freedom:** 7

**Launch mass:** 630 kg

**Handling capability:** 8000 kg

**Control:** Autonomous or by astronaut commands

**Main construction materials:** Carbon fibre and aluminium

**Home base:** Multipurpose Laboratory Module (Nauka)

**Range of motion:** Hand-over-hand on the Russian Space Station segment

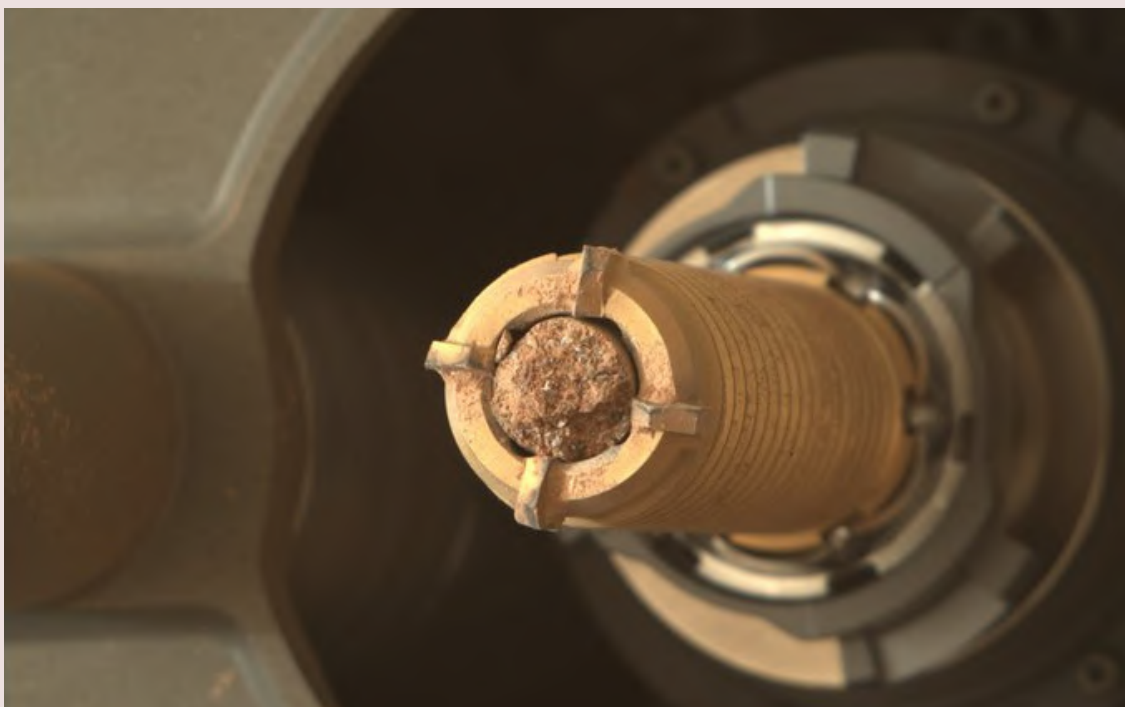
# NASA'S PERSEVERANCE COLLECTS 10TH ROCK SAMPLE ON MARS

**NASA'S Perseverance Mars rover is currently exploring Jezero Crater's ancient river delta and collecting samples for return to Earth. The six-wheeled explorer has collected ten samples of Martian rock to date.**

On July 13, NASA's Mars rover Perseverance collected its 10th tiny rock sample as it continues exploring the Red Planet looking for fragments of Martian soil that might harbor traces of past life, which a future mission might deliver to Earth.

Perseverance recently expanded the scope of its tasks and started scouting for a convenient location where a possible future sample return mission could land. That location would not only offer a future craft a place to safely touchdown but also provide a suitable environment to set up the first ever launchpad on a planet other than Earth.

The Mars Sample Return mission, proposed jointly by NASA and the European Space Agency (ESA), could launch to the Red Planet in 2028 and pick up the samples prepared by Perseverance in Jezero Crater. From there, a small rocket known as the Mars Ascent Vehicle (MAV) would bring the samples to an orbiter that can take them to Earth.

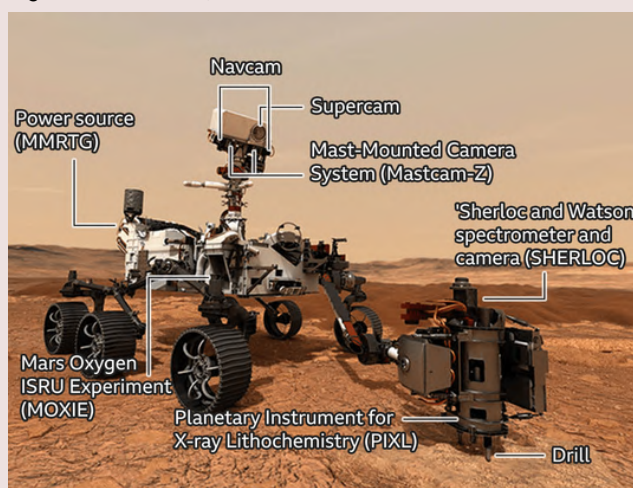


NASA's Mars rover Perseverance collected its tenth sample as it looks for rocks that have a potential to harbor traces of past life. (Image credit: NASA)

Perseverance, which landed on Mars in February 2021, carries 43 test tubes, 38 out of which are to be filled with samples. The rover uses a small drill on the end of its robotic arm to extract promising rock fragments.

Since there is only a limited number of tubes, the rover team carefully evaluates every location before drilling in order not to waste precious space on less promising rocks.

The rover, which filled its first tube in September 2021, is currently surveying an ancient river delta. During 2nd week of July, the rover collected its ninth sample at that location. The rover's team hinted at the potential for harboring traces of past life of this particular site.



(Image credit: NASA.gov)



# CHINA LAUNCHES SECOND SPACE STATION MODULE, WENTIAN

**The 23-tonne Wentian ("Quest for the Heavens") laboratory module launched on the back of China's most powerful rocket, the Long March 5B, at 2:22 p.m. on July 24.**

China began constructing the space station in April 2021 with the launch of the Tianhe module, the main living quarters, in the first of 11 crewed and uncrewed missions in the undertaking.

The Wentian lab module, 17.9 metres (59 feet) long, will be where astronauts can carry out scientific experiments, along with the other lab module yet to be launched ("Dreaming of the Heavens").

Wentian features an airlock cabin that is to be the main exit-entry point for extravehicular activities when the station is completed.

It will also serve as short-term living quarters for astronauts during crew rotations on the station, designed for long-term accommodation of just three astronauts.

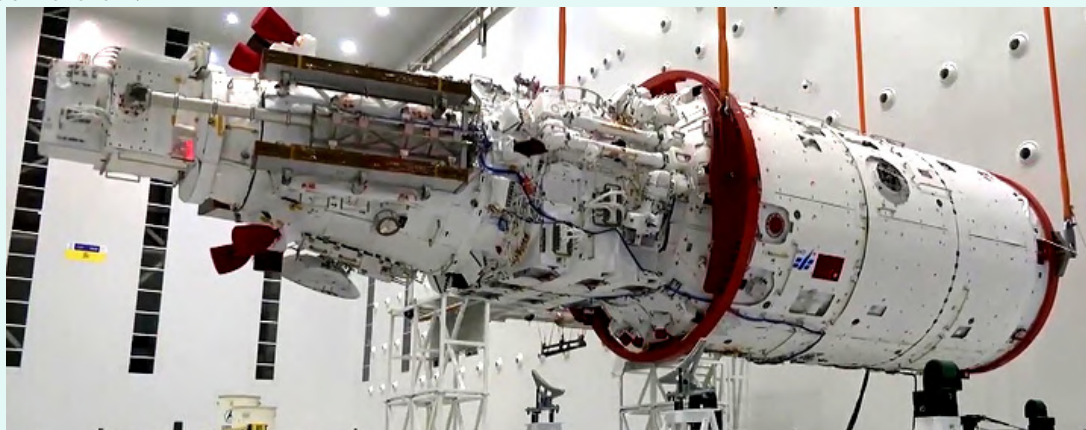
Mengtian is expected to be launched in October and, like Wentian, is to dock with Tianhe, forming a T-shaped structure.



A Long March-5B Y3 rocket carrying China's space station lab module Wentian blasts off from Wenchang Spacecraft Launch Site in Wenchang, Hainan Province of China. (Image credit: VCG/VCG via Getty Images)

The completion of the structure, about a fifth of the International Space Station (ISS) by mass, is a source of pride among ordinary Chinese people and will cap President Xi Jinping's 10 years as leader of China's ruling Communist Party.

On board the space station are Shenzhou-14 mission commander Chen Dong and team mates Liu Yang and Cai Xuzhe. They are slated to return to Earth in December with the arrival of the Shenzhou-15 crew.



(Wentian lab module prior to launch. Image credit: CNSA)

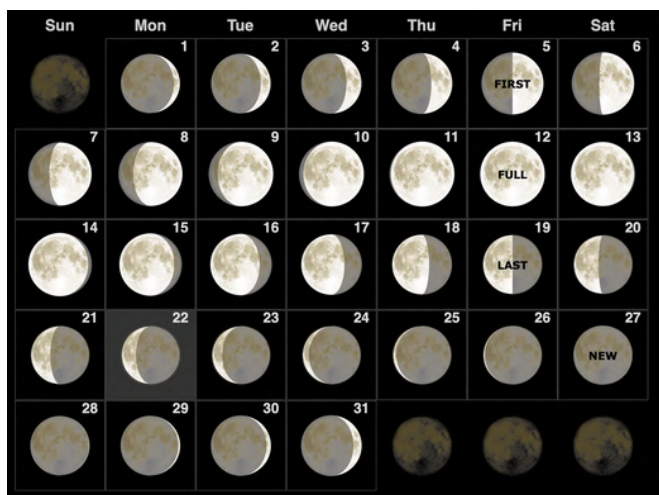
# WHAT'S UP IN THE SKY - AUGUST 2022

## LUNAR CALENDAR

### IMPORTANCE OF MOON PHASES FOR STARGAZERS

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

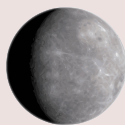
So, What Moon phase is best for stargazing? "The New Moon and the days immediately before and after the new moon (Crescent phases)" are among the best times for stargazing. Whereas the Remaining phases like Full Moon, waxing or waning gibbous, the first or third quarter Moon offers a time to zoom in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



## PLANETS VISIBILITY

### Mercury

Reaches greatest eastern elongation of 27.3 degrees from the Sun at 27th of August. Tricky to see.



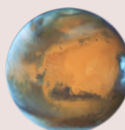
### Venus

Bright morning planet. Waning crescent Moon nearby on 25 and 26 August.



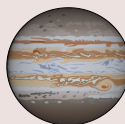
### Mars

Bright morning planet. Near Uranus at the start of August and the Pleiades on 18 August.



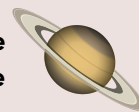
### Jupiter

Bright morning planet. It will be visible in the night sky throughout the month of August.



### Saturn

Opposition on 14 August. It will be visible in the night sky throughout the month of August.



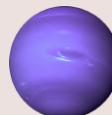
### Uranus

Morning planet, becoming well placed towards the end of August.



### Neptune

Morning planet reaching an altitude of over 30degrees from mid-August.



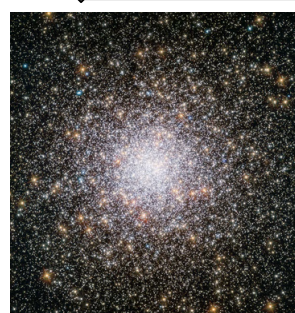
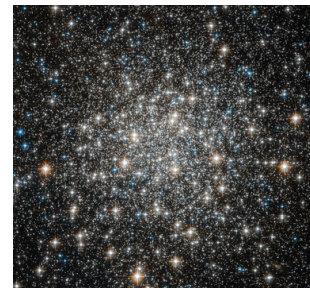
## BRIGHT DEEP SKY OBJECTS

Messier 6 also known as The Butterfly Cluster, M6, or NGC 6405 is an open cluster of stars in the constellation of Scorpius. Its name derives from the vague resemblance of its shape to a butterfly. Estimates of the Butterfly Cluster's distance have varied over the years, with a mean value of around 1,600 light years, giving it a spatial dimension of some 12 light years.



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

Messier 10 or M10 is a globular cluster of stars in the constellation of Ophiuchus. The object was discovered by the Charles Messier on 1764 and described it as a "Nebula without stars". It is roughly 15,000 light-years from Earth and has an apparent magnitude of 6.4. This cluster can be easily observed during early August.



Messier 19 or M19 is a globular cluster in the constellation Ophiuchus. It was discovered by Charles Messier on 1764 and added to his catalogue of comet like objects that same year. It was resolved into individual stars by William Herschel in 1784. The cluster is located 28,500 light-years from Earth and It has an apparent magnitude of 7.7.



# ROCKET LAUNCHES IN AUGUST 2022

## Blue Origin's NS-22 crewed mission has targeted the liftoff for August 4th

Blue Origin announced its next space tourist mission crew on the New Shepard rocket. The mission, called NS-22, will carry six passengers on a suborbital spaceflight from West Texas.



### Crew Members:

Riding aboard will be: engineer and researcher Sara Sabry, entrepreneur Mario Ferreira, explorer and retired financial manager Vanessa O'Brien, retired U.S. military manager Clint Kelly III, former telecommunications contractor Steve Young, and Dude Perfect co-founder and comedian Coby Cotton.

After the powered phase performed by the booster, the crew will experience roughly three minutes of weightlessness before the capsule began to reenter the atmosphere. Once in low atmosphere, the capsule will deploy parachutes and land softly in the Texas desert.



