



**SPACE™**  
EMPOWERING LIFE

JANUARY 2023  
VOLUME 2 | ISSUE 1

# Galactica

Astronomy and Space Science Magazine

## What's Inside?

SPACE Insights

Highlights From December

Moon Phases And Planet Visibility

What's Awaiting in January

Student's Corner

Historical Events Happened In January

January Born Legends

Train Your Brain

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

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

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# ABOUT SPACE



Legacy of 22 years



Pioneer Organization



10000+ Activities Developed



1000+ Schools Associated



1M+ Students Engaged



10k+ Outreach Events



10+ Cities Presence

**SPACE is the pioneer organization working towards 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.**



# Celestial Calendar 2023

## Hello Astronomers!

This yearly calendar covers all the major astronomical events that one can witness from the Indian subcontinent. Astronomers all around the world can also record and capture these events along with beautiful astrophotographs. You can also capture and share your photos with us.

For details of each event such as which direction to see, location & coordinates in the sky, timings as per your latitude can be taken from various astronomical apps and softwares. We suggest you use the app/software STELLARIUM. It is available across all platforms android/iOS/Windows/MAC.



## Major Astronomical Events Key

### Conjuction

When the Moon or a planet appears especially close either to another planet or to a bright star. Also used when, Moon or Planet sometimes is close to bright Deep sky objects.



### Eclipse

An event that occurs when the shadow of a planet or moon falls upon a second body.



### Elongation

The angular distance the Moon or a planet is from the Sun. The inner planets of Mercury and Venus are best seen when at maximum Elongation, and thus are highest above the horizon before sunrise or after sunset.



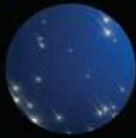
### Equinox

The two times each year, near March 20th and September 22nd, when the Sun is directly overhead at noon as seen from Earth's equator. On an equinox date, day and night are of equal length.



### Meteor Shower

An increase in meteor activity at certain times of the year due to Earth passing through a stream of particles along a comet's orbit around the Sun.



### Occultation

When the Moon or a planet passes directly in front of a more distant planet or star.



### Opposition

When a planet or asteroid is opposite the Sun in the sky. At such times, the object is visible all night — rising at sunset and setting at sunrise.



### Solstice

The two times each year, around June 20th and December 21st, when the Sun is farthest north or south in the sky. At the summer solstice, the day is longest and the night is shortest, and vice versa at the winter solstice.



\*Definitions are taken from Sky & Telescope for easier understanding

**3/4th JAN**  
Quadrants Meteor Shower



**4th JAN**  
Earth at Perihelion



**7th JAN**  
Full Moon



**22nd JAN**  
Conjunction of Venus and Saturn



**28th JAN**  
Planet Parade of Venus, Jupiter, Mars, Moon and Saturn



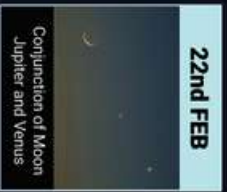
**5th FEB**  
Full Moon



**15th FEB**  
The Great Conjunction of Venus and Neptune



**22nd FEB**  
Conjunction of Moon, Jupiter and Venus



**27th FEB**  
Conjunction of Moon, Pleiades and Mars



**2nd MAR**  
Conjunction of Venus and Jupiter



**7th MAR**  
Full Moon



**21st MAR**  
March Equinox



**6th APR**  
Full Moon



**11th APR**  
Conjunction of Venus with Pleiades



**22/23rd APR**  
Lyrids Meteor Shower



**5th MAY**  
Full Moon




**5th MAY**  
Penumbral Lunar Eclipse



**6/7th MAY**  
Eta Aquarids Meteor Shower



**24th MAY**  
Conjunction of Moon with Mars and Venus



**2nd JUNE**  
Mars Transit Across The Beehive Cluster



**4th JUNE**  
Full Moon



**4th JUNE**  
Venus at Greatest Eastern Elongation



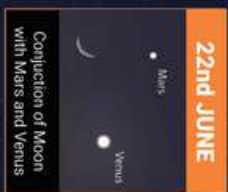
**13th JUNE**  
Conjunction of Venus with Beehive Cluster



**21st JUNE**  
June Solstice



**22nd JUNE**  
Conjunction of Moon with Mars and Venus



**3rd JULY**  
Super Moon



**7th JULY**  
Earth at Aphelion



**2nd AUG**  
Super Moon



**13/14th AUG**  
Perseids Meteor Shower



**27th AUG**  
Opposition of Saturn



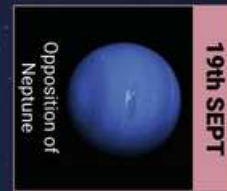
**30th AUG**  
Conjunction of Moon and Saturn



**31st AUG**  
Blue Moon



**19th SEPT**  
Opposition of Neptune



**22nd SEPT**  
Mercury at greatest Western Elongation



**23rd SEPT**  
Autumn Equinox



**29th SEPT**  
Full Moon



**30th SEPT**  
Planet Parade of Mercury, Venus, Jupiter and Moon



**1st OCT**  
Conjunction of Moon and Jupiter



**9/10th OCT**  
Draconids Meteor Shower



**21/22nd OCT**  
Orionids Meteor Shower



**23rd OCT**  
Venus at greatest western elongation



**29th OCT**  
Full Moon



**29th OCT**  
Partial Lunar Eclipse



**3rd NOV**  
Opposition of Jupiter



**13th NOV**  
Opposition of Uranus



**17/18th NOV**  
Leonids Meteor Shower



**27th NOV**  
Full Moon



**14/15th DEC**  
Geminids Meteor Shower



**22nd DEC**  
Winter Solstice



**27th DEC**  
Full Moon



Connect on:





## SPACE INSIGHTS

# THE STAR PARTY GET-TOGETHER FOR IASTRONOMERS

"The Cosmos is all that is or ever will be. Our feeblest contemplations of the Cosmos stir us – there is a tingling in the spine, a catch in the voice, a faint sensation, as if a distant memory, or falling from a height. We know we are approaching the greatest of mysteries."

-Carl Sagan, Astronomer and Science Communicator.

SPACE had been constantly working to make people more scientifically aware thorough its different programs of Astronomy and Space science. iAstronomer is one such endeavor by Space India wherein people of all ages are part of the Astronomy Club. In order to give the practical experience of stargazing to the members of iAstronomer Club - an overnight observation was scheduled at Astroport Sariska, Rajasthan.

During the overnight observation, at first everyone was oriented to the night sky where they were explained about the basic terms related to stargazing. They learnt to find the directions using the astronomical way i.e. with the help of pole star. Later on, participants were explained about the constellations and the asterisms. They were introduced to the star charts like planisphere and using the planisphere they hunted for constellations visible in the sky.



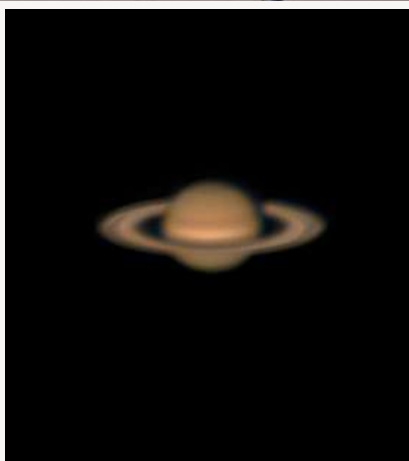
Alongside all these, participants were explained about different types of telescopes as well which were further used for the observation.

