

# Galactica

Astronomy and Space Science Magazine

## What's Inside?

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

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.**



**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 JUNE 2022

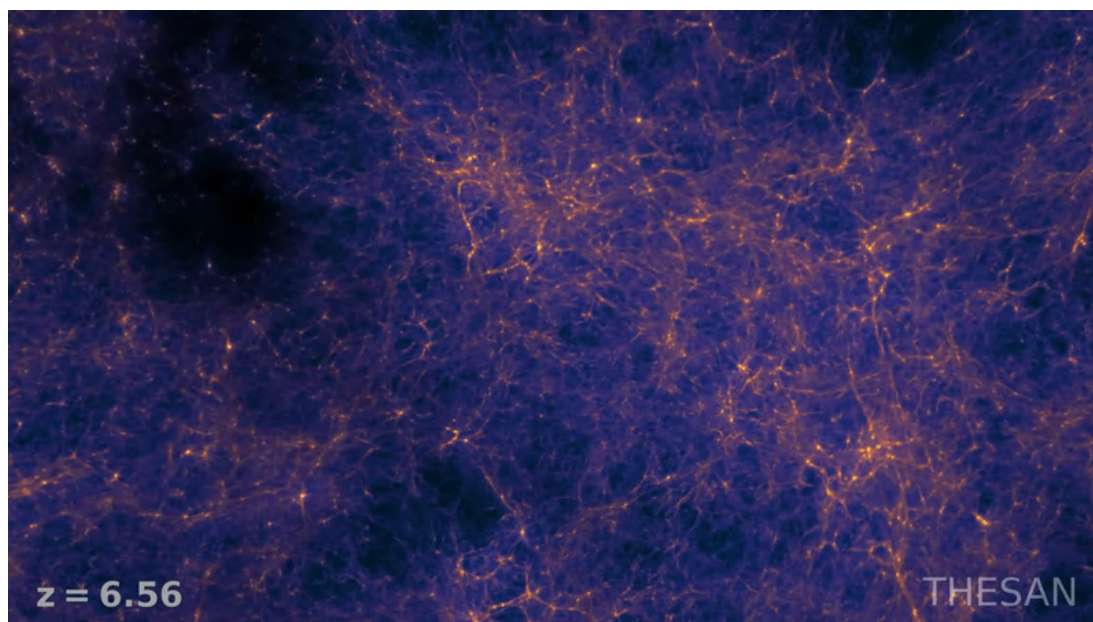
## SCIENTISTS FOUND A NEW WAY TO SHOW US HOW THE EARLY UNIVERSE FORMED

**A team of researchers at the Institute of Astrophysics of the Canary Islands (IAC) has created a new simulation of early galaxy formation. The simulation allows us to get a fascinating, albeit brief glimpse at how the early universe formed in the precious seconds following the Big Bang.**

**This new simulation of early galaxy formation is game-changing:**

Understanding the early universe has been a goal for scientists for decades. And, now with NASA's James Webb space telescope, and other technology, we're finally making some decent strides. A new simulation on early galaxy formation could be another key stepping stone, too.

Researchers created the simulation using machine learning. It then completed over 100,000 hours of computations to create the one of a kind simulation. The researchers named the algorithm responsible for the project Hydo-BAM. Creating a simulation of early galaxy formation has allowed researchers to chart the earliest moments of our universe. These important moments began just after the Big Bang set everything into motion. Understanding these key moments of the formation of the early universe could help us better understand how galaxies form in the universe today.



(The team's simulations named 'Thesan' –which resolve interactions in the early universe with the highest detail and over the largest volume of any previous simulation.)

### **Decoding dark matter:**

With the simulation, researchers can refine what we understand of the large-scale structuring of our universe. There are currently so many uncertainties about the formation of the early universe. Not to mention the current elements within the universe. For example, we still know very little about what part dark matter plays in the formation of galaxies and celestial objects.

This simulation of early galaxy formation won't explain away dark matter, though. But it could help us better understand how it played a role in the formation of our universe. That alone could open new doors to understanding cosmic evolution, too.

Overall, though, the simulation gives us a look at the galactic medium that we've never had before. Based on the research, members of the IAC say that the joint distribution of ionized gas and neutral hydrogen gas – both of which play an important role in galactic formation – can be clearly measured using the simulation.

This allows them to dig deeper into the different ages of the universe, like the present, past, and early universe. With that in mind, the simulation of early galaxy formation could present even more data. Of course, it isn't going to replace actually being able to study those pieces of the universe. But it could be a solid stand-in.

Ultimately, it will take some time to tell exactly how many doors this new simulation opens for the scientific community. But, with NASA and other space agencies looking so deeply into the universe beyond our own galaxy, we could get new answers in the coming years.

# OVER 100 HIDDEN ASTEROIDS DETECTED THANKS TO NEW ALGORITHM STUDYING OLD TELESCOPE DATA

Researchers using an innovative astrodynamics algorithm have uncovered over 100 asteroids that had gone undetected in archived images of the sky.



**ASTEROID INSTITUTE**  
A PROGRAM OF B612

The newfound asteroids were discovered using historical data from the NOIRLab Source Catalog. These data were analyzed by the THOR algorithm on the ADAM platform, which runs on Google Cloud. The NOIRLab data included a collection of nearly 68 billion observations taken by the National Optical Astronomy Observatory between 2012 and 2019. The asteroid candidates were submitted to the International Astronomical Union's Minor Planet Center for confirmation.

"A comprehensive map of the solar system gives astronomers critical insights both for science and planetary defense," Matthew Holman, a dynamicist and search algorithm expert at the Harvard & Smithsonian Center for Astrophysics and the former director of the IAU Minor Planet Center, said in the statement. "Tracklet-less algorithms such as THOR greatly expand the kinds of datasets astronomers can use in building such a map."

Identifying these first 104 asteroids using the THOR algorithm opens the door for even more asteroid discoveries using historical telescope data sets in the future, the researchers said.

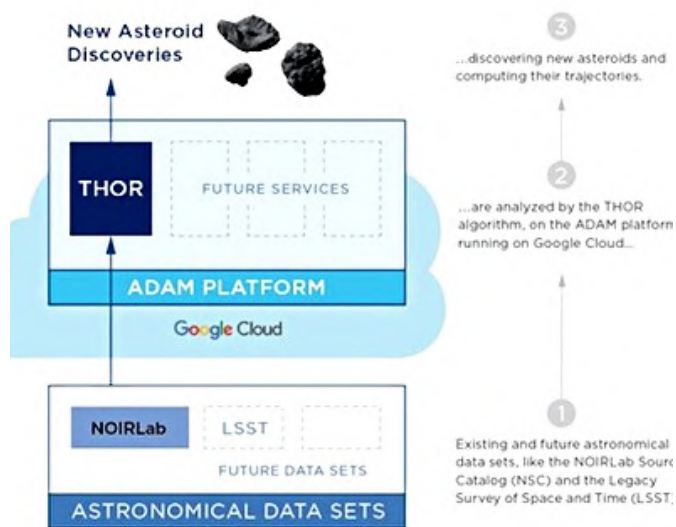
Asteroids are rocky objects left over from the formation of the solar system more than 4 billion years ago. Ranging in size from several feet to hundreds of miles across, these rocky bodies are too small to be considered planets.

The 104 previously undiscovered asteroids were detected using a new algorithm called Tracklet-less Heliocentric Orbit Recovery (THOR), which is a part of the Asteroid Institute's Asteroid Discovery Analysis and Mapping (ADAM) cloud-based astrodynamics platform. This algorithm recognizes asteroids and calculates their trajectories by linking points of light in different sky images that are consistent with asteroid orbits, according to a statement from the B612 Foundation, a nonprofit that supports research and technologies for mapping and navigating the solar system.

"Discovering and tracking asteroids is crucial to understanding our solar system, enabling development of space and protecting our planet from asteroid impacts," Ed Lu, executive director of the Asteroid Institute, a program of the B612 Foundation, said in the statement.

"With THOR running on ADAM, any telescope with an archive can now become an asteroid search telescope," said Lu, who is also a former NASA astronaut. "We are using the power of massive computation to enable not only more discoveries from existing telescopes, but also to find and track asteroids in historical images of the sky that had gone previously unnoticed because they were never intended for asteroid searches."

## Finding New Asteroids with the Asteroid Discovery Analysis and Mapping (ADAM) Platform





Hubble Space Telescope imagery of Minkowski's Object (lower left) and the elliptical galaxy NGC 541.

(Image credit: NASA, ESA, and S. Croft (Eureka Scientific Inc.); Image Processing: Gladys Kober (NASA Goddard/Catholic University of America))

**The Hubble Space Telescope has captured a dazzling new view of a busy star birth factory.**

The oddly shaped Minkowski's Object, a dwarf galaxy, glows in blue toward the bottom left of the image, while the elliptical galaxy NGC 541 shines brightly in the upper right. Minkowski's Object is bursting with stars, containing at least 20 million stellar objects, and it has been greatly influenced by its larger neighbor, NASA officials wrote in a statement.

The dwarf galaxy is named after German-American astronomer Rudolph Minkowski, whose multidisciplinary work included examining galaxy evolution and defining two types of supernovas, or star explosions.

"The radio jet from NGC 541 likely caused the star formation in Minkowski's Object," NASA officials said in the statement. This jet pushes against gas surrounding the galaxy, compressing the gas until the molecules become energized, or ionized.

"As the ionized gas reverts from its higher-energy state to a lower-energy state, energy leaves the cloud in the form of radiation," NASA added. "As the clouds cool, they collapse, giving rise to star birth."

NGC 541 is an elliptical galaxy that was likely created from a merger of two other galaxies, the agency said. The galaxy's radio jets were picked up by telescopes, showing that the streams emerge from an accretion disk surrounding a black hole in the center of the galaxy.

The radio activity was likely triggered by debris from nearby mergers, NASA said. All in all, the busy area was one reason Hubble was tasked with looking at the region to better understand the conditions under which star formation is triggered.

Both Hubble and a successor telescope, the James Webb Space Telescope, are engaged in better understanding how galaxies and stars form. Webb's larger mirror and deep-space location will allow it to look at some of the universe's first galaxies, once Webb finishes commissioning this summer.

Webb's research on galaxies will look at topics such as mergers, collisions, supermassive black holes and galactic types, according to NASA.

# HUBBLE TELESCOPE SPOTS PECULIAR DWARF GALAXY WITH REALLY BRIGHT NEIGHBOR

# JAMES WEBB SPACE TELESCOPE HIT BY MICRO METEOROID, AND NASA SAYS ALL IS WELL

Micrometeoroid strikes are an unavoidable aspect of operating any spacecraft, which routinely sustain many impacts over the course of long and productive science missions in space. Between May 23 and 25, NASA's James Webb Space Telescope sustained an impact to one of its primary mirror segments. After initial assessments, the team found the telescope is still performing at a level that exceeds all mission requirements despite a marginally detectable effect in the data. Thorough analysis and measurements are ongoing. Impacts will continue to occur throughout the entirety of Webb's lifetime in space; such events were anticipated when building and testing the mirror on the ground. After a successful launch, deployment, and telescope alignment, Webb's beginning-of-life performance is still well above expectations, and the observatory is fully capable of performing the science it was designed to achieve.

## **Webb: Engineered to Endure Micrometeoroid Impacts**

Webb's mirror was engineered to withstand bombardment from the micrometeoroid environment at its orbit around Sun-Earth L2 of dust-sized particles flying at extreme velocities. While the telescope was being built, engineers used a mixture of simulations and actual test impacts on mirror samples to get a clearer idea of how to fortify the observatory for operation in orbit. This most recent impact was larger than was modeled, and beyond what the team could have tested on the ground.

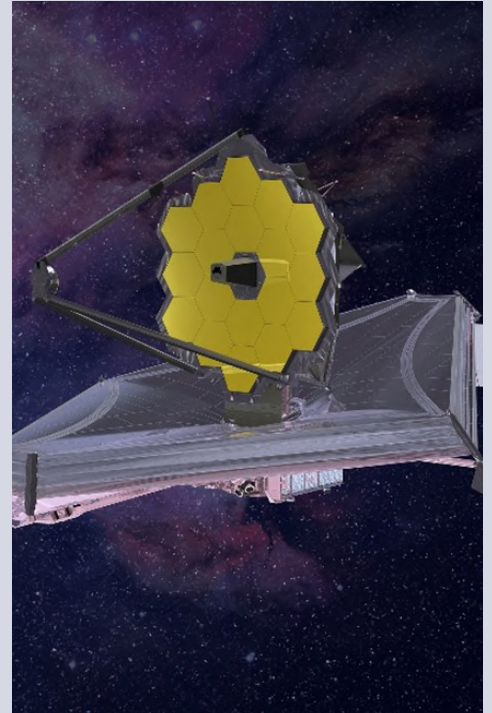
"We always knew that Webb would have to weather the space environment, which includes harsh ultraviolet light and charged particles from the Sun, cosmic rays from exotic sources in the galaxy, and occasional strikes by micrometeoroids within our solar system," said Paul Geithner, technical deputy project manager at NASA's Goddard Space Flight Center in Greenbelt, Maryland. "We designed and built Webb with performance margin – optical, thermal, electrical, mechanical – to ensure it can perform its ambitious science mission even after many years in space." For example, due to careful work by the launch site teams, Webb's optics were kept cleaner than required while on the ground; their pristine cleanliness improves the overall reflectivity and throughput, thereby improving total sensitivity. This and other performance margins make Webb's science capabilities robust to potential degradations over time.

Furthermore, Webb's capability to sense and adjust mirror positions enables partial correction for the result of impacts. By adjusting the position of the affected segment, engineers can cancel out a portion of the distortion. This minimizes the effect of any impact, although not all of the degradation can be cancelled out this way. Engineers have already performed a first such adjustment for the recently affected segment C3, and additional planned mirror adjustments will continue to fine tune this correction. These steps will be repeated when needed in response to future events as part of the monitoring and maintenance of the telescope throughout the mission.

To protect Webb in orbit, flight teams can use protective maneuvers that intentionally turn the optics away from known meteor showers before they are set to occur. This most recent hit was not a result of a meteor shower and is currently considered an unavoidable chance event. As a result of this impact, a specialized team of engineers has been formed to look at ways to mitigate the effects of further micrometeoroid hits of this scale. Over time, the team will collect invaluable data and work with micrometeoroid prediction experts at NASA's Marshall Space Flight Center to be able to better predict how performance may change, bearing in mind that the telescope's initial performance is better than expected. Webb's tremendous size and sensitivity make it a highly sensitive detector of micrometeorites; over time Webb will help improve knowledge of the solar system dust particle environment at L2, for this and future missions.