## TERRAN 1 - THE FIRST ENTIRELY 3D-PRINTED ROCKET

Relativity Space is scheduled to launch a Terran 1 rocket as part of the Good Luck, Have a Fun mission. The launch window for the Test Flight mission is on August 31, 2022, from Cape Canaveral Space Force Station, Florida.

Agency: Relativity Space



As a next-generation launch vehicle, Terran 1 is designed for the future of constellation deployment and resupply. Its groundbreaking, unique and software-driven architecture is capable of accommodating satellite customers' evolving needs, while also providing the most agile and affordable launch service on the market. Designed and printed in the USA, Terran 1 is the most innovative product to emerge from the aerospace manufacturing industry since the dawn of the privatization of space 20 years ago.

# ISRO to undertake maiden flight of SSLV

**Lift Off Date: August 7, 2022**

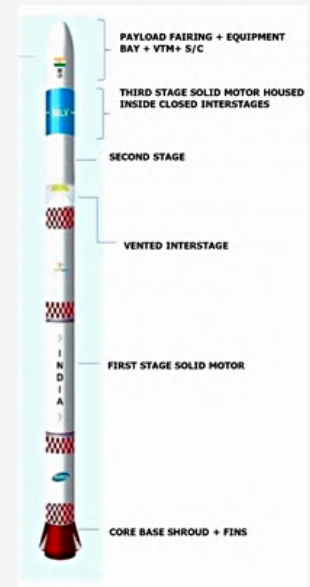
**MISSION: First test flight of Indian SSLV (Small Satellite Launch Vehicle).**

"The launch of the SSLV-D1/EOS-02 Mission is scheduled for Sunday, August 7, 2022, at 9:18 am (IST) from Satish Dhawan Space Centre (SDSC), Sriharikota," ISRO announced on its Twitter account.

The Indian Space Research Organisation (ISRO) will undertake the maiden flight of its newly developed Small Satellite Launch Vehicle (SSLV) on August 7, ahead of the Independence Day celebration.

This is significant given that India was set to celebrate 75th Independence Day with the first human spaceflight, as per the deadline set by Prime Minister Narendra Modi in his speech from the ramparts of the Red Fort on Independence day, 2018.

The work on Gaganyaan mission, country's first manned flight to space, was delayed due to the pandemic, with the first abort test scheduled for later this year, to demonstrate the crew escape system to be used in case of an emergency mid-flight.



The SSLV mission too was delayed by a couple of years due to the pandemic. Experts believed that this could hamper the economic prospects of the space agency in the global space market as the new launch vehicle has been designed keeping in mind commercial launches of small satellites with a quick turn-around time for the missions.

On its first flight, the SSLV will carry one of India's Earth Observation Satellites - EOS-2 - that will have applications in mapping and developing various GIS applications.

It will carry a mid-wavelength infrared camera and a long-wavelength infrared camera with a resolution of 6 metres. The satellite, weighing 142 kg, will have a mission life of ten months.

"The SSLV launch was long overdue. It will shift the burden of commercial launches from Polar Satellite Launch Vehicles (PSLV). And, will likely offer cheap, quick launch for small satellites. ISRO should have the wherewithal to do that, especially now that space startups are being encouraged," said Ajey Lele, senior fellow at Manohar Parrikar Institute for Defence Studies and Analyses.

In its maiden flight itself, SSLV will also carry the AzadiSat, a satellite developed by 750 rural students from across the country coordinated by SpaceKidz India, a space start-up.

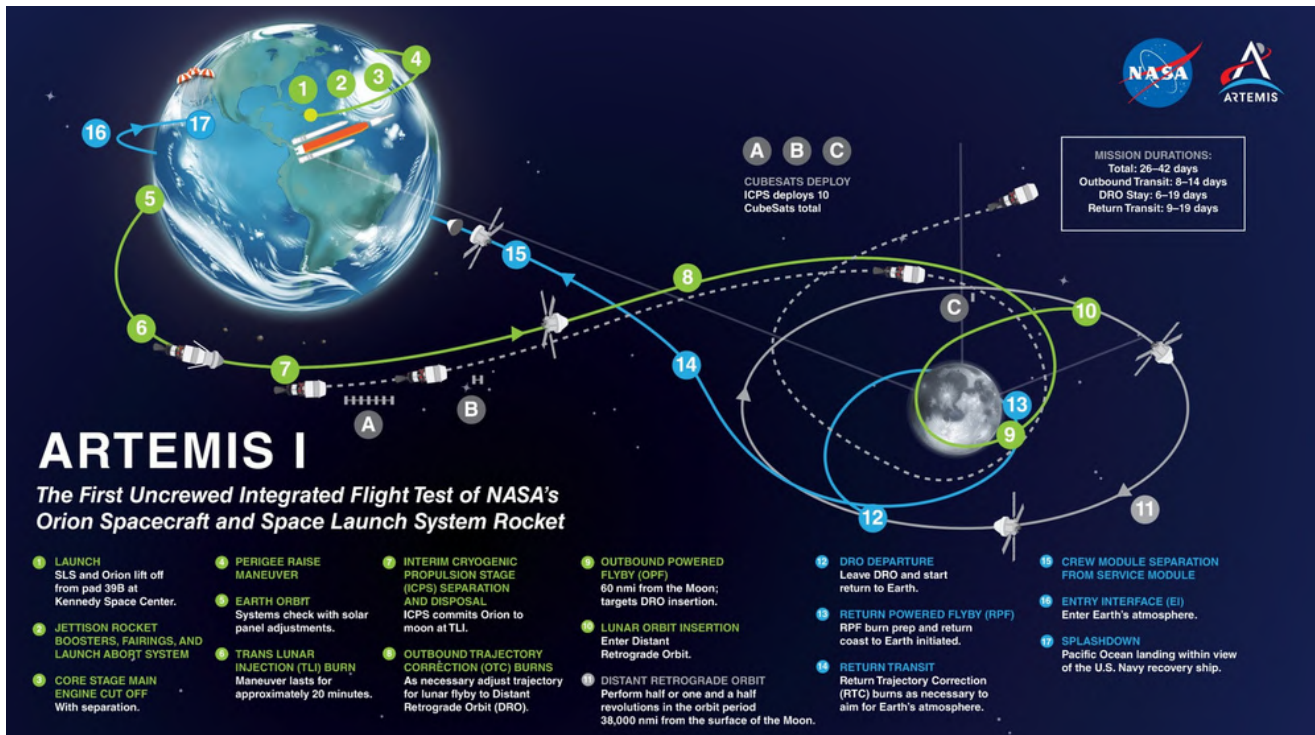
The satellite was shipped to Sriharikota on Monday, ready for integration with the launch vehicle.

Primarily designed as a commercial vehicle, the SSLV is likely to cost a fourth of the current PSLV. It can also be assembled by a team of six people within seven days in comparison to a team of 600 people who take a couple of months to assemble a PSLV.



# NASA'S 1ST UNCREWED MOON ROCKET TO LAUNCH IN AUGUST

Artemis-1 is the first in a series of missions as the United States seeks to return humans to the Moon, build a sustained presence there, and use the lessons gained to plan a trip to Mars sometime in the 2030s. NASA associate administrator Jim Free told reporters the first window of possible launch dates for the giant Space Launch System and Orion crew capsule were August 29, September 2, and September 5. The decision follows final checks on the ground at the Kennedy Space Center in Florida known as "wet dress rehearsals." The last of these tests, carried out in June, met 90 percent of the team's goals, and on Wednesday Cliff Lanham, senior vehicle operations manager, said engineers have now replaced faulty seals that had caused a hydrogen leak on SLS during the final trial.



Artemis-1 is set to journey around the far side of the Moon in a mission lasting four to six weeks longer than any ship for astronauts has done without docking, before returning home faster and hotter than every vessel before. It will also deploy several small satellites called CubeSats to perform experiments in space.

Artemis mission manager Mike Sarafin told reporters: "Our first and our primary objective is to demonstrate Orion's heat shield in lunar reentry conditions."

When the capsule returns from the Moon, it will be traveling about 24,500 miles an hour (39,400 kilometers per hour) and experience temperatures half as hot as the Sun outside its heat shield.

The second objective is to demonstrate the flight worthiness of the rocket and crew capsule as they perform all their maneuvers over the course of the mission.

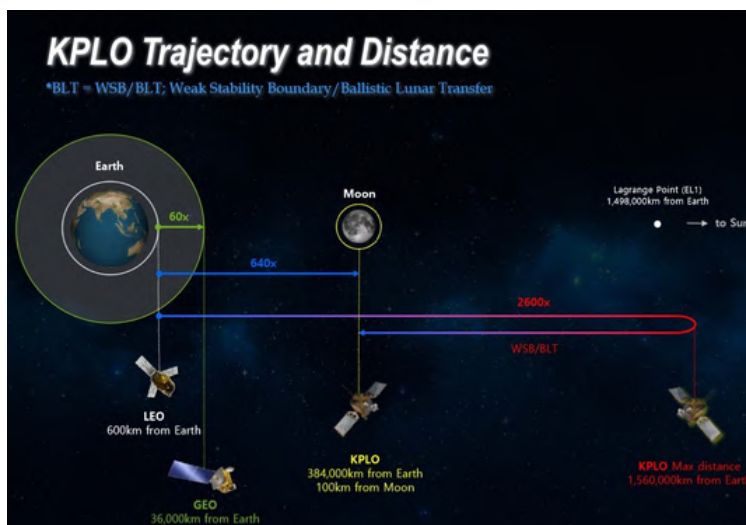
Finally, NASA will look to successfully retrieve Orion after splashdown, and thoroughly inspect it.



# SpaceX Launches - August 2022

## SPACE X FALCON 9 BLOCK 5 | KPLO | AUG 5, 2022

The **Korea Aerospace Research Institute (KARI)** signed a lunar exploration technical cooperation with NASA which increased the possibility of exploration success greatly. A Korean Pathfinder Lunar Orbiter (KPLO) is to be followed by a Korean Lunar Explorer (KLE) which consists of an orbiter and a lander unit equipped with a small rover with a mass of approximately 20 kg. The key goals of the Korean lunar mission are the investigations of lunar geology and space environment, exploration of lunar resources, and testing of future space and planetary exploration technology which will assist in future human activities on the moon and beyond. If all goes well, South Korea will join the small number of countries to have sent spacecraft to the Moon—and scientists around the world are looking forward to the results. The Korea Pathfinder Lunar Orbiter (KPLO) carries “a cadre of instruments that will yield important information about the Moon,” says Clive Neal, a lunar scientist at the University of Notre Dame.

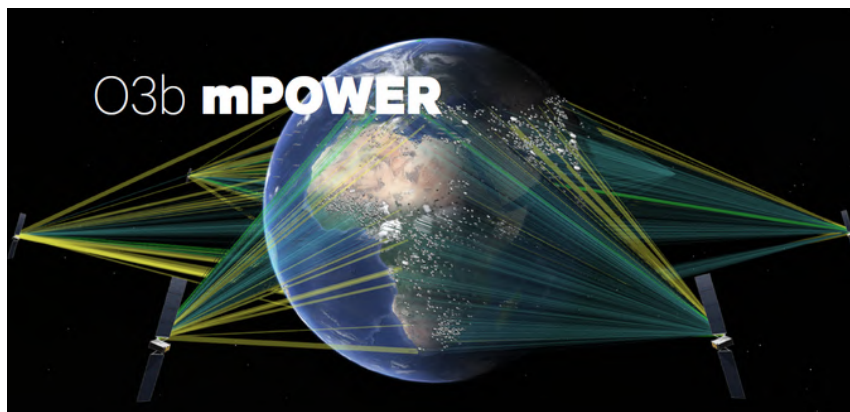


## SES'S O3B MPOWER SATELLITES TO PROVIDE GLOBAL HIGH-SPEED CONNECTIVITY

The O3b Satellite Constellation, provides telecommunications and data backhaul from remote locations, offering low-latency Internet backhaul to emerging markets and developing countries through a series of satellites in equatorial orbits 8,000 Kilometers in altitude.

Data speeds of up to 10 Gbps are supported by each first-generation satellite with a total capacity of over 160 Gbps Once the initial operational constellation has completed deployment. O3b Networks Ltd. is the operator of this new satellite constellation, named after “**the Other 3 Billion**” – referring to the population of the world that has no access to broadband data services without help.

The O3b satellite constellation is planned to consist of eight satellites in its initial phase before the number of active spacecraft is doubled to 16. The fleet of satellites orbits the Earth in a circular, equatorial Medium Earth Orbit at an altitude of 8,063 Kilometers. O3b provides fiber-like trunking capacity to telecom operators and backhaul directly to 3G Cellular and WiMAX towers. **SpaceX** will launch 6 satellites series of constellation on board the Falcon 9 rockets throughout the month of August, The launch dates are yet to be announced.