During observation, participants observed the planets - Jupiter, Saturn and Mars along with the deep sky objects like star clusters and nebulae.

Overall it was an amazing experience for all and space team got the amazing feedback.

# MONTHLY TELESCOPIC OBSERVATION

SPACE ARCADE team conducted their 6th Monthly Telescopic Experience session on 8th of December at two different places which are Delhi and Chennai respectively. People from various places joined the observation with their own telescopes, binoculars and other astronomical equipment to learn and experience the breathtaking view of the Moon! and planets such as Jupiter, Saturn and Mars. They also learnt about different types of telescopes and cleared all their queries on the Alignment of various telescopes then did basic Astrophotography. Everyone had their hands-on telescopic experience and enjoyed the view of the moon and its craters through the 8" Dobsonian telescope setup by Space team.



The above pictures are captured by Mr. Neeraj Ladia, CEO, Gnomon Astrotech Pvt Ltd. during the event.



# ASTRONOMY EXPO AT DELHI PUBLIC SCHOOL

In December 2022, on the occasion of annual function students of Delhi Public School, Greater Faridabad presented an astronomy exhibition. Students in Classes I through IX set off a variety of Moon expeditions. for the purpose of assisting them in comprehending the relationship between our planet and its most well-known neighbor, the Moon. Different Moon mission models were developed by the students as part of practical activities. Students obtained understanding of satellites like Chandrayaan1 and 2, lunar settlements, the Apollo and Artemis missions, and more. The models were built by students in classes I through IV, who showed them during the yearly event. The models included giant buildings, constellations, and aliens. In addition, kids got their parents involved in practical outdoor activities like stomp rocketry, ringing the planets, solar observation, lung capacity testing, and weighing oneself on various planets.





# PROJECT PARIDHI

Project Paridhi is a flagship project of SPACE India in which students do an activity to determine the circumference of our Earth. At Delhi Public School Grater Faridabad and Bal Bharti Public School, Pitumpura conducted the activity where they have to measure the circumference of the Earth. Solstice is the best time to conduct this activity. Students from class VIII participated in this activity on the occasion of the winter solstice under the supervision of space educators. Students followed the instructions and correctly followed the steps which were discussed during the previous session. Most of the students correctly estimated the circumference of the earth using the Eratosthenes technique.



Eratosthenes was a Greek mathematician served as the head librarian in Alexandria Library's. He was also credited for creating "geography" as a field of study. He used an ingenious application of basic geometry to a very challenging problem to determine the size of the Earth. Although he made a lot of assumptions and took a few slight liberties with the truth, his calculations were rather accurate.

Eratosthenes calculated the circumference of Earth by measuring the length of a stick's shadow in Alexandria and the distance between Alexandria and Syene on foot. He then took the inverse tangent of the ratio between the shadow's length and the stick's length to find the angle of inclination of the Sun. He calculated the total circumference of the Earth to be  $((360/7.2) \times D)$  kilometers, with D being the distance between Alexandria and Syene.



# HIGHLIGHTS OF DECEMBER 2022

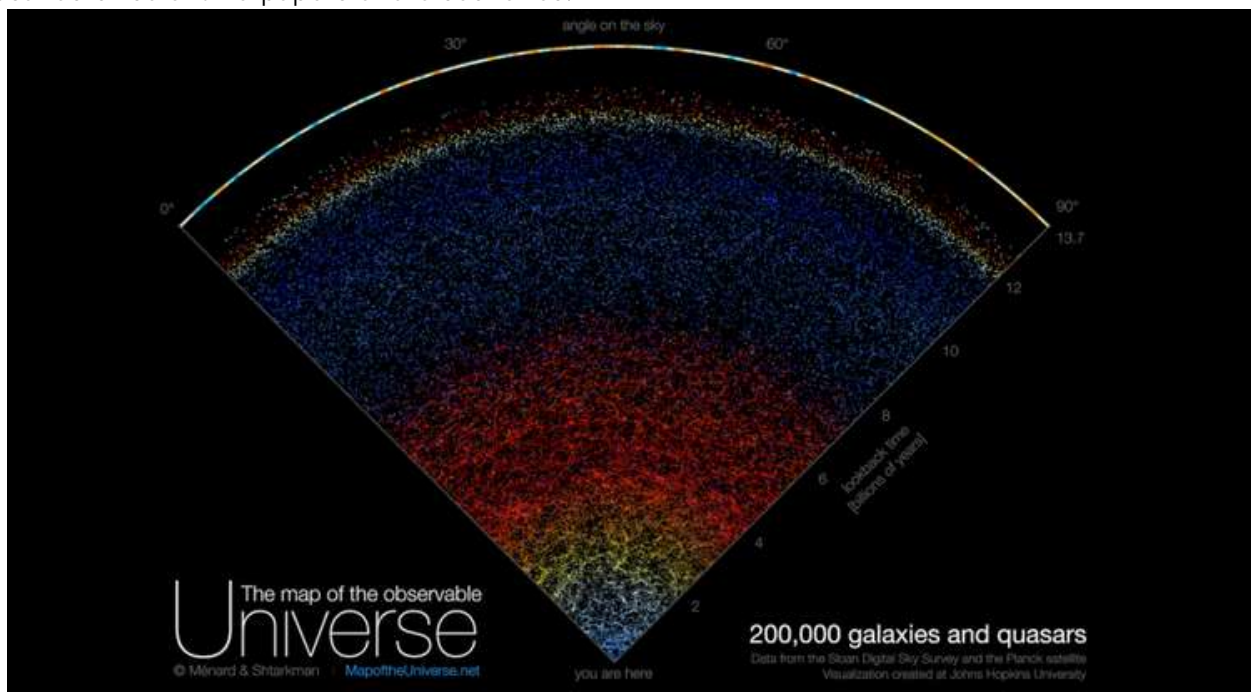
## INTERACTIVE MAP OF THE UNIVERSE THAT TAKES YOU ALL THE WAY BACK TO THE BIG BANG

The map charts a broad expanse of the universe, from the Milky Way to 'the edge of what can be seen'.

A new interactive map of the universe presents the entire span of the known cosmos in stunning detail and with pinpoint accuracy.

Astronomers created the map, which shows the positions and real colors of 200,000 galaxies, using two decades' worth of data collected by the Sloan Digital Sky Survey. The interactive map can be downloaded for free at [mapoftheuniverse.net](http://mapoftheuniverse.net), allowing the public to access information that was previously available only to scientists.

"Growing up, I was very inspired by astronomy pictures, stars, nebulae and galaxies, and now it's our time to create a new type of picture to inspire people," Brice Ménard, a professor in the Johns Hopkins University Department of Physics and Astronomy and co-creator of the map, said in a statement. "Astrophysicists around the world have been analyzing this data for years, leading to thousands of scientific papers and discoveries."



An interactive map of the universe displaying the actual positions and real colors of 200,000 galaxies.