"With Webb's mirrors exposed to space, we expected that occasional micrometeoroid impacts would gracefully degrade telescope performance over time," said Lee Feinberg, Webb optical telescope element manager at NASA Goddard. "Since launch, we have had four smaller measurable micrometeoroid strikes that were consistent with expectations and this one more recently that is larger than our degradation predictions assumed. We will use this flight data to update our analysis of performance over time and also develop operational approaches to assure we maximize the imaging performance of Webb to the best extent possible for many years to come."

This recent impact caused no change to Webb's operations schedule, as the team continues to check out the science instruments' observing modes and prepares for the release of Webb's first images and the start of science operations.





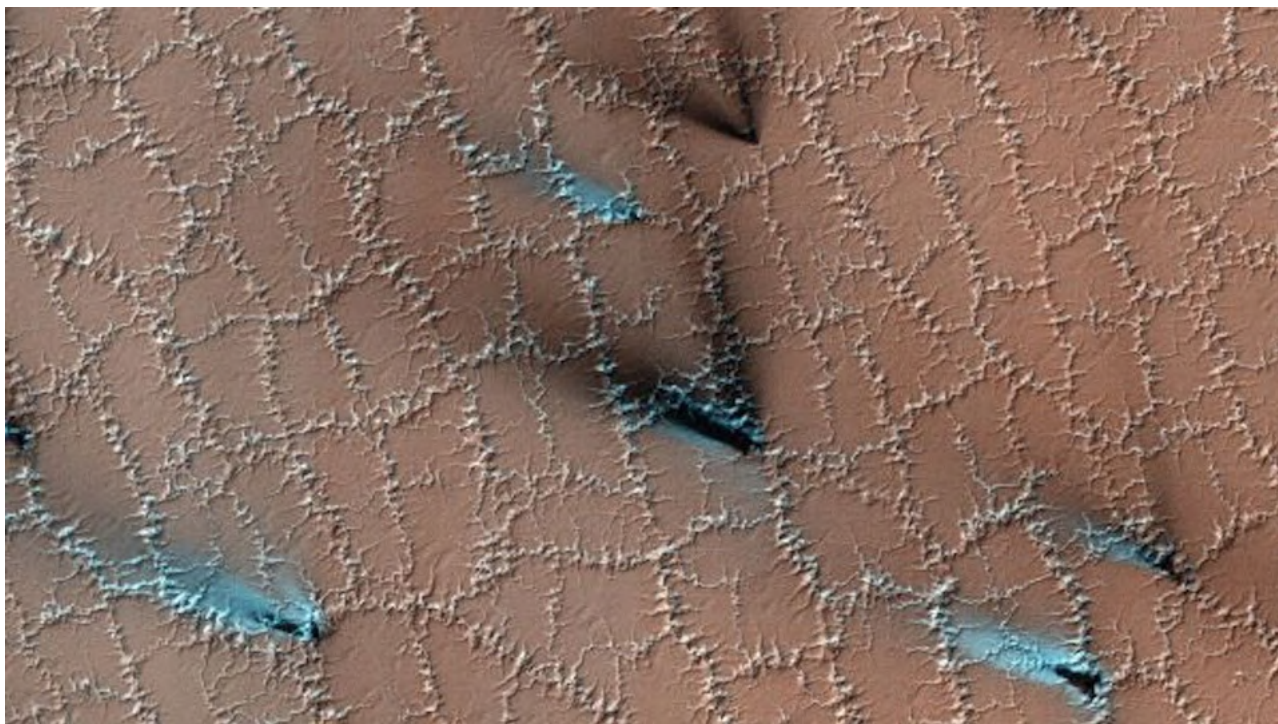
# BIZARRE 'POLYGONS' ARE CRACKING THROUGH THE SURFACE OF MARS

## Alien infrastructure, or just signs of spring?

It's springtime on Mars and the mysterious polygons are in bloom, a new image from the orbiting High Resolution Imaging Experiment (HIRISE) camera shows.

Recorded on March 30, the image reveals a patchwork of white zig-zags cracking across the Mars soil at high latitudes, with occasional sprays of black and blue mist fanning out between them. The zig-zags and colorful sprays are signature features of Martian spring, when hidden reservoirs of subterranean ice butt up against the dry Martian surface, researchers at the University of Arizona – which manages the HIRISE mission – wrote in a statement on June 20.

"Both water and dry ice have a major role in sculpting Mars' surface at high latitudes," the researchers wrote. "Water ice frozen in the soil splits the ground into polygons."



Polygons crack across the Martian surface as hidden ice expands and contracts with the seasons.  
(Image credit: NASA/JPL-Caltech/UArizona)

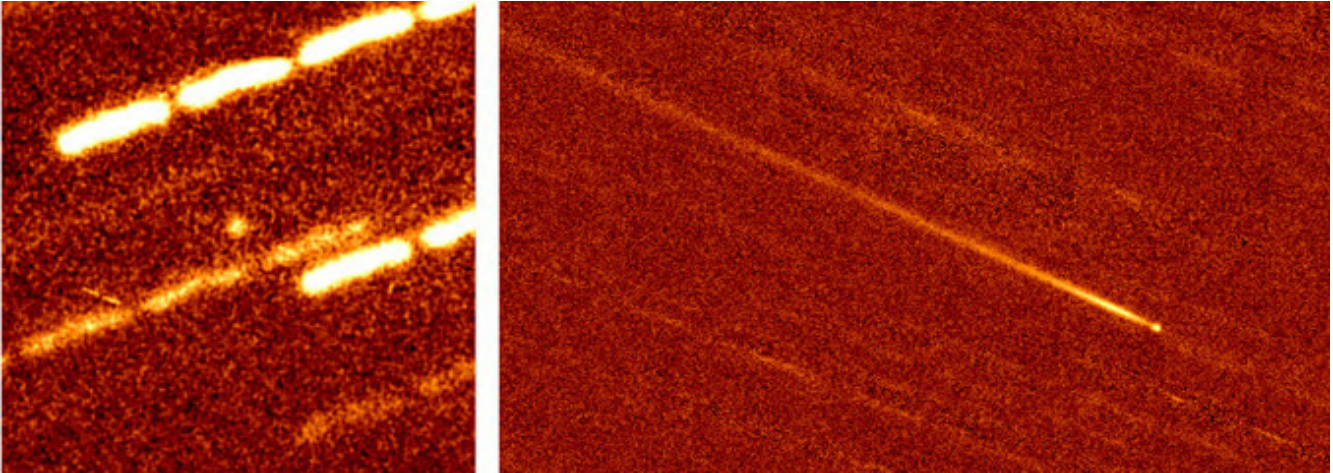
The edges of these polygons become cracked and frayed in springtime as surface ice transforms from a solid into a gas – a process known as sublimation. When this transformation occurs, vents of dry ice spray out of the Martian surface, leaving dark, fan-shaped deposits of particles spread across the ground, the researchers said. Where dark particles sink back into the dry ice on the surface, bright marks (seen as whitish-blue streaks in the image above) stain the ground.

A single ice vent can open and close multiple times, spraying particles in different directions across the Martian surface depending on the wind. That's why some areas show several different light and dark streaks jutting out of a single vent. Both the fans and polygons can stick around for many years, slowly warping the Martian landscape as ice expands and contracts seasonally.

The HIRISE camera rides aboard NASA's Mars Reconnaissance Orbiter, which began its mission in 2006. Soaring between about 155 and 196 miles (250 to 216 kilometers) over the planet, the orbiter has captured a treasure trove of bizarre and amusing images over the past few decades. For example, in 2018, the orbiter glimpsed a formation of rocks and craters that loo identical to the bug-eyed Muppet Beaker, meep-meeping near the Martian south pole.

Perhaps even more impressive are the orbiter's images of Valles Marineris, the largest canyon in our solar system (and therefore the largest known canyon in the universe). Spanning nearly 10 times as long as Earth's Grand Canyon and three times deeper, the canyon remains a mystery of Martian geology; scientists aren't really sure how it formed. If any Muppets were involved, they're keeping the truth to themselves.

# Maunakea telescopes capture near-Sun comet roasting to death



(On the left, an image of 323P/SOHO before the disintegration. On the right, the comet looks very different, having developed a distinct tail. Image credit: Subaru Telescope/CFHT/Man-To Hui)

Astronomers using world-leading telescopes, including several observatories on Maunakea and in space, have captured images of a periodic rocky near-Sun comet breaking apart. It marked the first time, 323P/SOHO, a known comet, was detected by a ground-based telescope and was caught in the act of disintegrating, which could help explain the scarcity of the near-Sun population of periodic comets and asteroids.

To better understand these bodies, a group of international researchers including Man-To Hui, a former University of Hawai'i Institute for Astronomy (IfA) researcher, and IfA Astronomer David Tholen, observed 323P/SOHO with multiple telescopes on Maunakea including the Subaru Telescope, Canada-France-Hawaii-Telescope (CFHT) and Gemini North, and Lowell Discovery Telescope in Arizona and Hubble Space Telescope.



(Star trails over the Canada-France-Hawaii Telescope on Maunakea. Courtesy Tayte Brock, the Bennet Group, and Maunakea Observatories.)

Since these objects pass so close to the molten heart of the Solar System, they are difficult to spot and study. Most have been discovered by accident in solar telescope observations. According to Hui, the group didn't know exactly where to look because the orbit was poorly constrained. However the wide field of view from the Subaru allowed them to "cast a wide net" and find the comet as it approached the Sun. Using new data, researchers were able to reposition other telescopes when the comet started to move away from the Sun.

"We work very closely with our University of Hawai'i users, including David Tholen and Man-to Hui, to optimize their observations, quickly following up observations made at other facilities and using MEGACam to recover interesting objects like 323P/SOHO." said Todd Burdullis, Queued Service Observing operations specialist at CFHT. "Working with UH astronomers studying the building blocks of our solar system never ceases to provide incredible discoveries."

Researchers found that 323P/SOHO had changed remarkably during its close passage by the Sun. They believe that the intense radiation from the Sun caused parts of the comet to break off due to thermal fracturing, similar to how ice cubes crack when you pour a hot drink over them. This mass loss mechanism could help explain what happens to the near-Sun population and why there are so few of them left. Astronomers also determined the comet's rapid rotation clocked in at just more than half an hour per revolution, and that its color is unlike anything else in the Solar System.

"Observations of other near-Sun objects are needed to see if they also share these traits," said Hui, who is now an assistant professor at Macau University of Science and Technology. "We couldn't have made this discovery without observations from the telescopes on Maunakea, made possible by the University of Hawai'i. The observations from the Subaru Telescope were the initiator, shrinking orbit uncertainties and making follow-up observations possible. CFHT provided the best coverage data and Gemini provided the densest data points."

# MARS INGENUITY HELICOPTER HAS A DEAD SENSOR, BUT IT MAY STILL WORK

**We have been following with excitement as Ingenuity, the small helicopter that accompanied NASA's Perseverance rover to Mars, landed in the Red Planet's Jezero Crater.**

As the season has turned to winter in Jezero Crater, the temperature on Mars can drop to around minus 112 degrees Fahrenheit (minus 80 degrees Celsius) at night, are impelling changes in Ingenuity's activities and software to keep the vehicle functional through the colder season. As temperatures decreased over the past several weeks, operators at NASA's Jet Propulsion Laboratory (JPL) in Southern California began putting Ingenuity to sleep every night as a way of protecting its systems from the harsh conditions. Even so, extreme fluctuations between day and night temperatures have caused stress on Ingenuity's components, and recent diagnostics revealed a failure in the vehicle's inclinometer, one of its navigational sensors, mission team members announced in a status update.



(NASA's Perseverance rover and Ingenuity helicopter on Mars. (Image credit: NASA/JPL-Caltech/MSSS))

## **A dead sensor: the inclinometer:**

The inclinometer is responsible for supplying Ingenuity's flight software with gravimetric data prior to takeoff. This data allows Ingenuity to determine its position relative to the downward pull of Mars gravity and enables calculations of the vehicle's roll and pitch prior to takeoff, Ingenuity chief pilot Harvard Grip of JPL explained in the status update. Without this initial data, the vehicle's software cannot determine proper orientation for Ingenuity during flight. But Grip and his colleagues think a redundancy in the helicopter's sensor array may allow them to keep Ingenuity flying. Redundancy is the name of the game for NASA engineers, even when it comes to technology demonstrators with short life expectancies such as Ingenuity. Mission team members had envisioned a possible inclinometer failure under a number of various hypothetical scenarios, so they were ready with a software patch to address the issue well before the rover/copter duo's arrival on Mars last year.

In addition to the inclinometer, the helicopter's navigational sensors include an inertial measurement unit (IMU) to measure acceleration and angular velocities, a laser rangefinder to measure altitude and a camera for taking pictures during flight.

Both the inclinometer and the IMU operate using accelerometers to determine orientation. However, the inclinometer does not operate during flight, only during preflight. With the inclinometer no longer functioning, the Ingenuity team aims to doubly purpose the accelerometer in Ingenuity's IMU to collect preflight gravitational data, as well as in-flight inertial awareness.



(Image credit: NASA.gov)

## **Implementing a patch:**

To proceed with this replacement of tasks, the engineers at NASA must implement a patch, a process of inserting a small code snippet into the software running on Ingenuity's flight computer. This patch will serve to intercept incoming garbage packets from the inclinometer and inject replacement packets constructed from IMU data.

What's even better is that NASA's engineers had anticipated that such a situation could arise and had prepared the required software patch prior to the chopper's arrival on Mars. They had kept the patch on the shelf for just such an occasion. One has to marvel at the incredible engineering and preparation of the NASA staff.

## SPACEX FALCON 9 ROCKET ACES RECORD 13TH FLIGHT IN STARLINK SATELLITE LAUNCH

SpaceX launched one of its Falcon 9 rockets for the 13th time on June 17, setting a new reuse record.

The two-stage Falcon 9 lifted off from NASA's Kennedy Space Center in Florida on 17th June at 12:09 p.m. EDT (1609 GMT), carrying 53 of SpaceX's Starlink internet satellites to orbit. It was the first of three rocket launches in three days from three different pads that SpaceX plans to pull off.

The 53 satellites were deployed into low Earth orbit about 15.5 minutes after launch, as planned. But there was action before then as well: About 8.5 minutes after liftoff, the Falcon 9's first stage came down to Earth for a vertical landing on the SpaceX dronship A Shortfall of Gravitas, which was stationed in the Atlantic Ocean off the Florida coast.