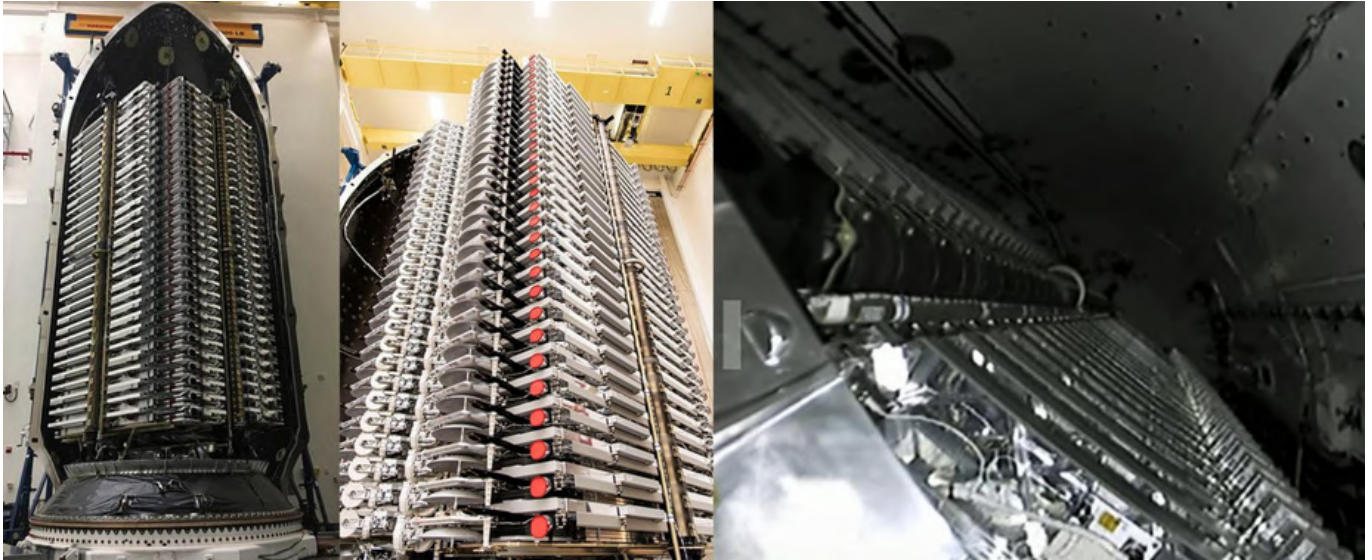




# STARLINK SATELLITE SERIES

## August 10: Starlink Group 4-26

SpaceX will launch Starlink satellites atop Falcon 9 Block 5, a partially reusable two-stage launch vehicle, from Launch Complex 40, Cape Canaveral Space Force Station, Florida. Starlink is a SpaceX initiative to create a global Broadband network by using a constellation of LEO satellites and providing high-speed, low-latency broadband internet across the globe.



(SpaceX's Starlink satellites launch in batches of 60.)

## Starlink Group 4-23 | Starlink Group 3-3 | Starlink Group 4-27

SpaceX will launch 3 more batches of Starlink satellites in the month of August (dates are yet to be announced) for their high-speed low earth orbit internet constellation on Falcon 9 Block 5 rocket from Space Launch Complex 4, Vandenberg Space Force Base, California.



(Image credit: Starwalk.medium)





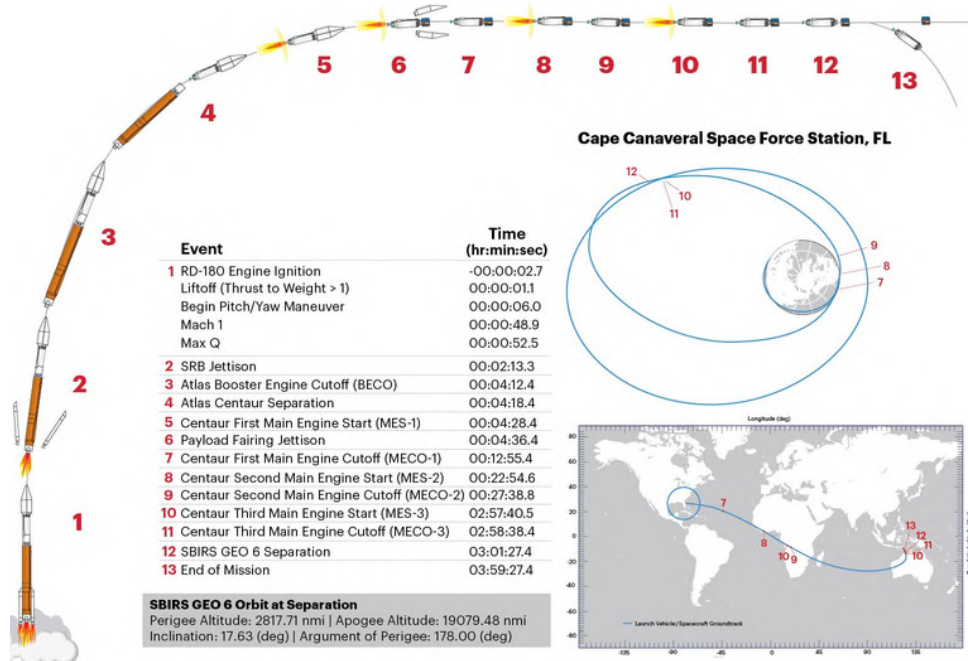
(Image credit: ulalaunch.Com)

## ATLAS V TO LAUNCH SBIRS GEO 6

A United Launch Alliance (ULA) Atlas V 421 rocket will launch the sixth and final Space Based Infrared System Geosynchronous Earth Orbit (SBIRS GEO 6) spacecraft for the U.S. Space Force's Space Systems Command (SSC). Launch Date: Aug. 4, 2022.

### MISSION OVERVIEW

A United Launch Alliance (ULA) Atlas V 421 rocket is launching the sixth Space Based Infrared System Geosynchronous Earth Orbit (SBIRS GEO 6) missile detection and early warning satellite for the U.S. Space Force's Space Systems Command (SSC). ULA's Atlas V rocket will launch SBIRS GEO 6 into a performance optimized geosynchronous transfer orbit (GTO). Liftoff will occur from Space Launch Complex-41 at Cape Canaveral Space Force Station, Florida.



Equipped with powerful scanning and staring infrared surveillance sensors to protect their nation 24/7, the SBIRS spacecraft continue to serve as the tip of the spear for global missile warning as ballistic missile threats proliferate around the world. These infrared sensors, and others in a constellation of persistent overhead satellites, collect data that allow the U.S. military to detect missile launches, support ballistic missile defense, expand technical intelligence gathering and bolster situational awareness on the battlefield.

Built by Lockheed Martin using its modernized LM 2100 Combat Bus™, SBIRS GEO 6 is an enhanced space vehicle providing even greater resiliency and cyber-hardening against growing threats, as well as improved spacecraft power, propulsion, and electronics.

**\*\*Note: Launch dates of missions are scheduled to be launched in August 2022 but may subject to change.**



# ASTRONOMICAL EVENTS - AUGUST 2022

## PERSEIDS METEOR SHOWER

**The Perseids is one of the best meteor showers to observe, producing up to 60 meteors per hour at its peak.**

### Comet Swift-Tuttle

The Perseids are famous for producing a large number of bright meteors. Made of tiny space debris from the comet Swift-Tuttle, which was discovered in 1862. The Perseids are named after the constellation Perseus. This is because the direction, or radiant, from which the shower seems to come in the sky lies in the same direction as Perseus. The Perseids are widely sought after by astronomers and stargazers because most years at its peak, one can see 60 to 100 meteors in an hour from a dark place. The shower runs annually from July 17 to August 24. It peaks this year on the night of August 12 and the morning of August 13.

### How and When to See the Perseids in 2022

You can view meteor showers from anywhere in the world. It doesn't matter what state or country you live in. The best times to watch the Perseids is late at night, in the middle of the night, or predawn. The meteor count is usually highest predawn when the skies are at their very darkest and when your position on Earth is forward to the motion through the dust cloud. Unfortunately, the Moon phases won't be doing us any favor this year. August's full Sturgeon Moon appears on the night of August 11, which means that the Perseids' peak will be considerably washed out by the light of the Moon. The full Moon rises around sunset and sets around sunrise the next morning, so your best chance at seeing meteors in a dark sky will be in the dark hours before dawn, when the Moon is low.



(Image credit: Sky and telescope.com)



### Viewing Tips for the Perseid Meteor Shower

Watching a meteor shower could not be simpler. Just go outside on the night(s) of the Perseid meteor shower "maximum" and look up! You can maximize your chances of seeing meteors by finding an open area far from man-made lights. Of course, cloud cover can prevent you from seeing the shower.

- Get away from light pollution! You'll want to avoid city lights.
- Gaze at whatever part of the sky is darkest at your location.
- You'll need about 20 minutes for your eyes to adapt to the darker skies, so get out earlier and be patient.
- Being comfortable is important. To avoid a stiff neck, bring a chaise lounge or reclining lawn chair.

Don't forget to witness the best Meteor shower of the year.

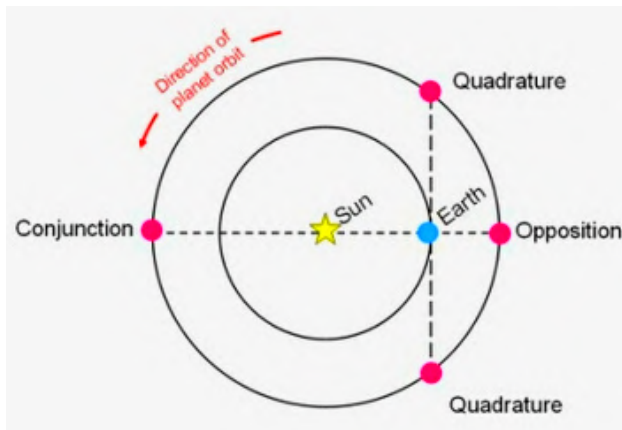
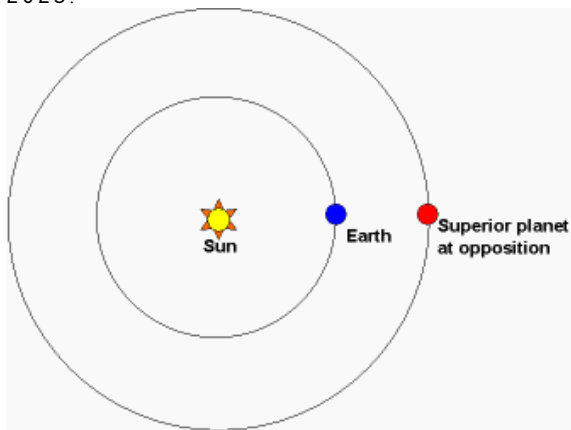


(An image of the comet Swift-Tuttle  
Credits - Planetary.org.)

# SATURN AT OPPOSITION

Saturn's opposition is on 14th August 2022. The ringed planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long. This is the best time to view and photograph Saturn and its moons. A medium-sized or larger telescope will allow you to see Saturn's rings and a few of its brightest moons.

**When and where to watch in 2022:** By early July 2022, Saturn is rising in the east in mid-to-late evening. By the time of its August 14 opposition, Saturn will be rising in the east at sunset and will be visible all night. Afterwards, for the rest of 2022, Saturn will be visible in the evening. It'll continue shifting west, remaining visible in the evening sky through January 2023.



(Opposition happens when Earth flies between an outer planet, like Saturn, and the sun.

Image credit: Heavens-Above.)

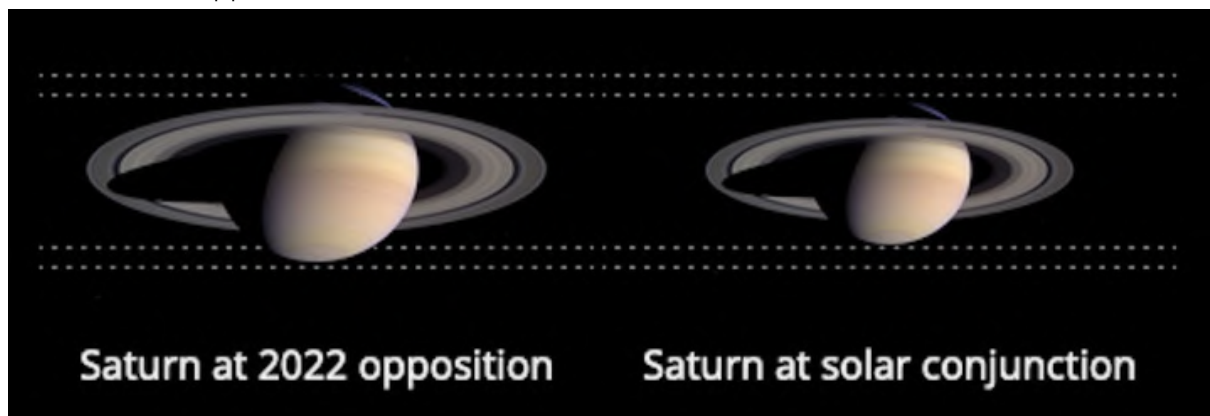
**Brightness at opposition:** Around opposition, the ringed planet shines at its brightest for 2022, at magnitude 0.3.

**Distance from Earth at opposition:** Around opposition, Saturn is at its least distance from Earth for 2022, at 73 light-minutes.

**Constellation at opposition:** Capricornus the Sea Goat.

**Disk size at opposition:** Saturn's disk size is largest around opposition. At its largest, Saturn will appear 18.76 arcseconds across.

**Ring tilt at opposition:** Saturn's rings will appear tilted by 13.9 degrees, relative to earthly viewers, around opposition.



(A comparison of the apparent size of Saturn at opposition (August 14, 2022) and when it is most distant from the Earth at solar conjunction (February 16, 2023). Image credit: In-the-Sky.org.)

## The opposition surge:

Sometimes known as the opposition effect, opposition spike or Seeliger effect, is the brightening of a rough surface, or an object with many particles, when illuminated from directly behind the observer. The term is most widely used in astronomy, where generally it refers to the sudden noticeable increase in the brightness of a celestial body such as a planet, moon, or comet as its phase angle of observation approaches zero. At zero phase angle, the Sun is directly behind the observer and the object is directly ahead, fully illuminated.