(Image credit: B. Menard & N. Shtarkman)

Despite this effort, nobody had taken the time to create a map that is beautiful, scientifically accurate and accessible to the lay public.

"Our goal here is to show everybody what the universe really looks like," Ménard said.

The detailed map was possible thanks to the pioneering Sloan Digital Sky Survey, one of the most influential surveys in the history of astronomy. The survey is an ambitious effort to capture a huge proportion of the night sky through the 2.5-meter telescope at Apache Point Observatory in New Mexico. Every night for eight years, the telescope has aimed its 120-megapixel camera on 1.5 square degrees of the sky at a time around eight times the area of the full moon at slightly different locations, to capture a broad perspective of the universe.

Ménard and former Johns Hopkins computer science student Nikita Shtarkman used these data to recreate a slice of the universe containing 200,000 galaxies. Each dot on the map is a galaxy with billions of stars and planets. Our own galaxy, the Milky Way, is just one of these dots located at the very bottom of the map.

## METEORITES REVEAL HOW THEY BROUGHT SPACE WATER TO EARTH

Space rocks that fall to Earth are ancient time capsules, and scientists who merged two imaging techniques may be able to tell us if and how they brought water to Earth.

Meteorites are shards that have broken off of larger objects such as comets or asteroids, and it is thought that asteroids and comets from the outer reaches of the solar system may have left water on nascent Earth after impact. To find out whether they really did carry over water from beyond our planet, a research team from the National Institute of Standards and Technology (NIST) came up with a method of simultaneously using X-ray and neutron imaging to get a glimpse inside a meteorite and determine what it might have been hiding for billions of years.



### THE ORIGIN OF EARTH'S WATER

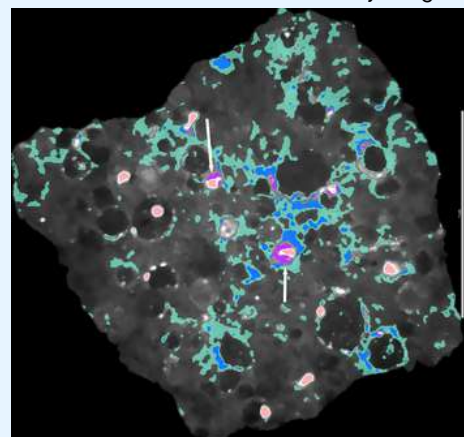
Already, the NIST team reports that this new method can "reveal the presence and distributions of hydrogen-bearing materials in meteorites, and thus help constrain the presence and actions of water in the early solar system," according to a recent study about the technique.

This new method is known as coordinated neutron and X-ray computed tomography (NXCT) and is basically an upgraded CT scan. Just as how diagnostic CT scans create cross-sections that are then reassembled into a 3D image which help doctors see what is going on inside the body without operating, the X-rays and neutron beams fired at a meteorite fragment in NXCT safely reveal what types of minerals and other elements or compounds it is made of, including water and other volatiles. Hydrogen in a meteorite can possibly mean it once contained water ice.

What the NIST researchers were looking for was either of the two forms of water. Hydrogen and oxygen fuse to create regular water, but there is also heavy water, whose hydrogen atoms each have an extra neutron that turns them into deuterium. How much of either type of water is present in a meteorite can be compared to levels of both types on Earth.

What gives NXCT an advantage in unearthing elements in a meteorite is that the neutrons aimed at the piece of rock will bounce off any trapped hydrogen, while heavier elements give themselves away by scattering X-rays. If evidence of water is found, 3D images created after the initial observation can also tell how it got there.

Meteorites tested were EET 87508 and GRA 06100 were tested for this experiment. GRA 06100 is a chondrite, which is embedded with chondrules, or grains, of other minerals. Its hydrogen also suggests the past presence of water. EET 87508 is especially interesting because, while it detached from the asteroid Vesta, it appears to contain material from a different type of asteroid that carried more water through space.



Color-coded X-ray image of a slice of the meteorite GRA 06100 overlaid with a neutron image of the same slice shows iron-rich material (pink), regions with low concentrations of hydrogen-bearing compounds (green), regions with high concentrations of hydrogen-bearing compounds (blue) and iron-rich hydrogenated compounds (purple). Scale bar is one centimeter. (Image credit: Treiman/Lunar and Planetary Institute/USRA)



# FROM THE EYES OF WEBB - DECEMBER 2022

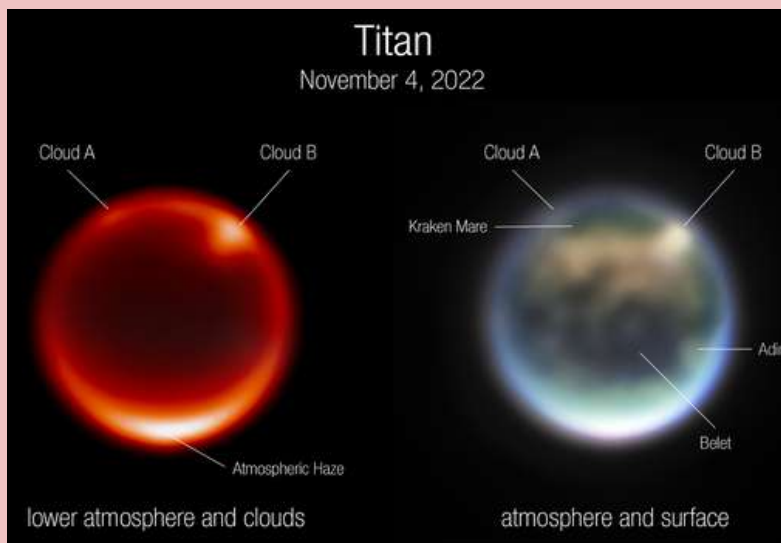
## WEBB CAPTURES 'EXTRAORDINARY' CLOUDS IN

### THE ATMOSPHERE OF SATURN'S MOON TITAN

**Studying Titan's clouds will help scientists understand why Saturn's largest moon is the only moon in the solar system with an atmosphere.**

Scientists spotted something exciting on Saturn's moon Titan in images taken by NASA's James Webb Space Telescope in early November – clouds. Specifically, clouds in Titan's northern hemisphere. To a casual observer, clouds might be a dime a dozen. But to scientists, clouds can reveal a lot about the atmosphere of a planet (or in this case, a moon). Titan is the only moon in the solar system with a thick atmosphere, so studying clouds helps scientists understand how Titan's atmosphere works and why it has an atmosphere in the first place.

The clouds further validate weather models that predict the appearance of clouds in Titan's northern hemisphere during its summer, when the region is bathed in sunlight.



Scientists have eagerly been awaiting observations of Titan since NASA's Cassini mission ended after plunging into Saturn's atmosphere in 2017. Titan's atmosphere is thick with nitrogen and methane, stretching 370 miles (600 kilometers) into space, an altitude 10 times taller than Earth's atmosphere, according to NASA. At its outer edges, solar radiation breaks up the methane and nitrogen molecules, and the remaining pieces recombine into large organic molecules that create a rich, soupy haze. This haze blocks visible light, making it hard to observe Titan's lower atmosphere and surface.

