

# Galactica

Astronomy and Space Science Magazine

**What's Inside?**

**SPACE Insights**

**Highlights From October**

**Moon Phases And Planet Visibility**

**What's Awaiting in November**

**Student's Corner**

**Historical Events Happened In November**

**Train Your Brain**

[www.space-global.com](http://www.space-global.com)

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.

# Team

**Editor in Chief**  
Sachin Bahmba

**Editor**  
Ranjith Kumar

**Contributors**  
Space Educators  
iAstronomers  
Space Students

This magazine contains original photos used with permission, as well as free-use images. All included photos are property of the author unless otherwise specified. If you are the owner of an image featured in this publication believed to be used without permission, kindly contact us.

# CONTENTS

Topics	Page no.
<b>About SPACE</b>	4
<b>SPACE Insights</b>	5
<b>Highlights of October 2022</b>	12
Pioneering Quantum Physicists Win Nobel Prize in Physics	12
India's most powerful rocket launches 36 OneWeb satellites	14
From the Eyes of Webb - October 2022	15
India's 'Mangalyaan' Runs Out of Fuel; ISRO Says 'Link Lost'	21
The DART Mission Impact Changed Asteroid's Motion	24
Object FASTER than light?	25
<b>What's up in the sky - November 2022</b>	26
<b>Rocket launches in November 2022</b>	27
Atlas 5 launch from California delayed for battery replacement	28
SpaceX Launches	30
ISRO to launch eos-06 and Thybolt satellite	33
NASA will launch the Artemis 1 mission on November 14	34
<b>Astronomical events - November 2022</b>	36
Total Lunar Eclipse	36
Leonids Meteor Shower	37
Uranus at Opposition	38
Conjunctions for the month	39
<b>Student's Corner</b>	40
<b>Astrophotographs by Space Team</b>	45
<b>Historical events that happened in November</b>	46
<b>Train Your Brain</b>	49



# ABOUT SPACE



Legacy of 22 years



Pioneer Organization



10000+ Activities Developed



1000+ Schools Associated



1M+ Students Engaged



10k+ Outreach Events



10+ Cities Presence

**SPACE is the pioneer organization working towards 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.*

## CMD'S MESSAGE:



Mr. Sachin Bahmba  
CMD, Space.

**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.**

# SPACE INSIGHTS

## PARTIAL SOLAR ECLIPSE, 25TH OCTOBER 2022

Himanshu Gautam

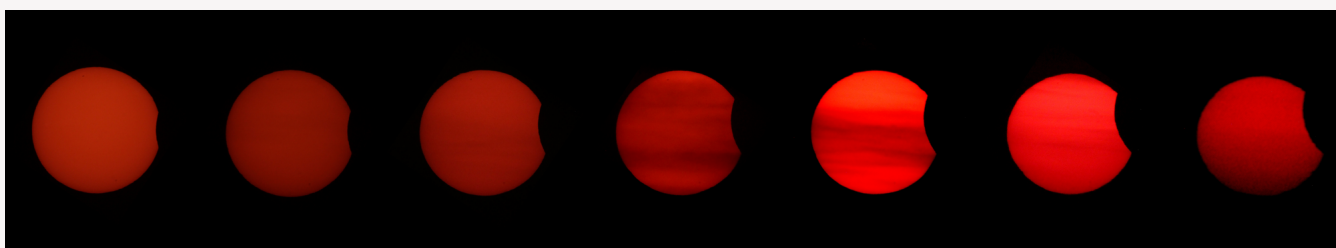
Space Educator.

SPACE is India's first organisation dedicated to the advancement of science and astronomy since 2001. It aims to create a scientifically aware society and to contribute to the country's technological and social development.

We are guided by the moral responsibility delineated by the constitution of India as a part of article 51(h)

"To develop the scientific temper, humanism and the spirit of inquiry and reform"

SPACE periodically organizes observations during special celestial events at schools and at public places to provide a great viewing opportunity for students and the Indian community as part of a public outreach program. Such events include eclipses and conjunctions when celestial objects appear close to each other.



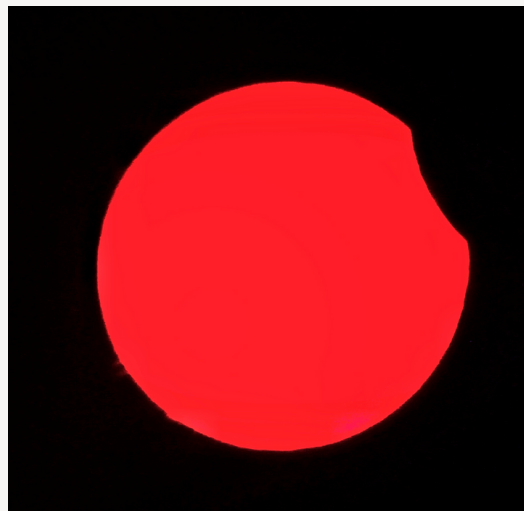
Sequence of partial solar eclipse captured by Mr. Neeraj Ladia, CEO, Gnomon Astrotech Pvt Ltd.

### Partial solar eclipse

A solar eclipse occurs when the moon blocks the sun either in part or in totality, as seen from Earth. As the moon makes its orbit around Earth, and as Earth orbits around the sun, the moon gets caught in the middle and casts a shadow on Earth. Anyone standing in that shadow will be able to see the solar eclipse.

When the Moon passes between the Sun and Earth, but the Sun, Moon, and Earth are not exactly lined up, a partial solar eclipse occurs. The Sun will appear to be partially obscured, giving it a crescent-shaped appearance.

The last Surya Grahan of 2022, a partial solar eclipse, graced the skies during the evening hours of Tuesday, October 25. This partial solar eclipse was visible from Europe, northern Africa, the Middle East and Asia. The majority of the Indian states saw the eclipse, too, with the exception of Northeast India. The eclipse lasted from 4:29 pm to 6:09 pm in India. During this time span, the sky watchers in different parts of Asia, Europe, and northern Africa was able to see the partial eclipse. This was the second partial solar eclipse of 2022.



The above Eclipse pictures was captured by SPACE Educator Mr. Ranjith Kumar.

**Live Interactions**

In order to reach students and masses, keeping the scenarios in mind, a live webcast was organized wherein students learnt about the eclipse and how it can be observed safely from their houses.

SPACE experts went on various Indian news channels and talked about the eclipse. They debunked common misconceptions about eclipses and provided information on how to see them safely.



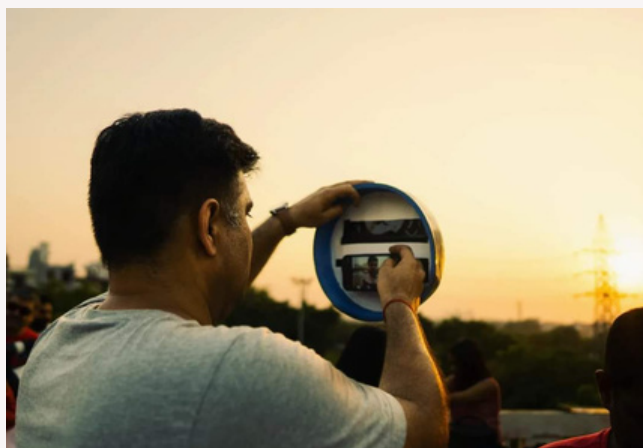
**Our accomplishments**

The SPACE Team viewed the eclipse from several locations across the nation and took stunning pictures. In addition to observing the eclipse, the SPACE Team captured some wonderful images during the eclipse and inspired students to do photography during the eclipse.

Through the webinar SPACE hosted about the eclipse, experiments to undertake while viewing it, and safe viewing procedures, we were able to reach over 3,500 individuals. The experts dispelled myths concerning eating during the eclipse.

Our experts appeared on news networks and shared information in an effort to inform the public.

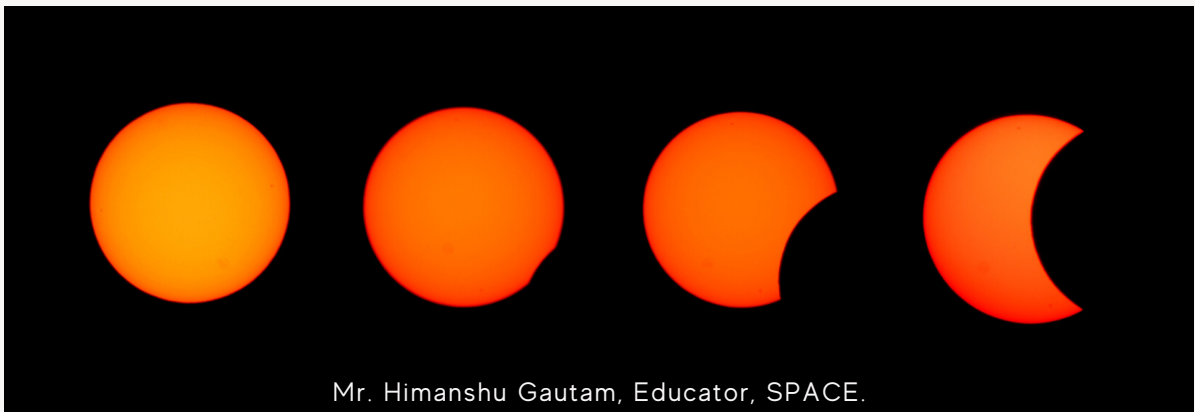
The knowledge gathered strengthened the scientific temperament of a vast number of individuals from various cultures, and chains of superstition and myths were broken, freeing the people to appreciate the beauty of this astounding occurrence.



The above Eclipse pictures was captured by Mr. Sachin Bahmba, CMD, SPACE.



Mr. Yogesh Kumar Joshi, Assistant Education In-charge, SPACE.



Mr. Himanshu Gautam, Educator, SPACE.



Mr. Shiril Mon, Executive, Gnomon Astrotech Pvt Ltd.

# INTERNATIONAL OBSERVE THE MOON NIGHT

Javed Alam

Space Educator.

International Observe the Moon Night is sponsored by NASA's Lunar Reconnaissance Orbiter (LRO) mission and the Solar System Exploration Division of NASA's Goddard Space Flight Center in Greenbelt, Maryland, with support from many partners. International Observe the Moon Night is a time to come together with fellow Moon enthusiasts and curious people worldwide. Since 2010, the celebration has occurred annually in September or October when the Moon is around first quarter - a great phase for excellent viewing opportunities. Every year about 500,000 people participate from 122 countries and all seven continents. This celebration provides opportunities to learn about lunar science and exploration, observe celestial bodies, and honor personal and cultural connections to the Moon.

## About the Event

On October 1, 2022 our group set up a telescope for public viewing on the terrace of our building. Additionally, we live-streamed the entire session on YouTube.

The speaker started the session by providing an insight about international observe the moon night. In this webinar the speaker explained about the basic features of the Moon like the near side of Moon which includes Craters, Mares, Regolith, Terraria and Rays. We also identified some basic features that were visible on that day such as the craters like Thiophillus, Crillus and Catherina, Lacus Mortis (Lake of death), Rima Ariadareus, Messier crater, Rupes Altae and Vallis Rheita.

Students from iAstronomer program named Vani goyal (New Delhi), Shaurya baitule (Nagpur), Daksh Rathi (Chennai) observed the Moon from their places and conducted live observation for their friends, family and for other students. One student Abdul Rehman Yaqub Khanche from Mumbai led the class VI government school kids to a Moon observation.





# DIWALI CELEBRATION 2022

Ranadeep Das  
Space Educator.

"All work and no play made Jack a dull boy". Therefore, it's important that we indulge our Spacians in recreational activities to rejuvenate their minds and inculcate a sense of unity and friendship. In the spirit of imbibing this in our work culture, we celebrated Diwali in our office with great pomp and ceremony. We involved Spacians in various team-building activities as well as had delicious food together. We also performed cake-cutting as a gesture to celebrate all the birthdays that fall in the month of October. Everyone enjoyed the day and it was a memorable event for everyone.



# GRA'VIT'AS 2022

It was all about telescopes, planets and stars at Vellore Institute of Technology during their Gra'VIT'as 2K22 event organized by VIT stellar club named "Kepler's gift" in collaboration with SPACE India at 1st of October 2022.

We were glad to see that around 200 students has enrolled for the workshop and this really shows how much people are inquisitive about knowing and observing the cosmos around us.

Students witnessed planets and stars through telescope and where thrilled to see Jupiter with Galilean Moons and differential bands, Saturn along with its beautiful rings and some glimpse of our celestial neighbor the Moon.

Students also got in-depth knowledge about telescopes and its usage, its working and all parts in details. Various kinds of telescopes were shown to the audience, refractors, reflectors, Alt-Az Mounts, Dobsonian Mounts, Equatorial Mounts, various apertures and Focal length telescopes. Objects were also shown through various eye-pieces to understand the differences.

They were then given telescopes to assemble, align and focus objects through telescopes themselves each one getting and hands-on experience for the same.

Students thoroughly enjoyed workshops and were inspired to take up astronomy and space sciences in future. After the workshop we received many queries of careers, internship, volunteering, higher studies and RnD in the field of astronomy and space sciences.

The event was conducted as a part of "International observe the Moon Night".

Here we present some of the pictures from the event at VIT.



# TELESCOPE EXPO AT 'SRM' UNIVERSITY

SPACE Arcade conducted a science expo on all kinds of Astronomical equipment's at SRM Institute of Science and Technology during their "AARUUSH 2K22" event on 28th, 29th and 30th October. Aaruush is a national Level Techno-Management Fest organized by SRMIST every year. One of the largest in the nation, Aaruush provides a platform for the best brains all over the country to converge their talents with competition and put into use their technical skills and management concept.

Students had a hands on experience of various telescopes and Binoculars, its working and all parts in details. Different telescope models were shown to the audience, refractors, reflectors, Alt-Az Mounts, Dobsonian Mounts, Equatorial Mounts, various apertures and Focal length telescopes. Objects were also shown through various eye-pieces to understand the differences.



More than 200 students showed their interest in the field of Astronomy and enquired about various kinds of telescopes and their applications.

# HIGHLIGHTS OF OCTOBER 2022

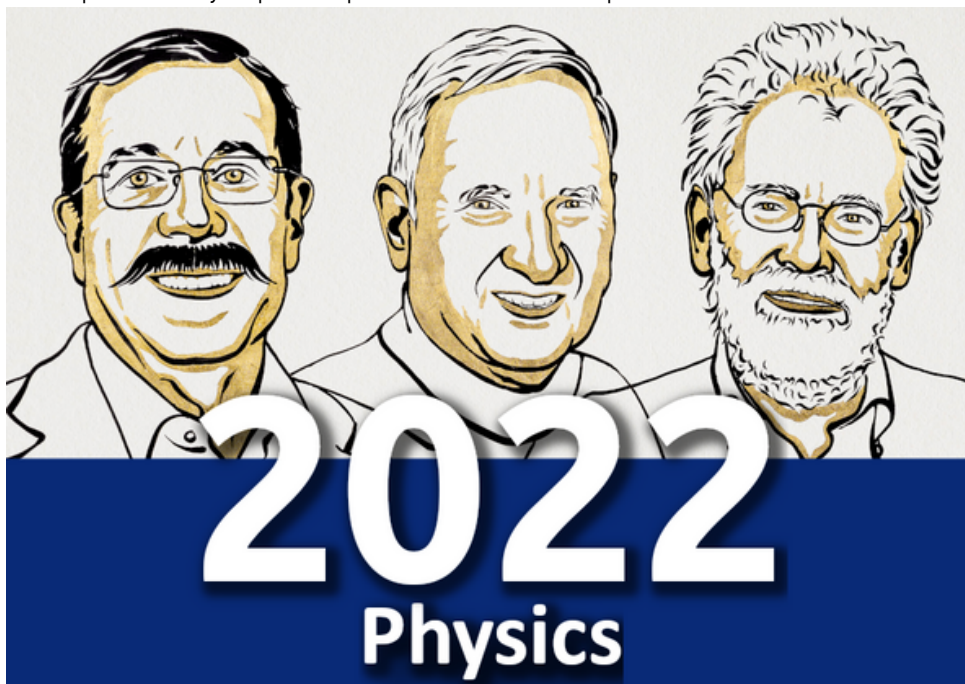
## PIONEERING QUANTUM PHYSICISTS WIN NOBEL PRIZE IN PHYSICS

The Nobel Committee of the Royal Swedish Academy of Sciences conferred the Nobel Prize in Physics for 2022 on Alain Aspect, John F Clauser and Anton Zeilinger October 4. The three physicists were awarded for their pioneering and groundbreaking work in quantum information science.

The Committee noted in a press statement that the award was “for experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science”.

Quantum mechanics is the physics of sub atomic particles. Its main characteristic that makes quantum information science possible is known as ‘quantum entanglement’.

The work of the three laureates provided a deeper understanding of quantum entanglement. It paved the way for quantum information science, quantum computing and quantum cryptography, according to Thors Hans Hansson, an expert on quantum entanglement and a member of the Nobel Committee for physics Quantum cryptography has created avenues for the most secure communication networks, already demonstrated by scientists around the world. Quantum computers, in the near future, would be able to carry out complex computations not possible for the most powerful present day supercomputers at breakneck speeds.



(From left: Alain Aspect, John Clauser and Anton Zeilinger)

### Einstein, Bohr and Schrodinger

Whatever happens to one particle, also happens to the other if both are quantum entangled. This is the case even if both particles are at distance.

The idea for quantum entanglement dates back to the very foundations of quantum mechanics which began with Albert Einstein, Neils Bohr and Erwin Schrodinger. The Nobel Committee stated that this year’s prize was also in honour of these pioneers.

Einstein famously called entanglement “spooky action at a distance”. It may have also brought about his oft quoted statement, “I at any rate am convinced that God does not play dice”.

He meant that a good theory should be able to make precise predictions and not dabble in probabilities, which is one of the primary characteristics of quantum mechanics.

Schrodinger, on the other hand, thought there was more to entanglement. He said: “Entanglement is not ‘one’ but rather ‘the’ characteristic trait of quantum mechanics.”

In 1935, Einstein, Boris Podolsky and Nathan Rosen came up with a thought experiment. The experiment concluded that there was hidden information in the form of variables within quantum entangled particles.

This data informed them about what results to display in an experiment. This somehow meant nature, especially what made up quantum particles, was a trickster.

## GALACTICA

There were no instruments available at the time to implement the thought experiment in the real world and know more about the hidden variables.

The idea of quantum entanglement remained more of a philosophical question rather than a question of physics for many years after this, according to Thors Hans Hansson, an expert on quantum entanglement and a member of the Nobel Committee for physics. Zeilinger, over a phone call with the Committee, also stated that when he had entered the field it was more philosophy than physics. Yet, he was supported by his then supervisor.



(From left: Einstein, Schrodinger and Bohr)

This changed in the 1960s when John Stewart Bell developed a mathematical inequality. This stated that if a large number of measurements of the hidden variables were conducted, the correlation between the results could not exceed a certain value.

This in turn meant that no local hidden variable theory could reproduce all the results of quantum mechanics.