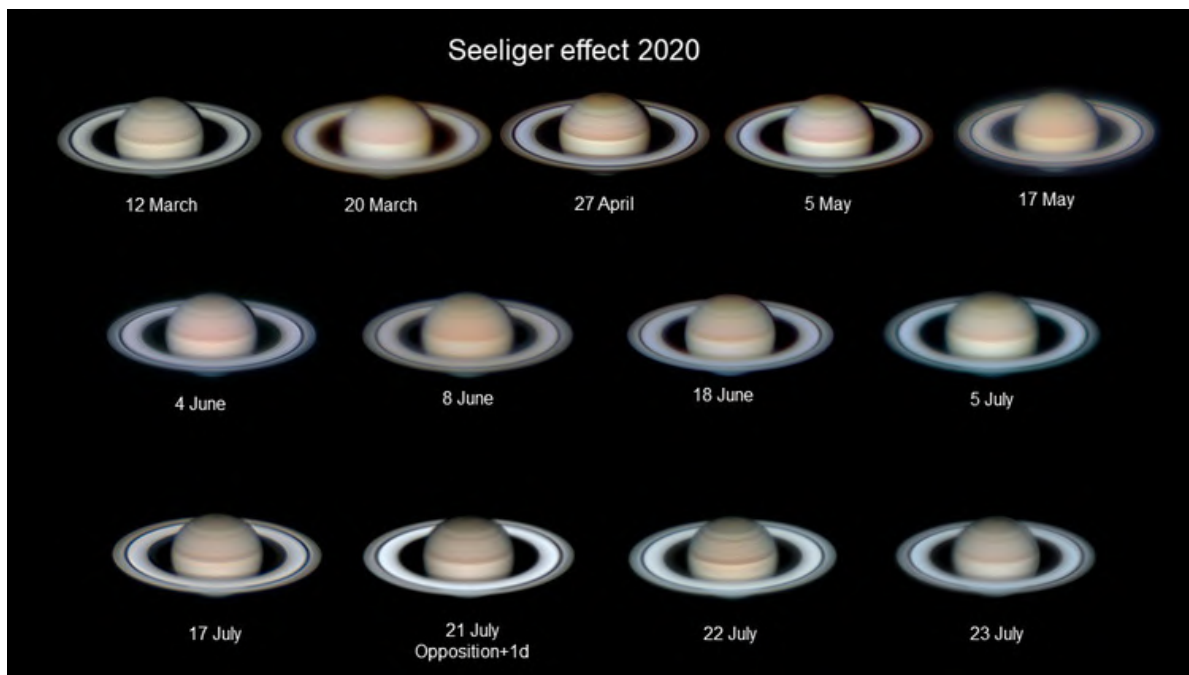
# SATURN AT OPPOSITION

## The Seeliger effect

Generally, when you observe Saturn through a telescope before or after opposition, the rings appear about as bright as the planet's globe. For days around the time of opposition, however, the rings suddenly intensify in apparent brightness, outshining the globe before dimming back to their normal appearance.

German astronomer Hugo von Seeliger (1849–1924) first noticed this change in 1887. Because of his pioneering research into its cause, which led him to conclude that Saturn's rings were composed of tiny particles, the effect was named in this scientist's honor.

**Two major physical processes lead to the Seeliger effect:** shadow hiding and coherent backscattering. When we see Saturn directly illuminated by the Sun (as it is during opposition), the planet's shadow "hides" behind the globe, placing more ring surface into view. As a result, the rings appear to brighten. The same direct lighting angle also causes the shadows of individual particles in the rings to temporarily vanish, enhancing the result.



(Image credit: Cloudy Night.com)

But that's not all. Observations of the opposition effect on Saturn's rings from the Cassini spacecraft, in orbit around the planet, reveal that "coherent backscattering" also contributes significantly to the phenomenon. This occurs when sunlight interacts with the collective particles in the planet's rings; reflections off the many irregular bits of rock and dust combine to produce a single (coherent) more intense light. This light scatters back to our eyes and makes the rings seem to brighten.

At opposition, and the days immediately surrounding it, we see the combination of these two mechanisms as a temporary surge in the overall illumination of the rings. The only way to fully appreciate the effect visually, however, is to monitor the planet and its rings for the days near that magic moment – weather permitting.

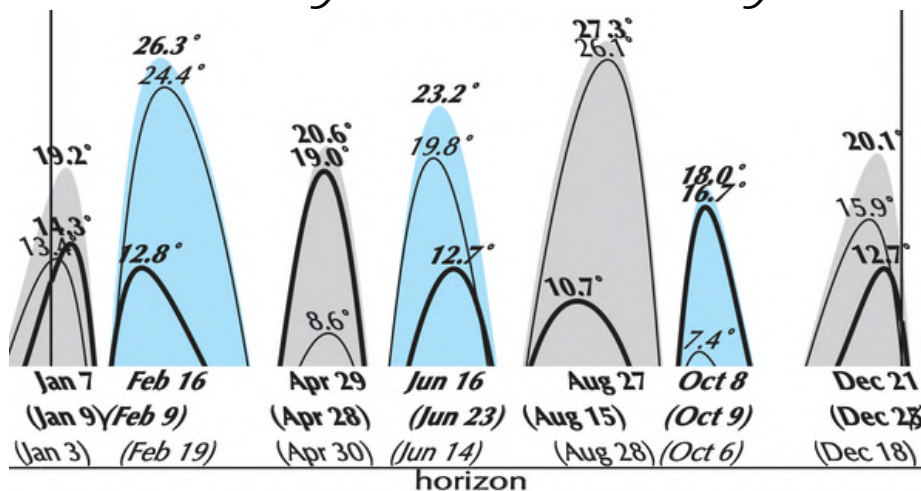
## More than Saturn

We also see the opposition effect each month when we look at the Full Moon. The Sun's direct illumination causes shadows to disappear from our satellite's craters, and the light it reflects at us increases by 40 percent. Based on the irregular particles in Apollo soil samples, scientists have determined that coherent backscatter is the phenomenon's principal cause.

The opposition effect has a terrestrial analog as well. Known as the heiligenschein, this optical phenomenon is a luminous enhancement around the shadow of a person's head. It is most pronounced at low Sun angles when the surface on which the shadow falls is especially dusty or dewy. The enhancement occurs at the antisolar point, or the spot directly opposite the Sun. Immediately around that area, the tiny particles hide their own shadows and scatter back sunlight. The word heiligenschein refers to the halo depicted around saints' heads and literally means "saint's light." Perhaps the painters of old had noticed this optical phenomenon.

# MERCURY AT GREATEST EASTERN ELONGATION

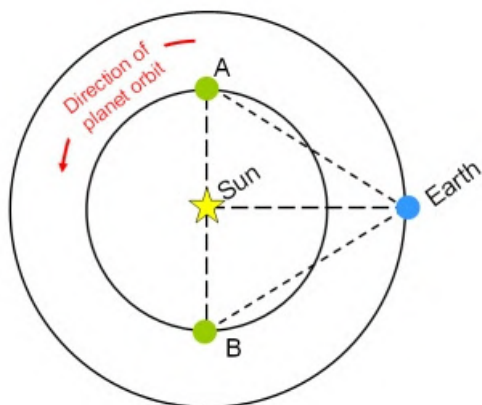
*Best day to observe Mercury*



(Mercury elongations compared. Gray areas represent evening apparitions (eastward elongation). Blue areas represent morning apparitions (westward elongation). The top figures are the maximum elongations, reached at the top dates shown beneath. Image credit: Earthsky.org)

## What's Elongation

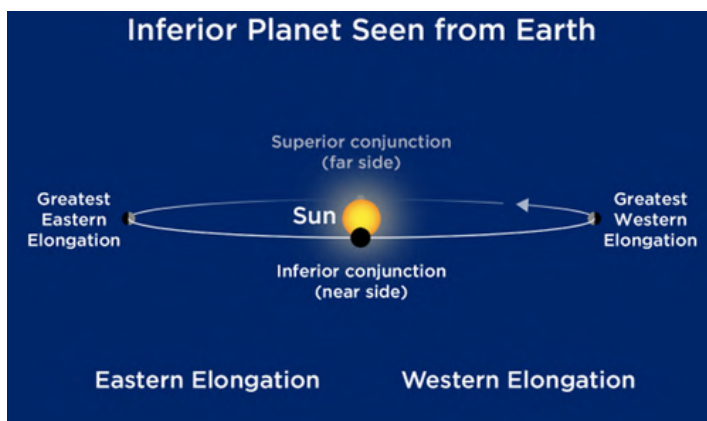
Astronomers use the word elongation to describe the angular distance – the distance on the sky’s dome – between the sun and one of the inner planets in our solar system, Mercury or Venus. Elongations are measured in degrees eastward or westward of the sun. Greatest elongations signal the best time to observe one of the inner planets. At greatest elongation, Venus or Mercury is typically farthest from the sun’s glare.



The position of an inferior planet at greatest western elongation (position A) and greatest eastern elongation (position B). In both cases, the elongation measured is less than 90degree.

**Where to look:** Look in the sunset direction, as the sky is darkening.

**When to look:** Mercury begins this evening apparition in late July and will disappear again by mid-September.



## Greatest Eastern Elongation

**On August 27, 2022** Mercury reaches its greatest distance from the sun on August 27. From the Northern Hemisphere it hugs the horizon shortly after sunset but it will be much easier to see in the Southern Hemisphere.

**"Maximum & Minimum Angular distance of Mercury from the sun (seen from the Earth)at greatest elongation are 28 & 18degrees respectively."**



# CONJUNCTIONS FOR THE MONTH

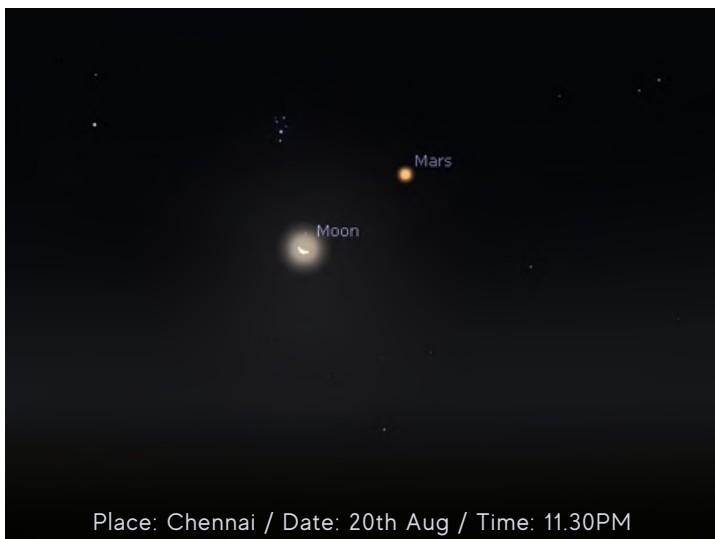
**Conjunction** - Occasionally two or more objects meet up with each other in our sky. Astronomers use the word conjunction to describe these meetings. Technically speaking, objects are said to be in conjunction in that instant when they have the same right ascension on our sky's dome. Practically speaking, 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.

## Pleiades, Mars and Moon Conjunction

**Date: 19th and 20th August**, Mars and quarter Moon will be seen near the Pleiades open star cluster.

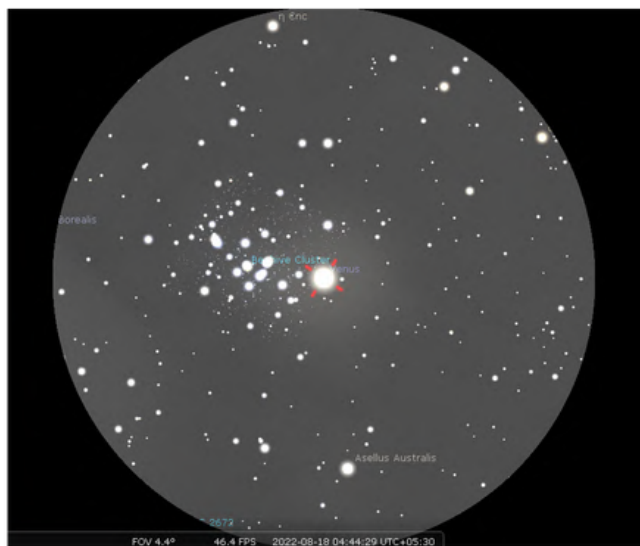


(Image credit: Stellarium)



## Conjunction of Beehive Cluster (M44) and Venus

**Date: 18th August**, Planet Venus & Beehive Cluster will align in the early morning sky. Look towards east before sunrise. The cluster is at a magnitude of 3.1, and Venus at a magnitude of -3.9. This event can be seen from 4.30am onwards till sunrise



# STUDENT'S CORNER

## *James Webb Space Telescope*

Daksh Rathi

iAstronomer member, Space India.

James Webb Space Telescope (JWST) is a large infrared telescope with 6.5-meter primary mirror. JWST is expected to cost at least \$11.23 billion, including design, construction, and 5 years of operation (does not include extended mission funding) or international contributions. The James Webb telescope is an international collaboration project between NASA, European space agency (ESA) and Canadian space agency (CSA). The telescope was launched on 25 December 2021 from Arianespace's Ela 3 launch complex at Europe's spaceport located near Kourou, French Guiana by the rocket Ariane 5. It is orbiting around Lagrange point located on the far side of the earth further from the sun, called L2. How far back will Webb see? Webb will be able to see how the universe looked like around a quarter of a billion years (possibly back to 100 million years) after the big bang, when the first stars and galaxies started to form. Nasa released Webb's first 5 images on 12 July 2022.