Fortunately, JWST's infrared cameras will be able to give scientists an unprecedented view of the moon's lower atmosphere and surface. Although the Goddard team was excited about seeing clouds, the JWST images showed only one snapshot in time. To really understand how Titan's atmosphere works, researchers need multiple images to see how the clouds change shape. So the team turned to colleagues at an Earth-based telescope, the Keck Observatory in Hawaii. Thankfully, the clouds hadn't dissipated by the time Keck made its observations a couple days later.

"We were concerned that the clouds would be gone when we looked at Titan two days later with Keck, but to our delight there were clouds at the same positions, looking like they had changed in shape," said Imke de Pater, an emeritus planetary scientist at the University of California, Berkeley.

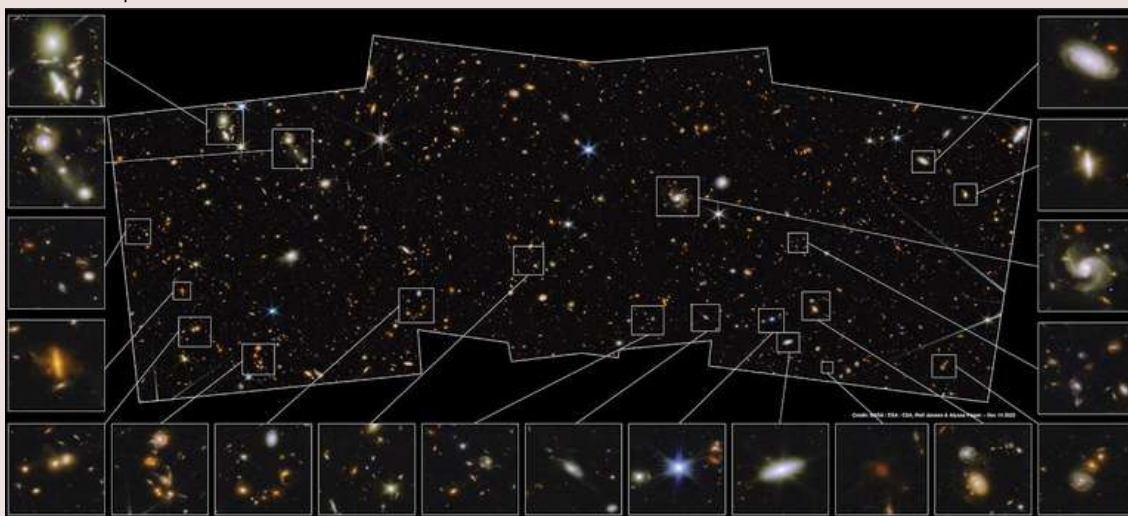
Titan captivates scientists for many reasons. For one, ultraviolet radiation from the sun creates huge organic molecules in Titan's nitrogen and methane-rich atmosphere. That hazy atmosphere obscures a surface covered in vast fields of dunes, along with lakes, seas and rivers of liquid hydrocarbons like methane and ethane. And, deep underneath Titan's surface, scientists suspect a salty liquid water ocean lurks, making Titan a candidate for potential life beyond Earth.



# WEBB GLIMPSES FIELD OF EXTRAGALACTIC PEARLS, STUDDED WITH GALACTIC DIAMONDS

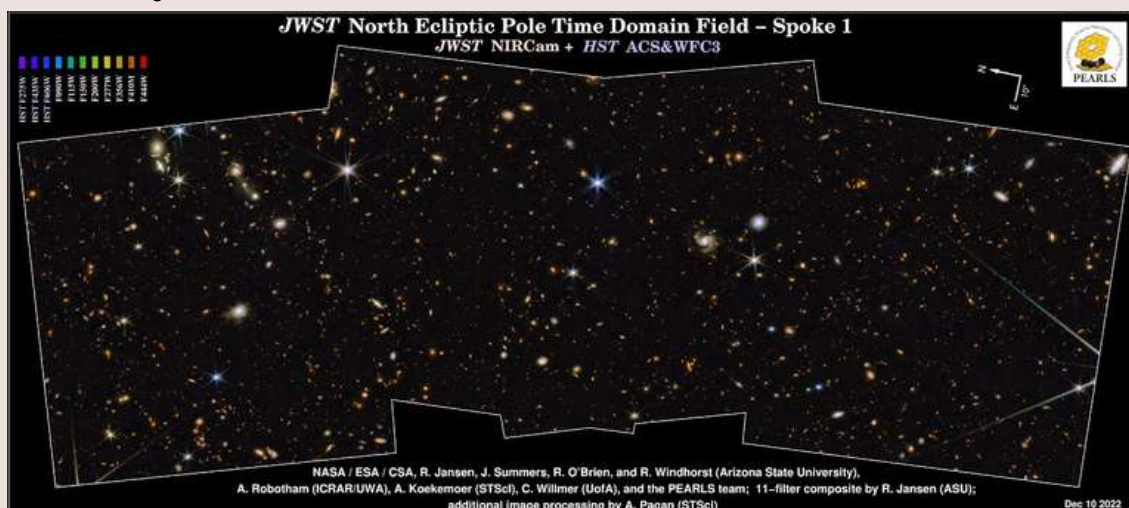
The James Webb Space Telescope has captured one of the first medium-deep wide-field images of the cosmos, featuring a region of the sky known as the North Ecliptic Pole. The image, which accompanies a paper published in the *Astronomical Journal*, is from the Prime Extragalactic Areas for Reionization and Lensing Science (PEARLS) GTO program.

“Medium-deep” refers to the faintest objects that can be seen in this image, which are about 29th magnitude (1 billion times fainter than what can be seen with the unaided eye), while “wide-field” refers to the total area that will be covered by the program, about one-twelfth the area of the full moon. The image is composed of eight different colors of near-infrared light captured by Webb’s Near-Infrared Camera (NIRCam), augmented with three colors of ultraviolet and visible light from the NASA/ESA Hubble Space Telescope. This beautiful color image unveils in unprecedented detail and to exquisite depth a universe full of galaxies to the furthest reaches, many of which were previously unseen by Hubble or the largest ground-based telescopes, as well as an assortment of stars within our own Milky Way galaxy. The NIRCam observations will be combined with spectra obtained with Webb’s Near-Infrared Imager and Slitless Spectrograph (NIRISS), allowing the team to search for faint objects with spectral emission lines, which can be used to estimate their distances more accurately.



A swath of sky measuring 2% of the area covered by the full moon was imaged here with NIRCam instrument in eight filters and with Hubble’s Advanced Camera for Surveys (ACS) and Wide-Field Camera 3 (WFC3) in three filters that together span the 0.25 – 5-micron wavelength range. This image represents a portion of the full PEARLS field, which will be about four times larger. Thousands of galaxies over an enormous range in distance and time are seen in exquisite detail, many for the first time. Light from the most distant galaxies has traveled almost 13.5 billion years to reach us. Because this image is a combination of multiple exposures, some stars show additional diffraction spikes.

This representative-color image was created using Hubble filters F275W (purple), F435W (blue), and F606W (blue); and Webb filters F090W (cyan), F115W (green), F150W (green), F200W (green), F277W (yellow), F356W (yellow), F410M (orange), and F444W (red).