But quantum mechanics also predicts that a certain kind of experiment can violate Bell's inequality. This results in a stronger correlation than would otherwise be possible.

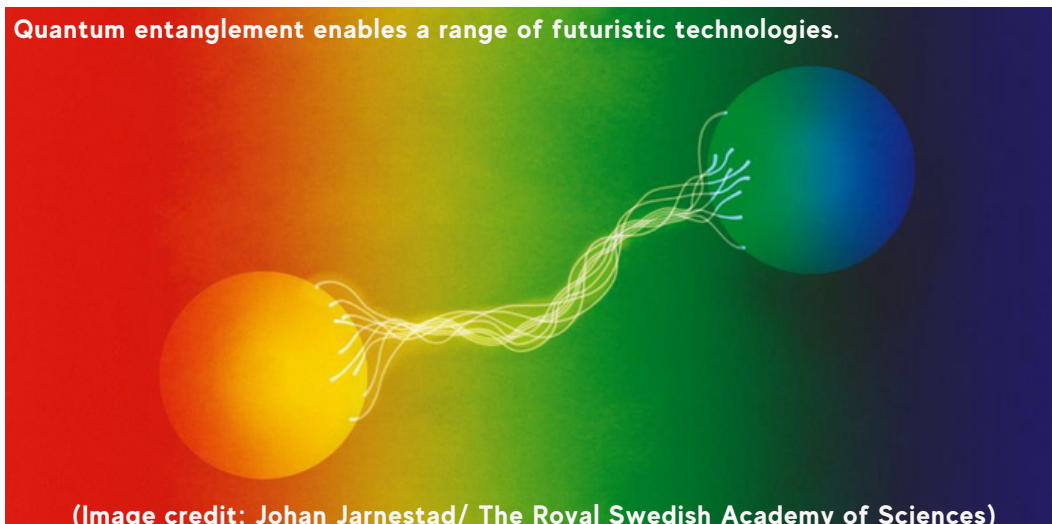
Such an experiment was first demonstrated by Clauser in 1974. "When he took the measurements, they supported quantum mechanics by clearly violating a Bell inequality. This means that quantum mechanics cannot be replaced by a theory that uses hidden variables," the Nobel press statement said.

There were still some problems with Clauser's experiment which were then worked upon by Aspect. He developed an experiment wherein he switched off the measurement settings of the instruments after the entangled pair of particles had left their source. Therefore, the initial settings of the experiment could not influence the result.

Later, Zeilinger started using entangled quantum states with advanced tools and instruments. His group was able to demonstrate quantum teleportation which aids in moving quantum information from one entangled particle to the other at a faraway distance for the first time.

Zeilinger also clarified that while physical teleportation was still in the realm of science fiction, quantum teleportation could ferry all the information of a mass, any mass, of entangled particles to another mass of entangled particles in the future. Once the information was transferred, new mass would have the same characteristics as the original mass. "Information defines individuality rather than matter," he stated.

Zeilinger also said that the prize is an encouragement to young scientists to take up the field and that there are a lot of fundamental questions about quantum entanglement that still remain to be answered.



# INDIA'S MOST POWERFUL ROCKET LAUNCHES 36 ONEWEB INTERNET SATELLITES INTO ORBIT

**"OneWeb" - The London based satellite company, is back on track with the launch of another 36 spacecraft for its global broadband internet system.**

**Sriharikota, India, 23 October 2022:** OneWeb confirmed the successful deployment of 36 satellites launched by New Space India Limited (NSIL), from the Satish Dhawan Space Centre (SDSC- SHAR) in Sriharikota, India. This launch by ISRO and NSIL is one of the biggest commercial orders by India's premier space organization, and the first using the LVM3 rocket.

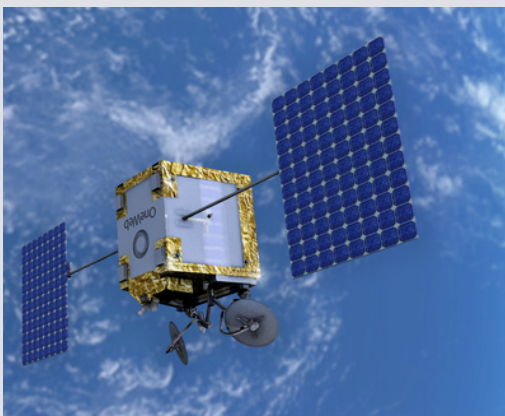
The LVM3 (Launch Vehicle Mark-3) is the same as the Geosynchronous Satellite Launch Vehicle Mark-3 (GSLV-Mk3), but has a slightly different name when orbits other than a geosynchronous one are being serviced. It is India's largest and most capable rocket.

The lift-off took place on Sunday, 23rd October 2022 at 00.07hrs local time.

**OneWeb's satellites separated successfully from the rocket and were dispensed in nine phases over a period of 1 hour and 15 minutes, with signal acquisition on all 36 satellites confirmed.**

The situation for OneWeb was looking very uncertain back in March. The company's plans were knocked off course by the war in Ukraine. The conflict, and the resulting Western sanctions against Russia, led to the firm losing access to Russian Soyuz rockets.

With only two-thirds of its satellites in orbit, OneWeb had to move quickly to secure rides on other carriers. Deals were struck with American rocket providers SpaceX and Relativity Space, and India's New Space India Limited, the commercial arm of India's space agency, Isro, which markets the LVM3.



An artist's illustration of a OneWeb internet satellite in orbit. (Image credit: OneWeb)

OneWeb is already offering high-speed broadband connections to beta customers above 50 degrees North and South. This latest launch and another before the end of the year will pull coverage closer to the equator. "We need to get these launches away that we're doing before Christmas, and that will enable us to turn on the service from 25 degrees North and 25 degrees South. Then we'll complete the roll-out of the constellation by spring, which enables us to complete global commercial service by the end of next year," OneWeb CEO Neil Masterson said.



# FROM THE EYES OF WEBB - NOVEMBER 2022

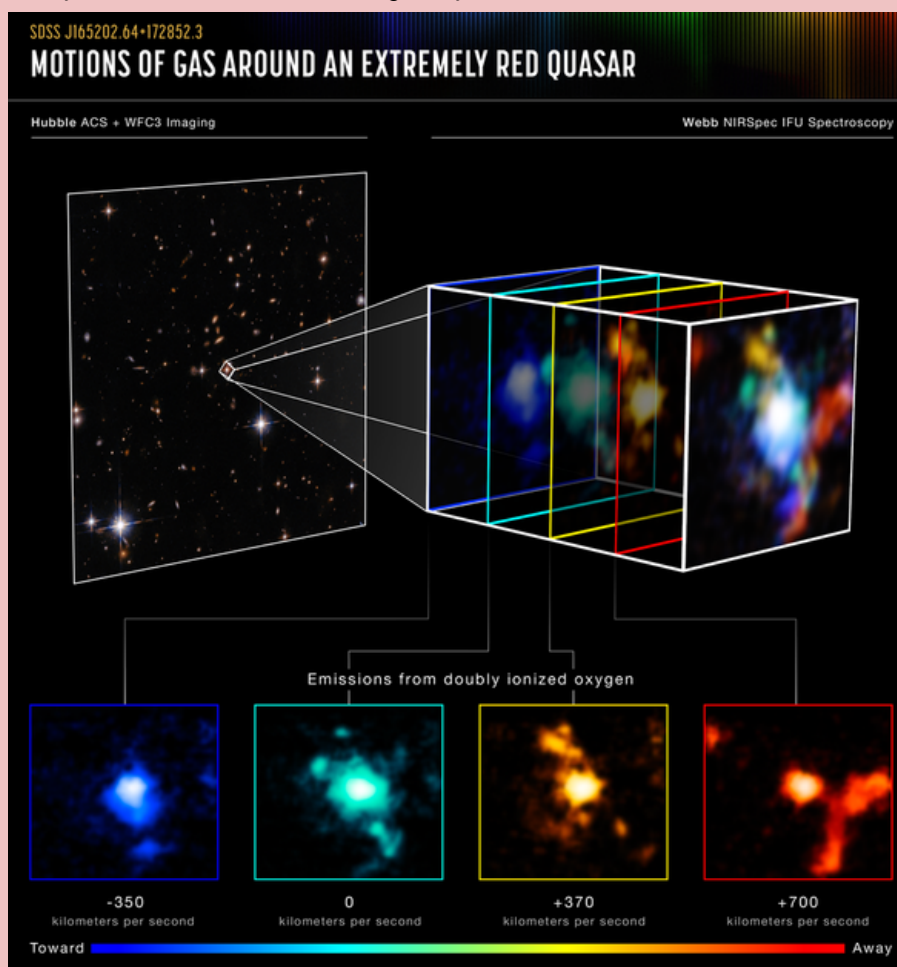
## NASA'S WEBB UNCOVERS DENSE COSMIC KNOT

### IN THE EARLY UNIVERSE

Astronomers looking into the early universe have made a surprising discovery using NASA's James Webb Space Telescope: a cluster of massive galaxies in the process of forming around an extremely red quasar. The result will expand our understanding of how galaxy clusters in the early universe came together and formed the cosmic web we see today.

A quasar, a special type of active galactic nucleus (AGN), is a compact region with a supermassive black hole at the center of a galaxy. Gas falling into a supermassive black hole makes the quasar bright enough to outshine all the galaxy's stars.

The quasar Webb explored, called SDSS J165202.64+172852.3, existed 11.5 billion years ago. It is unusually red not just because of its intrinsic red color, but also because the galaxy's light has been redshifted by its vast distance. That made Webb, having unparalleled sensitivity in infrared wavelengths, perfectly suited to examine the galaxy in detail.



This quasar is one of the most powerful known galactic nuclei that's been seen at such an extreme distance. Astronomers had speculated that the quasar's extreme emission could cause a "galactic wind," pushing free gas out of its host galaxy and possibly greatly influencing future star formation there.

To investigate the movement of the gas, dust and stellar material in the galaxy, the team used the telescope's Near Infrared Spectrograph (NIRSpec). This powerful instrument uses a technique called spectroscopy to look at the movement of various outflows and winds surrounding the quasar. NIRSpec can simultaneously gather spectra across the telescope's whole field of view, instead of just from one point at a time, enabling Webb to simultaneously examine the quasar, its galaxy and the wider surroundings.

# **WEBB TAKES STAR-FILLED PORTRAIT OF PILLARS OF CREATION**

NASA's James Webb Space Telescope has captured a lush, highly detailed landscape of the iconic "Pillars of Creation" where new stars are forming within dense clouds of gas and dust. The three-dimensional pillars look like majestic rock formations, but are far more permeable. These columns are made up of cool interstellar gas and dust that appear at times semi-transparent in near-infrared light. Webb's new view of the Pillars of Creation, which were first made famous when imaged by NASA's Hubble Space Telescope in 1995, will help researchers revamp their models of star formation by identifying far more precise counts of newly formed stars, along with the quantities of gas and dust in the region. Over time, they will begin to build a clearer understanding of how stars form and burst out of these dusty clouds over millions of years.



Newly formed stars are the scene-stealers in this image from Webb's Near-Infrared Camera (NIRCam). These are the bright red orbs that typically have diffraction spikes and lie outside one of the dusty pillars. When knots with sufficient mass form within the pillars of gas and dust, they begin to collapse under their own gravity, slowly heat up, and eventually form new stars.

What about those wavy lines that look like lava at the edges of some pillars? These are ejections from stars that are still forming within the gas and dust. Young stars periodically shoot out supersonic jets that collide with clouds of material, like these thick pillars. This sometimes also results in bow shocks, which can form wavy patterns like a boat does as it moves through water. The crimson glow comes from the energetic hydrogen molecules that result from jets and shocks. This is evident in the second and third pillars from the top – the NIRCam image is practically pulsing with their activity. These young stars are estimated to be only a few hundred thousand years old.



## GALACTICA

Although it may appear that near-infrared light has allowed Webb to “pierce through” the clouds to reveal great cosmic distances beyond the pillars, there are almost no galaxies in this view. Instead, a mix of translucent gas and dust known as the interstellar medium in the densest part of our Milky Way galaxy’s disk blocks our view to much of the of the deeper universe.

This scene was first imaged by Hubble in 1995 and revisited in 2014, but many other observatories have also stared deeply at this region. Each advanced instrument offers researchers new details about this region, which is practically overflowing with stars. This tightly cropped image is set within the vast Eagle Nebula, which lies 6,500 light-years away.

# **JWST HAS SPOTTED BIZARRE RINGS OF DUST AROUND A DYING STAR**

NASA’s James Webb Space Telescope continues to reveal images that give a look at the distant universe. The latest is an image of concentric dust rings emitted by a pair of stars, which are over 5,000 light years away from Earth. The pair is collectively known as Wolf-Rayet 140 and Webb Space telescope captures the stellar winds in this image that NASA has shared.

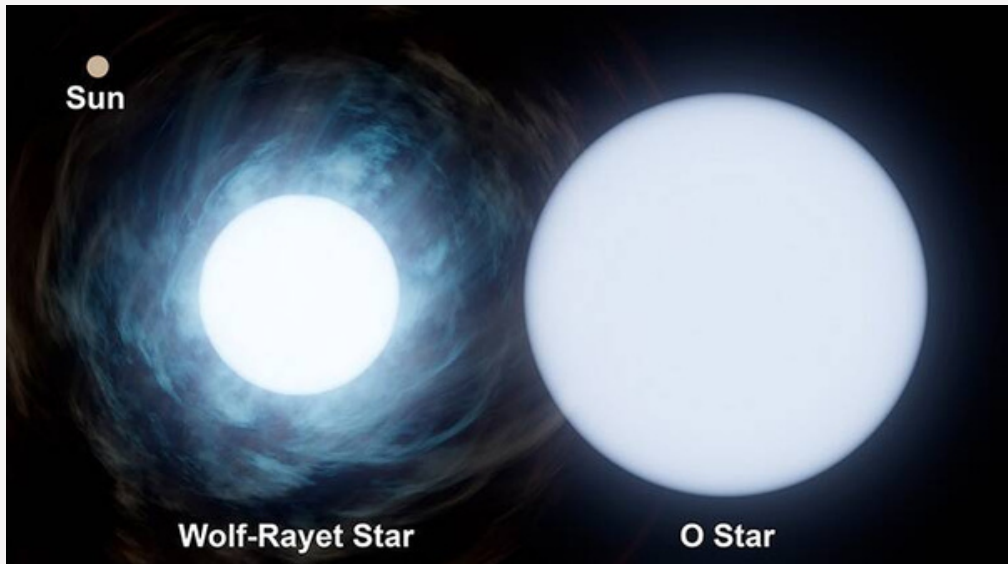
Stellar winds are streams of gas that stars blow into space. When these two stars came close together, their stellar winds met and compressed the gas, creating dust in the process. The orbit of these stars brings them together about once every eight years. These rings mark the passage of time just like the growth rings on a tree.



The unique rings captured by the Webb telescope originated from a rare pair of stars about 5,000 light years away. (Image credit: NASA, ESA, CSA, STScI, JPL-Caltech)

According to NASA, turning gas into dust requires specific conditions and ingredients, somewhat like turning flour into bread. Hydrogen is the most common element found in stars and it can’t form dust on its own. But the Wolf-Rayet system sheds so much mass that they also eject complex elements that are otherwise found deep in a star’s interior, including Carbon.

After they are emitted, these elements in the stellar wind cool down and are then compressed at the location where the winds from the two stars meet, like when a baker uses their hands to knead dough.



The size of the Sun in comparison with the two stars in the WR 140 system.  
 (Image credit: NASA/JPL-Caltech)

“We’re looking at over a century of dust production from this system. The image also illustrates just how sensitive this telescope is. Before, we were only able to see two dust rings, using ground-based telescopes. Now we see at least 17 of them,” said Ryan Lau, an astronomer at NSF’s NOIRLab, in a NASA press statement. Lau is the lead author of a new study on the Wolf-Rayet system, published yesterday in the journal *Nature Astronomy*.

There are other Wolf-Rayet systems that form dust but none of them make rings like Wolf-Rayet 140 does. The formation of the rings happens because the orbit of the Wolf-Rayet star in the system is elongated and not circular. The gas is only under enough pressure to form dust when the stars come close together and their winds collide.

The Webb telescope is uniquely suited to help scientists study the dust rings because its instruments detect infrared light. Webb’s MIRI (Mid-Infrared Instrument) detects the longest infrared wavelengths, which means that it can see much colder objects, like the dust rings.

## James Webb Space Telescope Snaps Image of Two Galaxies Merging.

The James Webb Space Telescope has captured an image of a pair of interacting galaxies, together designated as IC 1623. Individually, the two galaxies are known as IC 1623 A and IC 1623 B. The pair of galaxies are at a distance of 270 million lightyears from the Earth, in the direction of the Northern constellation of Cetus, or The Whale. The two galaxies are in the process of merging into a single galaxy, with the collision driving an intense period of star formation, known as a starburst. The rate of star formation in IC 1623 is more than 20 times that of the Milky Way.



Hubble and Webb images of IC 1623. (Image credit: ESA/Webb, NASA and CSA, L Armus and A Evans, Acknowledgement: R Colombari)

## GALACTICA

IC 1623 is particularly bright in the infrared frequencies, making it a suitable target for Webb. The scientific data is accompanied by observations of the same target by the Hubble Space Telescope in optical frequencies. The data from Webb reveals interstellar dust, the bright core of the merger, heated gas and dust, as well as the stellar nurseries where new stars are being born. The Hubble and Webb images together reveal the distorted spiral arms of the interacting pair of galaxies. IC 1623 is a well-studied interacting pair of galaxies, and has been observed by other astronomical instruments before. The infrared gaze of Webb was able to peer through an obscuring band of material, that had blocked the view of Hubble.



The pair of merging galaxies known as IC 1623 photographed by the James Webb Space Telescope. (Image credit: ESA/Webb, NASA & CSA, L. Armus & A. Evans)

There are intense infrared emissions from the merger because the galaxies are in a starburst state. The merging galaxies may also be in the process of forming a supermassive black hole. The luminous core of the merger is both extremely bright and extremely compact, resulting in the diffraction spikes seen in the image. The diffraction spike is created by the light interacting with the support structures within Webb, and are particularly noticeable in images of targets containing bright sources.

## Webb Offers Never-Before-Seen Details of an Early Universe

The James Webb Space Telescope has revealed surprising new details in a distant galaxy from the early universe designated as MACS0647-JD. The distant galaxy is gravitationally lensed by the closer galaxy cluster MACS0647, causing the image of MACS0647-JD to appear three times in the capture. MACS0647-JD is at a distance of 13.26 billion lightyears from the Earth, in the direction of the constellation of Camelopardalis. For a time, MACS0647-JD was the most distant galaxy and object known. MACS0647-JD has a redshift of 11, which means it was formed within the first 400 million years of the Big Bang. The galaxy was also imaged by the Hubble Space Telescope, which was only able to image it as a small red spot. The image captured by Webb has revealed surprising new details, and what appears to be two clumps of stars instead of one. It is not clear if the two groups of stars are from different galaxies, or the same galaxies. MACS0647-JD may be a galaxy merger from the early universe.