### **Image no 1: The sharpest and deepest image of universe ever**

This image shows a 4.6 billion-year-old galaxy cluster called **Smacs 07**.



(Image 1 - SMACS07)



(Image 2 - Southern Ring Nebula)

### **Image no 2: Southern Ring Nebula**

Southern ring nebula is a planetary nebula and is 2,500 light years away from Earth.

### **Image no 3: Carina Nebula**

The view of this image gives us a rare peek into stars in their earliest, rapid stages of formation. For an individual star, this period only lasts about 50,000 to 100,000 years.





## GALACTICA

### Image no 4: Stephan's Quintet

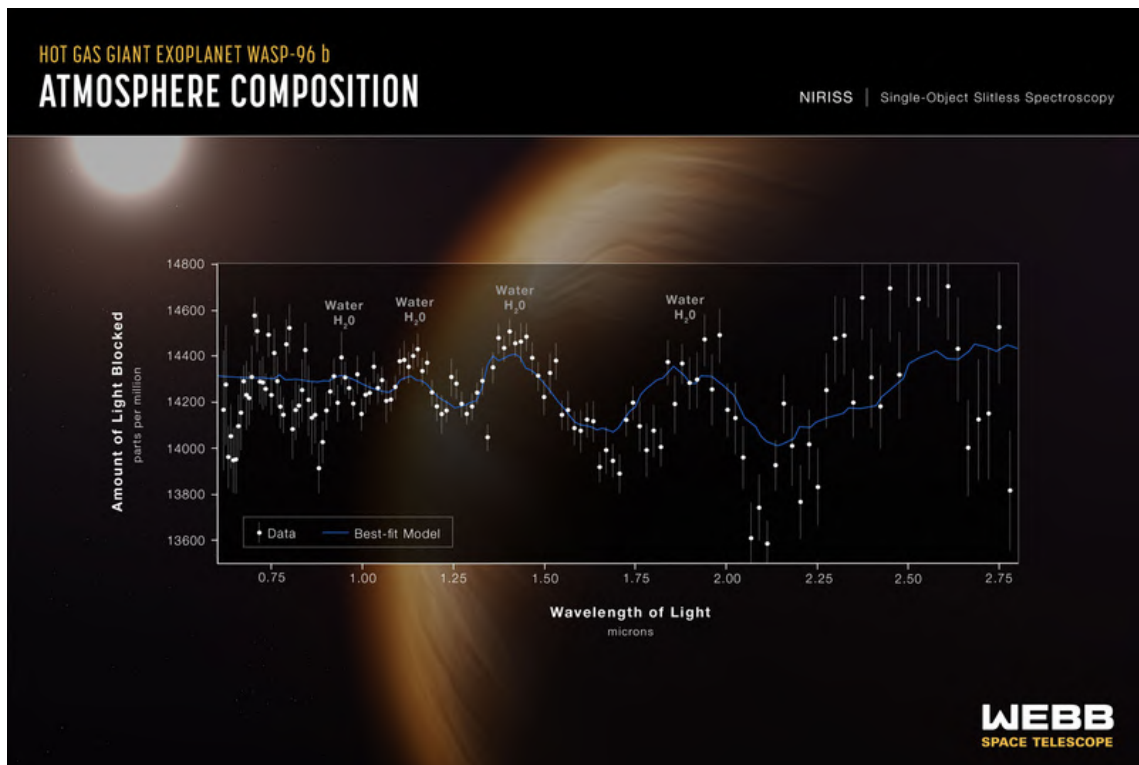
A group of 5 galaxies that appear close to each other.



(Image 4 - Stephan's Quintet )

### Image no 5: Atmospheric composition of an exoplanet wasp 96 b

JWST spotted the signature of water in the form of haze and evidence of clouds on this exoplanet wasp 96b.



(Image 5 - Atmospheric composition of the exoplanet wasp 96 b )

WASP-96b orbits its Sun-like star WASP-96 every 3.5 Earth days at a distance just one-ninth of the distance between Mercury and the Sun.

While the light curve released confirms properties of the planet that had already been determined from other observations – the existence, size, and orbit of the planet – the transmission spectrum revealed previously hidden details of the atmosphere: the unambiguous signature of water, indications of haze, and evidence of clouds that were thought not to exist based on prior observations.

# Are we alone in the universe?

Sourajit Mandal

iAstronomer member.

“Two possibilities exist: either we are alone in the Universe, or we are not. Both are equally terrifying” so said the sci-fi author Arthur C Clarke.

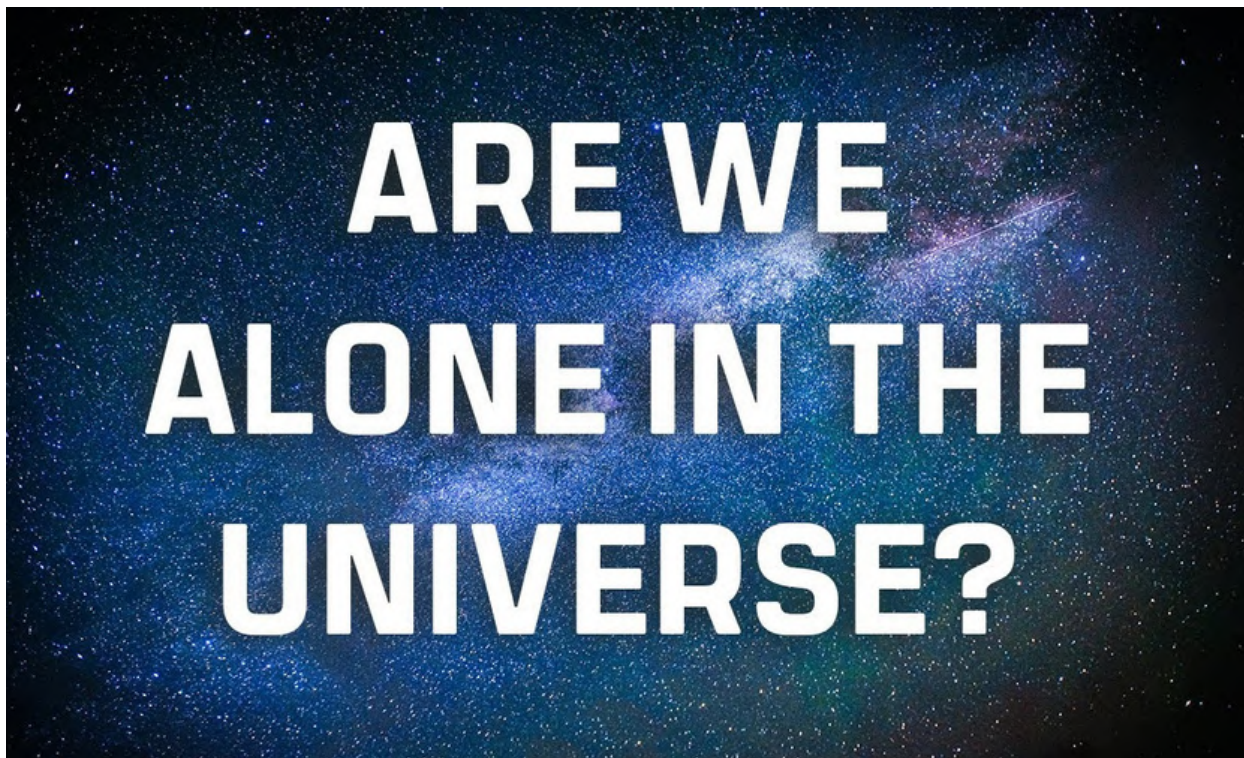
Are we alone in the universe? This question is nearly 3000 years old now. From the time of Democritus, people have wondered about this very same question.

Let us consider the following: Our galaxy milky way has around a 100 thousand million stars. There are around 170 billion galaxies in our universe. Now think of the number of stars. Most stars have at least some planets around it. It is a HUGE number.

Even if we consider that only one-fourth of the stars have rocky planets, then also we have a huge number of planets to consider. There must be a lot of planets that can support life! Then the universe MUST be a lively place! That is the problem. The universe is not a lively place. It is still and dead. Even after more than 50 years of putting our eyes and ears on the universe we still have not found life.

After this, a question arises, was there life on universe ever? Or is it that we are the first chapter of life in the universe. The universe is vast and old. Light takes years to travel to us from distant stars. Even if we find life on an extremely distant star, the life might already be extinct. For what reason, we have no idea.

The universe is old. It was formed 13 billion years ago. Best time for life to form in the universe was 4 billion years after the big bang. We are a new civilization. Humans first appeared on Earth 3 million years ago. We got the technology to search for life recently.



So, it might be likely that everyone is extinct. We are alone. The last and final chapter of life. Or is it?

The universe is old in respect to us, but to itself it is not. Let us take an example. Think of a mayfly. Its lifetime is around 24 hours. In respect to it, we are ancient creatures. Even if we are young children, we have seen thousands of their predecessors. Now put yourself in the place of the mayfly and the universe in your place. The universe is ancient in respect to us but in some other perspective, it is just a child. It might be possible, that we are just the first chapter of life.

We are in a void. We just don't know anything. Even after searching for around 60 years and finding over 4000 exoplanets we have not found anyone. But these numbers are tiny. And the universe is vast. Our radio signals only reach around 20 light years before decaying. Even if others like us exist and they are searching for us, they might face the same problem.

Our own galaxy, the milky way is 105,700 light years long. What we have currently observed is like observing a single grain of sand in a beach.

Perhaps, one day in the distant future, we will find others. Someone who is like us. Or maybe, they might find us! Who knows?.





# NEPTUNE'S MOON TRITON

T. Vetrivel  
iAstronomer member.

**Triton:** In 1746 William Lassell found the moon Triton but the special is after keeping Neptune's name they found the Triton moon in 17 days for all the planets didn't found like this if they found one planet at least 1 month will happen to find its moon but for Neptune moon, William Lassell found in 17 days to find the 1st moon. From that time till 2022 Neptune has only 14 moons in that Triton is the biggest moon.

They found the that itself the kept the name as Triton Neptune in roman mythology means god of seas and in Greek mythology god of seas are Poseidon hey kid names are only it is triton and roman Greek god name mix and keep Triton is so dense moon and it is a big moon even Pluto is smaller than Triton it is 7th biggest moon in the solar system.



If all the planets moon is round even its moon also rounds only but it is rotating retarget of the planet Neptune mean the planet rotating the side it will rotate opposite side. its rotating position is in inclined of 150 degrees they found it as the special thing is its axis is 40-degree slide almost it as a weather pattern it is making. Our moon takes 28days to complete a rotation but Neptune's moon takes only 5 days the moon's diameter is 2700 compared to our moon which is 20% smaller.

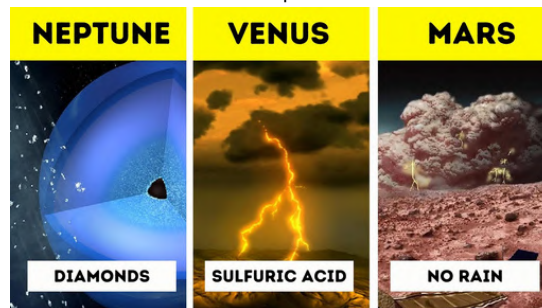
The triton and its host planet distance lesser 3,50,000 km only. Triton is going near Neptune in 300crore years it will cross the Roche limit. Roche limit means a maximum distance between the moon and the planet the moon will crack fully. The scientist thinks the triton has come from the Kepler belt now the Kepler belt king is Pluto if Neptune's moon triton didn't come means the Kepler belt king is triton only. Triton upside temperature is -235-degree Celsius triton have water volcanoes found by voyager-2.

# RAIN IN DIFFERENT PLANETS

T. Vetrivel  
iAstronomer member.

## Rain in our solar system planets:

- Mercury doesn't have an atmosphere so there will be no rain.
- The second planet Venus has more atmosphere hence it rains sulphuric acid Venus but before reaching the surface the rain evaporates and goes back because there will be more heat at the surface.
- The fourth planet Mars, scientists have found that it rained water in Mars. but now, we can't see the cloud's on mars as they are thin.
- And the last 4 planets are Jupiter, Saturn, Uranus & Neptune, in these planets, rains diamonds, and even on some moons of these planets will rain diamonds.
- In the sun, it rains plasma.



## Rain in Exoplanets:

- HAT P 7B, 1044 light years away from Earth. It rains Ruby because this planet has more aluminum oxide in it.
- HD18973 3B, this planet is mostly like our earth it rains molten glass pieces. if we go there then we will be like that pieces.
- CAROT 7B, 480 light-years away from earth. On this planet, it rains rock.
- OGLE TR 56B, 4700 light years away from earth. On this planet, it rains iron.



# SPACE Online "Astronomy Summer Camp"

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





# HISTORICAL EVENTS THAT HAPPENED IN AUGUST

## Curiosity rover celebrates 10 years on Mars

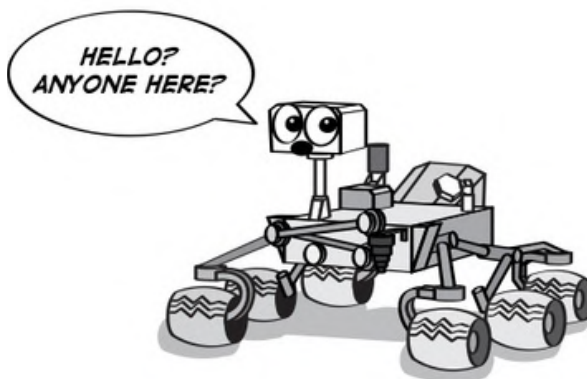
### Mars Laboratory Mission:

As part of NASA's Mars Science Laboratory mission, Curiosity is the second largest (after the Perseverance rover) and most capable rover ever sent to Mars. It launched on Nov. 26, 2011, and landed on Mars at 1:32 a.m. EDT on **Aug. 6, 2012**. Curiosity set out to answer the question: Did Mars ever have the right environmental conditions to support small life forms called microbes? Early in its mission, Curiosity's scientific tools found chemical and mineral evidence of past habitable environments on Mars. It continues to explore the rock record from a time when Mars could have been home to microbial life.