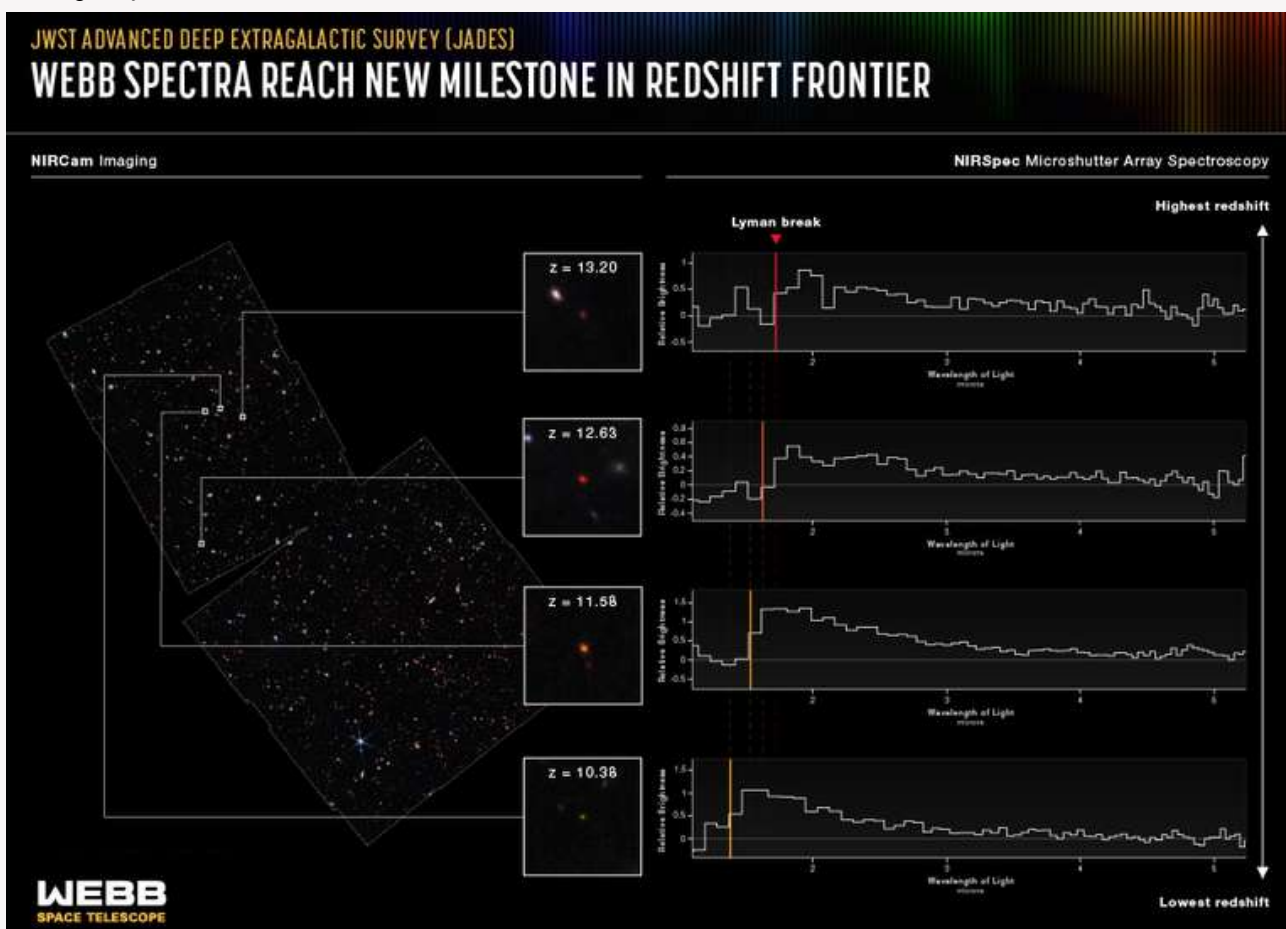




# JWST UNCOVERS UNIVERSE'S EARLIEST GALAXIES JUST AFTER BIG BANG

Webb captured an image of the galaxy known as "JADES-GS-z13-0" 325 million years after the Big Bang. Hubble made the previous-oldest galaxy known in July. The 'GN-z11' galaxy was founded 400 million years after the universe's creation.

This discovery is the result of work conducted by the JWST Advanced Deep Extragalactic Survey (JADES), an international team of more than 80 astronomers from 10 countries who used 10 days of observation to study a deep field of 100,000 galaxies first imaged by the Hubble Space Telescope in 2010. Apparent size, faintness, and distance of many of the galaxies suggested that they were fantastically old, but Hubble, which sees principally in visible light, didn't have the instrumentation to image them clearly or determine their age. That's because visible light from so far away can't easily penetrate the intervening dust of interstellar space. Infrared radiation, however, cuts right through the dust. This allows Webb a telescope which detects energy in that frequency to see as far as 13.6 billion light-years distant.



Using two instruments aboard the Webb—the Near Infrared Camera (NIRCam) and the Near Infrared Spectrograph (NIRSpec)—Robertson and his colleagues focused on four galaxies that appeared especially small, faint, and distant, studying what is known as their red shift. As objects move toward us in space, the wavelength of light they emit is compressed, shifting it to the bluer end of the visible spectrum. As objects move away from us, the wavelength is stretched, shifting it toward the red end. The redder an object appears, the more distant and old it is in our still-expanding universe. Red shift is a tricky thing to measure, because it has no particular units like inches or nanometers. Instead, it is just a number that indicates how stretched the wavelength of the light is. An object like Jupiter, which is pretty much stationary in the sky relative to Earth, has a red shift of zero. The higher the number, the greater the movement of an object away from Earth. The cosmic background radiation, a burst of universe-wide energy that was released just 380,000 years or so after the Big Bang has a red shift of about 1,100.

## **GALACTICA**

The explanation for that is a straightforward one. Astronomers don't yet know exactly when the first dust and gas began to accrete into galactic clouds, and stars then accreted within them, but the newly measured quartet emerged very early in that process. "The universe just wasn't building big galaxies at that point," Robertson says. "There was not a lot of time [for larger galaxies to form]."

The team not only measured the mass of the galaxies, but also used the NIRSpec to determine their chemical makeup. As would be expected for galaxies so early in their development phase, the principle components were hydrogen and helium, without enough time for the early stars within them to have developed heavier elements. "They are relatively metal-poor," says Robertson, "with fewer heavy elements compared to the sun."

The findings as a whole, promise still bigger discoveries and still older galaxies to come in the 20 some years Webb is expected to remain operational. "For us, this really was a paradigm shift in the way we were thinking about the high-red shift universe," says Robertson. "Because we know for certain that there are some galaxies to be studied only a couple of hundred million years after the Big Bang."

## **JAMES WEBB SPACE TELESCOPE PEERS INTO THE 'GHOSTLY LIGHT' OF INTERSTELLAR SPACE**

JWST has seen intracluster light (ICL), the very faint emission produced by stars pulled out of their galaxies as these cosmic islands interact inside a cluster. Seeing this light has big implications not just for understanding the evolution of galaxies and galaxy clusters, but also for a mystery crucial to our whole understanding of the cosmos.