It was the 13th launch and landing for this Falcon 9 first stage, setting a new SpaceX reuse record. The booster previously helped loft a GPS satellite, a Turkish communications satellite, a variety of spacecraft on the Transporter 2 "rideshare" mission and nine Starlink batches, according to a SpaceX mission description.

Such extensive reflight is a big priority for SpaceX and its billionaire founder and CEO, Elon Musk. Musk has repeatedly said that rapid and complete reuse is the key breakthrough that will allow humanity to settle Mars and achieve a variety of other ambitious spaceflight feats.

Starlink is SpaceX's constellation of internet satellites. The company has now launched more than 2,700 Starlink craft to orbit, and the number will continue to increase far into the future; the next-generation version of the network could eventually consist of up to 30,000 satellites.

This mission kicked off a planned rocket tripleheader for SpaceX, which also intends to launch a radar satellite for the German military on Saturday morning (June 18) and a commercial communications satellite early Sunday (June 19).

This intense 36-hour stretch will continue a very busy year for SpaceX. The company has already launched 24 missions in 2022, 15 of them dedicated Starlink flights.



Image credit: SpaceX)



A SpaceX Falcon 9 rocket topped with 53 Starlink internet satellites lifts off for a record-setting 13th time on June 17, 2022. (Image credit: SpaceX)

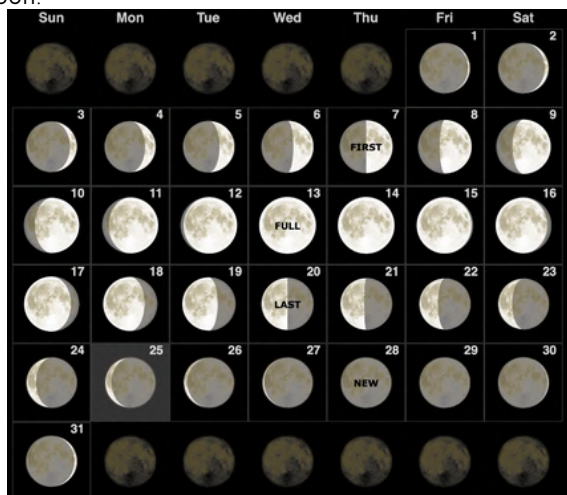
# WHAT'S UP IN THE SKY - JULY 2022

## 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.

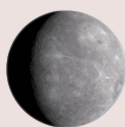
So, What Moon phase is best for stargazing? "The New Moon and the days immediately before and after the new moon (Crescent phases)" are among the best times for stargazing. Whereas the Remaining phases like Full Moon, waxing or waning gibbous, the first or third quarter Moon offers a time to zoom in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



## PLANETS VISIBILITY

### Mercury

Low morning planet early July and low evening planet at the end of the month. Tricky to see.



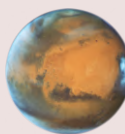
### Venus

Morning planet rising nearly two hours before sunrise. Thin crescent Moon nearby on 26 and 27 July.



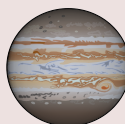
### Mars

Morning planet. Prominently visible throughout the whole month in the eastern direction before sunrise.



### Jupiter

Bright morning object in Cetus, improving throughout the month of July.



### Saturn

Improving morning planet. Bright gibbous Moon nearby on 16 July.



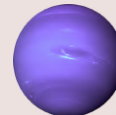
### Uranus

Morning planet, improving through July. Mars nearby at the end of the month.



### Neptune

Neptune is best seen at the end of the month.



## BRIGHT DEEP SKY OBJECTS

Messier 83 (M83) also known as the Southern Pinwheel Galaxy and NGC 5236, is a barred spiral galaxy approximately 15 million light-years away in the constellation borders of Hydra and Centaurus. It is one of the closest and brightest barred spiral galaxies in the sky, With an apparent magnitude of 7.5 and is one of the brightest spiral galaxies in the night sky.



M4, located in the constellation Scorpius, is a huge collection of stars known as a globular cluster. Just 5,500 light-years away, it is the closest globular cluster to Earth. Because of its apparent magnitude of 5.9 and proximity to Antares, one of the brightest stars in the night sky, M4 is relatively easy to find with a small telescope.

This stellar swarm is M80, one of the densest of the approximately 150 known globular clusters in the Milky Way galaxy. Located about 28,000 light-years from Earth in the constellation Scorpius, M80 has an apparent magnitude of 7.9 and can be spotted with a small telescope most easily during July.



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.

# ROCKET LAUNCHES IN JULY 2022

## SSLV: EOS-02 (Demo 1)

DATE: Expected to be launched in July.

VEHICLE: SSLV rocket.

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

LAUNCH SITE: Satish Dhawan Space Center, Sriharikota, India.



(Image credit: ISRO.in)

### Rocket: SSLV

The Small Satellite Launch Vehicle (or SSLV) is a launch vehicle being developed by the Indian Space Research Organisation (ISRO) with a payload capacity of 500 kg to Low Earth orbit or 300 kg to Sun synchronous orbit for launching small satellites, with the capability to support multiple orbital drop-offs.

India's Small Satellite Launch Vehicle (SSLV) will launch on its first orbital test flight. Consisting of three solid-fueled stages and a liquid-fueled upper stage, the SSLV is a new Indian launch vehicle designed to carry small satellites into low Earth orbit.

## Firefly Alpha Mission

On July 17, Alpha, the world's most advanced 1,000 kilogram-small satellite launch vehicle, will be launched into space. Alpha is developed by American private aerospace firm Firefly Aerospace.

### Mission Details

Alpha offers the highest payload capacity for the lowest cost per kilogram in its vehicle class, Firefly said on its website. It is a two-stage expendable launch vehicle intended to provide launch options for both vehicle and ride share customers.

The Firefly Alpha mission will lift off on July 17, from Space Launch Complex 2, Vandenberg Space Force Base, California. The spacecraft will carry educational payloads including Stanford University's Sapling 1 and California Polytechnic State University's Spinnaker3. This mission is Alpha's second orbital launch, and will carry more deployable educational payloads.



## United Launch Alliance Mission

On July 31, American spacecraft launch service provider United Launch Alliance (ULA) will launch Atlas V from Space Launch Complex 41, Cape Canaveral Space Force Station. Atlas V, which is an expendable launch vehicle, will carry two payloads, namely SBIRS GEO-6 and EZIO into geosynchronous Earth orbit.



The Space-Based Infrared System (SBIRS) is a United States Space Force system intended to meet the infrared space surveillance needs of the US through the first two to three decades of the 21st century. SBIRS GEO-6 is the sixth geosynchronous satellite of the Space-Based Infrared System program. It will provide capabilities for early missile warning and missile defence.

# China to launch new lab, robotic arm to its under-construction space station

**Lift Off Date:** July 23, 2022

**Mission Name:** Wentian - Long March 5B

Type: Human Exploration

## Wentian:

Wentian is the first Laboratory Cabin Module (LCM) and second major component of the Chinese space station Tiangong. It will provide additional navigation avionics, propulsion and orientation control as backup functions for the Core Cabin Module (CCM) as well as a pressurized environment for researchers to conduct science experiments in zero gravity.

**Rocket:** Long March 5B - China Aerospace Science and Technology Corporation

Length: 53.66 m and Diameter: 5 m

Launch Mass: 837 T

Low Earth Orbit Capacity: 25000 kg

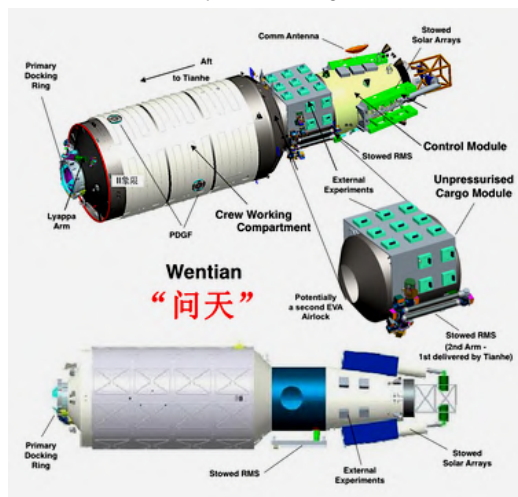
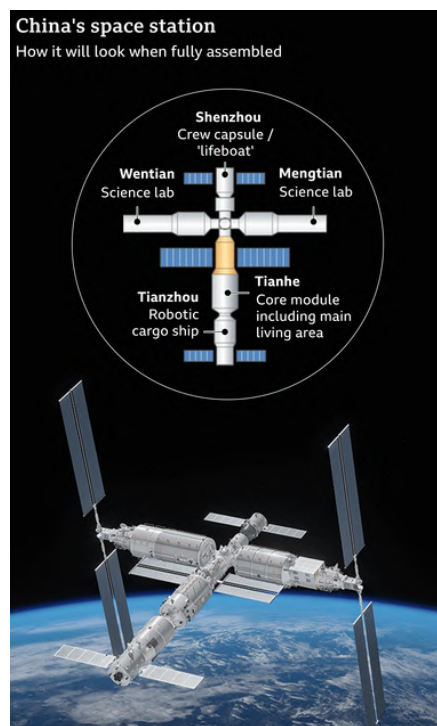
**The Long March 5B** was manufactured by China Aerospace Science and Technology Corporation with the first launch on 2020-05-05. Long March 5B has 2 successful launches and 0 failed launches with a total of 2 launches. The configuration of the CZ-5B variant consists of the Long March 5 core stage with its four strapped-on liquid-fueled boosters, but the usual second stage will be absent; in place of the second stage would be heavier low earth orbit payloads.

## Purpose:

The Wentian laboratory module will provide additional navigation avionics, propulsion and orientation control as backup functions for the Tianhe Core Module (TCM). It also provides a pressurized environment for researchers to conduct science experiments in freefall or zero gravity which could not be conducted on Earth for more than a few minutes. Experiments can also be placed on the outside of the modules, for exposure to the space environment, cosmic rays, vacuum, and solar winds. The axial port of Wentian will be fitted with rendezvous equipment and will first dock to the axial port of Tianhe. A mechanical arm dubbed, as Indexing robotic arm, looking a sort of Lyappa arm used on the Mir space station will then move the module to a radial port of the CCM.

It is different from Lyappa as it works on a different mechanism. Lyappa arm is needed to control the pitch of the spacecraft and redocking in a different plane. But the indexing robot arm where docking is needed in the same plane. In addition to this arm used for docking relocation, the Chinarm on Tianhe module can also be used as a backup.

Electrical power is provided by two steerable solar power arrays, which use photovoltaic cells to convert sunlight into electricity. Energy is stored to power the station when it passes into the Earth's shadow. Resupply ships will replenish fuel for LCM 1 for station-keeping, to counter the effects of atmospheric drag.



## Launch:

Wentian is scheduled to launch on 23 July 2022. It will be inserted into a low Earth orbit with an average altitude of 393 km (244 mi) at an orbital inclination of 42 degrees, centered in the Earth's thermosphere.

## Assembly:

The Shenzhou 14 mission to the space station will assist with setting up the Wentian module in orbit.



# ELECTRON: WISE ONE LOOKS AHEAD

## Mission Overview:

Wise One Looks Ahead is the first of two back-to-back launches for the National Reconnaissance Office. Launching from Rocket Lab Launch Complex 1 on two Electron rockets, Rocket Lab is scheduled to deploy satellites to space for the NRO within only 10 days of each other. Wise One Looks Ahead (NROL-162) will launch from Launch Complex 1's Pad A no earlier than July 12, 2022, with Antipodean Adventure (NROL-199) scheduled to launch from Pad B no earlier than July 22, 2022.

The NROL-162 and NROL-199 missions will carry national security payloads designed, built, and operated by the National Reconnaissance Office in partnership with the Australian Department of Defense as part of a broad range of cooperative satellite activities with Australia. The satellites will support the NRO to provide critical information to government agencies and decision makers monitoring international issues.

- Name: NROL-162 (RASR-3)
- Type: Government/Top Secret
- Launch Cost: \$6,000,000
- Classified payload for the US National Reconnaissance Office (NRO).

These twin missions will be a demonstration of responsive launch under NRO's Rapid Acquisition of a Small Rocket (RASR) contract for launching small satellite through a streamlined, commercial approach, and are the third and fourth missions contracted to Rocket Lab by the NRO under the contract. NROL-151 (RASR-1) was successfully deployed to space on a dedicated Electron launch in early 2020, followed by RASR-2 on another Electron launch in June 2020.



## About the Rocket:

The Electron was manufactured by Rocket Lab Ltd with the first launch on 2017-05-25. Electron has 24 successful launches and 3 failed launches with a total of 27 launches. 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.

**About the Agency:** Rocket Lab is an American aerospace manufacturer with a wholly owned New Zealand subsidiary. The company develops lightweight, cost-effective commercial rocket launch services. The Electron Program was founded on the premise that small payloads such as CubeSats require dedicated small launch vehicles and flexibility not currently offered by traditional rocket systems. Its rocket, the Electron, is a light-weight rocket and is now operating commercially. Electron currently launches from only Mahia Peninsula in New Zealand however a second launch complex in the US is under development.





# SpaceX Launches - July 2022

## SPACEX FALCON 9 CRS-25: JULY 15, 2022

NASA's SpaceX CR-25 is the 25th SpaceX cargo resupply services mission carrying scientific research and technology demonstrations to the International Space Station. It is scheduled to launch on July 15, from NASA's Kennedy Space Center in Florida. The SpaceX Crew Dragon spacecraft will carry scientific experiments including studies of the immune system, Earth's oceans and soil communities. The spacecraft will be launched atop a Falcon 9 rocket and will carry a payload called BeaverCube. This is a small satellite developed by the Massachusetts Institute of Technology which uses multiple cameras, one that takes colour images of Earth's oceans and two that collect thermal images of cloud tops and the ocean surface. The Dragon will also carry the Earth Surface Mineral Dust Source Investigation (EMIT), a technology to measure the mineral composition of dust in Earth's arid regions. As many as five CubeSats, namely MIT's BeaverCube, The Weiss School's CapSat 1, NASA Ames Research Center's CLICK A, Embry-Riddle Aeronautical University's D3, and University of South Alabama's JAGSAT will be launched as part of the ELaNa 45 mission. This is a part of the SpaceX CR-25 mission.



## STARLINK SATELLITE SERIES

### July 7: Starlink Launch

SpaceX will launch 53 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 provides high-speed, low-latency broadband internet across the globe.