### Curiosity Rover Science:

#### Surveying Gale Crater:

Curiosity explores Gale Crater and acquires rock, soil, and air samples for onboard analysis. The car-size rover is about as tall as a basketball player and uses a 7-foot-long arm to place tools close to rocks selected for the study. Curiosity's large size allows it to carry an advanced kit of 10 science instruments. It has tools including 17 cameras, a laser to vaporize and study small pinpoint spots of rocks at a distance, and a drill to collect powdered rock samples. It hunts for special rocks that formed in water and/or have signs of organics.



**The Mars Science Laboratory mission represents a huge step in Mars exploration because it has:**

- Demonstrated the ability to land a very large, heavy rover on the surface of Mars
- Demonstrated the ability to land more precisely in a 12.4-mile (20-kilometer) landing area
- Demonstrated long-range mobility on Mars for studying diverse environments and analyzing samples found in different settings.
- Curiosity Finds Evidence of Persistent Liquid Water in the Past.
- A Suitable Home for Life.
- Organic Carbon Found in Mars Rocks.
- Present and Active Methane in Mars' Atmosphere.
- Radiation Could Pose Health Risks for Humans.
- A Thicker Atmosphere and More Water in Mars' Past.

### Strong, Smart, and Curious:

Curiosity carries the biggest, most advanced instruments for scientific studies ever sent to the Martian surface. The history of Martian climate and geology is written in the chemistry and structure of the rocks and soil. Curiosity reads this record by analyzing powdered samples drilled from rocks. It also measures the chemical fingerprints present in different rocks and soils to determine their composition and history, especially their past interactions with water.

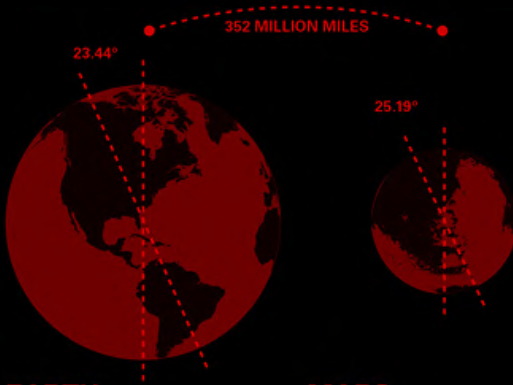
### Coming in for a Landing:

Mars Science Laboratory arrived at Mars through technological innovations that tested a completely new landing method. The spacecraft descended on a parachute, then during the final seconds before landing, the landing system fired rockets to allow it to hover while a tether lowered Curiosity to the surface. The rover landed on its wheels, the tether was cut, and the landing system flew off to crash-land a safe distance away.



# MARS ROVER CURIOSITY

MARS SCIENCE LABORATORY MISSION  
PART OF NASA'S MARS EXPLORATION PROGRAM  
A LONG-TERM EFFORT OF ROBOTIC EXPLORATION OF MARS  
MARS SCIENCE LABORATORY WILL STUDY MARS' HABITABILITY



## EARTH

- DAY 24 HOURS
- YEAR 365 DAYS
- SURFACE TEMPERATURE 57°F (14°C)
- GRAVITY 2.66 TIMES THAT OF MARS

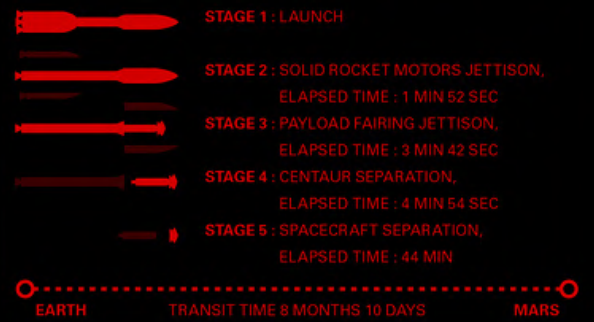
## MARS

- DAY 24 HOURS 40 MINS
- YEAR 687 DAYS
- SURFACE TEMPERATURE -81°F (-63°C)
- GRAVITY 0.375 THAT OF EARTH

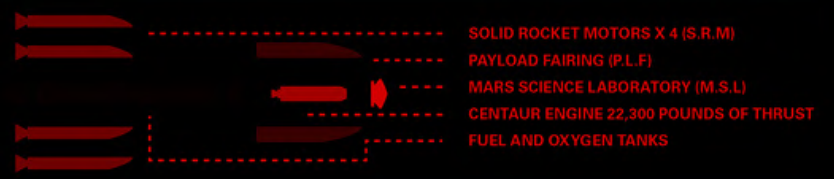
## LAUNCH VEHICLE

ATLAS V-541  
HEIGHT WITH PAYLOAD 191 FEET (58 METERS)  
WEIGHT 531,000 KG  
LIFTOFF 10:02 A.M. EST  
NOVEMBER 26 2011  
CAPE CANAVERAL AIR FORCE STATION  
FLORIDA

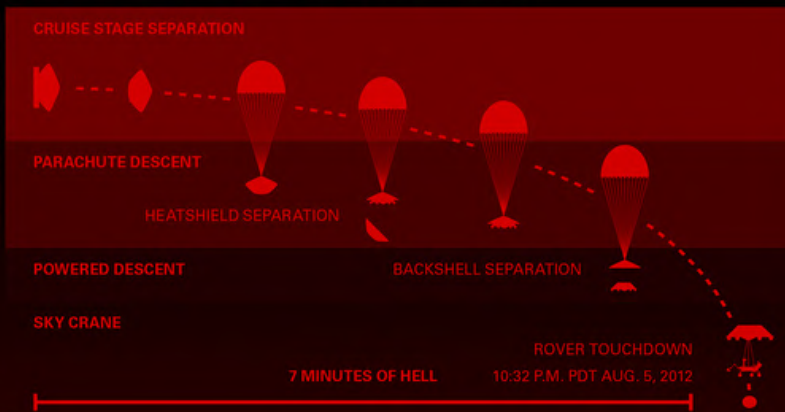
## ATLAS V-541 LAUNCH AND SEPARATION



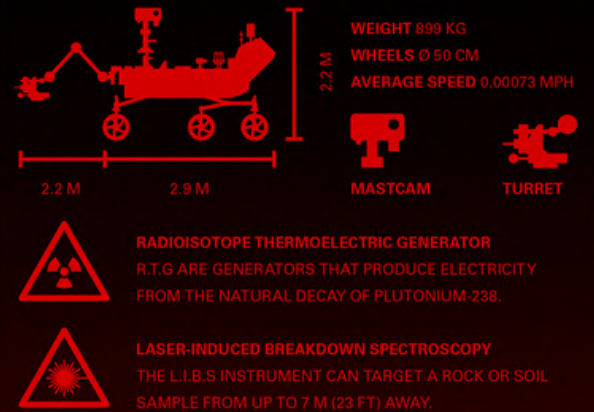
## ATLAS V-541



## M.S.L ENTRY, DESCENT, AND LANDING



## MARS ROVER CURIOSITY



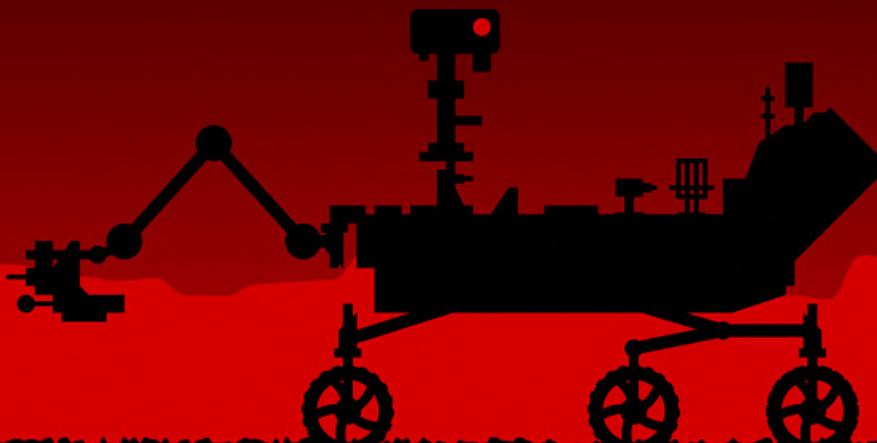
IN ORDER TO GET THE MARS ROVER CURIOSITY FROM EARTH TO MARS TRAVEL 350 MILLION MILES IN ONLY 253 DAYS TOOK

**\$ 2.5 BILLION**

**250 SCIENTISTS**

**160 ENGINEERS**

MARS ROVER FLIGHT DIRECTOR ROCKING A MOHAWK







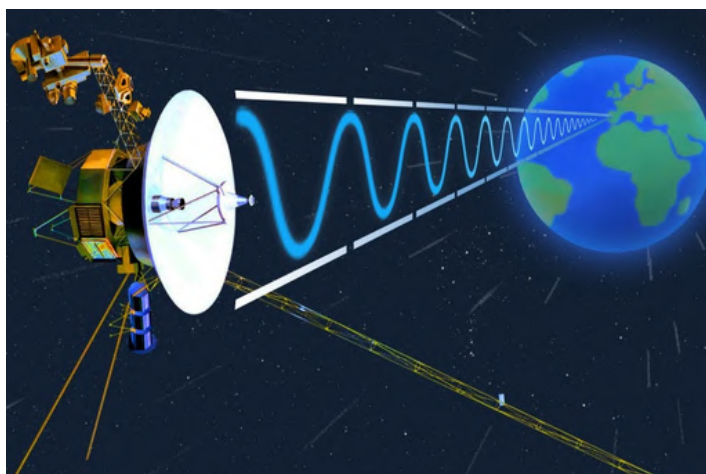
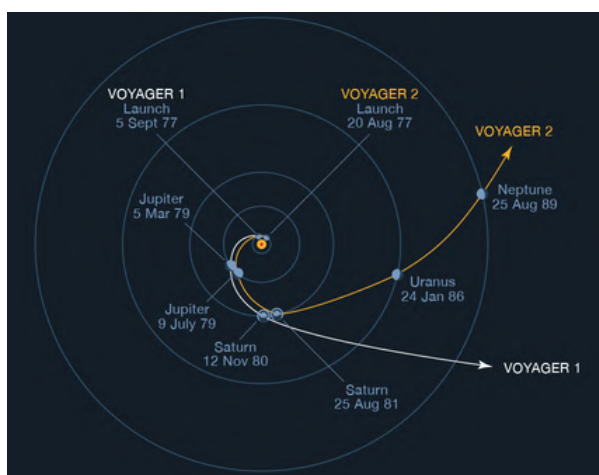
### About the mission:

Voyager 2 is a space probe launched by NASA on **August 20, 1977**, to study the outer planets and interstellar space beyond the Sun's heliosphere and is the only spacecraft to have ever visited Uranus and Neptune, and has made its way to interstellar space, where its twin spacecraft, Voyager 1, has resided since August 2012. During its travels through the outer solar system, Voyager 2 visited all four gas giant planets, and also discovered and photographed many of the planet's moons.

The spacecraft's flyby of Neptune in 1989 set it on a course below the ecliptic plane that eventually took it to interstellar space on November 5, 2018. In 1998, engineers switched off the spacecraft's nonessential instruments to conserve power. Data from at least some of the six instruments still in operation should be received until at least 2025.

### Firsts:

- Voyager 2 is the only spacecraft to study all four of the solar system's giant planets at close range.
- Voyager 2 discovered a 14th moon at Jupiter.
- Voyager 2 was the first human-made object to fly past Uranus.
- At Uranus, Voyager 2 discovered 10 new moons and two new rings.
- Voyager 2 was the first human-made object to fly by Neptune.
- At Neptune, Voyager 2 discovered five moons, four rings, and a "Great Dark Spot."



Early in their travels, four decades ago, the Voyagers gave astonished researchers the first close-up views of the moons of Jupiter and Saturn, revealing the existence of active volcanoes and fissured ice fields on worlds astronomers had thought would be as inert and crater-pocked as our moon. In 1986 Voyager 2 became the first spacecraft to fly past Uranus; three years later it passed Neptune. So far it is the only spacecraft to have made such journeys. Now, as pioneering interstellar probes more than 12 billion miles from Earth, they're simultaneously delighting and confounding theorists with a series of unexpected discoveries about that uncharted region.

Their remarkable odyssey is finally winding down. Over the past three years NASA has shut down heaters and other nonessential components, eking out the spacecrafts' remaining energy stores to extend their unprecedented journeys to about 2030.

## GALACTICA

### Jupiter Accomplishments:

During the Jupiter leg of its journey, Voyager 2 explored the giant planet, its magnetosphere, and moons in greater detail than had the Pioneer spacecraft that preceded it. Voyager 2 also used it as a springboard to Saturn, using the gravity-assist technique.

Voyager 2 succeeded on all counts. It returned spectacular photos of the entire Jovian system, and time-lapse movies made from its images of Jupiter showed how the planet had changed since Voyager 1's visit.

Its images of Io revealed changes in the moon's surface and the persistence of its volcanic eruptions. The spacecraft resolved the streaks Voyager 1 had shown on Europa into a collection of cracks in a thick and remarkably smooth icy crust.