JWST's deep field image of SMACS-J0723.3-7327 was the first science observation published from the space observatory. Its sharpness is incredible and twice as deep as what we can see with Hubble. Given that JWST sees the universe in infrared light, the observations allow for the study of galaxies that are much further away.

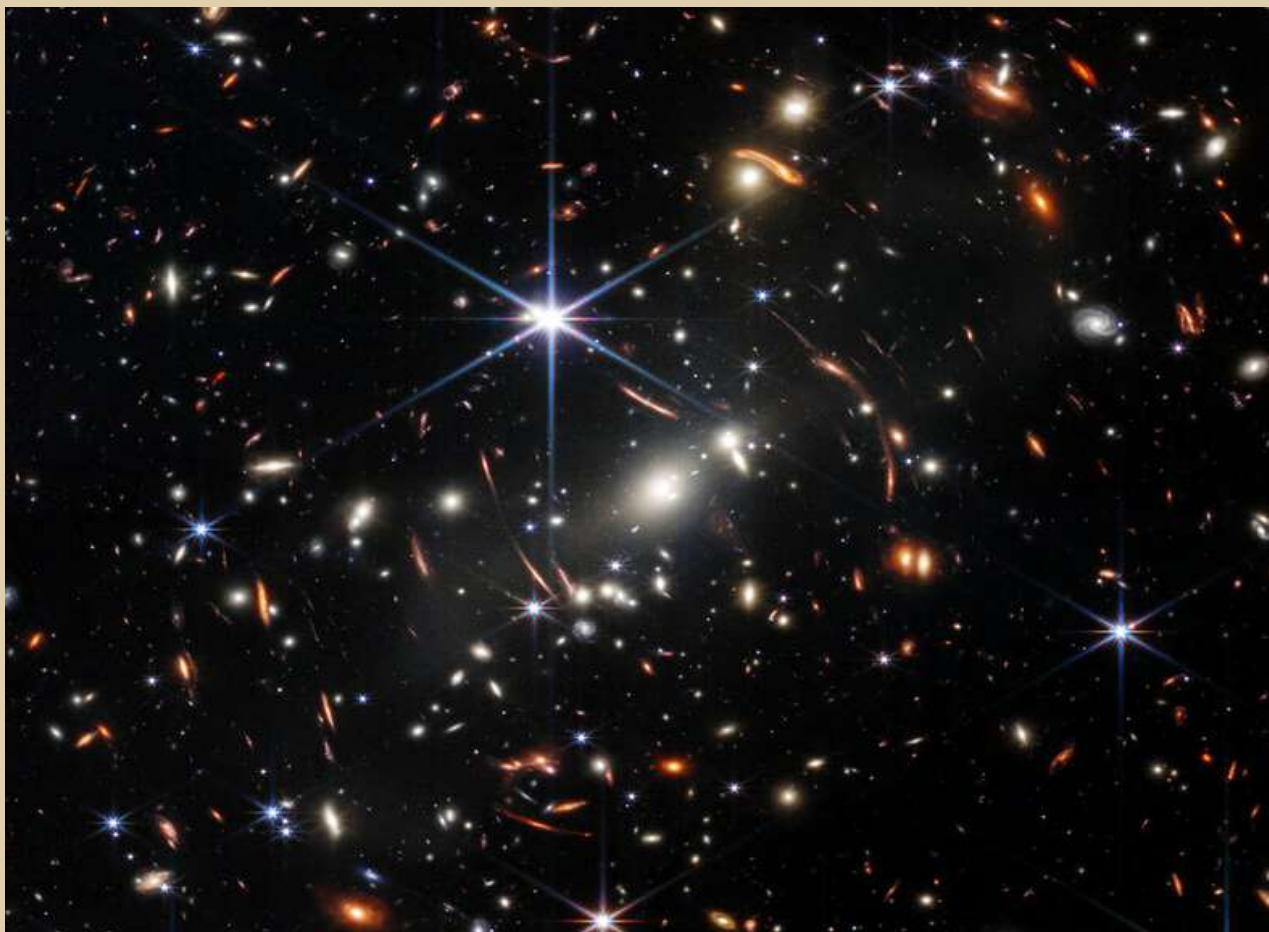


Image of the JWST's First Deep Field that has made it possible to study the intra-cluster light of the SMACS-J0723.3-7327 cluster. Image credit: NASA, ESA, CSA, STScI



## GALACTICA

As the universe expands, the light of distant galaxies is "stretched" and pushed towards redder wavelengths in a phenomenon similar to the doppler shift we can hear from, say, a passing ambulance where the pitch changes whether it's approaching or moving away from you.

"In this study, we show the great potential of JWST for observing an object which is so faint," Mireia Montes, the first author of the article, said in a statement from the Instituto de Astrofísica de Canarias. "This will let us study galaxy clusters which are much further away, and in much greater detail."

Now, while JWST is great, this light is still extremely faint and the galaxies in the cluster are extremely bright so the task is not accomplished by observations alone. It also requires techniques to analyze the observations in a way that the emissions can be isolated from the more luminous sources in the image. The data obtained paints a picture of how the galaxy cluster is evolving.

"Analyzing this diffuse light we find that the inner parts of the cluster are being formed by a merger of massive galaxies, while the outer parts are due to the accretion of galaxies similar to our Milky Way," explained Montes.

But galaxy evolution is not the only crucial factor here. Our best understanding of the universe requires the presence of an invisible (and still hypothetical) substance known as dark matter that only interacts gravitationally, so it does not clump and it stretches around galaxies. In a galaxy cluster, with hundreds if not thousands of galaxies, dark matter spreads across and around the whole cluster, and the ICL is a way to trace it.