The astronomer who discovered MACS0647-JD ten years ago, Dan Coe says, "I discovered this galaxy MACS0647-JD 10 years ago with the Hubble Space Telescope. At the time, I'd never worked on high redshift galaxies, and then I found this one that was potentially the most distant at redshift 11, about 97 percent of the way back to the big bang.

## GALACTICA

With Hubble, it was just this pale, red dot. We could tell it was really small, just a tiny galaxy in the first 400 million years of the universe. Now we look with Webb, and we're able to resolve TWO objects! We're actively discussing whether these are two galaxies or two clumps of stars within a galaxy. We don't know, but these are the questions that Webb is designed to help us answer."

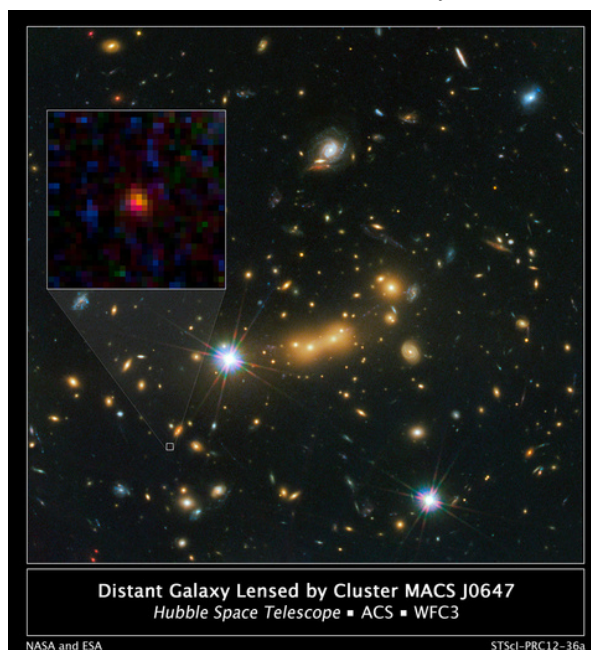


(MACS0647-JD lensed by MACS0647, with the white boxes showing the three images.)

One of the clumps of stars is redder than the other, with the bluer one having regions of active star formation, or stellar nurseries. The redder object has older stars and is more dusty.

Scientists were waiting for Webb to become operational to learn more about MACS0647-JD. The biggest and most expensive space telescope to be ever deployed is doing exactly what it was designed for, and revealing more information about the most distant objects in the universe. For the first time, Webb is allowing astronomers to investigate the earliest galaxies to form. The researchers intend to conduct a more detailed study of MACS0647-JD.

According to scientists, before the launch of James Webb, scientists could not study galaxies in detail in the early Universe. There were only a few dozen young galaxies known to science. But now a new generation space telescope is taking pictures with hundreds of the most distant galaxies. These discoveries will help to understand how the universe evolved over time, and how our Milky Way galaxy formed.



Distant Galaxy Lensed by Cluster MACS J0647  
Hubble Space Telescope ■ ACS ■ WFC3

NASA and ESA

STScI-PRC12-36a

# INDIA'S 'MANGALYAAN' RUNS OUT OF FUEL; ISRO SAYS 'LINK LOST'

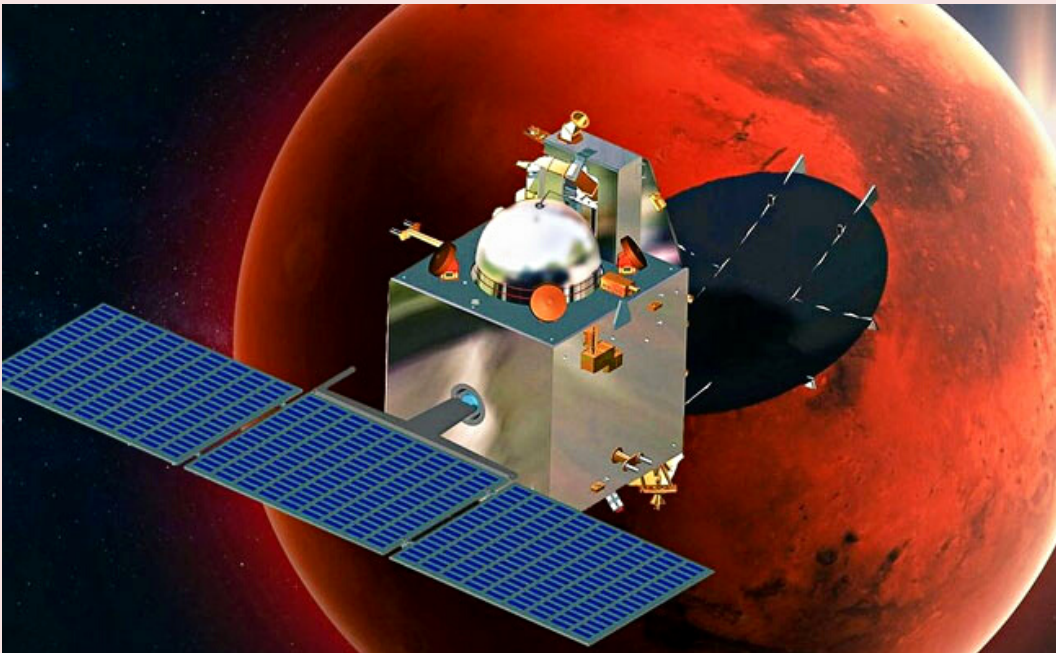
India's maiden mission to Mars – 'Mangalyaan' may have finally completed its long innings after over a decade of its launch. The Mars Orbiter Mission (MOM) has, reportedly, run out of propellant, and its battery drained beyond the safe limit, fueling speculation that the interplanetary mission has completed its journey.

The Rs.450 crore Mars Orbiter Mission was launched onboard PSLV-C25 on November five, 2013, and the MOM spacecraft was successfully inserted into Martian orbit on September 24, 2014 in its first attempt. "Right now, there is no fuel left. The satellite battery has drained," said sources in the Indian Space Research Organization (ISRO). "The link has been lost". There was, however, no official word from the country's national space agency, headquartered in Bengaluru.

With fuel on board, ISRO had been performing orbital maneuvers on MOM spacecraft to take it to a new orbit to avoid an impending eclipse in the past.

"But recently there were back-to-back eclipses including one that lasted seven-and-half hours," officials said on condition of anonymity, noting that all the propellant on board the ageing satellite had been consumed.

"As the satellite battery is designed to handle eclipse duration of only about one hour and 40 minutes, a longer eclipse would drain the battery beyond the safe limit," another official said.



Mangalyaan was modestly equipped with five instruments – a color camera, the Lyman Alpha Photometer used to measure the composition of Mars' upper atmosphere, a thermal imaging spectrometer, another named the "Mars Exospheric Neutral Composition Analyzer," and a methane sensor.

Those instruments nonetheless produced plenty of data. ISRO listed the following achievements of the mission:

- Captured the first photos of the far side of Mars' moon Deimos.
- Enhanced our understanding of the composition of several gases in the Martian exosphere.
- Quantified the altitude where the Martian atmosphere transitions from a CO<sub>2</sub>-rich regime to atomic Oxygen-rich regime during the local evening.
- Discovering "suprathermal" Argon-40 atoms in the Martian exosphere, hinting at why the red planet lost most of its atmosphere.
- Observed many Martian dust storms and advanced our understanding of their workings.
- Helped to generate an atlas of Mars.
- Recorded variations in Mars' ice caps.

# MASSIVE SPACE ROCK IMPACT COULD HAVE 'INSTANTLY' CREATED THE MOON

Billions of years ago, a version of our Earth that looks very different than the one we live on today was hit by an object about the size of Mars, called Theia – and out of that collision the Moon was formed. How exactly that formation occurred is a scientific puzzle researchers have studied for decades, without a conclusive answer.

Most theories claim the Moon formed out of the debris of this collision, coalescing in orbit over months or years. A new simulation puts forth a different theory – the Moon may have formed immediately, in a matter of hours, when material from the Earth and Theia was launched directly into orbit after the impact.

## A Puzzle of Planetary History

Previously prevailing theories could explain some aspects of the Moon's properties quite well, such as its mass and orbit, but with some major caveats. One outstanding mystery has been why the composition of the Moon is so similar to Earth's. Scientists can study the composition of a material based on its isotopic signature, a chemical clue to how and where an object was created. The lunar samples scientists have been able to study in labs show very similar isotopic signatures to rocks from Earth, unlike rocks from Mars or elsewhere in the solar system. This makes it likely that much of the material that makes up the Moon originally came from Earth.

In previous scenarios where Theia sprayed out into orbit and mixed with only a little material from Earth, it's less likely we'd see such strong similarities – unless Theia was also isotopically similar to Earth, an unlikely coincidence. In this theory, more Earth material is used to create the Moon, particularly its outer layers, which could help to explain this similarity in composition.



The simulation screenshot shows a stream of ejected material created by a giant impact coalesces into the body that would become the moon. (Image credit: Dr. Jacob Kegerreis)

There have been other theories proposed to explain these similarities in composition, such as the synestia model – where the Moon is formed inside a swirl of vaporized rock from the collision – but these arguably struggle to explain the Moon's current orbit.

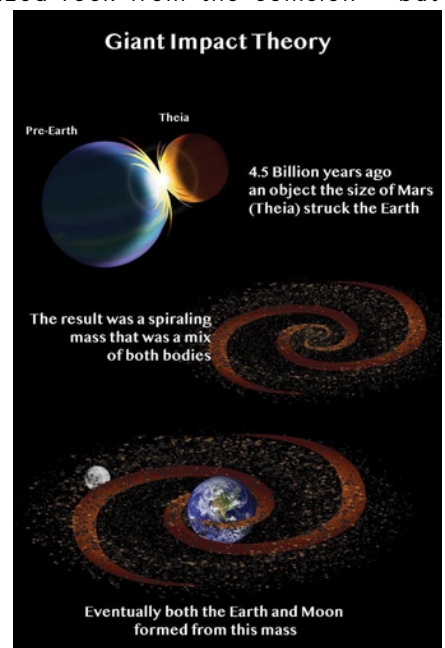
This faster, single-stage formation theory offers a cleaner and more elegant explanation for both these outstanding issues. It could also give new ways to find answers for other unsolved mysteries. This scenario can put the Moon into a wide orbit with an interior that isn't fully molten, potentially explaining properties like the Moon's tilted orbit and thin crust – making it one of the most enticing explanations for the Moon's origins yet.

Getting closer to confirming which of these theories is correct will require analysis of future lunar samples brought back to Earth for study from NASA's future Artemis missions.

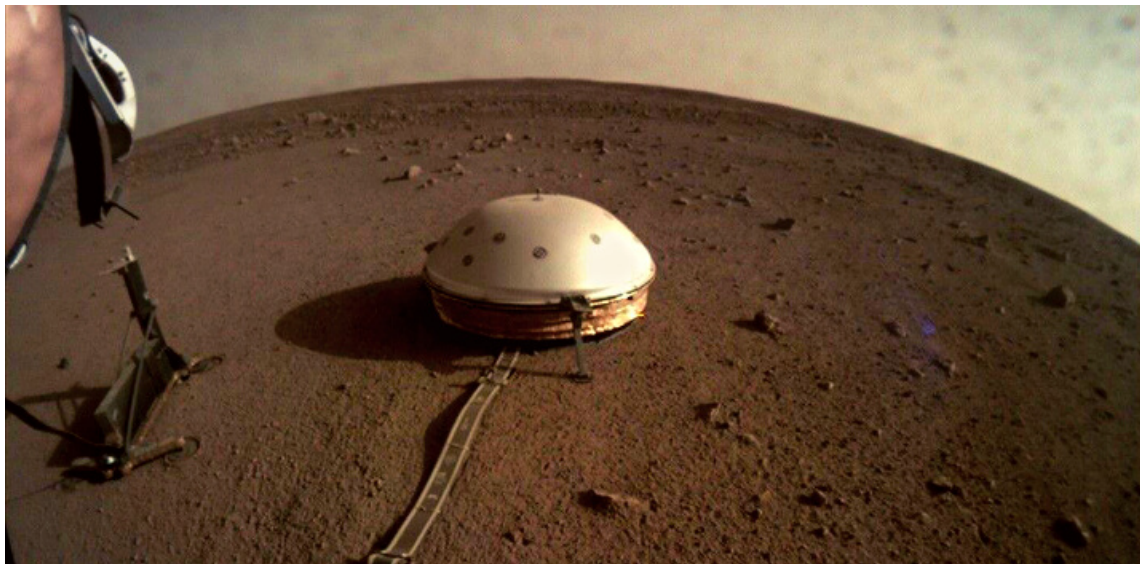
## A Shared Origin

"The more we learn about how the Moon came to be, the more we discover about the evolution of our own Earth," said Vincent Eke, a researcher at Durham University and a co-author on the paper. "Their histories are intertwined – and could be echoed in the stories of other planets changed by similar or very different collisions."

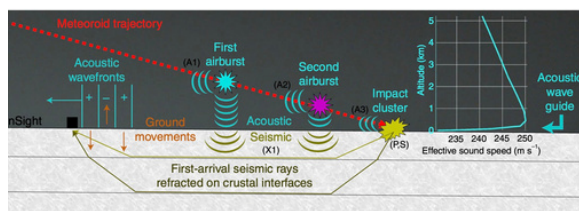
The cosmos is filled with collisions – impacts are an essential part of how planetary bodies form and evolve. The better scientists can simulate and analyze what's at play in these collisions, the more prepared we are to understand how a planet could evolve to be habitable like our own Earth.



# FOR THE FIRST TIME, ROBOTS ON MARS FOUND METEORITE IMPACT CRATERS BY SENSING SEISMIC SHOCK WAVES



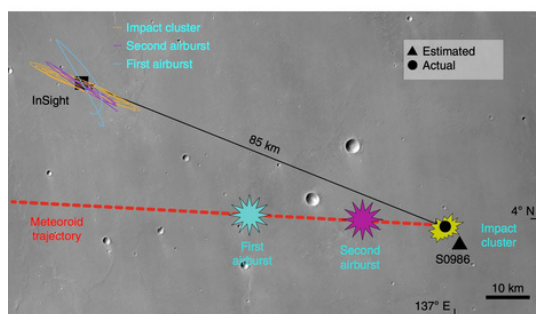
Since 2018, NASA's InSight mission to Mars has recorded seismic waves from more than 1,300 Mars quakes in its quest to probe the internal structure of the red planet. The solar panels of the car-sized robotic lander have become caked with Martian dust, and NASA scientists expect it will completely power down by the end of 2022. But the internal rumblings of our planetary neighbor aren't the only things that InSight's seismometers detect: they also pick up the thuds of space rocks crashing into the Martian soil. In new research published in *Nature Geoscience*, we used data from InSight to detect and locate four high-speed meteoroid collisions, and then tracked down the resulting craters in satellite images from NASA's Mars Reconnaissance Orbiter.



## Rocks from space

The Solar System is full of relatively small rocks called meteoroids, and it's common for them to collide with planets. When a meteoroid encounters a planet with an atmosphere, it heats up due to friction and may burn up entirely before reaching the ground.

On Earth, we know these incoming meteoroids as shooting stars, or meteors: beautiful events to observe in the night sky. Sometimes a meteoroid explodes when it reaches the thicker atmosphere closer to the ground, creating a spectacular airburst. Occasionally, a space rock survives its fiery path through the air and drops to the ground, where it is known as a meteorite.



(A sketch of how an incoming space rock makes waves that InSight can detect and interpret)

A few of these meteorites hit the surface at such speed they blast a hole in the ground called an impact crater.

## Martian meteorites

Incoming meteoroids make waves in the atmosphere and also the ground. The atmosphere of Mars is equivalent to 1% of the Earth's, and has a different chemical composition. This means meteor events on Mars take a different form.

For meteor events large enough to drop a meteorite, the fate of the meteorite and any resulting crater is different from what we have come to expect on our home planet.

Here on Earth, or on the moon, single craters are the norm. On Mars, however, about half the time a high-speed space rock will burst in the atmosphere shortly before impact, resulting in a tightly grouped cluster of craters. The separation of these individual fragments remains close at ground level, forming a cluster of small impacts.

## Recording space rock impacts

Scientists have detected the vibrations from meteoroid airbursts using seismic detectors numerous times, including a recent survey of bright meteors above Australia.

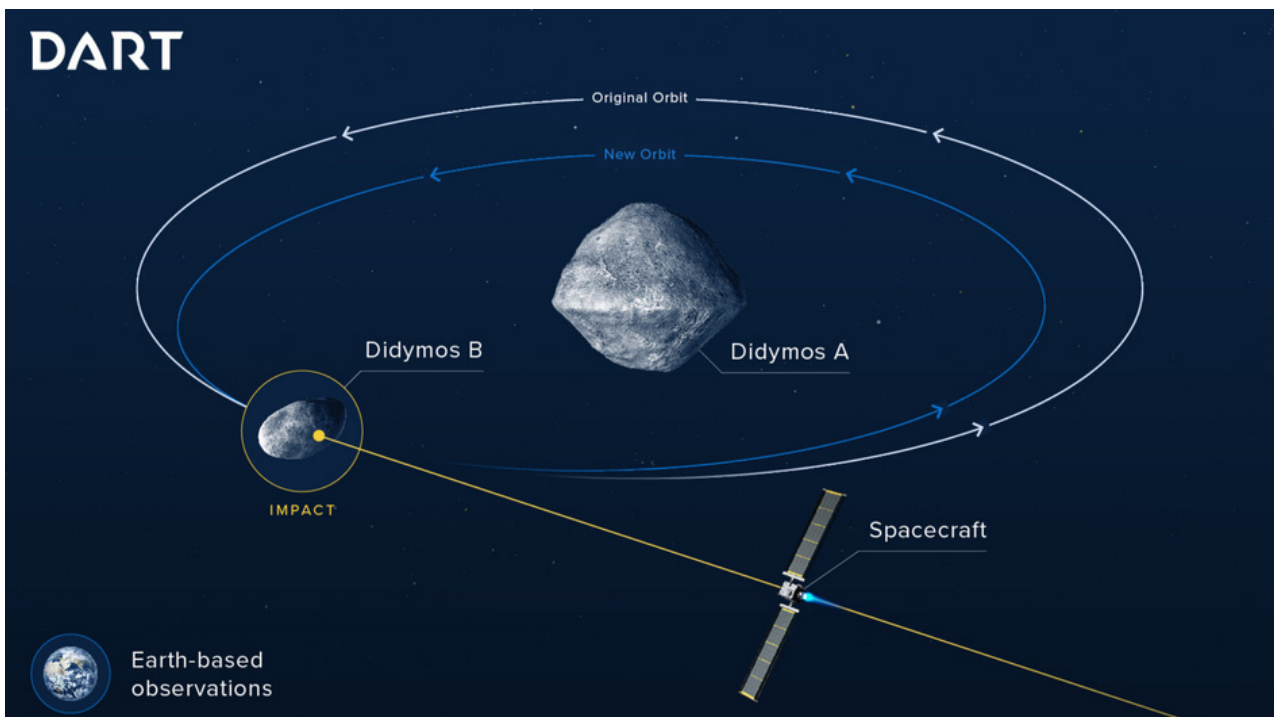
However, only once has a high-speed space rock crashing into the ground been observed both visually and with modern seismic equipment. This was an impact crater that formed in 2007 near the village of Carancas in Peru.