### July 8: Starlink Launch

On July 8, SpaceX will launch 53 Starlink satellites atop a Falcon 9 Block 5 rocket from Space Launch Complex 4, Vandenberg Space Force Base, California. This is the first dedicated mission deploying Starlink satellites to Sun-synchronous orbit.

### July 10: Starlink Launch

On July 10, SpaceX will launch 53 Starlink satellites atop a Falcon 9 Block 5 rocket from Cape Canaveral Space Force Station or Kennedy Space Center.



## First Flight Of Vega C

Vega C is a **European Space Agency** (ESA) program that will further solidify Arianspace's market position for small satellite launches to low-Earth orbit (LEO).

Arianspace is a French company founded in 1980 as the world's first commercial launch service provider, and undertakes the operation and marketing of the Ariane programme, a mission that has been leading Europe to the forefront of space transportation for over 40 years.

Vega C, which is an upgraded and more powerful version of the current Vega launch vehicle, will blast off into space on July 7, from Ensemble de Lancement Ariane 1 (ELA-1), a launch pad in French Guiana.



Vega C will carry a number of payloads including Italian Space Agency's LARES 2 (Laser Relativity Satellite) and Sapienza University of Rome's AstroBio CubeSat.

Vega C is a flexible launch system that can be adapted for a broad range of missions from nanosatellites to larger optical and radar observation spacecraft.

# China's Galactic Energy Aims to launch Ceres-1



(Image credit: Galactic Energy.Cn)

**Galactic Energy is a Chinese private space launch enterprise developing the Ceres-1 and Pallas-1 orbital rockets. Ceres-1 is a four-stage rocket, the first three stages use solid-propellant rocket motors and the final stage uses a hydrazine propulsion system. It is about 19 m tall and 1.4 m in diameter.**

The Ceres-1 rocket can put up to 350 kg into low earth orbit and 270 kg into a 700 km sun synchronous orbit. The first launch of Ceres-1 took place at 7 November 2020, successfully placing the Tianqi 11 (also transcribed Tiange, also known as TQ 11, and Scorpio 1, COSPAR 2020-080A) satellite in orbit. The satellite's mass was about 50 kg (110 lb) and its purpose was to function as an experimental satellite offering Internet of things (IoT) communications.

Galactic Energy became the second private company of China to successfully put a satellite in orbit (after i-Space) and the fourth to attempt to do that (after Landspace, OneSpace and i-Space).

On 6 December 2021, Galactic Energy launched its second Ceres-1 rocket becoming the first Chinese private firm to reach orbit twice. In January 2022, the company raised \$200 million for reusable launch vehicle development.

Ceres-1 was named after the dwarf planet Ceres, symbolizing Galactic Energy's eventual ambitions to mine asteroids for resources. Discovered in 1801 by Italian astronomer Giuseppe Piazzi, Ceres would later become the first object to be designated an asteroid before being reclassified again as a dwarf planet in 2006.

While Galactic Energy appears to have developed their own series of solid motors, named Lightyear, other companies in their sector including i-Space are building their rockets using solid motors purchased from the state-owned China Aerospace Science and Technology Corporation (CASC).

Galactic Energy, a private launcher service provider, is planning to launch its third Ceres-1 solid rocket by the end of July, and could test a sea launch of the vehicle before the end of year.

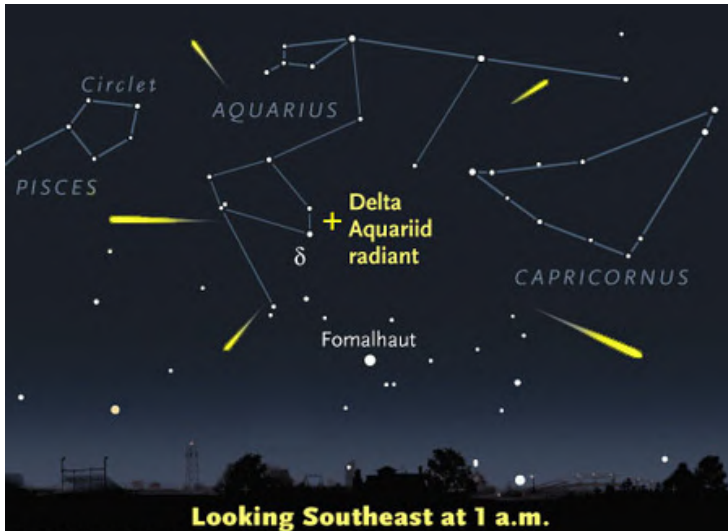


**\*\*Note: Launch dates of missions are scheduled to be launched in July 2022 but may subject to change.**

# ASTRONOMICAL EVENTS - JULY 2022

## DELTA AQUARIDS METEOR SHOWER

The Delta Aquarids ramble along for weeks, combining with the Perseids. Just be sure you're looking in a dark sky.



(Image credit: Sky and telescope.com)

The Delta Aquarids are active beginning in mid-July and are visible until late-August. There's a nominal predicted peak on July 29, 2022. These faint meteors are difficult to spot, and if there is a moon you will not be able to view them. If the moon is not present, your best chance to see the Delta Aquarids is when meteor rates rise during the shower's peak at the end of July.

If you are unable to view the Delta Aquarids during their peak, look for them again during the Perseids in August: You will know that you have spotted a Delta Aquarid if the meteor is coming from the direction of the constellation Aquarius—its radiant will be in the southern part of the sky. The Perseid radiant is in the northern part of the sky.

**Viewing Tips:** The Delta Aquarids are best viewed in the Southern Hemisphere and southern latitudes of the Northern Hemisphere. 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 and look up, taking in as much of the sky as possible. Looking halfway between the horizon and the zenith, and 45 degrees from the constellation of Aquarius will improve your chances of viewing the Delta Aquarids. In less than 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.

**Where Do these Meteors Come From?:** Meteors come from leftover comet particles and bits from broken asteroids. When comets come around the sun, the dust they emit gradually spreads into a dusty trail around their orbits. 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 Delta Aquarids are suspected to originate from comet 96P/Machholz. This short period comet orbits the sun about once every five years. Comet Machholz was discovered by Donald Machholz in 1986. Comet Machholz's nucleus is about 4 miles (6.4 kilometers) across (a little more than half the size of the object hypothesized to have led to the demise of the dinosaurs).

**The Radiant:** Radiant is the point in the sky from which the Delta Aquarids appear to come from—is the constellation Aquarius. The third brightest star within this constellation is called Delta. This star and the constellation is also where we get the name for the shower: Delta Aquarids.



(An image of the comet 96P/Machholz captured by the STEREO-A spacecraft.)

# EARTH AT APHELION

Did you know that Earth reaches its farthest point from the Sun about two weeks after the June solstice? It happens on July 4, 2022! We call this point in Earth's orbit around the Sun "aphelion." Interestingly, we're closest to our fiery star in the winter and farthest away in the hot summer. Learn all about perihelion and aphelion!

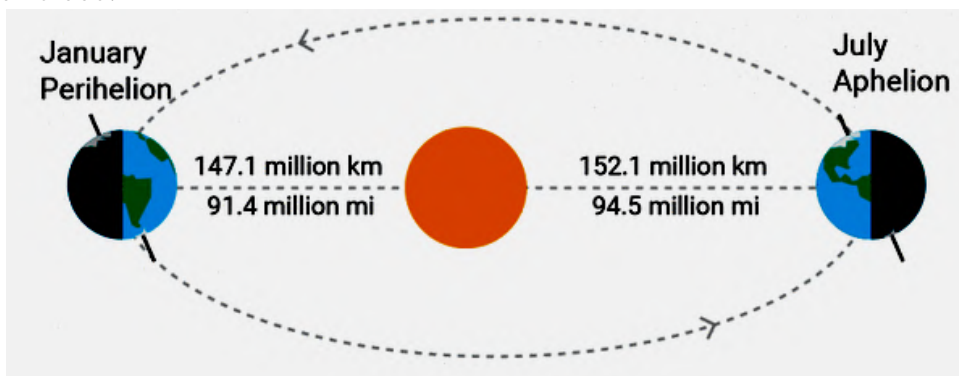
## What Are Perihelion and Aphelion?

The terms perihelion and aphelion describe different points in the Earth's orbit of the Sun.

Remember that the Earth orbits the Sun in an elliptical path—which is oval, not circular. This means that the Earth is about 3 million miles nearer to the Sun in January at its nearest point than in July at its farthest point.

- Aphelion is the point of the Earth's orbit that is farthest away from the Sun.
- Perihelion is the point of the Earth's orbit that is nearest to the Sun.

The words come from Ancient Greek, in which helios means "Sun," apo means "far," and peri means "close."



(Image credit: Timenanddate.com)

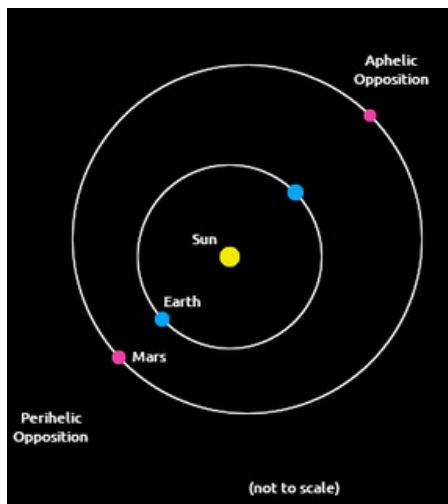
## Perihelion and Aphelion in 2022

In 2022, Earth was at perihelion on January 4 at 1:52 A.M. Eastern Time and will be at aphelion on July 4 at 3:10 A.M. Eastern Time.

This year, Earth will be 91,406,842 miles away from the Sun at perihelion and 94,509,598 miles away from the Sun at aphelion.

## Are Aphelion and Perihelion Related to Earth's Seasons?

It's not the distance from the Sun that causes our seasons. Seasons happen because Earth's axis is tilted at an angle. It's because Earth orbits the Sun on a tilt that our planet gets more or less of the Sun's direct rays at different times of the year.



## Aphelion and Perihelion on Mars

Though aphelion and perihelion are terms mostly used in reference to Earth since it's our home planet, they are also relevant to other planets orbiting the Sun. Every planet has points in the orbits when they are farthest or closest away from their star.

For example, planet Mars has an even more elliptical orbit than Earth. In comparison, Earth's orbit seems almost circular; this almost-circular orbit may be why Earth's climate is relatively stable.

Mars also has four seasons but they are twice as long because it takes about two Earth years for Mars to go around the Sun.

The southern hemisphere of Mars has a warmer, shorter spring and summer than in the north, as Mars is closest to the Sun towards the end of southern spring. The southern winter is longer because Mars is farthest away from the Sun then, moving more slowly in its elliptical orbit around the Sun.

# PLUTO OPPOSITION

Pluto will reach opposition, when it lies opposite to the Sun in the sky. Lying in the constellation Sagittarius, it will be visible for much of the night, reaching its highest point in the sky around midnight local time. The dwarf planet reaches opposition on July 20. Here's what you need to know to spot it.

**Pluto the active world:** On July 14, 2015, the New Horizons probe swept within 7,700 miles (12,400 kilometers) of Pluto's surface. With the flyby, features that the Hubble Space Telescope previously saw as fuzzy spots suddenly resolved into broad canyons, flowing ice, expansive craters, mountains of frozen water, and a giant glacier only 10 million years old. The spacecraft proved that Pluto is still a geologically active world, but it also provided a list of questions that will take scientists decades to answer.

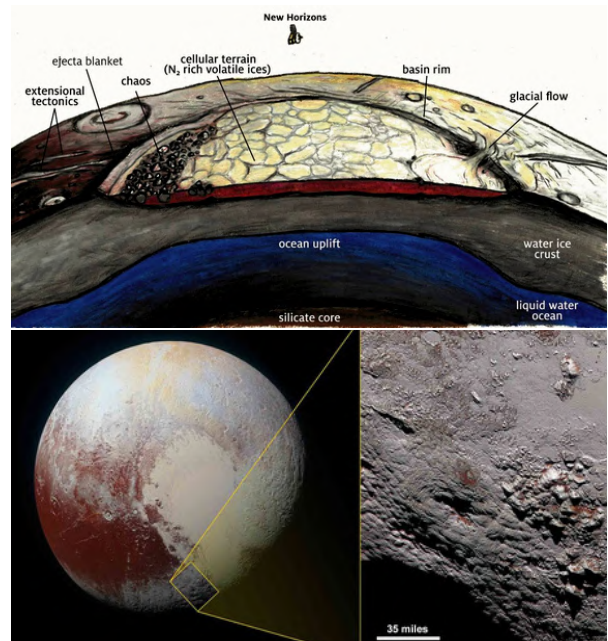
Still, researchers aren't the only ones entranced by the wondrous world of Pluto – amateur astronomers across the globe are eager to check the dwarf planet off their observing bucket lists. Luckily, this summer, Pluto moves into prime position. Well, about as prime as it gets for the distant dwarf planet.

## Prepare for the hunt

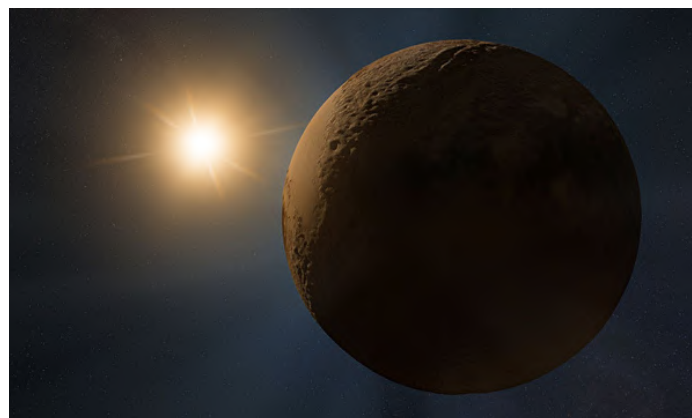
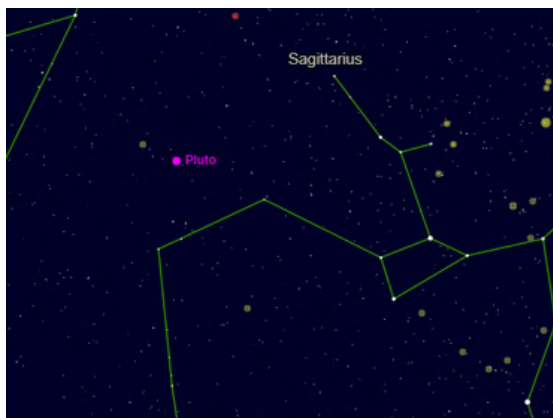
Because Pluto glows dimly at magnitude 14.9 and appears as a mere point of light through any telescope, simply identifying it brings a sense of satisfaction. But to see it, you need the right telescope, a dark site, and the star charts that accompany this story.