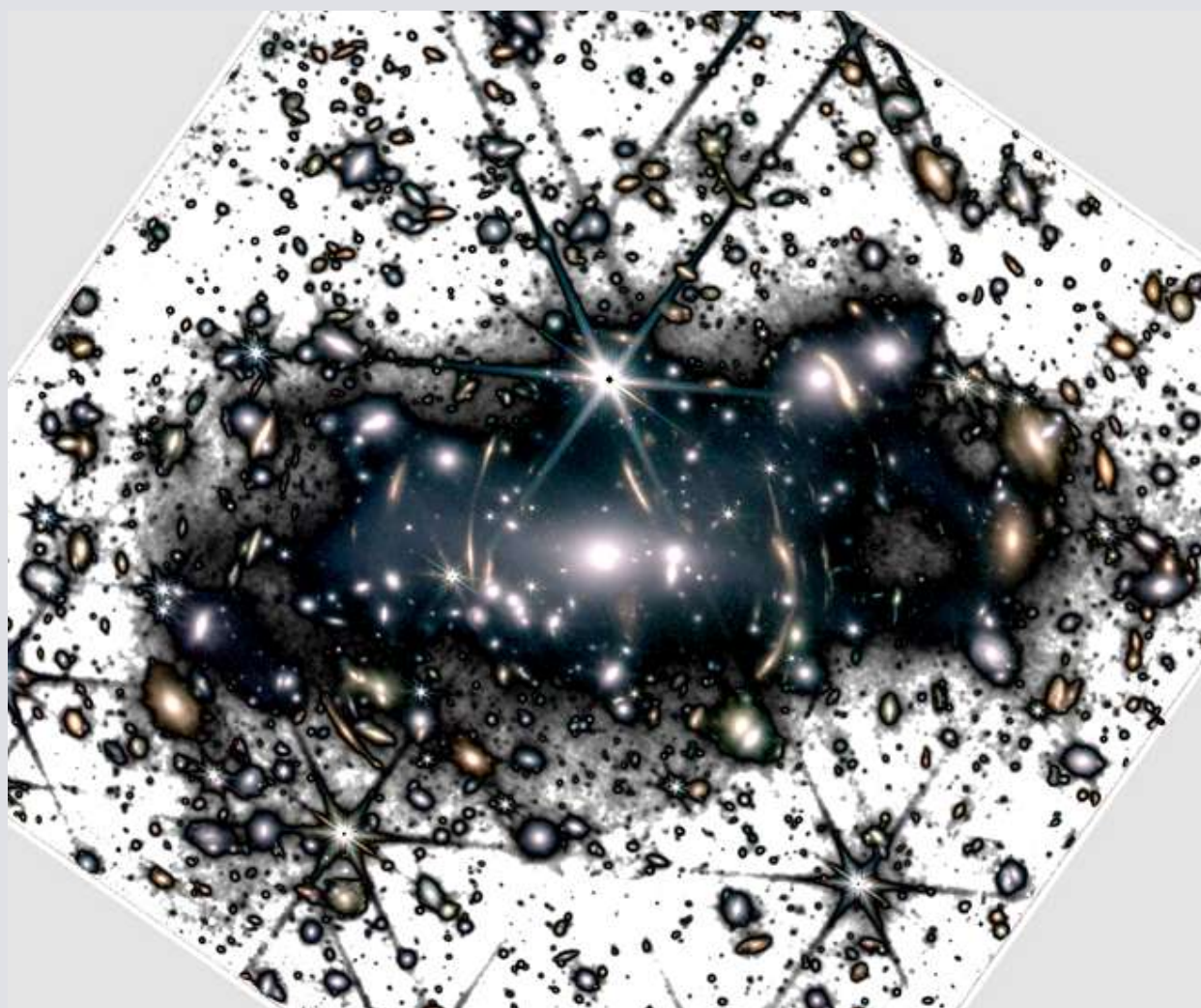
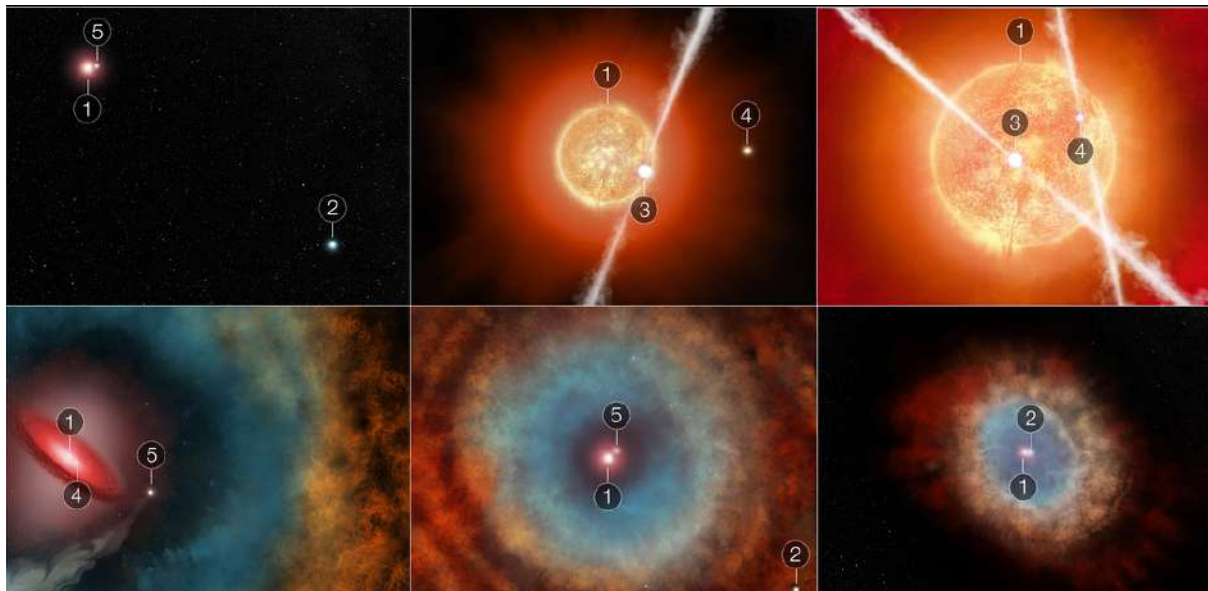


Image of the intracluster light of the cluster SMACS-J0723.3-7327 obtained with the NIRCAM camera on board of JWST. The data have been processed by the IAC team to improve the detection of the faint light between the galaxies (black and white). (Image credit: NASA, ESA, CSA, STScI)

"The JWST will let us characterize the distribution of the dark matter in these enormous structures with unprecedented precision, and throw light on its basic nature," concludes Ignacio Trujillo, the second author of the article.



How did all the “partygoers” – up to five stars – create the Southern Ring Nebula? Let’s hit “rewind” and replay the interactions that might have created the scene!

First, it’s important to know that none of these illustrations are properly scaled, and three or as many as four of the stars would be too small and dim to appear in Webb’s image. Second, star 1 and star 2 are the only stars we see in the sixth and final panel above. The remaining “guests” will be known as stars 3, 4, and 5. They are all much less massive in other words far smaller and dimmer than stars 1 and 2.

The first illustration shows a wider field. Star 1, the most massive of this group of five stars, is the fastest to age and is responsible for creating the planetary nebula. Star 2 very slowly orbits star 1, which is easier to see in the last panel. All is relatively quiet at this stage as they orbit one another, though there is another star on the scene, number 5. It orbits star 1 far more tightly than star 2 does. Cue the action! The second panel zooms way in on the scene – and two other companions appear in view. Star 1 has begun to swell as it ages rapidly, swallowing star 3. Through gravity, star 3 starts to draw in material from star 1 and launches jets in both directions. Star 4 is close by, but not yet interacting.

## ***"Illustration of Star Interactions in the Southern Ring Nebula"***

The third panel shows how much star 1 has expanded as it ages. Two companions also enter the mix. Stars 3 and 4 have sent off a series of bipolar jets. As these two stars interact, the jets they sent out are tumbled, which leads to the irregular, wavy edges of the gas and dust ejected by aging star 1. Both companions 3 and 4 are interacting within the gas and dust star 1 has ejected.

In panel 4, we zoom out to see more of the scene. Ultraviolet light and a fast, spherical wind from the newly exposed ultra-hot core of star 1 is helping to carve out its previously ejected gas and dust, creating a bubble-like cavity. There is also a leftover disk of material from the previous interactions with star 3. Star 3 is no longer visible, but star 5 is now in view. It has a wider orbit and is drawing “lines” through the ejected gas and dust from star 1 as it orbits, like a knife through a bowl of icing. Now, it’s time to zoom out even wider! At this stage, we’re getting closer to a view of the planetary nebula we see today. The fifth panel shows the same trio – stars 1 and 2 with star 5. Now, to mix it up again: As it orbits, star 5 continues to interact with the ejected gas and dust that slowly travels farther and farther from star 1 into the surrounding space, generating the system of large rings seen in the outer nebula.