It also discovered a 14th moon and revealed a third component to the planet's rings.

### Saturn Accomplishments:

Voyager 2 was to become the third spacecraft to visit Saturn. It gave us another close-range look at Saturn and its moons.

Using its photopolarimeter, an instrument that had failed on Voyager 1, Voyager 2 was able to observe the planet's rings at a much higher resolution and discover many more ringlets. It also provided more detailed images of the ring spokes and kinks, and the F-ring and its shepherding moons.

Finally, it employed a gravity-assist maneuver at Saturn to help it reach its next destination, Uranus.

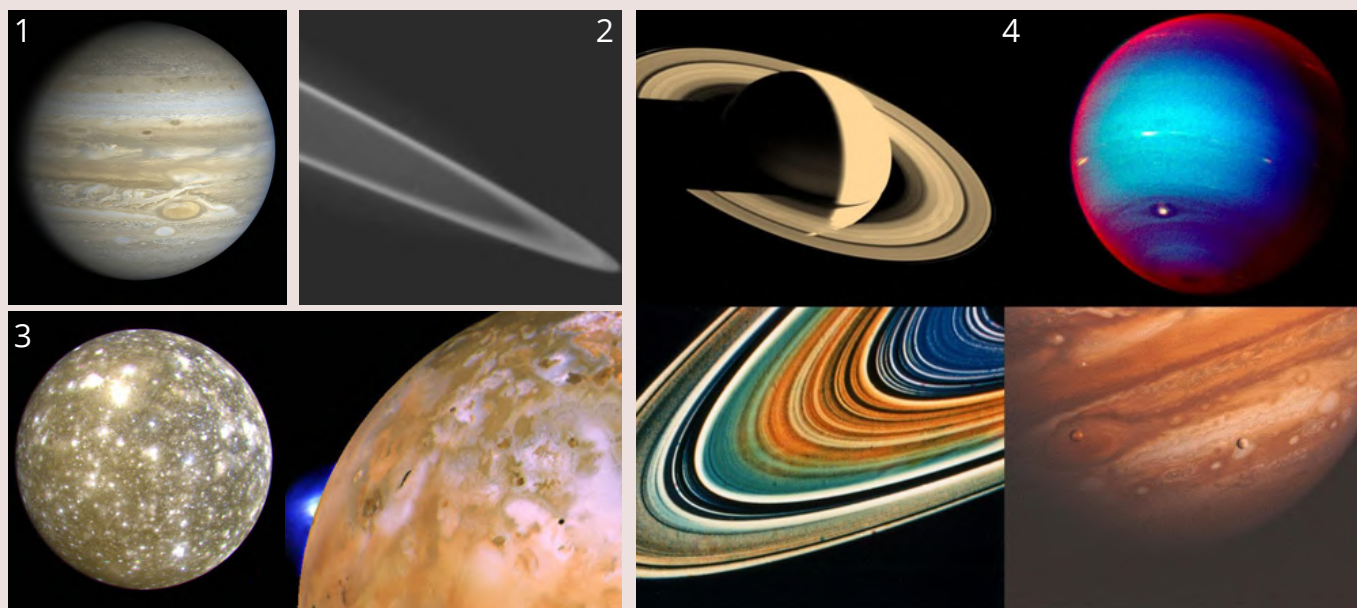


Image 1: Voyager 2 image of Jupiter and its Great Red Spot. Image 2: Voyager 2 image of Jupiter's thin ring system. Image 3: Voyager 2 images of Jupiter's satellites Callisto, and Io. Image 4: Collection of Voyager 2 pictures of planet Saturn, Neptune and Jupiter.

### Uranus Accomplishments:

Following its flybys of Jupiter and Saturn, Voyager 2 became the first spacecraft to visit Uranus. Voyager 2 remains the only spacecraft to have flown by Uranus. The planet appeared to have few features but Voyager 2 found evidence of an ocean of boiling water about 500 miles (800 kilometers) below its cloud tops.

Curiously, the average temperature of its Sun-facing pole was found to be the same as that at the equator.

Voyager 2 discovered 10 new moons, two new rings, and a strangely tilted magnetic field stronger than that of Saturn. A gravity assist at Uranus propelled the spacecraft toward its next destination, Neptune.

### Neptune Accomplishments:

Voyager 2 is the only human-made object to have flown by Neptune. In the closest approach of its entire tour, the spacecraft passed less than 3,100 miles (5,000 kilometers) above the planet's cloud tops.

It discovered five moons, four rings, and a "Great Dark Spot" that vanished by the time the Hubble Space Telescope imaged Neptune five years later.

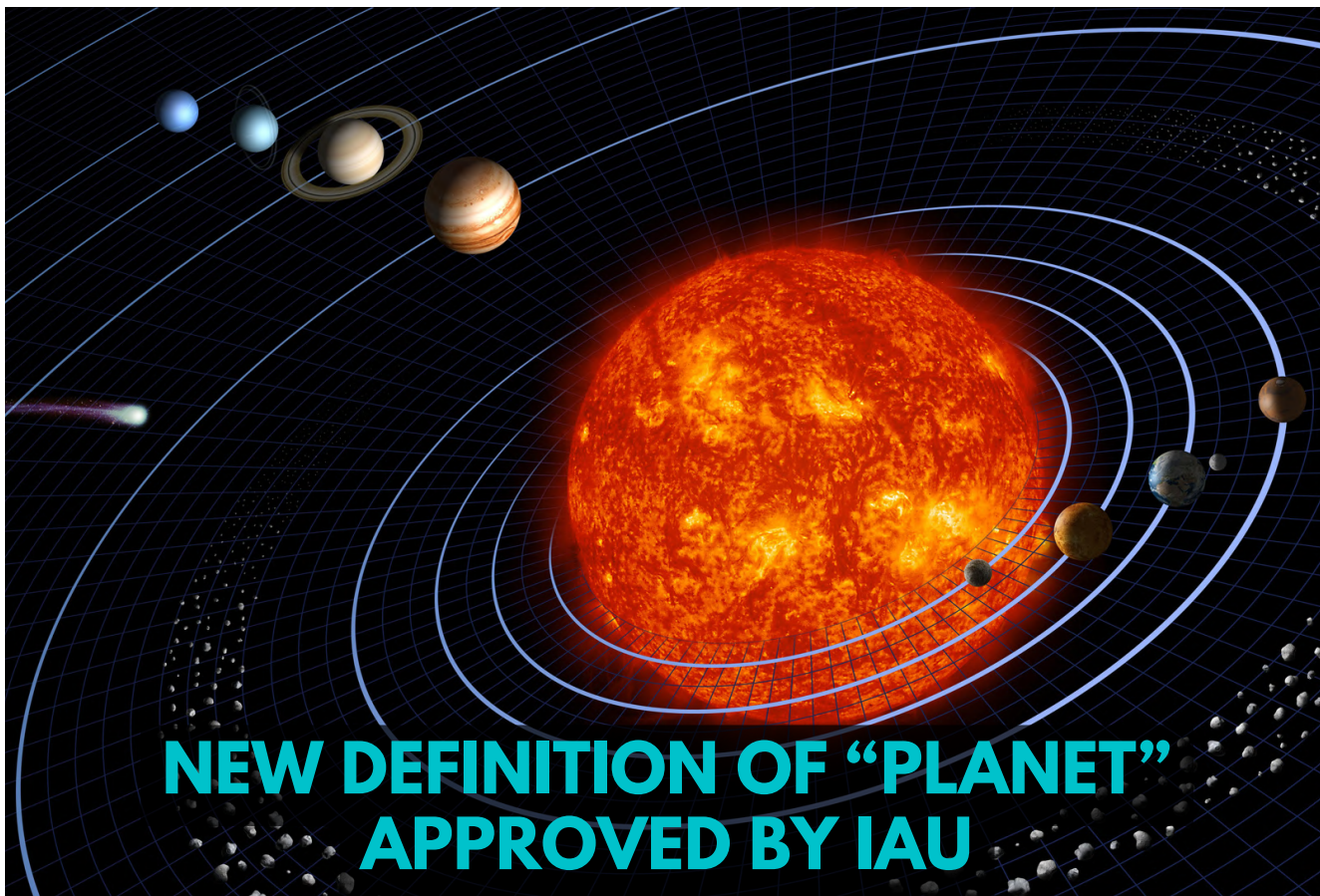
Neptune's largest moon, Triton, was found to be the coldest known planetary body in the solar system, with a nitrogen ice "volcano" on its surface.

### Interstellar Accomplishments:

A gravity assist at Neptune shot Voyager 2 below the plane in which the planets orbit the Sun, on a course out of the solar system. NASA announced in December 2018 that Voyager 2 had entered interstellar space, the second spacecraft to do so after sister ship Voyager 1. As of July 2019, Voyager 2 continued to return data from five instruments as it travels through interstellar space.

Eventually, there will not be enough electricity to power even one instrument. Then, Voyager 2 will silently continue its eternal journey among the stars.





The IAU members gathered on **24th August 2006** at the 2006 General Assembly agreed that a "planet" is defined as a celestial body that (a) is in orbit around the Sun, (b) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape, and (c) has cleared the neighborhood around its orbit.

This means that the Solar System consists of eight "planets" Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. A new distinct class of objects called "dwarf planets" was also decided. It was agreed that "planets" and "dwarf planets" are two distinct classes of objects. The first members of the "dwarf planet" category are Ceres, Pluto and 2003 UB313 (temporary name). More "dwarf planets" are expected to be announced by the IAU in the coming months and years. Currently a dozen candidate "dwarf planets" are listed on IAU's "dwarf planet" watchlist, which keeps changing as new objects are found and the physics of the existing candidates becomes better known.

The "dwarf planet" Pluto is recognized as an important prototype of a new class of trans-Neptunian objects. The IAU will set up a process to name these objects.

**RESOLUTIONS:**

Resolution 5A is the principal definition for the IAU usage of "planet" and related terms.

Resolution 6A creates for IAU usage a new class of objects, for which Pluto is the prototype. The IAU will set up a process to name these objects.

**IAU Resolution:** Definition of a "Planet" in the Solar System

Contemporary observations are changing our understanding of planetary systems, and it is important that our nomenclature for objects reflect our current understanding. This applies, in particular, to the designation "planets". The word "planet" originally described "wanderers" that were known only as moving lights in the sky. Recent discoveries lead us to create a new definition, which we can make using currently available scientific information.



# EVENTS BY SPACE

## CITIZEN SCIENCE PROJECT: GALAXY CRUISE



In its endeavor to popularize astronomy and space science, SPACE India had been conducting multiple events as well as extending the opportunity of astronomical events by different organizations to its associated members.

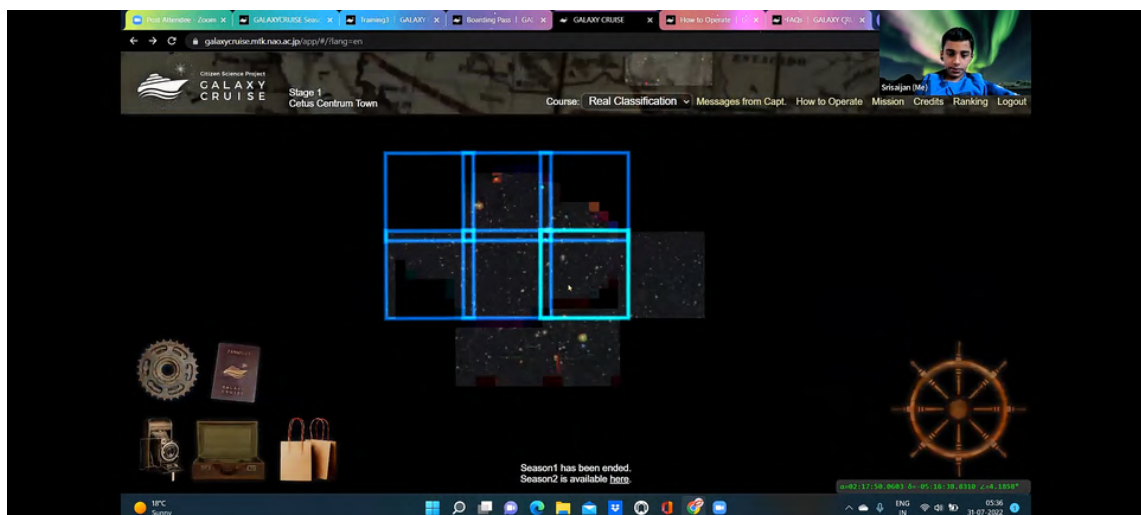
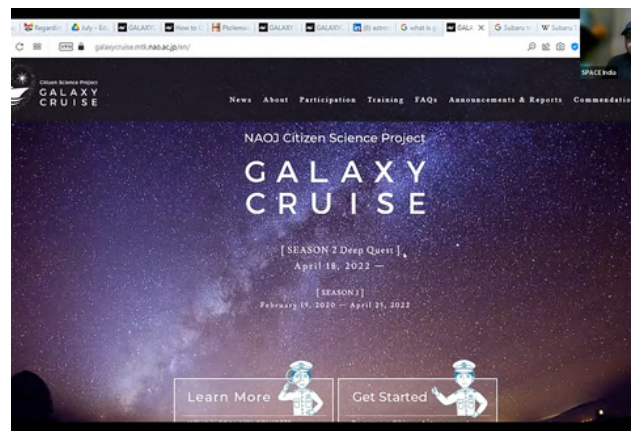
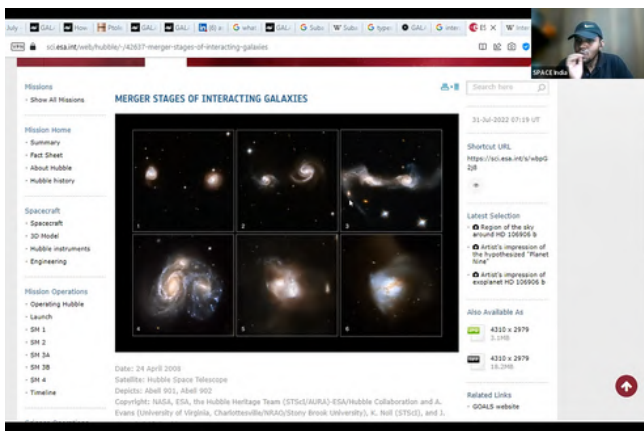
This time, members of the iAstronomer Space Astronomy Club were introduced to a citizen science project: GALAXY Cruise.