The frozen world reaches opposition July 20. At that point, it lies opposite the Sun in our sky and is visible all night. Pluto's visibility changes so slowly, however, that it remains just as easy to spot for a few weeks on either side of this peak date. That's good, because the 20th is the date of the Third Quarter Moon, which will scatter enough light throughout Earth's atmosphere that it will make finding Pluto difficult.

An 8-inch telescope will be enough to reveal Pluto, although a larger instrument, which collects more light, will make the task quite a bit easier. Once you've got your gear lined up, locate an observing site that isn't simply dark, but also has good seeing, or atmospheric steadiness.



(Image credit: nasa.org)



In practice, however, 134340 Pluto orbits much further out in the solar system than the Earth – at an average distance from the Sun of 39.74 times that of the Earth, and so its brightness does not vary much as it cycles between opposition and solar conjunction.

# CONJUNCTIONS FOR THE MONTH

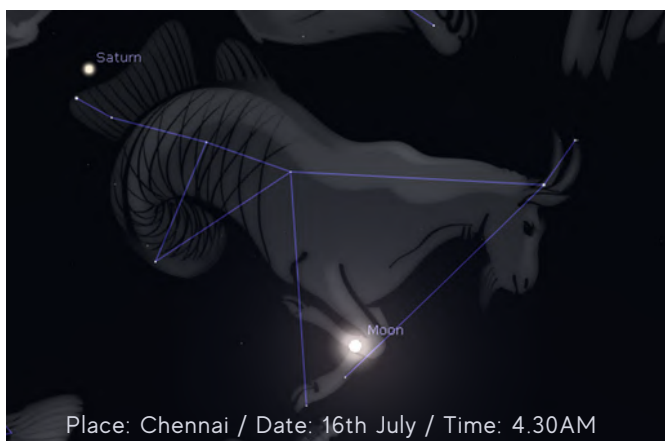
**Conjunction** - Occasionally two or more objects meet up with each other in our sky. Astronomers use the word conjunction to describe these meetings. Technically speaking, objects are said to be in conjunction in that instant when they have the same right ascension on our sky's dome. Practically speaking,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

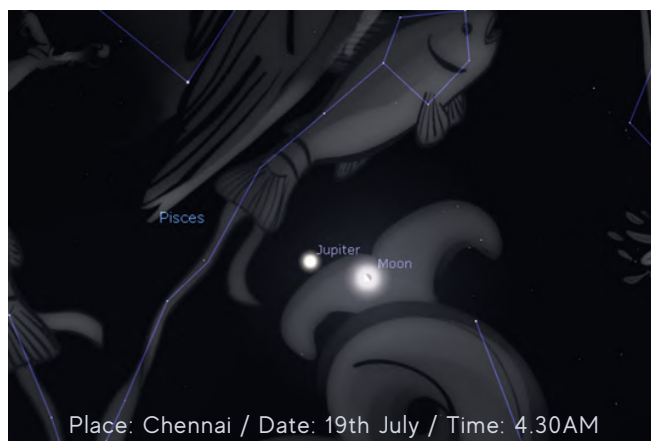
**Date: 16th July**, Planet Saturn & Moon will align in the early morning sky. Look towards east before sunrise. The Moon is at a magnitude of -12.7, and Saturn at a magnitude of 0.4. At this time the Moon phase is 93.5%.



Place: Chennai / Date: 16th July / Time: 4.30AM  
(Image credit: Stellarium)

## Conjunction of Moon and Jupiter

**Date: 19th July**, Moon will have a closer approach of Jupiter during the early morning of 19th July. The Moon is at a magnitude of -12.2, and Jupiter at a magnitude of -2.6. At this time the Moon phase is 66.1%.



Place: Chennai / Date: 19th July / Time: 4.30AM  
(Image credit: Stellarium)

## Conjunction of Moon and Mars

**Date: 22nd July**, Planet Mars & Moon will align in the early morning sky. Look towards east before sunrise. The Moon is at a magnitude of -11.5, and Mars at a magnitude of 0.3. At this time the Moon phase is 39.1%.



Place: Chennai / Date: 22nd July / Time: 4.30AM  
(Image credit: Stellarium)

## Conjunction of Moon and Venus

**Date: 27th July**, Moon will have a closer approach with the planet also known as the morning and evening star Venus. The Moon is at a magnitude of -9.1, and Venus at a magnitude of -3.9. At this time the Moon phase is 4.3%.



Place: Chennai / Date: 27th July / Time: 5.00AM  
(Image credit: Stellarium)

# STUDENT'S CORNER

## *Astronomy in Ancient Civilizations*

Sourajit Mandal

iAstronomer member, Space India.

We have reached great heights. We have landed on the moon, launched thousands of satellites, made high-tech space telescopes like Hubble and James-Webb and even taken pictures of 2 black-holes!

Have you ever wondered where all this advanced astronomy started at the basic level? Probably 100 years back? Probably 1000 years back?

No. It started as soon as humanity itself.

In the ancient Mesopotamian civilization celestial objects such as sun and moon were given significant powers as omens. An omen is an observed phenomenon that is interpreted as signifying good or bad fortune. "When the moon disappears, evil will befall the land. "

This means when the moon disappears out of its place, an eclipse will take place.

With this we can know that, they kept a track of the movements of the sun and the moon. We also know that they kept a detailed document including a daily, monthly, and yearly position of the celestial bodies. They were also the first one to document the Halley's comet and dividing the sky into zones.

In the ancient Egyptian civilization pyramids were built based on astronomical positions. An example is the Great pyramid of Giza. It was built to align with the North Star which at that time was Thuban instead of Polaris.



(Image credit: Astronomy trek)



(Location: Nabta playa - Ancient stone structure)

The Nabta Playa is where a circular stone structure can be found which is presumed to be a giant calendar to identify the summer solstice.

The Indian civilization had many contributions to the field of astronomy but the most notable one was by Aryabhata.

Although his works are based on a geocentric earth model, many are still of value to modern mathematics and astronomy. Aryabhata was able to assume that the Earth is rotating on its axis and that the Moon and other planets shine through reflected light from the Sun.

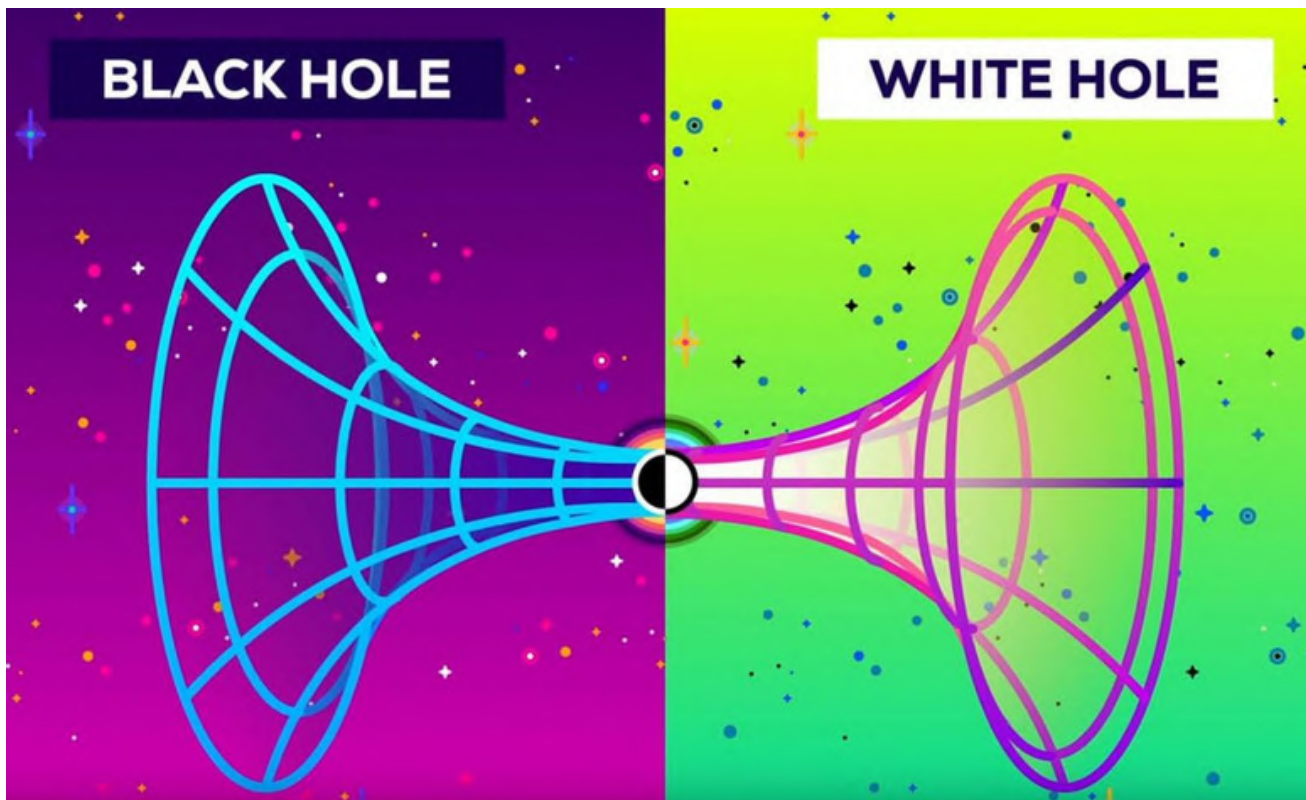
The Chinese civilization had one of the most detailed documentation of astronomical observations. Gang De, one of the most notable astronomers in Ancient China, was the first to take notice of Ganymede. He described it as a small reddish "star" around Jupiter.

Shi Shen, another astronomer, also created one of the most detailed and oldest catalogs of the stars - Star Catalogue of Shi.

They also noticed the sudden appearance of a star among other fixed stars. It is believed what they observed was a supernova. The Dunhuang Star Atlas discovered in a cave in China is said to be the earliest known preserved star map in the world.

These amazing advancements in astronomy are just a small fraction of what they have actually done. We still do not know everything they have done.

It is because of our ancestors that we have advanced so much in astronomy. We should remember them and keep working on. Then maybe, in the future, people will remember us for the advancements we made.



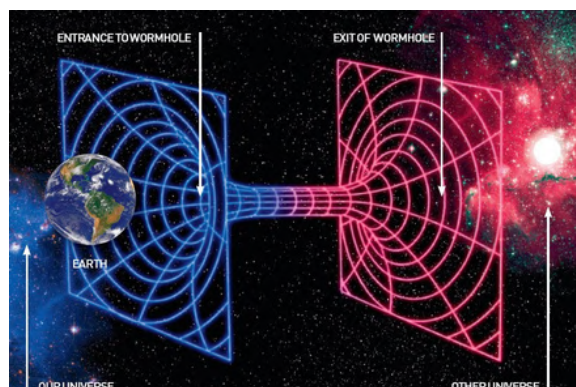
## Wormholes

Aarav Bhardwaj  
iAstronomer member.

We know that black holes suck whatever comes near it, but where does that material go. Does it stay in the black hole forever or is it thrown somewhere else?

Wormholes are like a tunnel which connect two points in space and time. Wormholes are a hypothesis given by Sir Albert Einstein and Rosen. That is why wormholes are also known as EINSTEIN -ROSEN BRIDGE. In his theory of general relativity. If Black hole sucks things, then where is it thrown away. Well, it is believed that Black Hole-SUCKS things and White Hole-THROWS thing out. This connection between black hole and white hole can be referred as wormholes.

It is also believed that if a matter goes from our universe to the MOUTH OF WORMHOLE it is transported to another universe.



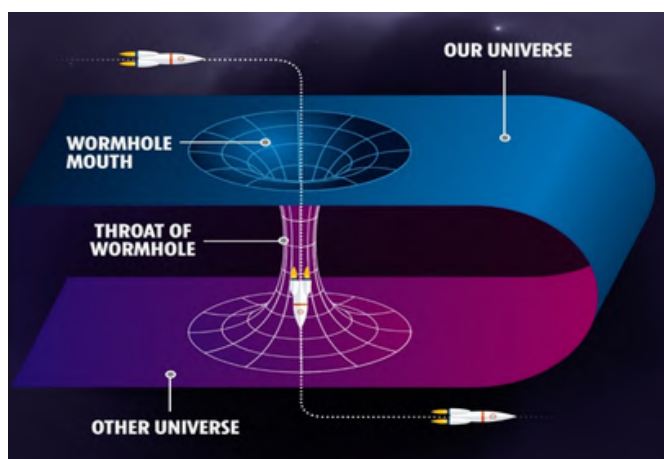
One mathematical formula for Wormholes is,

$$R_{\mu\nu} - \frac{1}{2}R g_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

The left-hand side is called the Einstein Tensor.  $R_{\mu\nu}$  is the Ricci tensor.  $R$  is how curved is spacetime near your location.  $G_{\mu\nu}$  is how the distances measured in spacetime.  $T_{\mu\nu}$  is how are the things distributed in space time.

I believe that if matter is transported through wormholes into a parallel universe, for us Black Hole-SUCKS things and White Hole-THROWS things out but there might be a chance for the people living in the parallel universe White Hole: Sucks things and Black Hole: throws out.

There might be a chance that there are hundreds of universes. But for now, nobody knows that.





# Replacing the sun with a Blackhole

G. Sai Ganesh

iAstronomer member.

In an infinite universe, every point can be regarded as the center because every point has an infinite number of stars on each side of it. Yes, here we are and welcome to the space journey of our not so owned space but true that we sure share it with the parallel us.

Black holes, one of the strangest objects that mankind ever encountered in their lives, regardless of what our own space wizard, Sir Albert Einstein thought of and taught us. The Debate here is quite simple of a thought rather than a practical sort. So, for the rest of the journey what if a black hole is being replaced in the place of our sun of same mass.

Quite simple we will receive no heat and light and would be freezing in the elms of darkness without noticing our own satellite, the moon and the entire solar system. But I could say this won't affect much for the first 8 minutes, it is when this time-lapse of 8 minutes fades away to days, months or rather years. Humanity would thrive for solar energy which is perpetual for the future of humans.