# NASA CONFIRMED THAT THE DART MISSION IMPACT CHANGED ASTEROID'S MOTION

**NASA says its mission to knock an asteroid off course – a test of planetary defense – succeeded beyond its expectations.**

The Double Asteroid Redirection Test (DART) slammed a spacecraft into one asteroid to see if it could change its orbit around another asteroid. In fact, it did. About 7 million miles away from Earth, the asteroid Dimorphos is in orbit around a larger asteroid called Didymos. It usually takes 11 hours 55 minutes for Dimorphos to make a complete orbit. After the DART spacecraft made impact two weeks ago, that orbit has shortened to 11 hours, 23 minutes: a 32-minute change.

"This is a watershed moment for defense," NASA Administrator Bill Nelson said on Tuesday. "This mission shows that NASA is trying to be ready for whatever the universe throws at us." The two asteroids pose no threat to Earth, but the test is proof of concept that if another asteroid does appear headed in Earth's direction, scientists have a way of pushing it off course.



## **A push for planetary defense**

"For the first time ever, humanity has changed the orbit of a planetary body," said Lori Glaze, director of the Planetary Science Division at NASA. The time was shortened by pushing Dimorphos, which has a diameter of about 525 feet, into a slightly closer orbit around Didymos. What pushed it closer was a combination of the kinetic force of the impact as well as the ejecta – dust and rock that was blown off the asteroid's surface when the spacecraft hit.

Observers measured the time of the orbit by looking through telescopes in Chile and South Africa at the timing of when one asteroid eclipsed the other.

Visibility from Earth isn't great, so they were essentially looking at how often they saw "dips in brightness" from the area, according to Nancy Chabot, the DART coordination lead at the Johns Hopkins Applied Physics Laboratory. Planetary radar facilities in California and West Virginia were also used to measure orbit times.

NASA initially predicted the orbit would be shortened by somewhere around 10 minutes, but estimates ranged from only a few minutes to "several tens of minutes," Glaze said, putting the 32-minute change in the upper range. The orbit time is accurate to within plus or minus two minutes, she said. Now that the test has proved successful, if an asteroid one day threatens Earth, scientists should get to work years ahead of time, according to Glaze. "We are capable of deflecting an asteroid," she said.

But the mission only caused a 4% change in orbit time, so "the more time we have for that little nudge the better off we are," Glaze added. NASA expects to continue monitoring the asteroids through early next year. A European spacecraft is scheduled to arrive at the Didymos system in 2027 to investigate the asteroids in more detail.



## THIS BIZARRE OBJECT IS FASTER THAN LIGHT? WHAT DID HUBBLE CAPTURED?

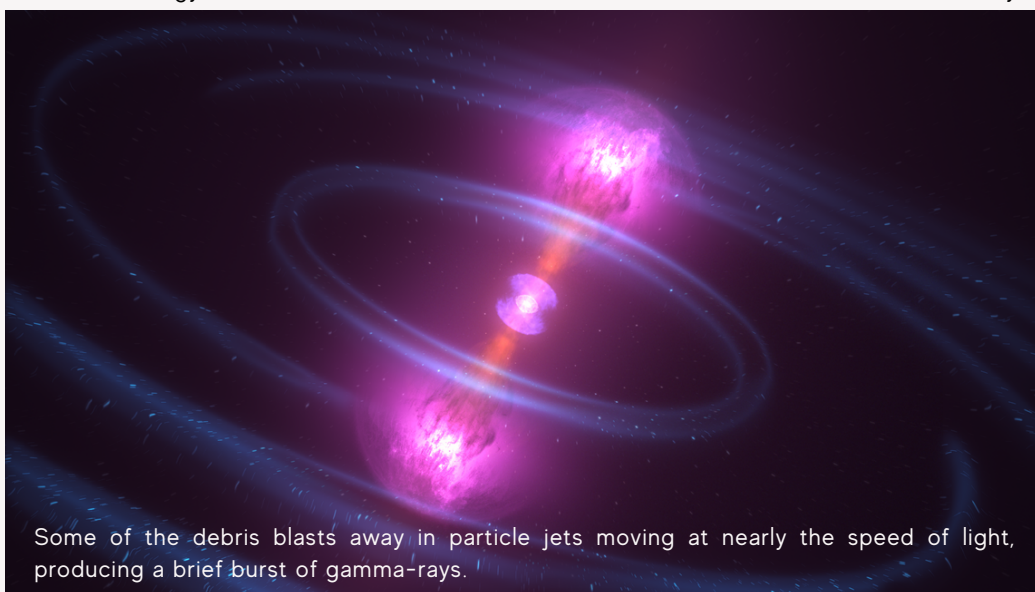
In August 2017, astronomers witnessed an incredible explosion in space – two ultra-dense neutron stars collided head-on, releasing an extraordinarily powerful jet of radiation.

Two days later, the Hubble Space Telescope was on the scene studying that jet. Now, five years after the event, which was astronomers' first detection of gravitational waves from neutron stars, researchers have finally been able to measure the speed of the jet.

### A mighty collision and a super-fast jet

According to the known laws of physics, nothing can travel faster than light. And it's rare to see any space objects traveling at speeds anywhere even close to the speed of light, although some relativistic jets from exotic phenomena like black holes, pulsars and quasars do sometimes move nearly that fast. But now astronomers have found a super-fast jet, plowing through space at speeds greater than 99.97% the speed of light. Wow!

NASA said on October 12, 2022, that astronomers used the Hubble Space Telescope to measure the speed of this jet, which they believe sprang into being when two neutron stars collided. They've named this event GW170817 and said the energy from the collision was comparable to that of a supernova, or exploding star, which can emit more energy in a few seconds than our sun will radiate in its lifetime of billions of years.



Some of the debris blasts away in particle jets moving at nearly the speed of light, producing a brief burst of gamma-rays.

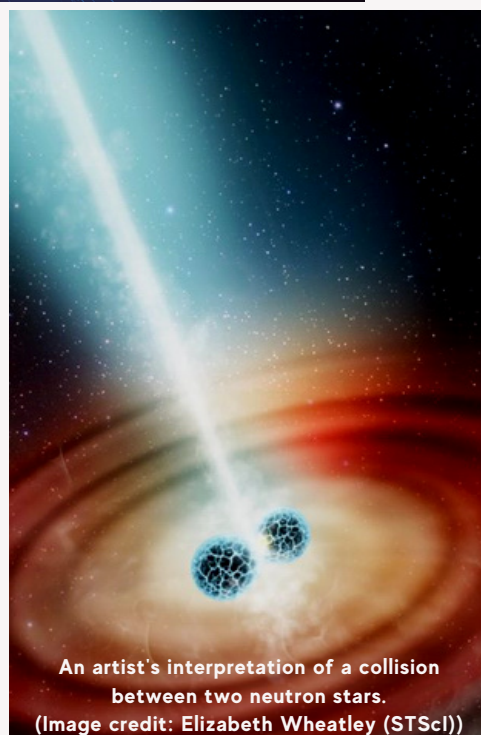
### Super-fast jet faster than light?

By combining the different observations, they were able to pinpoint the explosion site. The Hubble measurement showed the jet was moving at an apparent velocity of seven times the speed of light. The radio observations show the jet later had decelerated to an apparent speed of four times faster than the speed of light.

But, as noted at the top of this page, nothing can travel faster than light, according to the known laws of physics. So today's astronomers agree that this superluminal motion is an illusion. The astronomers explained: Because the jet is approaching Earth at nearly the speed of light, the light it emits at a later time has a shorter distance to go. In essence the jet is chasing its own light. In actuality, more time has passed between the jet's emission of the light than the observer thinks. This causes the object's velocity to be overestimated – in this case seemingly exceeding the speed of light.

### Why astronomers are excited?

These astronomers called the work "a significant breakthrough" for two emerging and interrelated fields of study. One is time-domain astronomy (studying how space objects change over time). And the other is multi-messenger astronomy (using various sorts of signals, like light and gravitational waves, to study a single astrophysical object or event). This work also paves the way for more precision studies of neutron star mergers.



An artist's interpretation of a collision between two neutron stars.  
(Image credit: Elizabeth Wheatley (STScI))

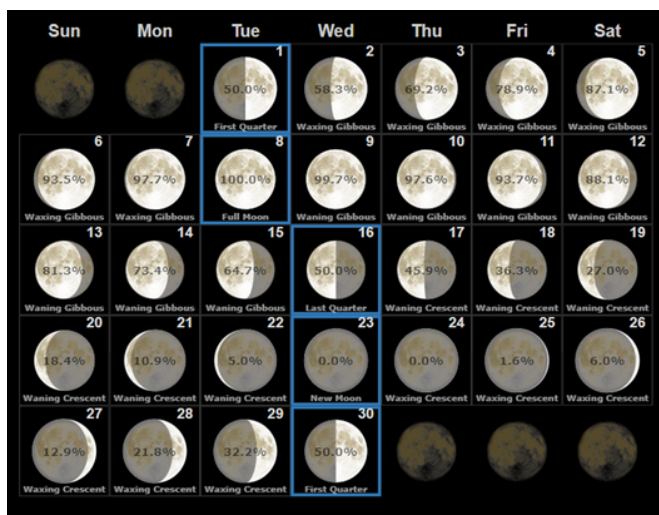
# WHAT'S UP IN THE SKY - NOVEMBER 2022

## 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.

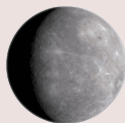
So, What Moon phase is best for stargazing? "The New Moon and the days immediately before and after the new moon (Crescent phases)" are among the best times for stargazing. Whereas the Remaining phases like Full Moon, waxing or waning gibbous, the first or third quarter Moon offers a time to zoom in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



## PLANETS VISIBILITY

### Mercury

Mercury is lost in morning light early November and then is barely visible after twilight at month's end.



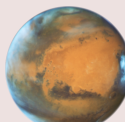
### Venus

Hidden in the sun's glare. It'll return to our evening sky before the year ends.



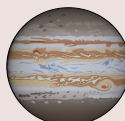
### Mars

Mars rises in the east a few hours after sunset. It's very red now and brighter than most stars.



### Jupiter

Jupiter is easy to spot, brighter than all the stars. It's high in the east after sunset and sets earlier each night.



### Saturn

Saturn is high in the sky after sunset - golden in color, shining steadily, perfect for observing in the evening.



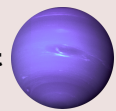
### Uranus

Uranus opposition on November 9, making it an all-night target during November.



### Neptune

Well positioned binocular planet throughout the month.



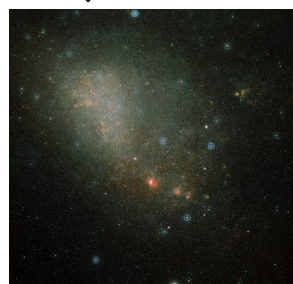
## BRIGHT DEEP SKY OBJECTS

Messier 103 is a pretty small open cluster in the constellation of Cassiopeia. The cluster lies at a distance of 10,000 light years from Earth and has an apparent magnitude of 7.4. Its designation in the New General Catalogue is NGC 581. M103 was discovered in 1781 by Pierre Méchain, who is also to thank for many other objects in the Messier catalog.



The Andromeda Galaxy, also known as M31, originally the Andromeda Nebula, is a barred spiral galaxy with an apparent magnitude of 3.4, the Andromeda Galaxy is among the brightest of the Messier objects, and is visible to the naked eye from Earth on moonless nights, even when viewed from areas with moderate light pollution.

Pierre Méchain, a French astronomer and colleague of Charles Messier, discovered the globular cluster M72 in 1780. At 50,000 light-years from Earth, M72 is located in the constellation Aquarius and has an apparent magnitude of 9.4. The cluster appears as a faint patch of light in small telescopes, and the best time to observe it is during November.



The Small Magellanic Cloud (SMC) is an irregular dwarf galaxy located only 7,000 light years outside our Milky Way galaxy. It is one of the few galaxies that can be seen with naked eye. The galaxy is located across both the constellations of Tucana & part of Hydrus and has an apparent magnitude of 2.7.

# ROCKET LAUNCHES IN NOVEMBER 2022

## PLÉIADES NEO SATELLITES ARE READY TO JOIN REST OF FAMILY

**The Pléiades Neo 5 and 6 Earth observation satellites will launch aboard an Arianespace Vega-C rocket for Airbus from Kourou, French Guiana.**

Pléiades Neo is a very high resolution optical constellation of four identical satellites phased at 90° from each other. The constellation provides continuity for the Pléiades mission, with enhanced performance in terms of accuracy, reactivity and frequency. Fast tasking, high agility and a huge volume of data are the main advantages of the mission. The constellation is manufactured, owned and operated by Airbus Defence and Space.

Pléiades Neo 3, the first satellite in the constellation, was launched on 28 April 2021, followed by Pléiades Neo 4 on 16 August 2021. Pléiades Neo 5 and 6 are planned to be launched during 2022. The constellation remains operational.

The last two satellites of the Airbus-built, owned and operated Pléiades Neo constellation are on track for launch later this year, following successful final tests in Toulouse's clean rooms.

Following the seamless parallel integration of both Pléiades Neo 5 and 6 satellites, and the successful conclusion of the environment (thermal vacuum, acoustic, vibration) test campaign, both final spacecraft are now ready to complete the Pléiades Neo constellation.

Both satellites are due to be launched simultaneously on the Vega C European launcher from Kourou, in French Guiana. To tackle this dual launch, the Airbus space engineers came up with a smart and efficient dispenser-free design, where the satellites are stacked on top of each other, linked only by a clamp band. This compact dispenser-free launch configuration saves volume and mass, as well as reducing cost. Simultaneously testing both satellites in their stacked launch configuration enabled significant time saving, with only four days needed to pass both the three axes Sine testing and the acoustic test.

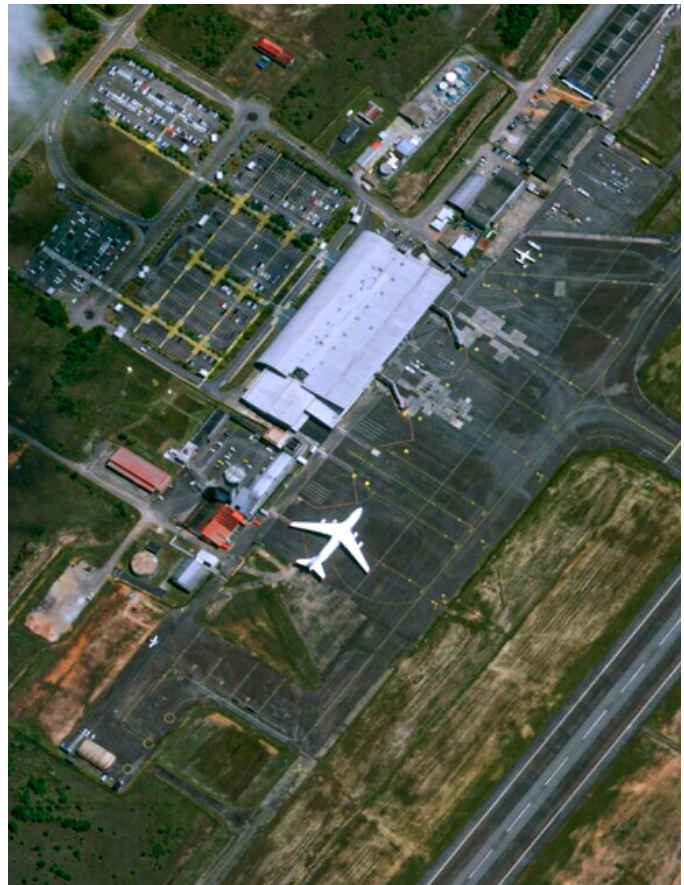
### Next-gen optical instrument

High resolution Pléiades Neo imagery offers an unmatched level of detail, including more visibility of small objects such as vehicles and road markings. This level of detection, recognition and identification provides more ground truth for image analysts and improves reliability for machine learning capabilities.

The constellation also will deliver higher geolocation accuracy and deeper spectral band information, allowing more insights to be derived for various applications, including the monitoring of strategic sites, commercial activities, maritime zones and the environment; along with mapping, infrastructure and urban development.

### Reshaping Earth observation-based services

In today's constantly changing environment where information is key, Pléiades Neo imaging enables fresh topographic mapping for many applications. The satellites bring a significant level of information required for precise large-scale mapping in the military and civilian contexts up to 1:2000 scale, while the intraday revisit rate with the constellation's four identical satellites enables rapid acquisitions with frequent updates for any product layer. Additionally, Pléiades Neo's agility ensures multi-stereo acquisitions in one single pass – which is essential in building topographic maps.



Pleiades Neo 5 and 6 spotted by Pleiades Neo 3 after landing at Cayenne Airport, French Guiana. Credit Airbus DS 2022

# ATLAS 5 LAUNCH FROM CALIFORNIA DELAYED FOR BATTERY REPLACEMENT

**The final flight of an Atlas 5 rocket from California has been delayed from Nov. 1 until no earlier than Nov. 9 to replace a battery on the launcher's Centaur upper stage, United Launch Alliance and NASA officials said.**

The Atlas 5 rocket's Centaur upper stage will place the JPSS 2 weather satellite into polar orbit for NOAA and NASA, then the rocket stage will perform a deorbit burn and deploy a joint ULA-NASA re-entry technology experiment named LOFTID, or the Low-Earth Orbit Flight Test of an Inflatable Decelerator.

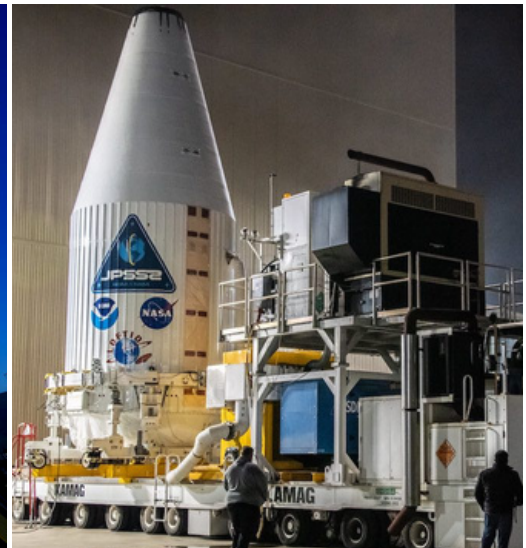
The mission will have to wait until no earlier than Nov. 9 to blast off from Vandenberg Space Force Base in California. The launch time Nov. 9 is set for 0925 GMT.