### About the project

"GALAXY CRUISE" is a Citizen Astronomy project (citizen science project in astronomy) run by the National Astronomical Observatory of Japan (NAOJ). This project utilizes the data from a large-scale survey program using Hyper Supreme-Cam (HSC), the world's best wide-field imaging camera mounted on the Subaru Telescope. The organization believes that, while exploring the Universe captured by the Subaru Telescope and classifying the shapes of interacting galaxies, Citizen Astronomers and researchers can come together to solve the mysteries of galaxies and generate new research results.

### Opportunity for iAstronomers

Members of the iAstronomer Club were introduced to the program and were trained by SPACE Educator on the process of identifying and classifying galaxies from the data captured by the Subaru Telescope.





# ALL INDIA ASTEROID SEARCH CAMPAIGN 2022

All India Asteroid Search Campaign, a unique and exclusive International platform created by SPACE for Indian students and amateur astronomers across India since 2010.

SPACE conducts this campaign across India, in association with International Astronomical Search Collaboration (IASC) conducted by Dr. Patrick Miller of Hardin Simmons University, the USA as an educational outreach program.

The students will be specially trained to search asteroids in the Main Belt Asteroid through advanced data analysis and specially designed software.

In AIASC 2022, students will access the real-time data from the 'Pan Starrs' (The Panoramic Survey Telescope and Rapid Response System) Telescope, located at Hawaii, USA. They use a 1.8 m (60 inch) telescope to survey the sky to look for asteroids, comets and Near-Earth Objects (NEO).

The Campaign enables the students and amateurs to get exclusive access to astronomy images, which are otherwise not accessible till the postgraduate level, and they get training in advanced data analysis and software as well as interact with international scientists, all of which builds up to an invaluable real-time research experience. Through this campaign, students have made confirmed discoveries of Main Belt Asteroids and important observations that contribute to the NASA Near-Earth Object (NEO) Program at the Jet Propulsion Laboratory (Pasadena, CA).

**Till now students have discovered 2 Numbered Asteroid Discovery, 76 Provisional Discoveries of Asteroids, 2 Special Discoveries, 11,325 Preliminary Discoveries of Asteroids, 62 Near-Earth Object Confirmations and 1636 Near-Earth Object Observations.**

All India Asteroid Search Campaign (AIASC) 2022

Phase I: 27th May 2022 – 20th June 2022

Phase II: 24th June 2022 – 18th July 2022

**Total 500 Teams participated in AIASC 2022 from all over India.**

**SPACE**  
An Opportunity To **DISCOVER ASTEROIDS**

## ALL INDIA ASTEROID SEARCH CAMPAIGN - 2022

**Most Prestigious Project for Students**

Phase I - May 27<sup>th</sup> to June 20<sup>th</sup> 2022  
Phase II - June 24<sup>th</sup> to July 18<sup>th</sup> 2022

**A Citizen Science Project By NASA**

**Online Training**  
15 May 2022, 4:00 pm - 6:00 pm

**Last Date of Registration 10<sup>th</sup> May 2022**

for details, Email us at [outreach@space-india.com](mailto:outreach@space-india.com)

Scan to Register  
**@ No Cost or Hidden Changes**

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### Astrometrica Software

Download and run the exe to install Astrometrica. This is a NEW version that must be installed for the campaigns (updated January 2022)  
Astrometrica Setup  
Not for Mac operating systems

**Astrometrica guides**  
Download and extract the zip file for helpful information on how to use Astrometrica and properly detect asteroids.  
Quick Start Guide

**Practice image sets**  
Download and extract the image sets from zip files to practice Astrometrica and detecting asteroids.  
Practice Image Sets

**Top chat reply**  
Some messages, such as potential spam, may not be visible

**Live chat reply**  
All messages are visible

ANDHRA PRADESH

- banvaran Thathi mohankumar (Scorp\_ Jr) Team
- KARTIK SHAIRMA Hi Kartik sharma from GDGS team, surul
- SS-19 Divyash Jaiswal CIPS galaxy PRESENT joined from different ID
- Nish's Gaming World When is it going to be start
- KISHAN THE LITTLE ASTRONAUT and all-rounder guys there are taking us to be the authorities
- Geeta Kishan Geeta from team "ASTEROID RAIDERS"
- Sagar Goel Sir Sagar Goel from SD astronauta team
- KISHAN THE LITTLE ASTRONAUT and all-rounder dont write your space team name and its not true

All India Asteroid Search Campaign 2022 Phase 2 Training

1,953 views Streamed live on Jun 12, 2022 All India Asteroid Search Campaign (AIASC) has got ...more

This year's campaign was conducted in two phases in which 500 teams having 1000 participants got the chance to be a part of this campaign and contributed to finding the asteroids.

In AIASC 2022, Space India has received 137 Preliminary Discoveries status in Phase I and 84 Preliminary Discoveries status in Phase II.

Also, we have sent the participation certificates to all the active team members in the month of July.

# ASTROPHOTOGRAPHS BY STUDENTS



Daksh Rathi  
iAstronomer member.

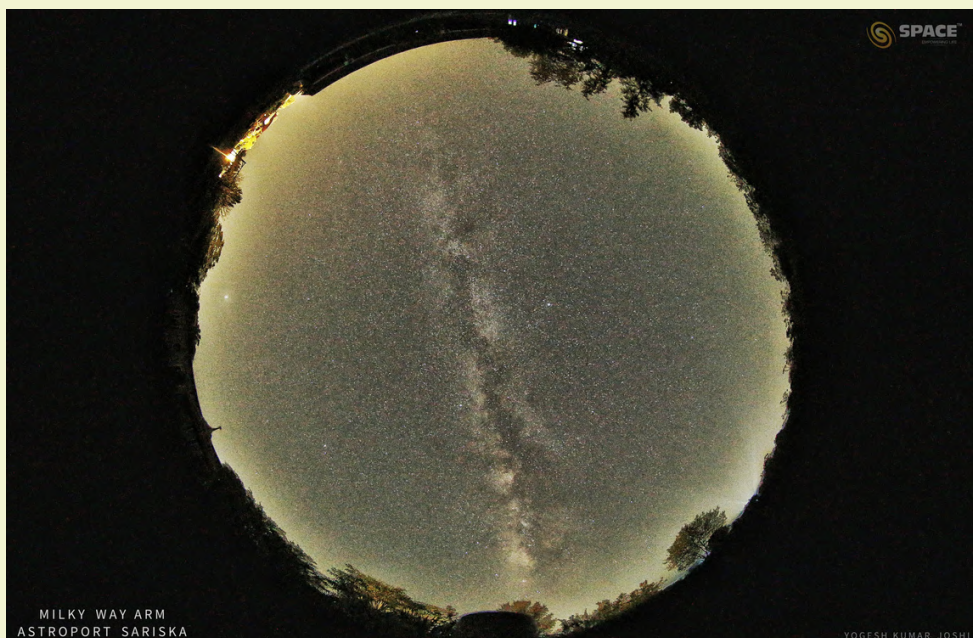


Sajan Saravanan  
iAstronomer member.



Vanshika Sehrawat  
iAstronomer member.

# ASTROPHOTOGRAPHS BY SPACE



Milkyway circular panorama captured by senior Educator of SPACE Mr. Yogesh Kumar Joshi.

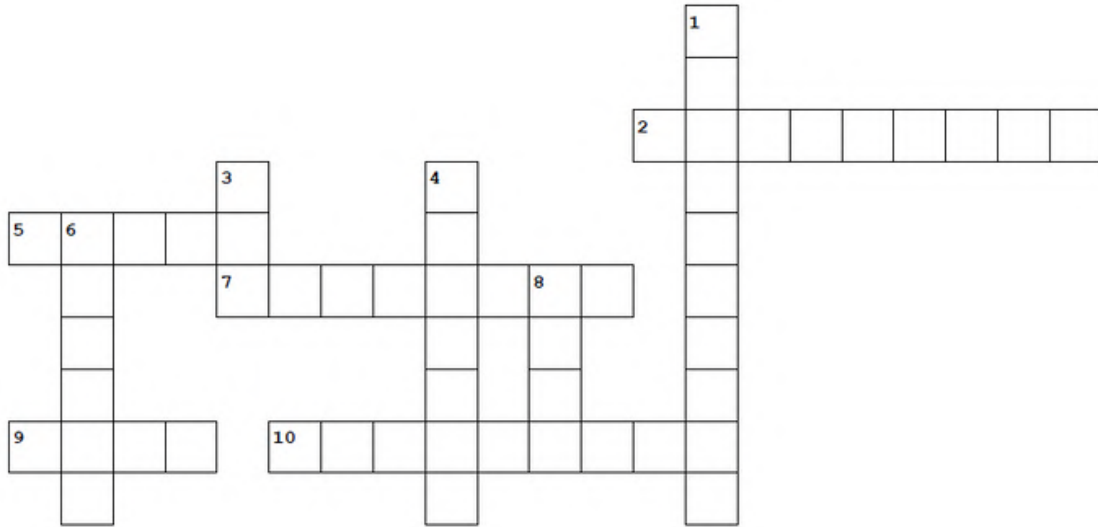


Milkyway arm captured by SPACE Educator Mr. Ranjith Kumar.



# TRAIN YOUR BRAIN

## CROSSWORD



**Across**

- 2. Name of the first fish in space.
- 5. The name of the dog that the Russians sent into orbit.
- 7. The first rabbit to go into space.
- 9. The latest country to launch animals into space.
- 10. The first and only cat to have survived spaceflight.

**Down**

- 1. Which insect went to space first?
- 3. The first chimpanzee to orbit the Earth.
- 4. What spacecraft was used to send Laika into space?
- 6. What is the name of the macaque monkey that flew inside a V2 rocket?
- 8. Name the first creature (cockroach) to conceive in space.

## ASTRONOMY WORD PUZZLE

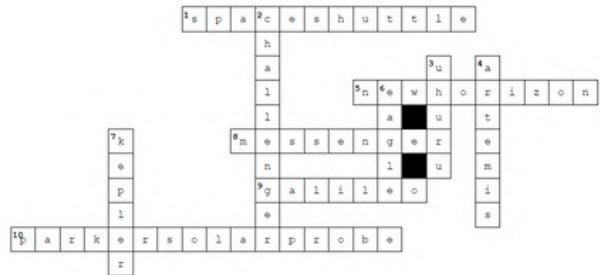
Find the names of various Indian space missions from the mixed letters and mark them.

### Parts of James Webb Space Telescope

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

- FILTERS
- SPACECRAFTBUS
- MIRRORS
- APERTUREMASK
- SOLARARRAY
- SPECTROGRAPH
- SOLARPANELS
- DETECTORS
- CORONAGRAPH
- MOMENTUMFLAP
- MIRICRYOCOOLER
- ANTENNA
- NIRCAM
- STARTRACKERS
- SUNSHIELD

Answers for last month puzzles.



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

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



THERE IS A SCIENTIST IN EVERY CHILD LET'S DISCOVER IT



Join **iASTRONOMER**  
(World's Largest Astronomy Club)

Inviting Astronomy Ambassadors Globally

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- University Programs & Internships
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PRISM SYSTEM: PORRO PRISM  
PRISM GLASS: Bak-4  
APERTURE: 70MM  
EXIT PUPIL: 4.7MM  
MAGNIFICATION: 15X  
ANGULAR FOV: 6.4 Deg

CELESTRON SKYMASTER 20X80  
PRISM SYSTEM: PORRO PRISM  
PRISM GLASS: Bak-4  
APERTURE: 80MM  
EXIT PUPIL: 4MM  
MAGNIFICATION: 20X  
ANGULAR FOV: 3.7 Deg

CELESTRON SKYMASTER 25X100  
PRISM SYSTEM: PORRO PRISM  
PRISM GLASS: Bak-4  
APERTURE: 100MM  
EXIT PUPIL: 4MM  
MAGNIFICATION: 25X  
ANGULAR FOV: 3 Deg

1 | [www.spacearcade.in](http://www.spacearcade.in) For all other models, availability and current pricing please visit website.

**REFRACTOR TELESCOPES**

SPACE LAUNCHER 60MM  
TYPE: REFRACTOR  
MOUNT: ALT-AZ  
APERTURE: 60MM  
FOCAL LENGTH: 700MM

CELESTRON POWERSEEKER 60EQ  
TYPE: REFRACTOR  
MOUNT: EQ  
APERTURE: 60MM  
FOCAL LENGTH: 900MM

SPACE PROBE BDEQ  
TYPE: REFRACTOR  
MOUNT: EQ  
APERTURE: 80MM  
FOCAL LENGTH: 400MM

**REFLECTOR TELESCOPES**

SPACE LAUNCHER 76MM  
TYPE: REFLECTOR  
MOUNT: ALT-AZ  
APERTURE: 76MM  
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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**Brands**

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