(Image credit: Science.org)

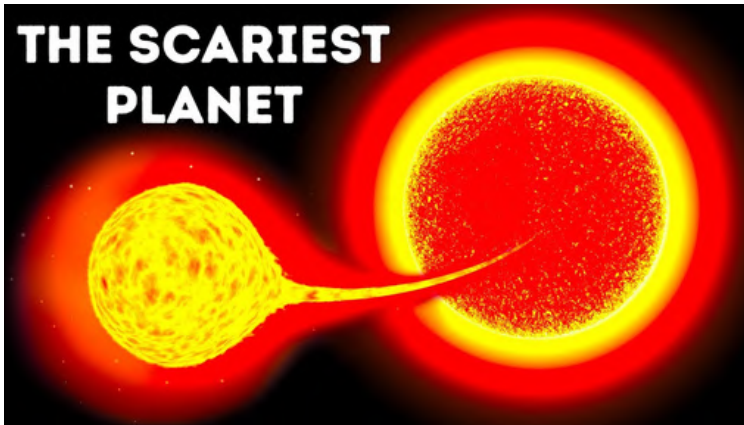
Earth's temperature would drop at an immense rate, due to lack of solar energy, life is obvious for a clear-cut question mark on planet "Earth" as well as surrounding planets unless we would search for a parallel home which is still a story for another "What If". Pretty sure photosynthesis process is no longer earth's part and it will leave the chat, and humans should survive by using underground geothermal energy for heat and electricity. This will change the way of living and surface would be a protruding way for homes as underground becomes our shelter for life eradicating, natural disasters, and elements of pollution.

The gravity would still not affect much of the activities that would happen on earth but prepare for an Isolated Era, where species would turn hungry for light unless they still not consider the regard for our Mother earth's Son, (Sun). Still, the quantum gravity and mechanics will remain as a theoretical thought as there is long way, we remain motionless in encountering a black hole near us.

For the fate of our earth, we would not be experiencing any gravitational force or the other planets would, in the solar system than it does now. Because, it would not contain no more matter than it does now and the arrow of time would not be disturbed. Henceforth, it is true that we are still revolving around a blackhole that is at the center of our milky way galaxy, and we are indeed puppets surrounding the master.

This will be the end of mankind and photochemical stock in the existing universe, where these black holes will rule the universe until it evaporates and spends its last moment with the dark phase of almighty, if supposed to say...

# THE SCARIEST PLANET



## Scariest Planets

Doyel Chanda  
iAstronomer member.

### WASP - 76B

Also known as the Ultra Hot Jupiter. It can trap 94% Radiation coming from the host star. But the most dangerous part is that instead of water it rains melted iron this takes science to a whole new level.

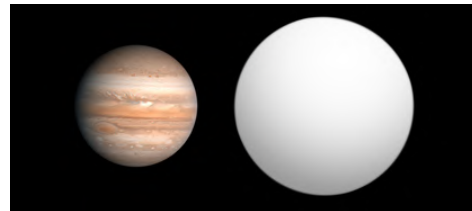
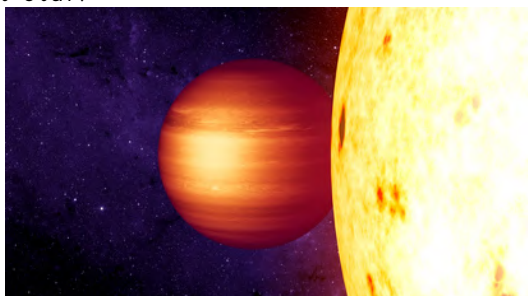


(Wasp-76b, a planet where it rains liquid iron)

It's also a surface less planet so from where the iron drops will fall no idea every drop temperature is 2.4 degree Celsius. If we try to get in this planet, we will turn into iron statue and vaporize. It's a tidal locked planet just like our moon so it doesn't rotate.

### Corot - 7B

Also known as two hells in one. It is mostly a Red Giant Star. It consists of magma and the reason behind it, is the distance between the Host star and the planet. Its Host Star is 360 times bigger than our Sun and the distance of the planet is 60 times closer than our Sun to its host star.

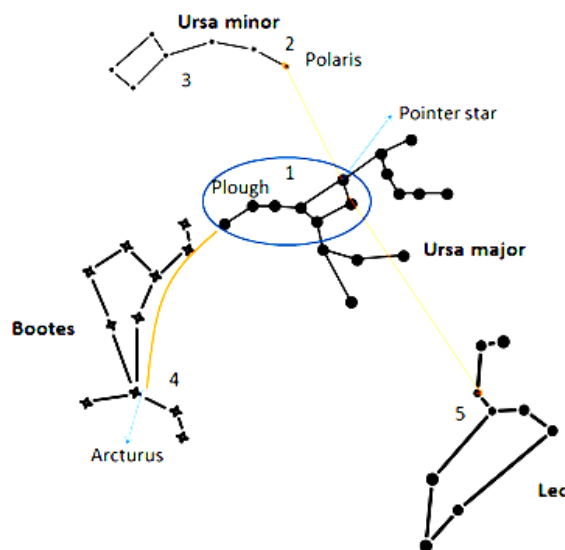


This planet can cut down any rock and make it evaporate in just a few seconds. It is also tidally locked so in the other side you will become a snowman. Here rains of pebbles take place at the speed of 10% of light.

## THE PLOUGH TO LEO

Sajan Saravanan  
iAstronomer member.

Ursa major is the third largest constellation in the sky also known as Great bear. The Plough is a part of Ursa major constellation. Plough (big dipper) is not a constellation its an Asterism. Ursa minor is the closest constellation to the north celestial pole and includes Polaris or north star. Leo is the zodiac constellation and represents lion.

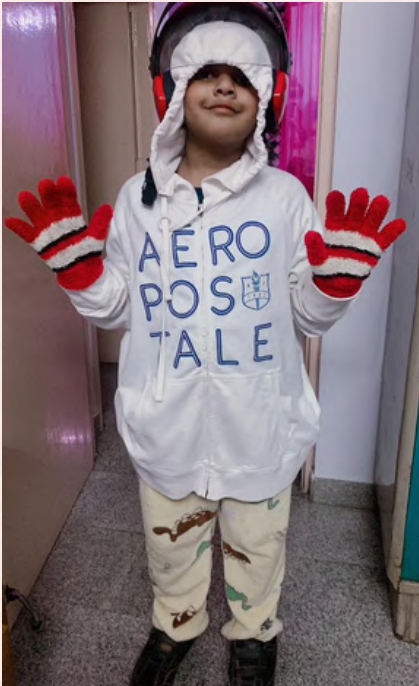


### Steps:

1. We can easily find plough in the sky during spring, the two stars in pan of the plough are called pointing stars.
2. Trace a line from the pointing stars above the plough till it reaches the bright star called Polaris.
3. Using Polaris we can find Ursa minor the little bear.
4. From the handle of plough trace an arc through the sky you can find 4th brightest star Arcturus in the Bootes constellation.
5. Trace a line from pointer star below the plough you can find the constellation Leo.

# 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 JULY

## Cassini spacecraft arrived at Saturn - 1 July, 2004

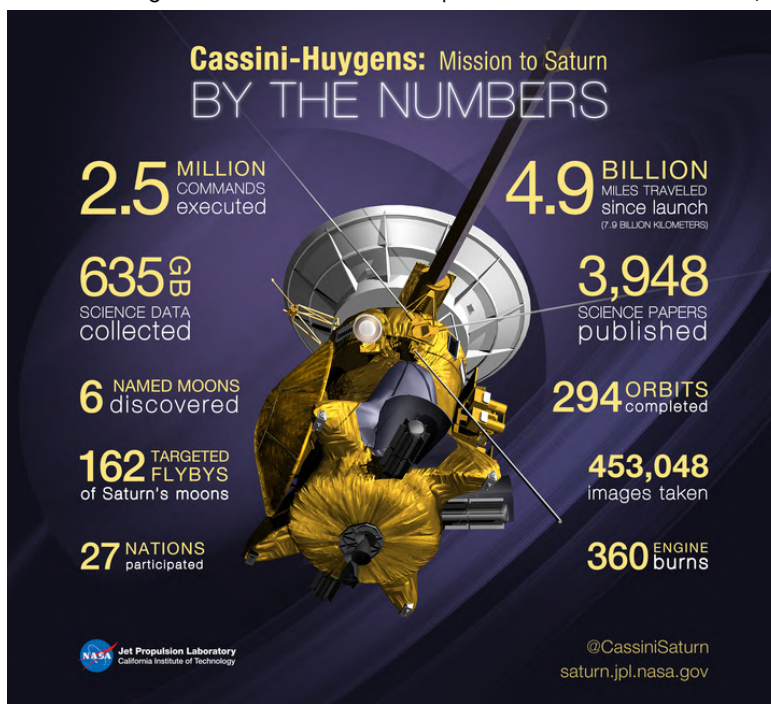
### The first spacecraft to orbit Saturn

Cassini-Huygens is a joint NASA/ESA/ASI unmanned space mission intended to study Saturn and its moons. The spacecraft consists of two main elements: the NASA Cassini orbiter, named after the Italian-French astronomer Giovanni Domenico Cassini, and the ESA Huygens probe, named after the Dutch astronomer Christiaan Huygens. It was launched on October 15, 1997.

### Arrival at Saturn

On July 1, 2004, the spacecraft flew through the gap between the F and G rings and achieved orbit, after a seven year voyage. It is the first spacecraft to ever orbit Saturn.

The Saturn Orbital Insertion (SOI) maneuver performed by Cassini was notably complex, requiring the craft to orient its High-Gain Antenna away from Earth and along its flight path, in order to shield its instruments from particles in Saturn's rings. Once the craft crossed the ring plane, it then had to rotate again so that its engine was pointed along its flight path, and then the engine fired to decelerate the craft and allow Saturn to capture it. Cassini was captured by Saturn's gravity at around 8:54 p.m. Pacific Daylight Time on June 30, 2004. During the maneuver Cassini passed within 20,000 km (13,000 miles) of Saturn's cloud tops.

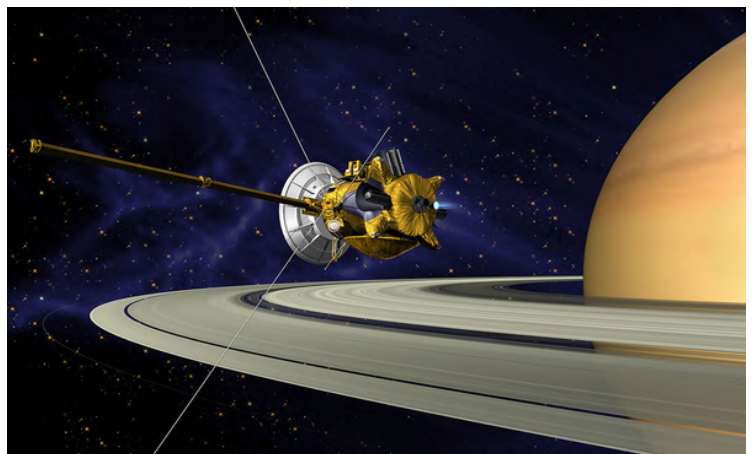


**Titan Flyby:** Cassini had its first distant flyby of Saturn's largest moon, Titan, on July 2, 2004, only a day after orbit insertion, when it approached to within 339,000 kilometers of Titan and provided the best look at the moon's surface to date. Images taken through special filters showed south polar clouds thought to be composed of methane and surface features with widely differing brightness. On October 27, 2004 the spacecraft executed the first of the 45 planned close flybys of Titan when it flew a mere 1,200 kilometers above the moon. Almost four gigabits of data were collected and transmitted to Earth, including the first radar images of the moon's haze-enshrouded surface. Radar imagery observed no conclusive evidence of lakes of liquid hydrocarbons, though it did not dismiss the possibility such lakes could exist.

It also revealed the surface of Titan to be relatively level, with topography reaching no more than about 50 meters in altitude. The flyby provided a remarkable increase in imaging resolution over previous coverage. Images with up to 100 times higher resolution were taken and are typical of resolutions planned for subsequent Titan flybys.

### Huygens encounter with Titan

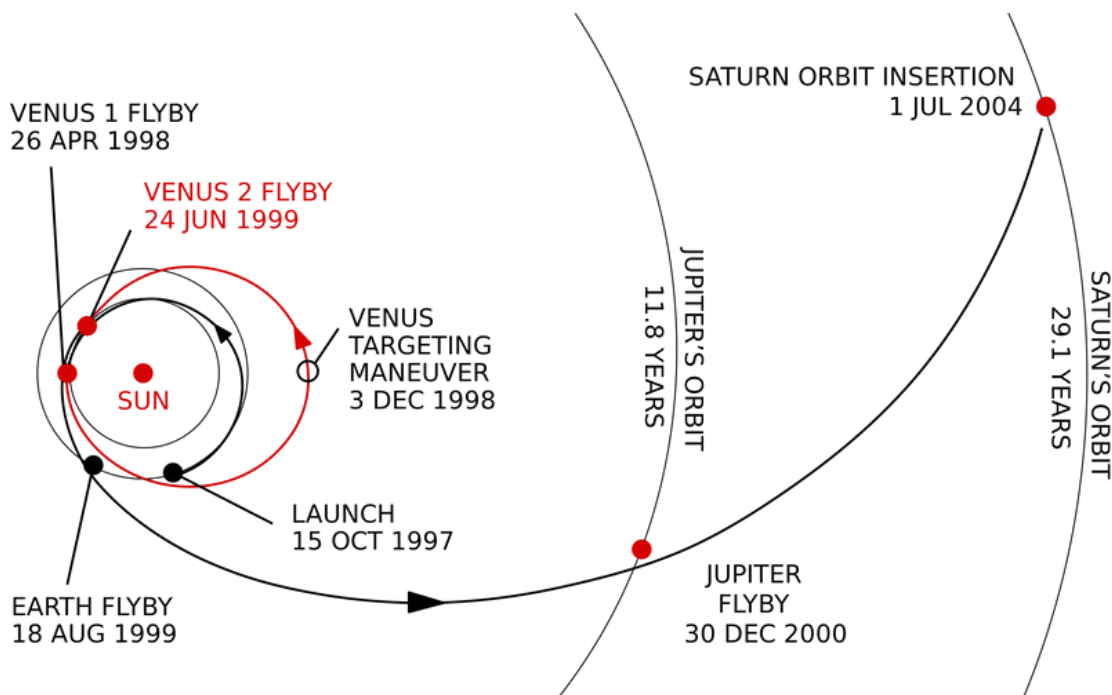
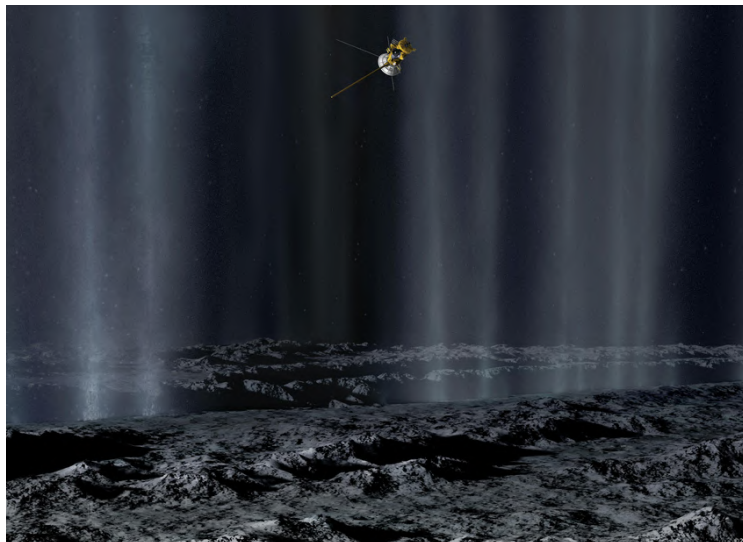
Cassini released the Huygens probe on 25 December 2004, by means of a spring. It entered the atmosphere of Titan on January 14, 2005. For more information on the landing, see Huygens probe.