The rocket is fully stacked on its launch pad at Vandenberg to begin a mission that will close long chapters in the history of the Atlas rocket program. It will mark the final flight of an Atlas rocket from Vandenberg, and the last Atlas 5 rocket to fly with the vehicle's classic 4-meter-diameter (13-foot) payload fairing.

There are 20 more Atlas 5 rocket flights on ULA's schedule in the next few years, including the JPSS 2 mission. ULA is phasing out the Atlas 5 rocket, along with its other legacy rocket, the Delta 4. There are two Delta 4-Heavy rockets left on ULA's launch manifest.



The first stage of ULA's Atlas 5 rocket was lifted onto its launch stand. Credit: USSF 30th Space Wing/Steve Gerlich)



The Atlas 5's payload containing the JPSS & LOFTID was moved to the launch pad.

The Atlas 5 and Delta 4 rockets will be replaced by the next-generation Vulcan Centaur launcher, which ULA says will be cheaper to build and operate, and will exceed the capabilities of the company's previous vehicles. The JPSS 2 weather satellite is the second in NOAA's newest generation of observatories gathering data on Earth's atmosphere and oceans, mapping and monitoring wildfires and volcanoes, and measuring dust and smoke in the air. JPSS 2 will also track the health of the ozone layer.

Built by Northrop Grumman, the JPSS 2 spacecraft is the third satellite in NOAA's Joint Polar Satellite System series of weather observatories. It follows the launch of the Suomi NPP and JPSS 1 weather satellites in 2011 and 2017, both on ULA's now-retired Delta 2 rocket.

JPSS 2 will fly at an altitude of 824 kilometers, allowing its four instruments to collect data over the same location on Earth twice per day, once in sunlight and once at nighttime, as the planet rotates underneath the satellite's orbit. The new satellite will be renamed NOAA 21 after it reaches orbit, continuing a line of U.S. government weather satellites dating back to 1960.

Forecasters use data from polar-orbiting satellites to help predict weather three to seven days in advance, while NOAA's GOES weather satellites in geostationary orbit provide real-time monitoring of severe weather and tropical cyclones.

The LOFTID secondary payload on the Atlas 5 rocket will test an inflatable heat shield design that could be used in the future to help land massive cargo on Mars. ULA partnered with NASA on the re-entry tech demo experiment because the company could use a similar heat shield system to help it recover rocket engines from the next-generation Vulcan rocket for refurbishment and reuse.

# NASA Sets TV Coverage for Cygnus Cargo Launch to International Space Station

## Lift Off Date: November 6, 2022

NASA and commercial cargo provider Northrop Grumman are targeting 5:50 a.m. EST, Sunday, Nov. 6, for launch of the company's 18th resupply mission to the International Space Station.

Live coverage of the launch from NASA's Wallops Flight Facility in Wallops Island, Virginia, will air on NASA Television. Watch live beginning at 5:30 a.m. on the agency's website at: [www.nasa.gov/live](http://www.nasa.gov/live)

Loaded with approximately 8,200 pounds of research, crew supplies, and hardware, Northrop Grumman's Cygnus cargo spacecraft will launch on the company's Antares rocket from Virginia Space's Mid-Atlantic Regional Spaceport. It will arrive at the space station on Tuesday, Nov. 8.



Northrop Grumman's Cygnus space freighter, with its prominent cymbal-shaped UltraFlex solar arrays, is pictured Feb. 21, 2022, approaching the ISS carrying 8,300 pounds of new science experiments, crew supplies, and station hardware to replenish the Expedition 66 crew. (Credits: NASA)

## Highlights of hardware and space station research facilitated by samples and equipment aboard this Cygnus are:

- A facility and study that attempt to advance the 3D biological printing of human tissue in space.
- A study taking advantage of microgravity to better understand catastrophic mudflows that can occur after wildfires.
- Uganda and Zimbabwe's first satellites developed as a part of the BIRDS program, an interdisciplinary project for non-space faring countries.
- An investigation into how microgravity influences ovary function.
- An experiment that studies if changes space-grown plants undergo to adapt to microgravity can be transmitted through seeds to the next generation.
- Hardware to be installed outside the station in preparation for the installation of Roll-Out Solar Arrays.

The Cygnus spacecraft is scheduled to remain at the space station until late January 2023 when it will depart, disposing of several tons of trash during a destructive re-entry into Earth's atmosphere. This Cygnus is dubbed the Sally Ride in honor of late NASA astronaut, physicist, and first American woman to fly in space, Sally Ride. Ride spent 14 days across two space shuttle missions performing science experiments, making observations of Earth, deploying satellites, and conducting technology demonstrations. She was an advocate for diversity and representation in science and dedicated much of her life to inspiring young people, particularly young women, to pursue careers in science, technology, engineering, and math fields.

# SpaceX Launches - November 2022

## SPACEX'S FALCON 9 ROCKET WILL LAUNCH DRAGON 2 SPACECRAFT TO ISS

SpaceX CRS-26, also known as SpX-26, is a Commercial Resupply Service mission to the International Space Station (ISS) scheduled to be launched on 20 November 2022. The mission is contracted by NASA and will be flown by SpaceX using a Cargo Dragon. This will be the sixth flight for SpaceX under NASA's CRS Phase 2 contract awarded in January 2016.

### Cargo Dragon

SpaceX plans to reuse the Cargo Dragons up to five times. The Cargo Dragon will launch without SuperDraco abort engines, without seats, cockpit controls and the life support system required to sustain astronauts in space. Dragon 2 improves on Dragon 1 in several ways, including lessened refurbishment time, leading to shorter periods between flights.

### Dragon CRS-2 SpX-26

Type: Resupply

Launch Cost: \$52,000,000

26th commercial resupply services mission to the International Space Station operated by SpaceX. The flight will be conducted under the second Commercial Resupply Services contract with NASA. Cargo Dragon 2 brings supplies and payloads, including critical materials to directly support science and research investigations that occur onboard the orbiting laboratory.



## HOTBIRD 13G BY FALCON 9 BLOCK 5

**Lift Off Date: November 03, 2022**

SpaceX will be launching the Hotbird 13G satellite on their 51st mission of the year. The 4,500 kg (99,000 lb) satellite will launch atop a Falcon 9 rocket from Space Launch Complex 40 (SLC-40), Cape Canaveral Space Force Station in Florida, USA. Hotbird 13F was built by Airbus Defense and Space for joint operation by the European Space Agency and Eutelsat.



### What Is The Eutelsat Hotbird 13G?

In short, the Eutelsat Hotbird 13G satellite is a telecommunications satellite. The satellite has an estimated lifetime of 15 years and will be replacing the Hotbird 13 B, C, and D respectively which lasted about 14 years. The increased Ku band capacity on the newly update Hotbird 13F and 13G satellites now only requires two satellites to be at Eutelsat's East position in geostationary orbit instead of the prior three.

Two solar panels generate 22 kW of power to enable efficient use of 80 Ku band transponders. That totals 160 Ku band transponders between both satellites in same position.

# SPACEX TO LAUNCH FALCON HEAVY ROCKET FOR U.S. SPACE FORCE MISSION

SpaceX will launch a Falcon Heavy rocket on 1st of November for the first time in more than three years as part of a U.S. Space Force mission.



Nov. 1: A SpaceX Falcon-Heavy will launch the USSF 44 mission for the U.S. Space Force. The mission will deploy two payloads into geosynchronous orbit, one of which is the military's TETRA 1 microsatellite. The launch is scheduled for 5:25 a.m. EDT (0925 GMT).

"The threat for showers over land will be low going into the primary launch window Tuesday morning with fog and stratus potentially around in the morning," Space Launch Delta 45 forecasters said Sunday.

"An isolated shower moving in from the Atlantic can't be ruled out, which will be the primary weather concern for the launch."

The Falcon Heavy rocket's two side boosters are expected to land on Landing Zone 1 and Landing Zone 2 at the Cape Canaveral Space Force Station.

During the landing, viewers can expect to experience a double sonic boom from their re-entry into the atmosphere. SpaceX has described the Falcon Heavy rocket as the "most powerful operational rocket in the world by a factor of two."

It is composed of three Falcon 9 nine-engine cores whose 27 Merlin engines together generate more than 5 million pounds of thrust at liftoff, equal to approximately eighteen 747 aircraft.



This launch will be the first time a Falcon Heavy rocket is lifted off since June 2019 and will be just the fourth mission ever for the rocket, which debuted in 2018

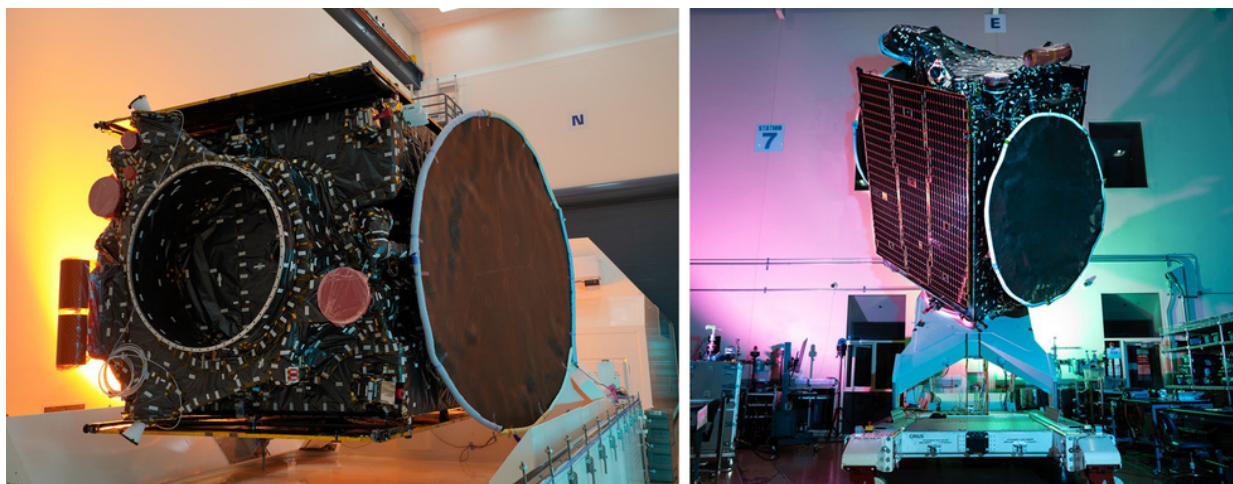
# MAXAR DELIVERS INTELSAT'S GALAXY 31 AND GALAXY 32 TO LAUNCH BASE

The Maxar-built Galaxy 31 and Galaxy 32 satellites for Intelsat have arrived at Cape Canaveral. The two geostationary communications satellites will launch together in a stacked configuration at the beginning of November on a SpaceX Falcon 9 rocket.

Intelsat ORDERED FIVE GEOSTATIONARY COMMUNICATIONS SATELLITES from Maxar in 2020 as part of its effort to transition its services—uninterrupted—as part of the U.S. Federal Communications Commission (FCC) plan to reallocate parts of the C-band spectrum for 5G terrestrial wireless services.

Galaxy 31 and Galaxy 32 are built on Maxar's proven 1300-class platform, which offers the flexibility and power needed for a broad range of customer missions.

Maxar has built nearly 60 spacecraft for Intelsat since the 1970s, including these satellites. The launch of Galaxy 31 and Galaxy 32 will be broadcast on SpaceX's YouTube channel.



Galaxy 31 (left) and Galaxy 32 (right) are shown here at Maxar's manufacturing facility in Palo Alto, California, ahead of shipment to launch base.

## STARLINK SATELLITE SERIES

Starlink Group 2-4 | Starlink Group 4-37

SpaceX will launch two more batches of Starlink satellites in the month of November for their high-speed low earth orbit internet constellation on Falcon 9 Block 5 rocket from Space Launch Complex 4, Vandenberg Space Force Base, California.



A satellite constellation is a group of satellites that work in conjunction for a common purpose. Currently, SpaceX plans to form a network of 11,716 satellites; however, in 2019 SpaceX filed an application with the Federal Communication Commission for permission to launch and operate an additional 30,000 satellites as part of phase 2 of Starlink. To put this number of satellites into perspective, this is roughly 20 times more satellites than were launched before 2019.



# ISRO TO LAUNCH EOS-06 AND THYBOLT SATELLITE

**PSLV C54 with Oceansat-3 (EOS-06), 4 x Astrocast-2 (Swiss), INS-2B (Bhutansat), Thybolt-1 & 2 (Dhruva) and Anand (Pixxel) - November 2022**

The PSLV-C54 is the 55th mission of the Indian Polar Satellite Launch Vehicle (PSLV). It will be launched in November of 2022 with the EOS-06 satellite and Thybolt Satellites of Dhruva Space from Satish Dhawan Space Centre Sriharikota.

## Mission overview

The PSLV C54 rocket has four stages; each one was self-contained, with its own propulsion system, thereby capable of functioning independently. The first and third stages used composite solid propellants, while the second and fourth stage use earth-storable liquid propellant.

## EOS-06

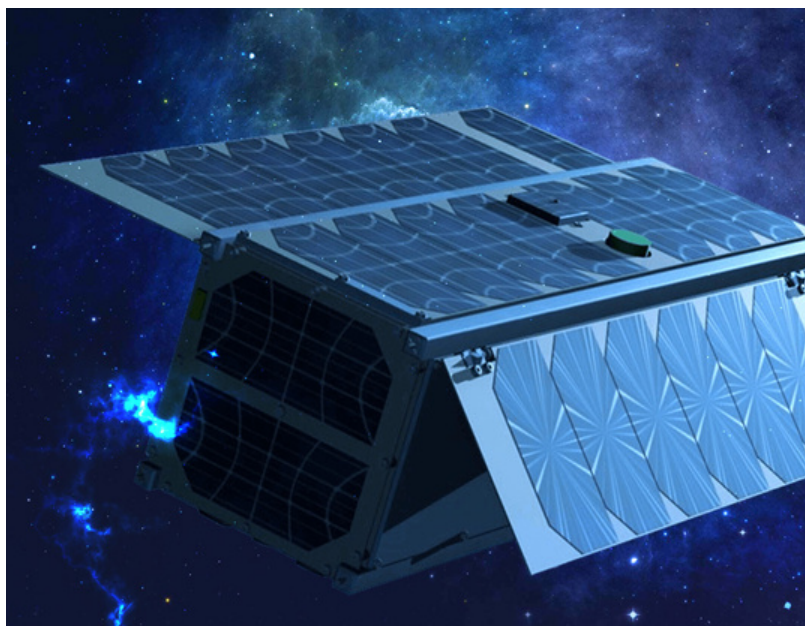
EOS-06, also named Oceansat-3A, is an Indian satellite designed to provide service continuity for operational users of the Ocean Colour Monitor (OCM) instrument on Oceansat-2. It will also enhance the potential of applications in other areas. The main objectives of OceanSat-3A are to study surface winds and ocean surface strata, observation of chlorophyll concentrations, monitoring of phytoplankton blooms, study of atmospheric aerosols and suspended sediments in the water.



## Astrocast Nanosatellites - Swiss state-of-the-art nanosatellites

- Weight: 5kg
- Dimensions: 10x10x34 cm
- Number of mechanical parts: ~150
- Number of electronic boards: ~25

In addition, our satellites have propulsion and deorbiting capabilities to avoid debris in space. They take a little piece of everyone at Astrocast with them to orbit. Our team members have a designated spot near the solar panels for engraving, so that not only their hard work is imprinted in the satellites, but also a nice personal message. There's a personal attachment to each satellite, that is why the team also gets to choose the names of the satellites via an internal voting process.



# NASA will launch the Artemis 1 moon mission on November 14

Artemis I is the first integrated test of NASA's deep space exploration systems: the Orion spacecraft, Space Launch System (SLS) rocket and the ground systems at the agency's Kennedy Space Center in Florida. The first in a series of increasingly complex missions, Artemis I is an uncrewed flight test that will provide a foundation for human deep space exploration and demonstrate our commitment and capability to return humans to the Moon and extend beyond.

- Launch site: Launch Pad 39B at NASA's Kennedy Space Center in Florida
- Launch date: Nov. 14, 2022
- Launch window: 12:07 a.m. EST to 1:16 p.m.
- Mission Duration: 25 days, 11 hours, 21 minutes
- Destination: distant retrograde orbit around the Moon
- Targeted splashdown site: Pacific Ocean, off the coast of San Diego
- Return speed: Up to 25,000 mph (40,000 kph)
- Splashdown: Dec. 09, 2022

During this flight, Orion will launch atop the most powerful rocket in the world and fly farther than any spacecraft built for humans has ever flown. Over the course of the mission, it will travel 280,000 miles (450,000 kilometers) from Earth and 40,000 miles (64,000 kilometers) beyond the far side of the Moon. Orion will stay in space longer than any human spacecraft has without docking to a space station and return home faster and hotter than ever before.



This first Artemis mission will demonstrate the performance of both Orion and the SLS rocket and test our capabilities to orbit the Moon and return to Earth. The flight will pave the way for future missions to the lunar vicinity, including landing the first woman and first person of color on the surface of the Moon.

With Artemis I, NASA sets the stage for human exploration into deep space, where astronauts will build and begin testing the systems near the Moon needed for lunar surface missions and exploration to other destinations farther from Earth, including Mars. With Artemis, NASA will collaborate with industry and international partners to establish long-term exploration for the first time.





**A Rocket Lab Electron rocket will launch the "Catch Me If You Can" mission on Friday, November 4, 2022.**

**Mission Overview:** Rocket Lab USA, Inc. a leading launch and space systems company, today confirmed that it will attempt to catch an Electron rocket with a helicopter as it returns to Earth from space during the Company's next launch.

Rocket Lab's 32<sup>nd</sup> Electron launch, the "Catch Me If You Can" mission, is scheduled to launch from Pad B at Rocket Lab Launch Complex 1 during a launch window opening on November 04, UTC. Electron will carry a science research satellite by space systems provider OHB Sweden for the Swedish National Space Agency (SNSA).

The Mesospheric Airglow/Aerosol Tomography and Spectroscopy (MATS) satellite is the basis for the SNSA's science mission to investigate atmospheric waves and better understand how the upper layer of Earth's atmosphere interacts with wind and weather patterns closer to the ground. MATS was originally due to fly on a Russian launch service before the mission was manifested on Rocket Lab's Electron.

"Catch Me If You Can" will see Rocket Lab attempt to capture the rocket's first stage mid-air with a helicopter as it returns from space. Using a modified Sikorsky S-92 helicopter to catch and secure the rocket by its parachute line, Rocket Lab will bring the captured stage back to its Auckland Production Complex to be processed and assessed by engineers and technicians for possible re-use.

This Electron recovery effort follows the catch of an Electron first stage during Rocket Lab's first helicopter recovery attempt on the "There And Back Again" launch in May, and the recovery attempt for this mission will follow the same concept of operations as the previous launch.

Rocket Lab CEO and founder, Peter Beck, says: "Our first helicopter catch only a few months ago proved we can do what we set out to do with Electron, and we're eager to get the helicopter back out there and advance our rocket reusability even further by bringing back a dry stage for the first time."

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

# ASTRONOMICAL EVENTS - NOVEMBER 2022

## TOTAL LUNAR ECLIPSE - NOVEMBER 8

**Lunar Eclipse 2022:** A total lunar eclipse will occur in the month of November this year. This would be the second eclipse of the moon of the year 2022. The magnitude of the eclipse would be 1.36.

Since this is a total eclipse, the Moon will be entirely engulfed in the Earth's shadow at the time of the maximum eclipse. The part of the Moon inside the umbral shadow will be illuminated only by sunlight refracted through Earth's atmosphere and by a reddish tint. The longest duration of totality will be 1 hour 24 minutes and 28 seconds.

**Eclipse Visibility:** In India, total eclipse would be visible only from eastern parts whereas the rest of the country would see a partial eclipse.



### Moon, constellation, Saros

Greatest eclipse takes place 5.8 days before the moon reaches apogee, its farthest point from Earth for the month. So, it's a relatively small-sized moon during this eclipse. During the eclipse, the moon is located in the direction of the constellation Aries.

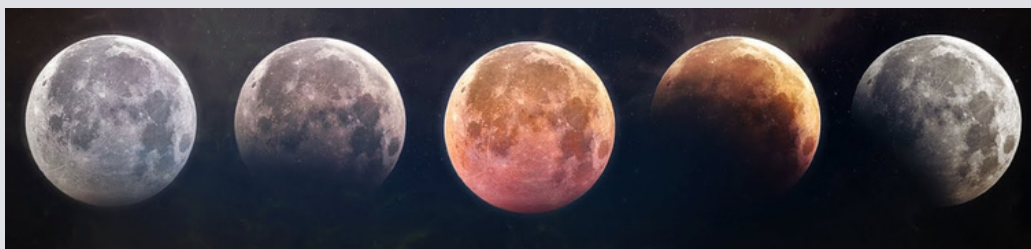
The Saros catalog describes the periodicity of eclipses. This November 8 total eclipse belongs to Saros 136. It is number 20 of 72 eclipses in the series. All eclipses in this series occur at the moon's ascending node. The moon moves southward with respect to the node with each succeeding eclipse in the series.

**The instant of greatest eclipse - when the axis of the moon's shadow cone passes closest to Earth's center. This total eclipse is central, meaning the moon's disk actually passes through the axis of Earth's umbral shadow. During the eclipse, the moon is located in the direction of the constellation Aries.**

Because they are so deep, such eclipses typically have the longest total phases. In this case, the duration of totality lasts almost an hour and a half: 85.7 minutes.

### Half-Saros cycle

A lunar eclipse will be preceded and followed by solar eclipses by 9 years and 5.5 days (a half saros). This lunar eclipse is related to two hybrid solar eclipses of Solar Saros 143.



### Metonic series

This eclipse is the third of five Metonic cycle lunar eclipses on the same date, 8-9 November:

The Metonic cycle repeats nearly exactly every 19 years and represents a Saros cycle plus one lunar year. Because it occurs on the same calendar date, the earth's shadow will be in nearly the same location relative to the background stars.

# LEONIDS METEOR SHOWER - 2022

The Leonid meteor shower will be active from 6 November to 30 November, producing its peak rate of meteors around 18 November. and it usually peaks around November 17 or 18. The shower is called Leonids because its radiant, or the point in the sky where the meteors seem to emerge from, lies in the constellation Leo. The radiant rises before midnight and is highest in the sky around 2 a.m.

## **Comet Tempel-Tuttle**

The Leonids occur when the Earth passes through the debris left by Comet Tempel-Tuttle. The comet takes around 33 years to make one orbit around the Sun.



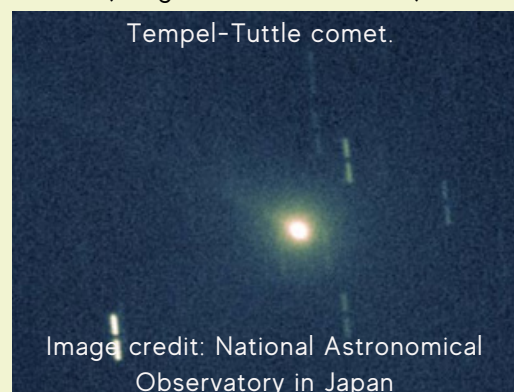
## **How to See the Leonids**

You don't need any special equipment or a lot of skills to view a meteor shower. Even though all you really need is a clear sky, lots of patience, and our handy Interactive Meteor Shower Sky Map with a visibility conditions meter to see a meteor shower, the following tips can help maximize your shooting star viewing experience.

- Find a secluded viewing spot, away from the city lights. Once at the venue, your eyes may take 15 to 20 minutes to get used to the dark.
- Dress for the weather, and make sure you are comfortable, especially if you plan to stay out long. Bring a blanket or a comfortable chair with you—meteor watching can be a waiting game.
- Once you have found your viewing spot, lie down on the ground and look at the sky. You can use our Interactive Meteor Shower Sky Map or the table above to find the direction of the radiant; the higher the radiant is above the horizon, the more meteors you are likely to see.
- Meteor showers appear to originate from the radiant, but meteors can appear in any part of the sky.

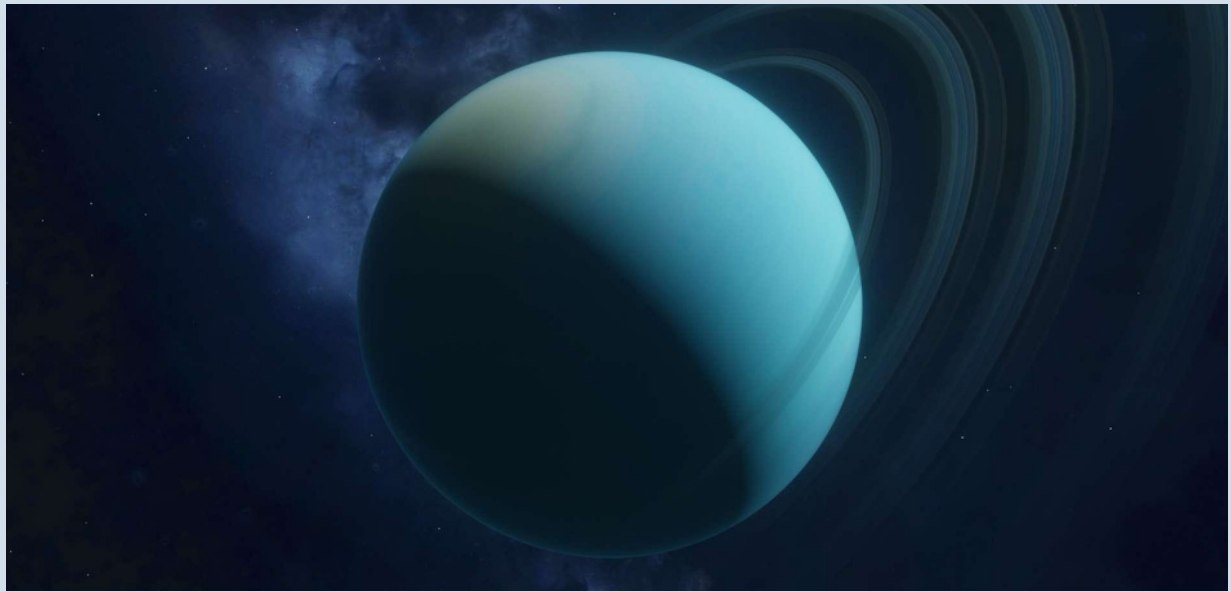


(Image credit: Newsweek)



# URANUS AT OPPOSITION NOVEMBER 9, 2022

## *Best day to observe Uranus*



**When and where to watch in 2022:** Uranus is visible as a naked eye object in a dark sky by people with good eyesight. It is easily visible in good binoculars or a telescope in the morning sky through October. By the time of its November 9 opposition, Uranus is rising in the east at sunset and is visible all night. Because Uranus is opposite the sun in early November 2022, it climbs highest up for the night at midnight. So, Uranus stays out all night long. Also, around the time of opposition, Earth's motion brings Uranus closest to Earth for 2022. The planet shines at its brightest in our sky.

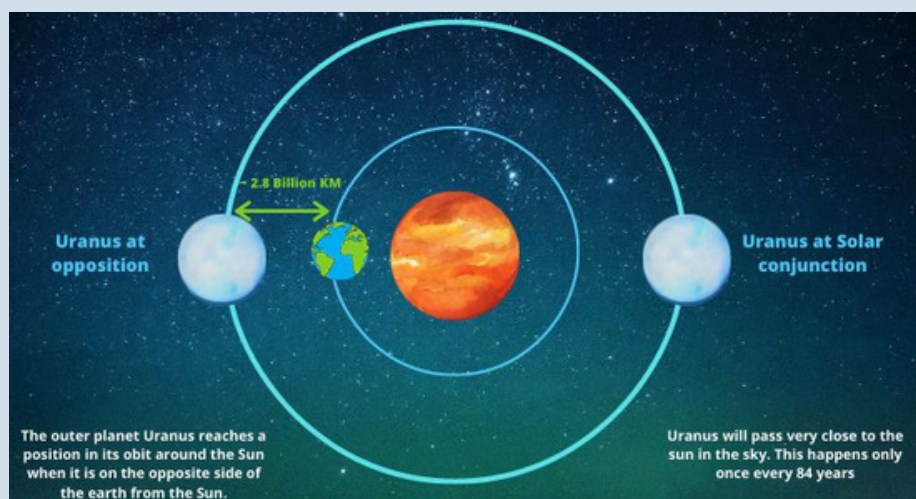
### **How often is Uranus at opposition?**

Uranus is the seventh planet from our sun. A year on Uranus is 84.4 Earth-years long. Because Uranus's orbit around the sun is so gigantic, and because Earth whips around the sun so quickly in comparison, Uranus's opposition date falls about 4 days later each year.

**"Opposition marks the middle of the best time of year to see an outer planet. Uranus reaches a yearly maximum in brightness brightest at +5.6 magnitude so it is visible to the unaided eye. Around the same time as Uranus reaches opposition, it is also making its closest approach to Earth."**

**In 2022, Uranus is quite close to the moon during the November 8 lunar eclipse making it easy to find while the moon is in total eclipse.**

**Distance to Uranus:** At its closest point to Earth, Uranus is still twice as far away from us as its next-door neighbor, Saturn. At opposition, Uranus will be just shy of 19 astronomical units (AU) away from Earth and 20 AU from the sun.



# 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 with Saturn

On **November 1, 2022**, Moon and Saturn will be very close to together in Early evening sky. The Moon is at a magnitude of -12.1, and Saturn at a magnitude of 0.4.



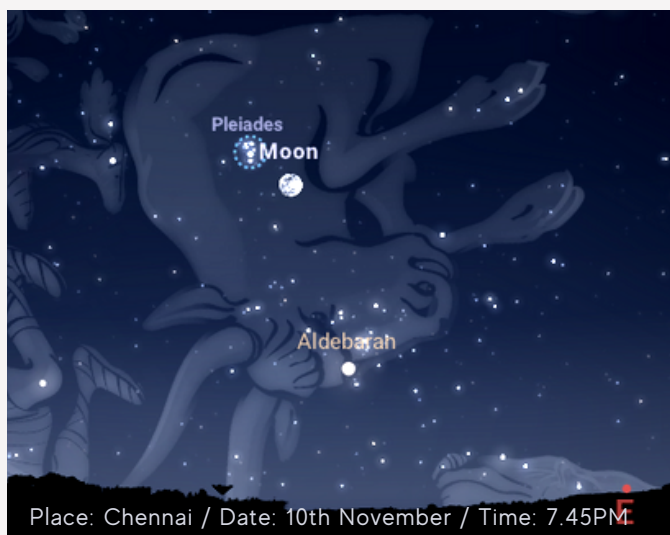
## Close encounter of Moon and Jupiter

On **November 4, 2022**, Moon and the giant planet Jupiter will be very close to together in Early evening sky. The Moon is at a magnitude of -12.60, and Jupiter at a magnitude of -2.63.



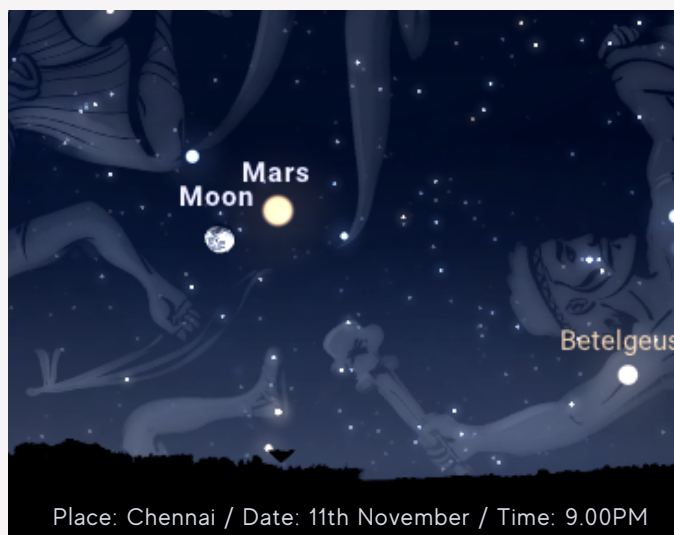
## Conjunction of Moon and Pleiades

**Date: 10th November**, Moon will have a closer approach with the open star cluster Pleiades. The Moon is at a magnitude of -12.59, and Pleiades at a magnitude of 1.59. They will be in the northeast as night begins and will cross the sky throughout the night.



## Conjunction of Gibbous Moon with Mars

On late evening of **November 11**, Mars is the bright object near the waning gibbous moon. They will be in the northeast after mid night begins and will cross the sky throughout the night. The Moon is at a magnitude of -12.45, and Mars at a magnitude of -1.48.



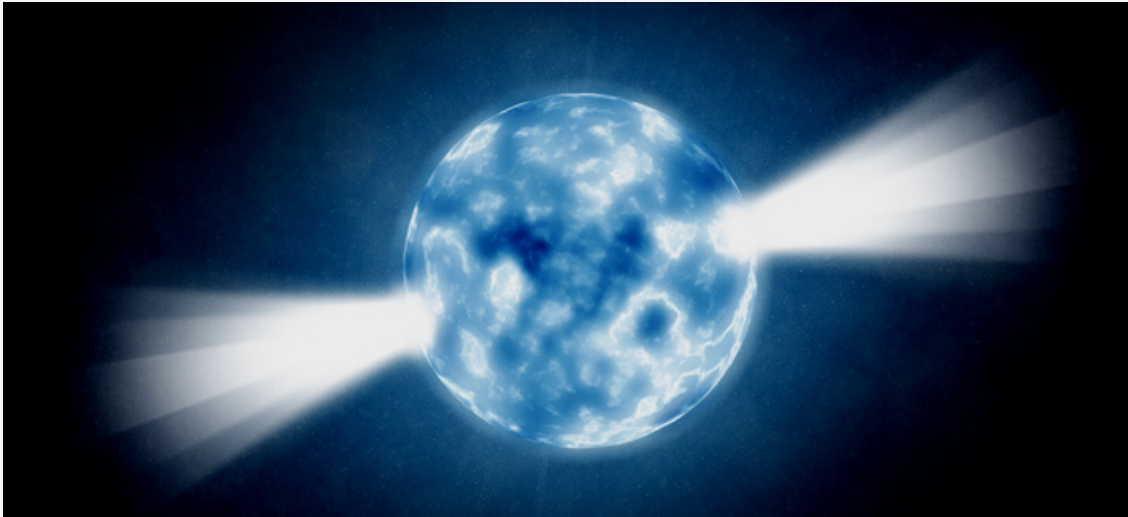
# STUDENT'S CORNER

## THE FORMATION OF NEUTRON STARS

Sai Karthik

iAstronomer member, Space India.

**Neutron stars and Black holes are interesting things that the universe is composed of. Scientists all around the world are baffled by the characteristics exhibited by both the celestial objects.**

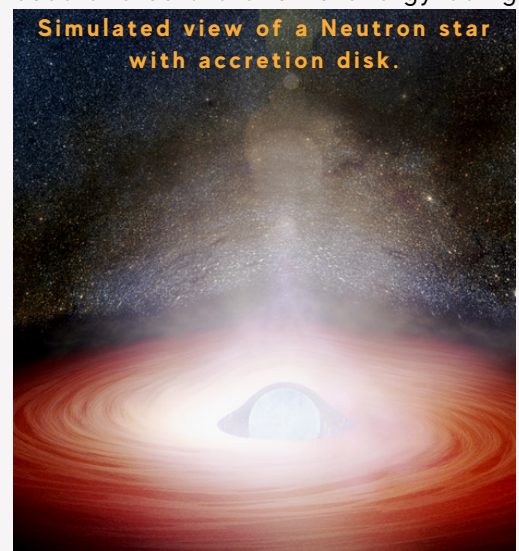


### FORMATION OF NEUTRON STARS:

1) Neutron stars and black holes are formed from the remains of a supergiant's core. If the core's solar mass is 3 times or more, then the core contracts to form a black hole. Neutron stars are formed when the core is lesser than 3 solar masses. The outer layers of a star are squeezed inwards due to gravity and this leads to the fusion of hydrogen into helium which releases a gigantic amount of energy. This energy counteracts with force of gravity and this is how a star remains stable.

2) When a star like our sun becomes unstable, it burns helium into oxygen and carbon and goes through a giant phase; eating up all our terrestrial planets. It becomes a white dwarf. When a star having a mass 100 times than our sun starts dying, it becomes unstable and the balance between radiation and gravity tips off. The core starts burning faster and the outer layers of the supergiant expand. Due to this Gravity wins over the radiation and starts crushing the core. This makes it fuse into heavier and heavier elements – carbon to neon in centuries, neon to oxygen in a year, oxygen to silicon to months, silicon to iron in a day. Iron cannot be fused and so there is no energy being released to counteract the force of gravity.

3) The core is crushed by the immense weight of the star above it. Now because of this the subatomic particles in the core such as the protons and neutrons fuse together to form neutrons. All the neutrons which were formed due to the fusing of protons and electrons come close together and are tightly packed due to the pressure of the enormous weight of the star. This is not only applicable for the core, the outer layers of the star together come close to each other. Gravity pulls the outer layers at 25% of the speed of light and Bang!!!! A shockwave is released catapulting the rest of the star into space. This phenomenon is called the supernova explosion. The remains of this star are a neutron star, an object which is million times the mass of our earth compressed to 25 km radius.







## Mission Dart

Sourajit Mandal  
iAstronomer member.

Do you know the greatest threat to humanity that can make our civilization extinct at any time and in an instant? It is the exact cause of the extinction of the dinosaurs- Asteroids.