## GALACTICA

### Enceladus flybys

During the first two close flybys of the moon Enceladus in 2005, Cassini discovered a "deflection" in the local magnetic field that is characteristic for the existence of a thin but significant atmosphere. Other measurements obtained at that time point to ionized water vapor as being its main constituent. Cassini also observed water ice geysers erupting from the south pole of Enceladus giving more credibility to the idea that Enceladus is supplying the particles of Saturn's E ring. Mission scientists hypothesize that there may be pockets of liquid water near the surface of the moon that fuel the eruptions, making Enceladus one of the few bodies in our solar system to have liquid water present.



The image above displays the initial gravity-assist trajectory of Cassini/Huygens. This is the process whereby an insignificant mass approaches a significant mass 'from behind' and 'steals' some of its orbital energy. The significant mass, usually a planet, loses virtually zero of its orbital energy yet the insignificant mass (in this case, the probe) gains a very large proportion of its orbital energy. Cassini/Huygens performed two gravity assists at Venus, one at Earth and one at Jupiter.

### Radio occultations of Saturn's rings

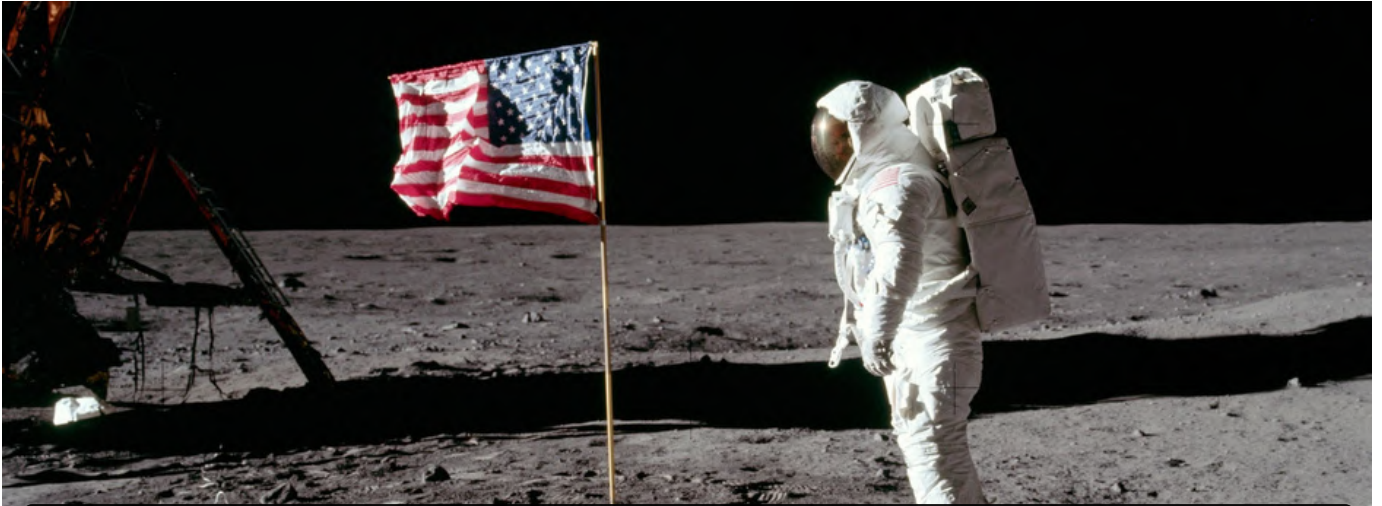
In May 2005, Cassini began a series of occultation experiments, designed to measure the size-distribution of particles in Saturn's rings, and to measure the atmosphere of Saturn itself. For over 4 months, Cassini will complete orbits specifically designed for this purpose. During these occultation experiments, Cassini will fly behind the ring plane of Saturn, as seen from Earth, and transmit radio waves through the particles. The radio signals are received on Earth, where the frequency, phase, and power of the signal is analyzed to help determine the structure of the rings.

### Lakes of Titan

Radar images obtained on July 21, 2006 appear to show lakes of liquid hydrocarbons (such as methane and ethane) in Titan's northern latitudes. This is the first discovery of currently-existing lakes anywhere besides Earth. The lakes range in size from about a kilometer to one which is one hundred kilometers across.

### Saturn hurricane

In November 2006, scientists discovered a storm at the south pole of Saturn with a distinct eyewall. This characteristic of a hurricane on Earth had never been seen on another planet before. Unlike a hurricane, the storm appears to be stationary at the pole. The storm is 5,000 miles across, 45 miles high and packing winds blowing 350 miles per hour.



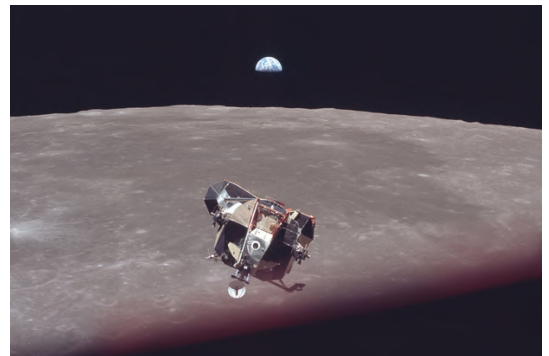
# APOLLO 11: THE FIRST MISSION THAT ACHIEVED A CREWED MOON LANDING

## Mission Highlights

Apollo 11 launched from Cape Kennedy on **July 16, 1969**, carrying Commander Neil Armstrong, Command Module Pilot Michael Collins and Lunar Module Pilot Edwin "Buzz" Aldrin into an initial Earth-orbit of 114 by 116 miles. An estimated 650 million people watched Armstrong's televised image and heard his voice describe the event as he took "one small step for a man, one giant leap for mankind" on July 20, 1969.

Two hours, 44 minutes and one-and-a-half revolutions after launch, the S-IVB stage reignited for a second burn of five minutes, 48 seconds, placing Apollo 11 into a translunar orbit. The command and service module, or CSM, Columbia separated from the stage, which included the spacecraft-lunar module adapter, or SLA, containing the lunar module, or LM, Eagle. After transposition and jettisoning of the SLA panels on the S-IVB stage, the CSM docked with the LM. The S-IVB stage separated and injected into heliocentric orbit four hours, 40 minutes into the flight.

The first color TV transmission to Earth from Apollo 11 occurred during the translunar coast of the CSM/LM. Later, on July 17, a three-second burn of the SPS was made to perform the second of four scheduled midcourse corrections programmed for the flight. The launch had been so successful that the other three were not needed.



On July 18, Armstrong and Aldrin put on their spacesuits and climbed through the docking tunnel from Columbia to Eagle to check out the LM, and to make the second TV transmission.

On July 19, after Apollo 11 had flown behind the moon out of contact with Earth, came the first lunar orbit insertion maneuver. At about 75 hours, 50 minutes into the flight, a retrograde firing of the SPS for 357.5 seconds placed the spacecraft into an initial, elliptical-lunar orbit of 69 by 190 miles. Later, a second burn of the SPS for 17 seconds placed the docked vehicles into a lunar orbit of 62 by 70.5 miles, which was calculated to change the orbit of the CSM piloted by Collins. The change happened because of lunar-gravity perturbations to the nominal 69 miles required for subsequent LM rendezvous and docking after completion of the lunar landing. Before this second SPS firing, another TV transmission was made, this time from the surface of the moon.

On July 20, Armstrong and Aldrin entered the LM again, made a final check, and at 100 hours, 12 minutes into the flight, the Eagle undocked and separated from Columbia for visual inspection. At 101 hours, 36 minutes, when the LM was behind the moon on its 13th orbit, the LM descent engine fired for 30 seconds to provide retrograde thrust and commence descent orbit insertion, changing to an orbit of 9 by 67 miles, on a trajectory that was virtually identical to that flown by Apollo 10. At 102 hours, 33 minutes, after Columbia and Eagle had reappeared from behind the moon and when the LM was about 300 miles uprange, powered descent initiation was performed with the descent engine firing for 756.3 seconds. After eight minutes, the LM was at "high gate" about 26,000 feet above the surface and about five miles from the landing site.



Viking 1 was the first of two spacecraft, along with Viking 2, each consisting of an orbiter and a lander, sent to Mars as part of NASA's Viking Program. The lander touched down on Mars on **July 20, 1976**, the first successful Mars lander in history. Viking 1 operated on Mars for 2307 days (over 6 $\frac{1}{4}$  years) or 2245 Martian solar days, the longest Mars surface mission until the record was broken by the Opportunity rover on May 19, 2010.

#### **Search for life**

Viking 1 carried a biology experiment whose purpose was to look for evidence of life. The Viking lander biological experiments weighed 15.5 kg and consisted of three subsystems: the pyrolytic release experiment (PR), the labeled release experiment (LR), and the gas exchange experiment (GEX). In addition, independent of the biology experiments, Viking carried a gas chromatograph-mass spectrometer (GCMS) that could measure the composition and abundance of organic compounds in the Martian soil.



(First "clear" image ever transmitted from the surface of Mars – shows rocks near the Viking 1 Lander – 20 July 1976).

#### **Test of general relativity**

Gravitational time dilation is a phenomenon predicted by the theory of general relativity whereby time passes more slowly in regions of lower gravitational potential. Scientists used the lander to test this hypothesis, by sending radio signals to the lander on Mars, and instructing the lander to send back signals, in cases which sometimes included the signal passing close to the Sun. Scientists found that the observed Shapiro delays of the signals matched the predictions of general relativity.

# EVENTS BY SPACE

## INTERNATIONAL ASTEROID DAY 2022

International Asteroid Day is an UN-sanctioned global awareness campaign participated annually on 30th June, to inspire, engage and educate the public about asteroid opportunities and risks. SPACE being the regional coordinator from India conducts showcases, webinars, presentations across India and welcome collaborations PAN-India.

Asteroid Day 2022 commemorates the 114th anniversary of the Tunguska Event, the day when the largest known asteroid impact happened on Earth in recorded history. SPACE India conducted an interaction to raise awareness among the masses on 30th June 2022 from 5:00 pm to 6:00 pm.

The live interaction with experts was done in collaboration with Chhatrapati Shivaji Maharaj Vastu Sangrahalaya, (CSMVS) Mumbai.

The guest speakers were:

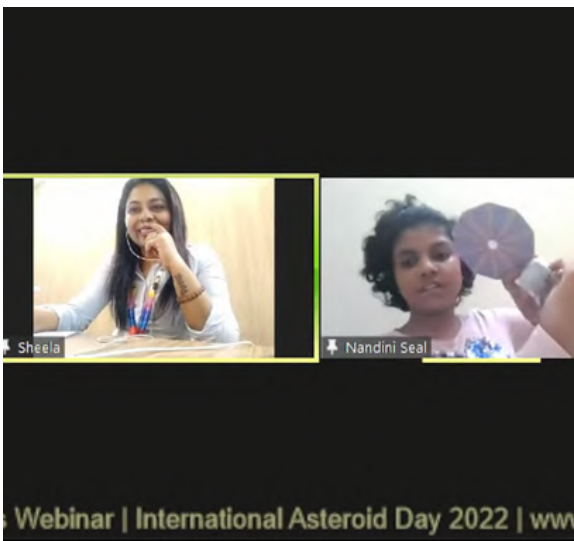
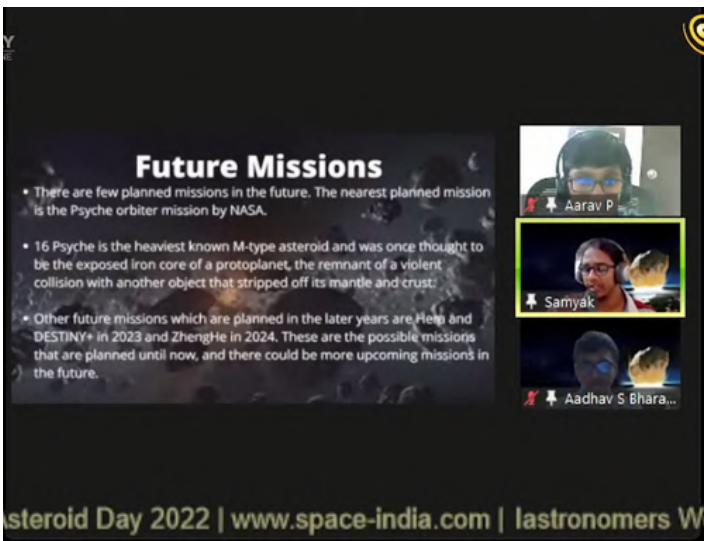
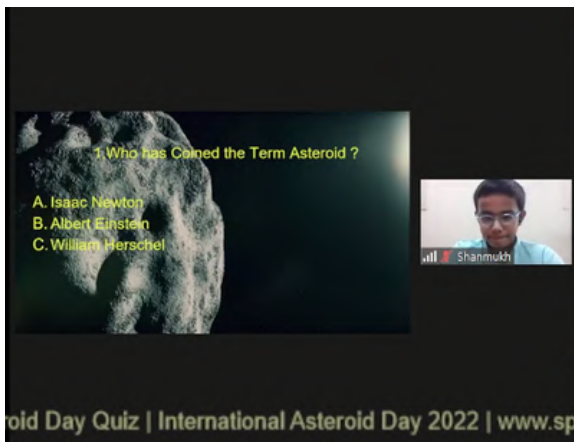
1. Dr. Narendra Bhandari, Ph.D. (Physics), FNA, FASc, FNASc, FJAS, Former Chair, Planetary Science and Exploration Division, Indian Space Research organisation, Science and Spirituality Research Institute, Ahmedabad.