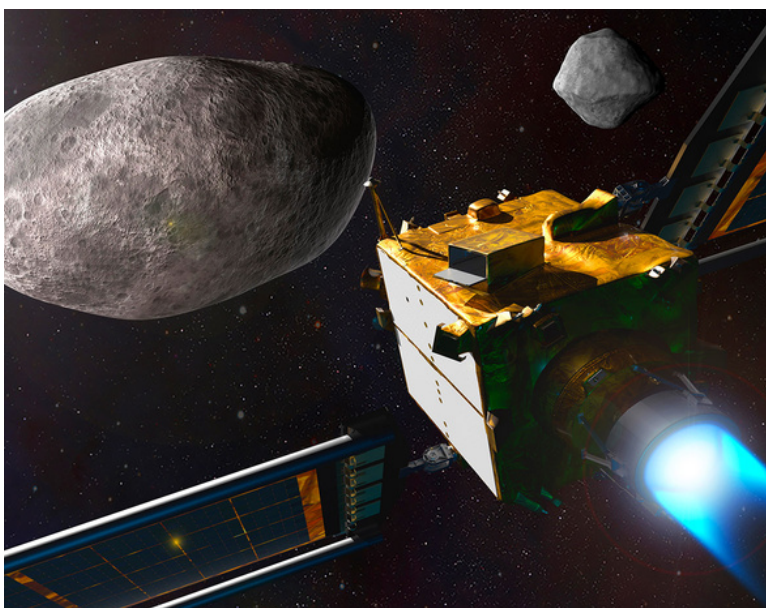
Asteroids and other small objects pose a significant threat to humanity. It is common for asteroids to hit Earth. Hundreds of meteorites fall to the surface of the Earth every year. Occasionally some large rocks fall to the surface of the planet and cause immense damage. In 2013, the Chelyabinsk meteor burst over Russia, injuring hundreds.

Scientists are doing several studies to avert asteroid strikes on Earth. The International Astronomical Search Collaboration is a campaign that helps citizen scientists search for asteroids in a simple procedure. This has also led to the discovery of thousands of asteroids, near-earth objects, and minor planets.

The Dart mission by Nasa was a recent test mission to change the course of an asteroid. It is a form of planetary defense against near-Earth objects. In it, a satellite intentionally rammed itself into an asteroid redirecting it in another direction. It crashed into the moonlet asteroid of Didymos i.e., Dimorphous.

The main reason for the mission was to redirect Dimorphous a little closer to the main asteroid- Didymos.

The satellite also had an inbuilt camera, which allowed us to see it crash into the asteroid.



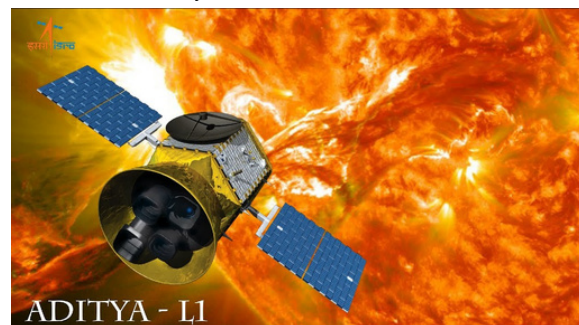
The mission went successful. It successfully crashed into the asteroid and moved it. Nasa said that the mission altered the orbit by 32 minutes i.e., it changed the orbit of Didymos from 11 hours 52 minutes orbit to 11 hours and 23 minutes with a margin of uncertainty of 2 minutes.

These kinds of missions will help us to protect our planet in the future. They would protect us from near-Earth objects and asteroids. We should celebrate the fact that we will not meet the same fate as the dinosaurs.

## Aditya L-1: India's Solar mission

Daksh Rathi  
iAstronomer member.

Aditya L-1 is India's first solar mission planned by Indian space research organization (ISRO) earlier its name was Aditya 1 but it has been renamed to Aditya L-1. Its mission is to study the corona, chromosphere and photosphere of the sun .in addition it will study the particle flux emanating from sun and the variation of magnetic field strength. Its main objective is to help in tracking earth-directed storms and predict its impact through solar observation. Aditya L-1 is expected to be launched by 2023. It was set to be launched by 2019 however it has since been delayed it will be launched by the polar satellite launch vehicle xl (PSLV XL) from Satish Dhawan Space Centre (SDSC) located in Sriharikota with the budget of 1275 crores. The weight of the satellite will be 1500kg. In 2008 it was originally announced by ISRO by the name Aditya 1. Earlier the mission aimed to be launched 800km in the low earth orbit (Leo), however realizing that halo orbit L1 will be better to capture sun's corona (L1 is 1.5 million km far from the earth), hence it was renamed as Aditya L-1.

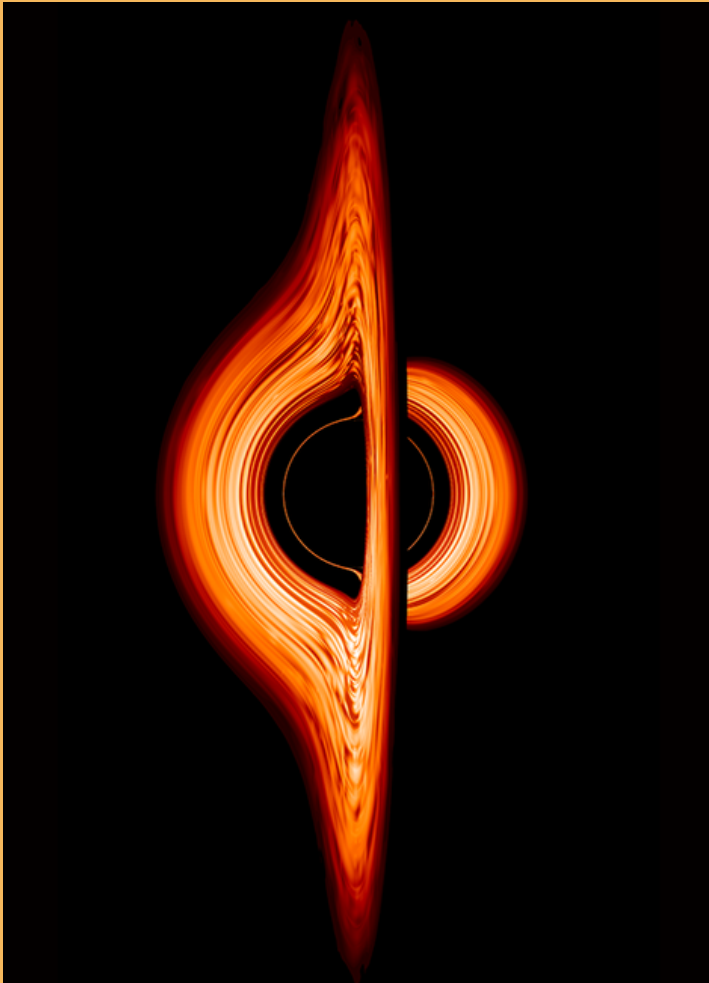


Given below is a list of payloads which have been used for the mission:

- Visible emission line coronagraph (VELC)
- Solar ultraviolet imaging telescope (SUIT)
- Aditya solar wind particle experiment (ASPEX)
- Plasma Analyser package for Aditya (PAPA)
- Solar low energy x-ray spectrometer (SOLEXS)
- High energy L1 orbiting x-ray spectrometer (HEL1OS)
- Magnetometer

# Why Black Holes Fascinate Me?

Harsh Dubey V B  
Astronomy Club Student.



Since childhood, I loved knowing more about our universe. My favorite topic is black holes. They are vast objects that have a huge gravitational force that can also suck in light particles that are called photons. They are also featured in some sci-fi films like interstellar.

They are very much more massive than our Sun. Some are of the size of 15-20 Suns, but some are of the size of 150-200 Suns. Sometimes they are so large that some smaller black holes orbit the bigger ones. Black holes have a part named "event horizon" when an object/living being crosses this part so it/he/she will be pulled by the gravitational force of the black hole.

No one knows what happens to a living being/object after it/he/she enters the black hole. There are only theories about it like, the human body start to stretch when it enters a black hole because of the gravitational force of the black hole and the human body gets divided into pieces. People know about black holes for decades, but Stephen Hawking was the first one to discover black holes recently.

He was a great scientist who discovered many things related to the universe. But his main discovery was about black holes. He discovered many more things related to black holes.

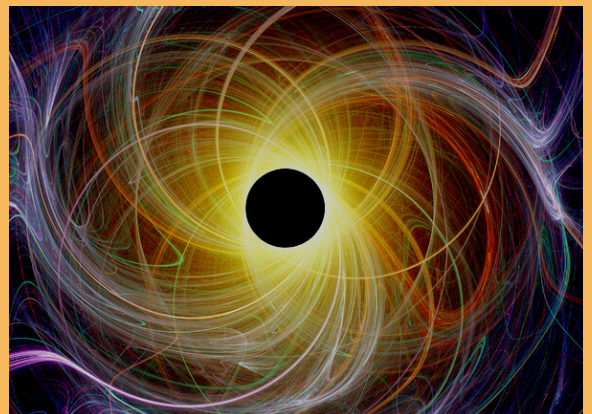
Scientists found that there were black holes that were formed after the beginning of the universe. They were surprised to see so as black holes can only be formed when stars die. And till that no stars were formed.

Scientists gave a theory that the stars were formed but their core collapsed at the instant they were formed. And their core became a black hole. These types of stars were called quasi stars. But these stars are not real or we can call hypothetical as they are not detected or seen by any satellite or telescope.

Black holes do not go around in space eating stars, moons, and planets. Earth will not fall into a black hole because no black hole is close enough to the solar system for Earth to do that.

Even if a black hole the same mass as the sun were to take the place of the sun, Earth still would not fall in. The black hole would have the same gravity as the sun. Earth and the other planets would orbit the black hole as they orbit the sun now.

The sun will never turn into a black hole. The sun is not a big enough star to make a black hole. This is because of Chandrashekhar's limit that tells us the conditions in which a star could become a black hole. Sun is less than the limit.



(Simulation of a black hole. Credits: Quanta)

# Importance of space Exploration

Harshul Mahajan  
iAstronomer member.

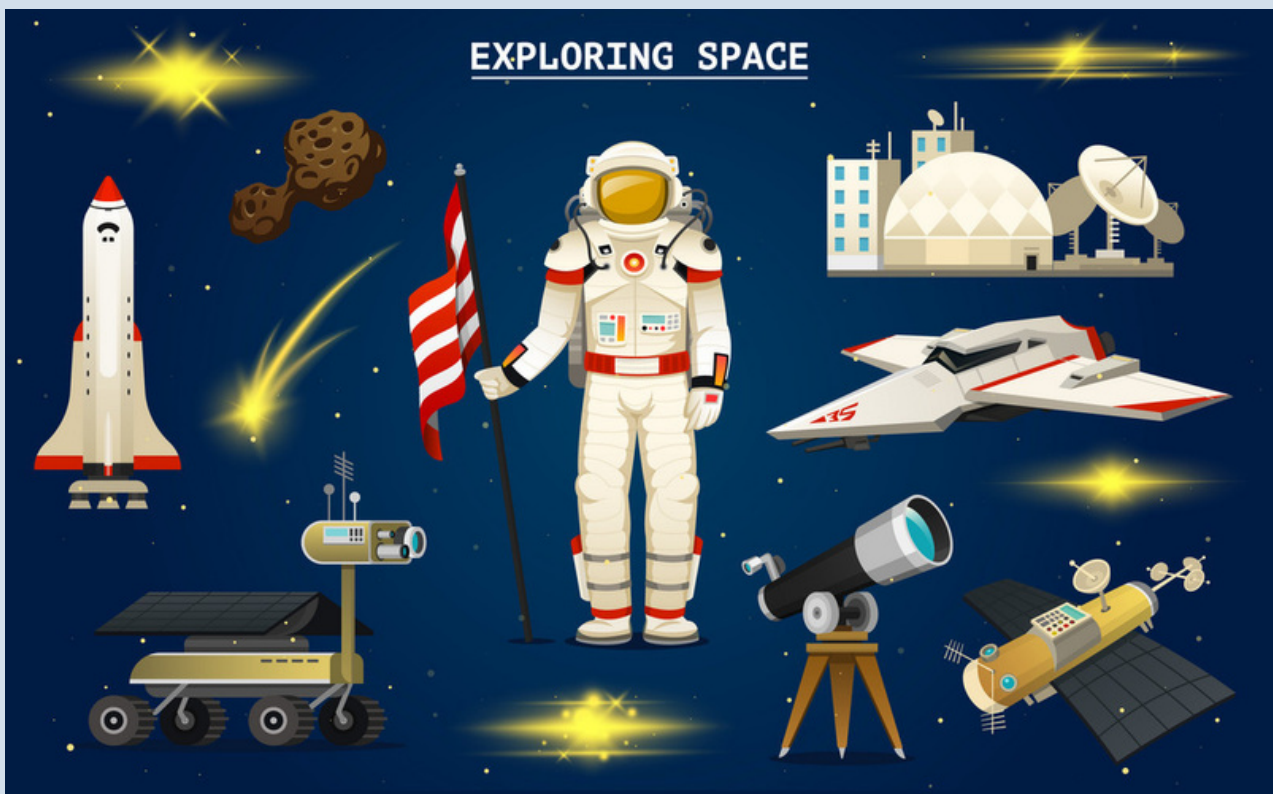
Space exploration is important for human species because the earth can be extinct any time and if we not find a planet before earth extinct so our living will be impossible. According to a space company the milky way galaxy is going to crash with another galaxy within 2.5 billion years.

Year by year the technologies are developing and spacecrafts too so it could be easier to explore space. after all NASA is in a mission of running a spacecraft into asteroid to test the impacts that it could damage earth or not.

Currently space is a backup for us if earth will be destroyed SPACE X the company of Elon Musk is trying to find life on mars. Approximately there are 8 billion people living on earth currently in one planet if the earth is destroyed our species will be wiped out. the space has many numbers of satellites if we didn't explore space we can't make google maps and many more tracking sites. Space is infinite we can travel anywhere.

Space has resources that we can use many thing are also a mystery to humans many galaxy are a mystery they are many gadgets that are important for space exploration. some scientists are also told something like Stephen Hawking's said that a space is a violent space. there are many discoveries in space there are myths lies and truths. The first flight was in 1942 with German V 2 and many came and first space shuttle that travelled through Earth orbit was Columbia.

There are resources on earth that we can't bring to space like oxygen and gravity and the resources that we bring cannot be preserved so there is only one chance if earth destroyed is many galaxies and many Milky way galaxies and Earths are there but it could be a myth too because there is many unsolved mysteries that mankind cannot find.



There are many species the we can find and it is important to find resources and explore space to find new things that can help us in space travel. The space exploration is necessary because the mysteries That are unsolved we can solve and take benefit out of and it's fun too but there are some dangers like exploding of aircraft less food ,water and oxygen it takes many years of hard work so it's worth to go to space with this hard work there is space training after you are send to space you can discover things and you can be popular and discoveries can makes mankind more powerful and technologies can be improved and you can experience many things after the hard work you can achieve success in your journey to space . after all you can go too far but you can explore many things. after all it is very necessary to travel in space but is full of danger. You can also see space with a telescope a explore and learn things form internet if you want to.

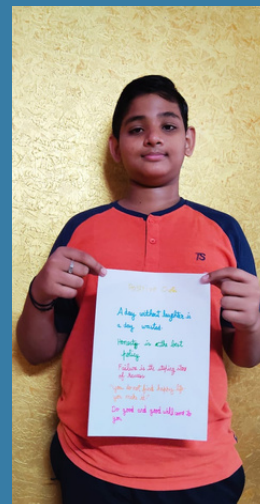
# CAPTURES FROM SPACE ASSOCIATED ASTRONOMERS



Aditte Kinger, Astronomy Club Student.



Pareesa Dudia, iAstronomer member.

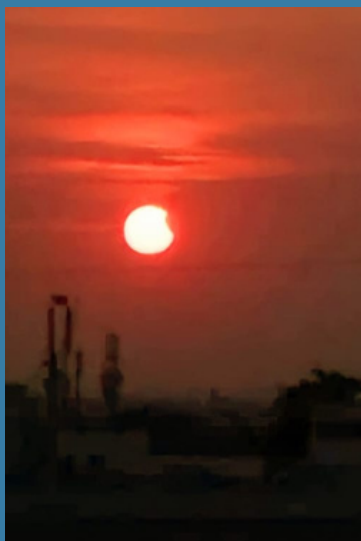


Prassana Devi, iAstronomer member.

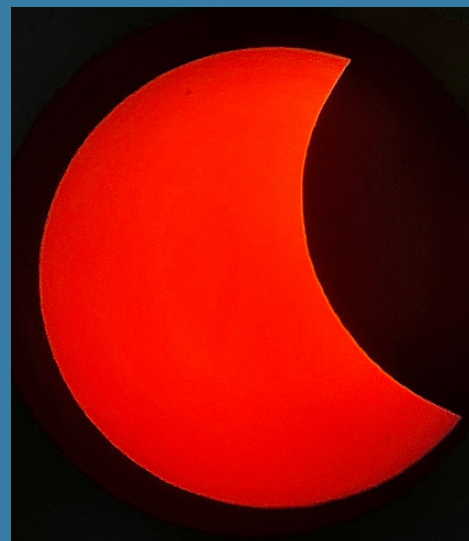
SPACE Students from various places observed the Partial solar eclipse using safe methods and captured the eclipse. Here are some of the best pictures captured by our students.



Aryan Gupta, iAstronomer member.



Niharika, Club Student.



Muskan Rajawat, Associate Astronomer.

# ASTROPHOTOGRAPHS BY SPACE



The above Milkyway galaxy arm pictures was captured by SPACE Educator Mr. Ranjith Kumar.



CLOSE-UP OF SUN  
26.10.22 | 4:00 PM | CHENNAI | INDIA  
SUNSPOTS - AR3131 (TOP) AND AR3133 (BOTTOM)  
EQUIPMENT - SPACE VOYAGE 150/750023 NEWTONIAN TELESCOPE  
THOUSAND OAKS SILVER-BLACK POLYMER FILM FILTER

NEERAJ LADIA

Sun spots captured by Mr. Neeraj Ladia, CEO, Gnomon Astrotech Pvt Ltd.

# HISTORICAL EVENTS HAPPENED IN NOVEMBER

## Laika the space dog: First living creature in orbit

**The name Laika is derived from the Russian-language word for “bark.” Laika is also a breed name applied to certain Russian sled dogs, but they are unrelated to the space dog. In 2008 a small monument with a statue of Laika was unveiled in Moscow.**

Laika, a dog that was the first living creature to be launched into Earth orbit, on board the Soviet artificial satellite Sputnik 2, on November 3, 1957. It was always understood that Laika would not survive the mission, but her actual fate was misrepresented for decades.

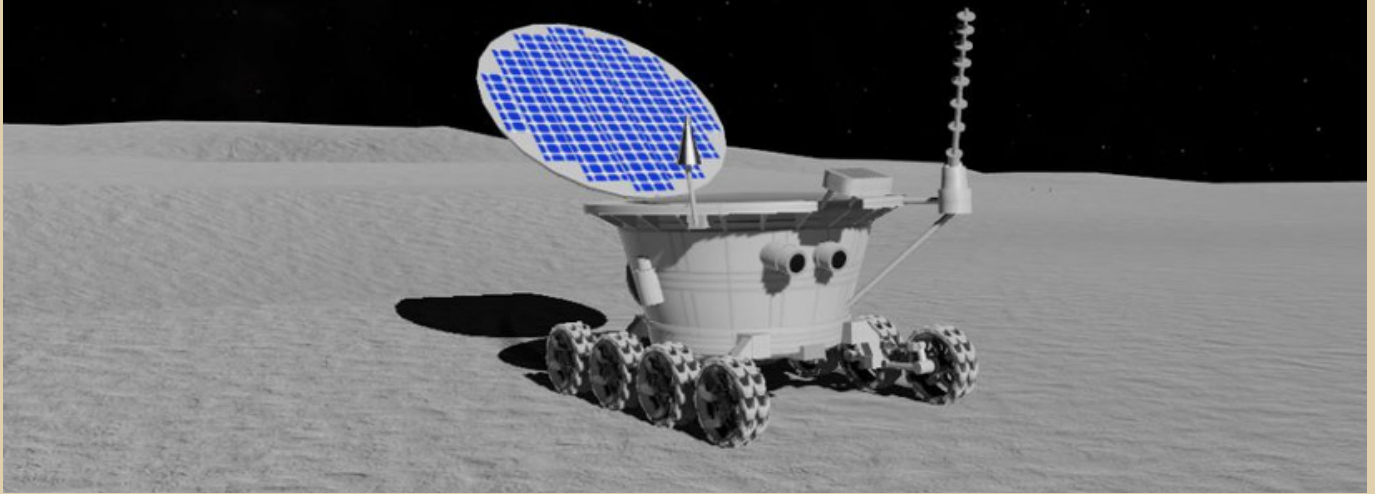
Laika was a small (13 pounds [6 kg]), even-tempered, mixed-breed dog about two years of age. She was one of a number of stray dogs that were taken into the Soviet spaceflight program after being rescued from the streets. Only female dogs were used because they were considered to be anatomically better suited than males for close confinement. Laika trained for life on board the satellite by learning to accept progressively smaller living spaces. She was spun in a centrifuge to accustom her to changes in gravitation, and she learned to accept food in jellied form that could be easily served in an environment of weightlessness.

When the launch was announced, Laika became an international celebrity. The satellite and its passenger soon acquired the journalistic nickname of “Muttnik.” Contemporaneous Soviet accounts implied that the dog was kept alive for six or seven days into the mission and then euthanized with poisoned food before her oxygen supply could run out. The satellite was destroyed reentering Earth’s atmosphere on April 14, 1958. Laika’s sad fate aroused worldwide concern and sympathy.



In 2002, however, Russian scientist Dimitri Malashenkov revealed that the previous accounts of her death were false. Laika had actually survived only about five to seven hours after liftoff before dying of overheating and panic. It was belatedly made known that Laika’s pulse rate, which had been measured with electrodes, tripled during takeoff and only came down somewhat during weightlessness. Apparently the Soviet scientists had insufficient time to perfect life-support systems because of intense political pressure to launch Sputnik 2 in time for the celebration of the 40th anniversary of the Bolshevik Revolution.

# LUNOKHOD 1: 1ST SUCCESSFUL LUNAR ROVER



## Lunokhod 1

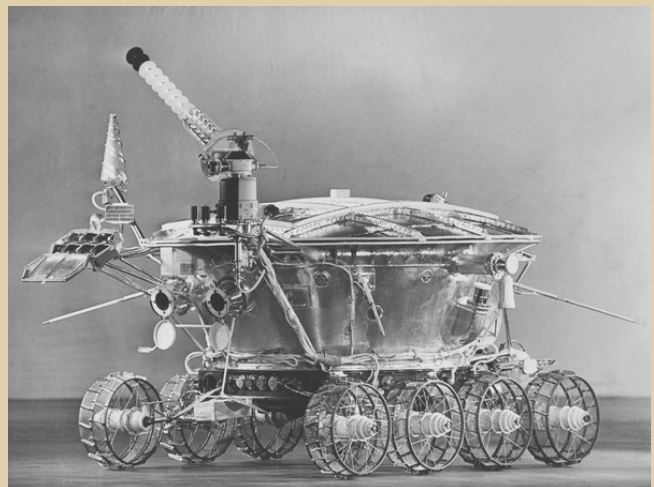
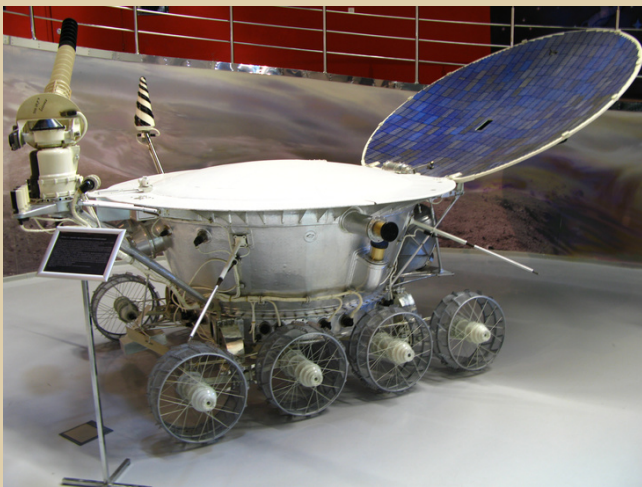
Luna 17 launched successfully on Nov. 10, 1970, and made it to lunar orbit five days later. It soft-landed in the Sea of Rains, and Lunokhod 1, the rover it carried onboard, descended a ramp to the lunar surface. Lunokhod 1 was the first successful rover to explore another world. It arrived on the moon on Nov. 17, 1970, upon the Luna 17 lander. Driven by remote-control operators in the Soviet Union, it travelled more than 10 kilometers (6 miles) in just 10 months. By comparison, it took the Mars Opportunity rover about six years to reach the same milestone.

## Goals

The Soviet Lunokhod 1 rover flew to the Moon aboard Luna 17. The rover was to travel to various locations under the near real-time control of operators on Earth and conduct tests on the lunar soil for three lunar days (about three Earth months).

## Accomplishments

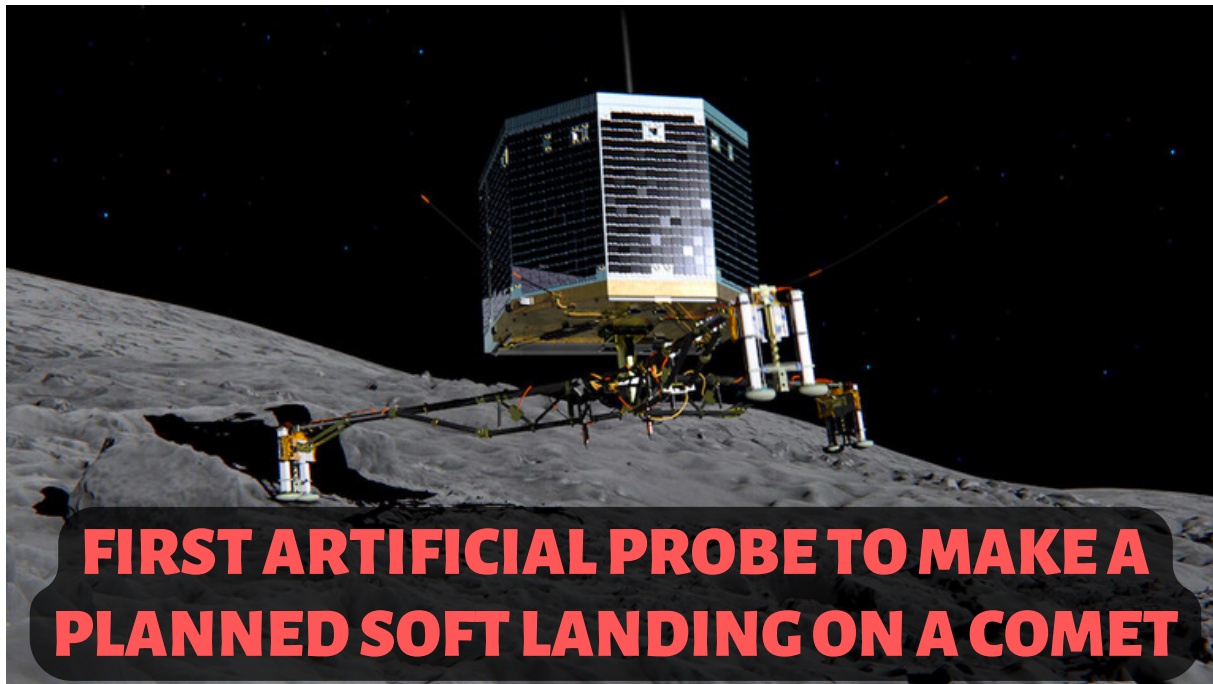
The Lunokhod 1 rover was delivered to the lunar surface by the Luna 17 spacecraft and was first successful rover to operate beyond Earth. It operated for 11 lunar days, the equivalent of 322 Earth days, and traveled more than six miles (10 kilometers) across the lunar surface, during which it transmitted more than 20,000 TV images and 206 high-resolution panoramas, performed 25 soil analyses with its spectrometer, and used a penetrometer to test the soil's mechanical characteristics at more than 500 locations. Lunokhod 1 also conducted a French experiment (similar to a U.S. Apollo experiment a year earlier) in which laser pulses from two observatories—one Soviet and one French—were reflected back to Earth, enabling measurement of the Earth-Moon distance to within about an inch (30 centimeters).



(Image credit: NASA)

## Lunokhod 1's legacy:

The success of Lunokhod 1 was repeated with Lunokhod 2 in 1973, which eventually drove approximately 37 kilometers (22.9 miles) on the lunar surface. It would take the Opportunity rover more than a decade to reach that same milestone on Mars.

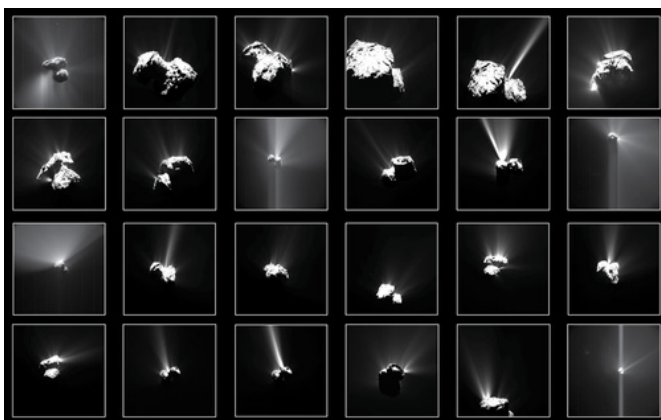


On November 14, 2014, the Philae lander accomplished the first ever soft landing of a human-made spacecraft on the surface of a comet—a never before accomplished feat, and one that was considered very ambitious and risky at the time. The landing was part of the Rosetta mission launched by the European Space Agency (ESA), which aimed to improve our understanding of comets and their role in the formation of our Solar System.

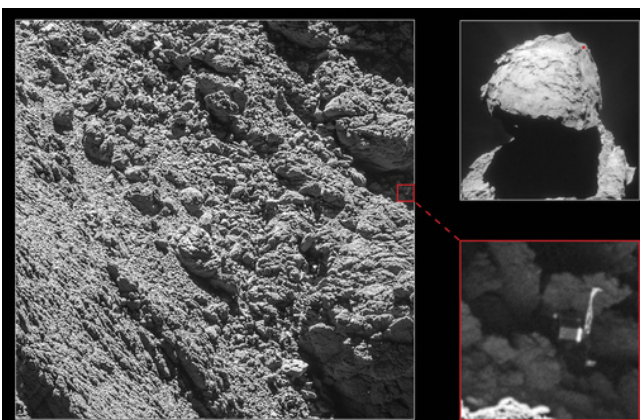
In August 2014, after a ten year voyage through the solar system, Rosetta became the first spacecraft to orbit a comet, catching up with 67P/Churyumov-Gerasimenko (67P/C-G) (67P indicates that it was the 67th periodic comet discovered, and Churyumov and Gerasimenko are the names of its discoverers) on its own orbit around the sun.

After launch, Rosetta completed a series of gravity-assisted maneuvers around Earth and Mars, completing the most risky of these when it passed behind the Red Planet, losing contact with Earth for a brief (and likely nerve-wracking) period. Along the way, Rosetta completed close flybys of asteroid 2867 Steins in the main asteroid belt and asteroid 21 Lutetia, producing spectacular images and gathering a large amount of data that was sent back to Earth.

252 million miles (405.5 million km) from Earth, Rosetta finally arrived at its target destination, and after an initial survey and careful selection of a landing site, Philae was sent to the comet surface; it's mission was to land successfully, attach itself, and transmit data about the comet's composition. The Philae lander was a passive lander, meaning it did not contain any guidance systems to manipulate its movement before landing. The Philae lander was equipped with ten instruments to study the interior and surface of 67P/C-G, as well as its cometary environment.



Compilation of the brightest outbursts seen at Comet 67P/Churyumov-Gerasimenko. Credit: OSIRIS/ESA



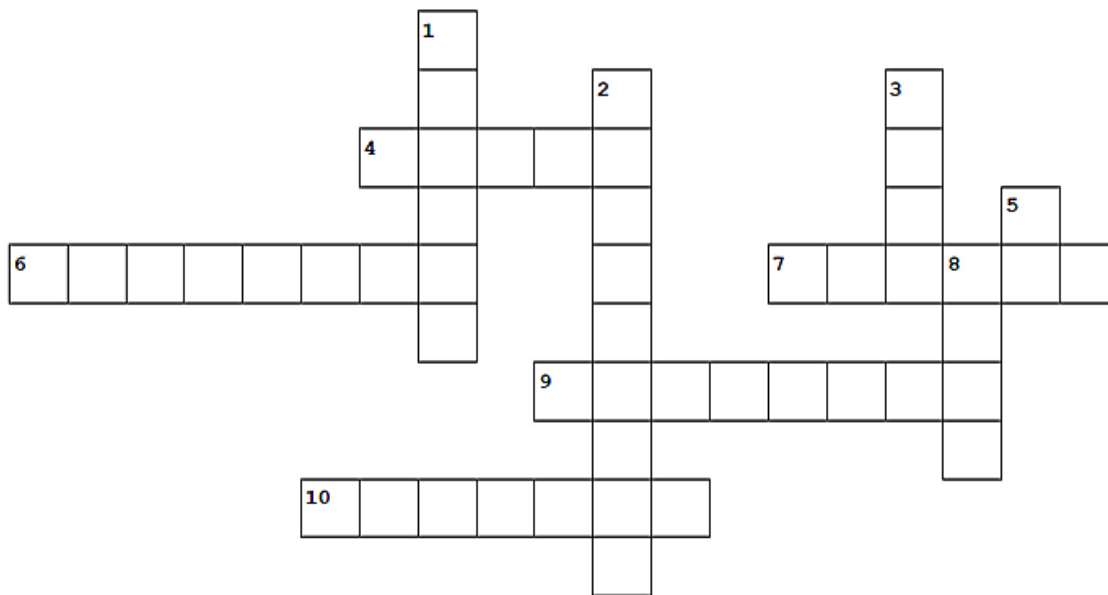
Philae lander found on the surface of the Comet 67P/Churyumov-Gerasimenko. Credit: OSIRIS/ESA

Unfortunately, the landing did not go exactly as planned. On November 12, controllers identified a problem with one of Philae's thrusters, which was meant to prevent the lander from bouncing after making contact with the surface. The team decided to rely on a series of harpoons to anchor the lander to the surface and proceeded with the mission. The harpoon system did not work the first time, causing the lander to bounce after its initial touchdown and tumble for two hours before settling on its side about half a mile away from the intended landing site.



# TRAIN YOUR BRAIN

## CROSSWORD



### Across

4. The second-largest natural satellite in the Solar System.
6. The most heavily cratered moon in the solar system.
7. The largest known satellite relative to its parent body in our solar system.
9. The only moon known to have its own magnetic field.
10. Which moon of Saturn also called as yin yang moon?

### Down

1. The only moon that orbits in the opposite direction of its planet's rotation.
2. The most reflective moon in the solar system.
3. What is the name of earth's natural satellite?
5. The most volcanically active world in the solar system
8. The only moon with rings?

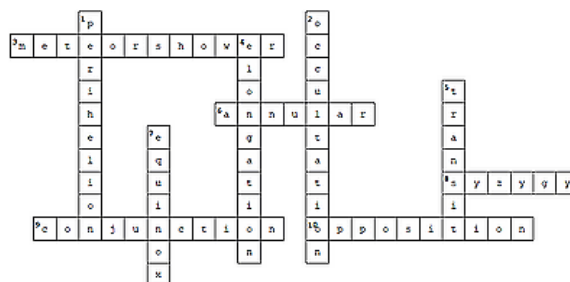
## ASTRONOMY WORD PUZZLE

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

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

- SOJOURNER
- MOONBUGGY
- CURIOSITY
- OPPORTUNITY
- MARSOKHOD
- YUTU
- MASCOT
- PRAGYAN
- LUNOKHOD
- PERSEVERANCE
- SPIRIT
- ZHURONG
- VENERA
- MINERVA
- TIANWEN

Answers for last month puzzles.



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

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

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



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

Inviting Astronomy Ambassadors Globally

HIGHLIGHTS OF THE PROGRAM

MEMBERSHIP BENEFITS

- Interaction With The International Astronomers Every Month
- Training & Access To Robotic Telescope To Each Member
- Largest Coverage Of Astronomical Events
- virtual/Physical trips to Observatories World wide
- International Star Parties
- Telescopes, Equipments, Spectroscopes, Astrophotography, and Many More
- Eclipse Chasing

- Transferable Global Membership
- Scientific Publications by Members
- University Programs & Internships
- Profile Building for Admissions in Foreign Universities
- International Scientific Expeditions
- Yearly Meets & Conferences
- Enhancement of STEM & Scientific Skills



Membership open in all Countries

India, USA, Canada, Germany, Russia, UAE, Oman, Qatar, Doha, Singapore, Hong Kong, Australia, Nepal, Sri Lanka, Bhutan

For Joining iAstronomer course visit - <https://learn.spaceindia.com/courses/iastronomer>

For Astronomy related products & equipment's visit - <https://spacearcade.in/>

Buy astronomical products from us

**SPACE ARCADE**  
WWW.SPACEARCADE.IN  
A unit of SPACE Group of Companies  
One-stop solution of all your Astronomical Equipment needs

**ASTRO BINOCULARS**

**CELESTRON SKYMASTER 15X70**  
PRISM SYSTEM: PORRO PRISM  
PRISM GLASS: Bak-4  
APERTURE: 70MM  
EXIT PUPIL: 4.7MM  
MAGNIFICATION: 15X  
ANGULAR FOV: 6.4 Deg

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

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

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

**REFRACTOR TELESCOPES**

**REFLECTOR TELESCOPES**

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

## Brands

Guan Sheng Optical

Astrotech (P) Ltd.

Optical & Sport Systems

FOR FUTURE SCIENTISTS