2. Dr. Ankush Bhaskar, DST / INSPIRE Faculty, Space Physics Laboratory, Vikram Sarabhai Space Centre, ISRO, Thiruvananthapuram.

- To see the recorded interaction, kindly follow the link <https://youtu.be/673NMBsKNG8>

Also, the Young Astronomers associated with SPACE India organised a quiz and webinar on the occasion of Asteroids Day. These young astronomers, students of iAstronomer program of Astronomy Club, conducted a quiz and gave a presentation on Asteroid Day followed by a model making activity of the LUCY Spacecraft paper model.

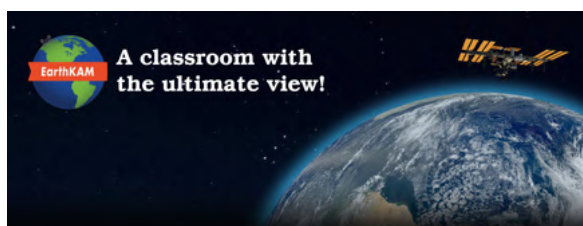
- To watch the recorded program of quiz, click: [https://fb.watch/d\\_hobm1oUS/](https://fb.watch/d_hobm1oUS/)
- To watch the presentation and model making activity, click: <https://youtu.be/2vGoUejsaGA>





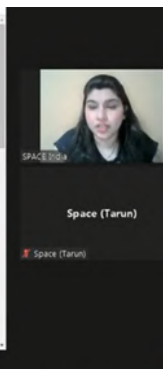
# SALLY RIDE EARTHKAM MISSION - 79, JUNE 2022

Sally Ride EarthKAM (Earth Knowledge Acquired by Middle school students) is a NASA educational outreach program that enables students, teachers, and the public to learn about Earth from the unique perspective of space. During Sally Ride EarthKAM missions (periods when the Sally Ride EarthKAM camera is operational), middle school students around the world request images of specific locations on Earth. The entire collection of Sally Ride EarthKAM images is available in a searchable Sally Ride EarthKAM image archive. This image collection and accompanying activities are extraordinary resources to engage students in Earth and space science, geography, social studies, mathematics, communications, and art. Students get the chance to take photographs of Earth using the camera aboard the International Space Station (ISS) in collaboration with NASA's educational outreach program.



Sally Ride EarthKAM Mission 79, June 2022: 27th June - 30th June 2022.

SPACE India conducted an online training regarding this event on June 27, 2022.



### Step 2

Rockwell Center Foundation (US) | <https://www.earthkam.org/mission>

Home Image Request View Requests School Gallery Status Help

Status: No status updates yet

Deadlines:
 

- Orbit 2206 is due at 27821.31.21
- Orbit 2207 to 2217 are due at 27822.00.00
- Orbit 2218 is due at 27916.03.21
- Orbit 2219 is due at 27917.36.00

Current and Future Orbits

Orbit	Longitude Day	GMT Day	Longitude Night	GMT Night	Deadline
2200	159.801° E	27818.53.20	52.50° W	27819.39.32	27816.53.20
2204	136.561° E	27820.26.01	55.454° W	27821.12.12	27818.26.01
2205	113.67° E	27821.58.41	78.836° W	27822.44.53	27819.58.41
2206	50.158° E	27823.31.21	102.284° W	27900.17.33	27821.31.21
2207	66.853° E	27901.04.01	125.128° W	27901.50.12	27822.00.00
2208	44.019° E	27902.36.41	148.587° W	27903.22.82	27822.00.00
2209	20.516° E	27904.09.21	171.922° W	27904.55.33	27822.00.00

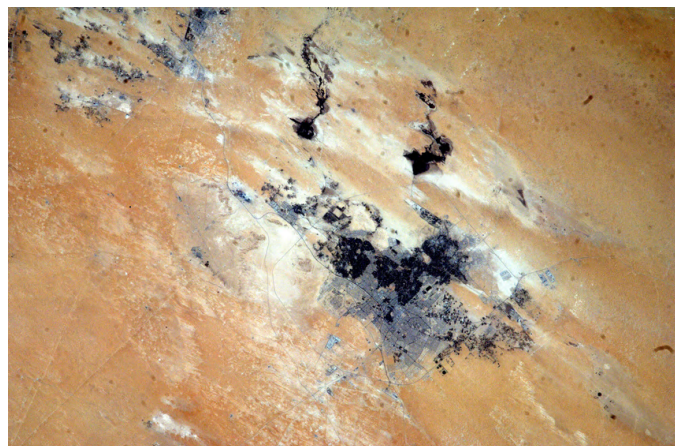
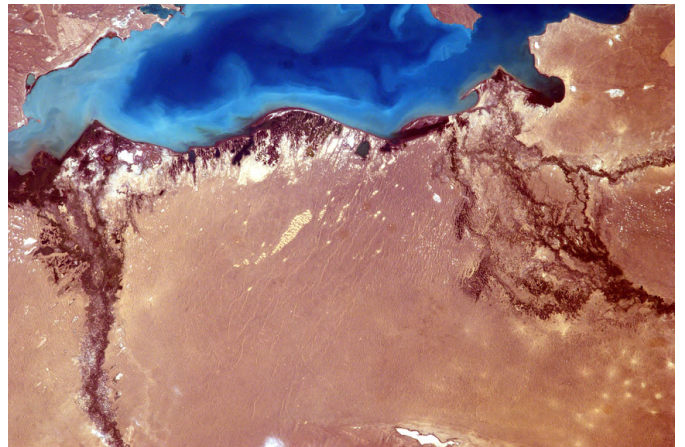
**Dr. Sally Ride**

- Youngest!!
- First American female Astronaut (1983)
- Co founded Sally Ride Science
- To ignite students enthusiasm in science.

www.space-india.com

# SALLY RIDE EARTHKAM MISSION

Some of the pictures captured from the camera of ISS which are requested by participants during the mission are follows,



# ALL INDIA ASTEROID SEARCH CAMPAIGN

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.**

In the past 12 years of its successful conduction, following are the achievements of AIASC.

**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.**

This year's campaign is running in two phases in which 500 teams having 1000 participants will take part and contribute in finding the asteroids.

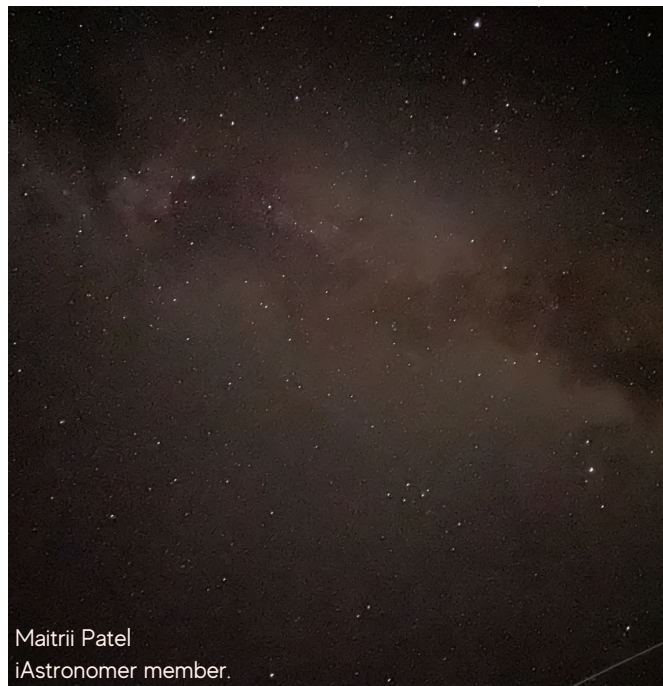
For each phase, SPACE conducts the training session for the participants to train them in finding asteroids using the Astrometrica Software.

If you all wish to be the part of this campaign in future then follow SPACE India on various social media platforms and stay updated regarding events.

# ASTROPHOTOGRAPHS BY STUDENTS



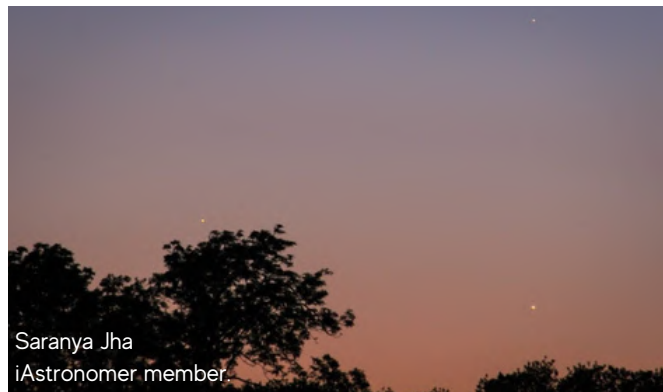
Santam kishan  
iAstronomer member.



Mairii Patel  
iAstronomer member.



Daksh Rathi  
iAstronomer member.

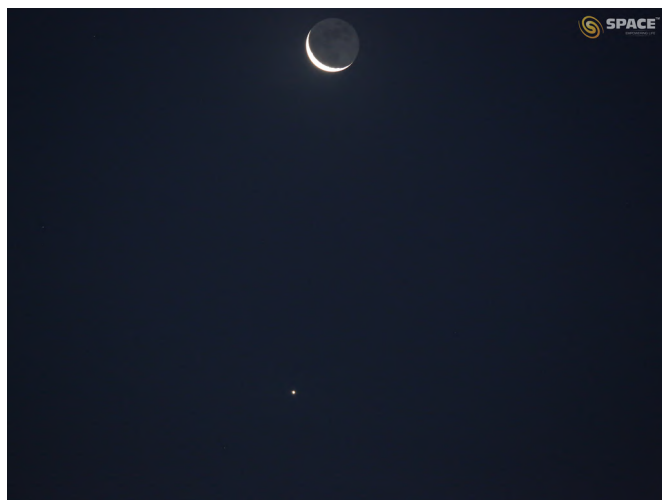


Saranya Jha  
iAstronomer member.

# ASTROPHOTOGRAPHS BY SPACE



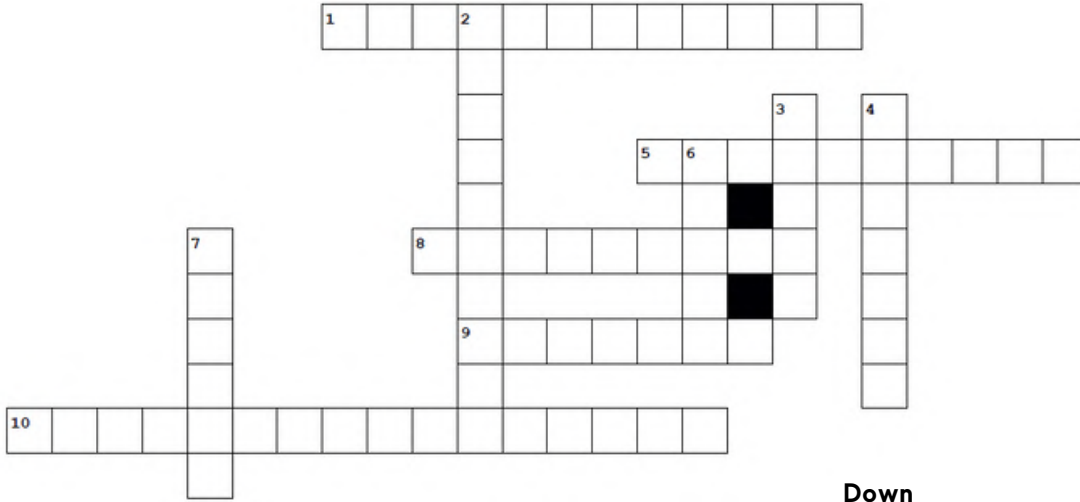
Solar Features Captured by SPACE  
Educator Mr. Ranjith Kumar.



Conjunction of Moon and Venus Captured by senior  
Educator of SPACE Mr. Yogesh Kumar Joshi.

# TRAIN YOUR BRAIN

## CROSSWORD



**Across**

1. Name the first mission of NASA in which a spacecraft was reused?
5. Spacecraft that reached Pluto in 2015 and will leave the solar system in 2029.
8. The first spacecraft to orbit Mercury.
9. The first spacecraft to fly past the asteroid 'Gaspara'.
10. The fastest moving human-made spacecraft.

**Down**

2. what mission took up the first American woman in space?
3. the first satellite which was launched specifically for the purpose of X-ray astronomy?
4. the name of the future mission to land humans on the moon?
6. The name of lunar lander for the Mission Apollo 11
7. the space telescope is dedicated to searching for other planets like Earth

## ASTRONOMY WORD PUZZLE

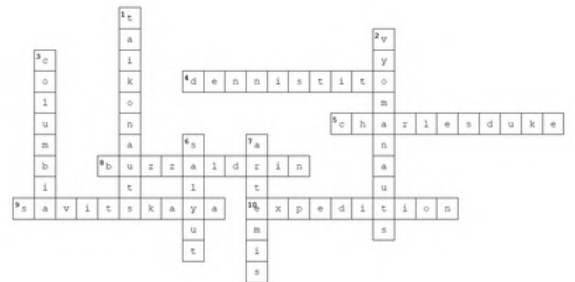
Find the names of various Indian space missions from the mixed letters and mark them.

### Indian Space Missions

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	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

- KALPANA
- MICROSAT
- RESOURCESAT
- SHUKRAYAAN
- MANGALYAAN
- ARYABHATA
- CHANDRAYAAN
- ROHINI
- IRNSS
- BHASKARA
- CARTOSAT
- GAGANYAAN
- ADITYA
- SROSS
- OCEANSAT

Answers for last month puzzles.



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

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

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

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Inviting Astronomy Ambassadors Globally

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- Largest Coverage Of Astronomical Events
- virtual/Physical trips to Observatories World wide
- International Star Parties
- Telescopes, Equipments, Spectroscopes, Astrophotography, and Many More
- Eclipse Chasing

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