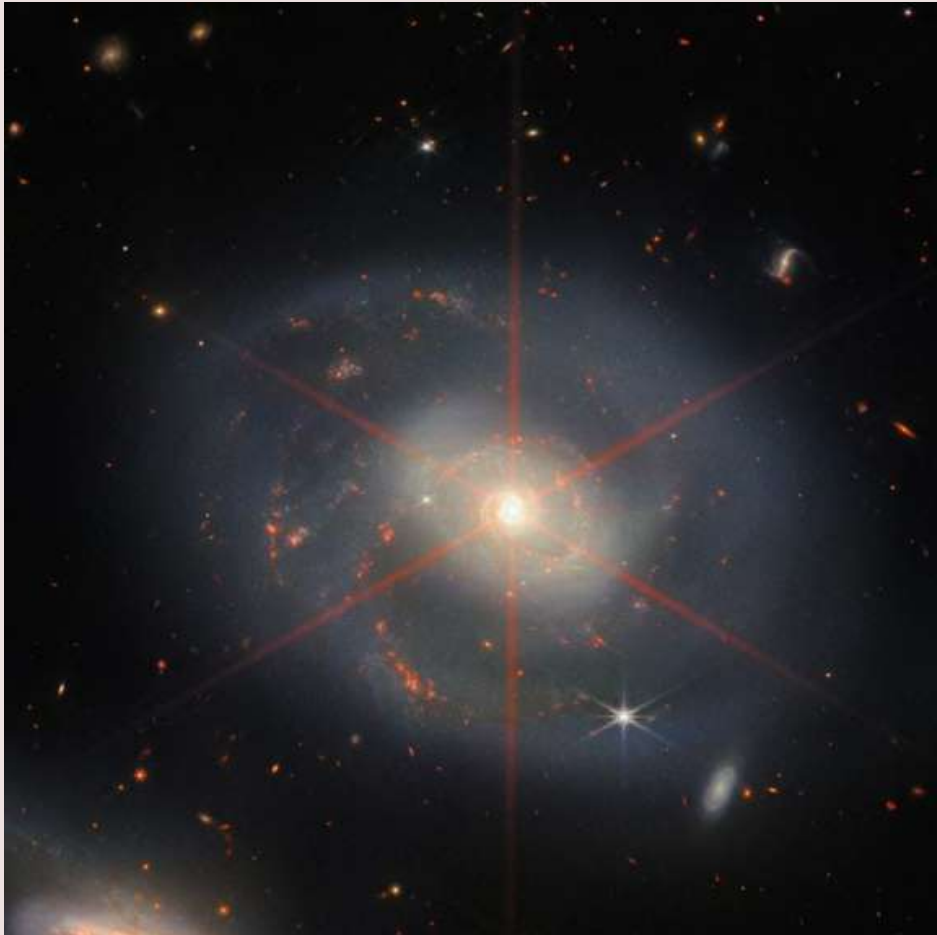
The sixth panel portrays the scene as we observe it today – by zooming all the way out, we see only stars 1 and 2 in the Southern Ring Nebula.



# **JAMES WEBB SPACE TELESCOPE CAPTURES THE GLOWING BRIGHT HEART OF A GALAXY**

The European Space Agency (ESA) shared this image of a face-on spiral galaxy that is approximately 90,000 light-years in diameter and sits 220 million light-years away from our planet in the constellation Pegasus. The image is dominated by the galaxy's extremely bright "active galactic nucleus."

The active galactic nucleus (AGN) of NGC 7469—the spiral galaxy in the image—is so bright because of the light emitted by the dust and gas as it falls into the black hole at the galaxy's centre. According to ESA, this galaxy provides astronomers with a "unique opportunity" to study the relationship between AGNs and starburst activity because its AGN is surrounded by a starburst ring that is at a distance of 1,500 light-years. Starburst refers to the intense activity involving the formation of new stars.



JWST's New image of NGC 7469. (Credits: NASA, ESA, CSA, J. Olmsted (STScI))

NGC 7469 is one of the best-studied AGNs in the sky but the compact nature of its systems and the presence of large amounts of dust made it difficult for scientists to achieve both the resolution and the sensitivity needed to study this relationship in the infrared. But thanks to Webb's immense infrared capabilities, astronomers can explore the central AGN, the galaxy's starburst ring and the gas and dust in between.

Scientists used Webb's MIRI, NIRCам and NIRspec instruments to obtain images and spectra of NGC 7469, revealing a number of new details. They discovered very young star-forming clusters that were not discovered before. They also discovered pockets of very warm, turbulent molecular gas and direct evidence for the destruction of small dust grains within a few hundred light-years of the nucleus. This proves that the AGN is affecting the interstellar medium that surrounds it.

There is also observed highly ionised atomic gas exiting the nucleus at nearly 6.4 million kilometres per hour. This is part of a galactic outflow that had previously been identified but Webb revealed it in unprecedented new detail.

## ARTEMIS 1 VS APOLLO 17: 50 YEARS APART, WHICH WAS THE GREATER CHALLENGE?

**Is it easier to touch down on the moon for a sixth time or to enter Earth's atmosphere with a new, never-tried approach?**

With the 50th anniversary of the Apollo 17 mission coinciding with Artemis 1, the question arises: Which is (or was) the greater challenge, safely returning a new spacecraft from the moon for the first time or landing a spacecraft on the moon for the sixth?

"This is my 65th mission supporting human spaceflight, and flight testing is my jam. I love flight testing," Mike Sarafin, NASA's Artemis mission manager and a former space shuttle and International Space Station flight director, said during a press conference on Thursday (Dec. 8). "I would say that the first time you do anything is harder than a repeat, but that doesn't account for new changes or objectives or harder objectives that occur on later flights."

"It's a difficult question to answer, because [the landing of] Apollo 17 was one of the farthest off the equator of the moon relative to the other Apollo landing sites. And the farther you got away from the equator with the Apollo architecture, it made for a much more difficult mission to accomplish," he said.



Not that the Artemis 1 mission doesn't have its own complexities. Beyond being the first time that an Orion spacecraft has returned to Earth at lunar velocities, it will also reenter Earth's atmosphere using a different approach than Apollo or any other human-rated spacecraft before it.

"The 'skip reentry' has a lower profile than a direct or ballistic reentry in the amount of deceleration that you put not only on the spacecraft, but on the passengers, the astronauts riding on board," Sarafin said.

Like skipping a rock across a lake, Orion will dip into Earth's upper atmosphere and use the resulting pressure, along with the lift generated by its capsule design, to skip back out. It will then plunge back into the atmosphere for its second and final descent under parachutes to a splashdown.

"Another important aspect of the skip entry is, it allows us to target a single landing site," said Judd Frieling, entry flight director for the Artemis 1 mission. "By varying what we call the azimuth the direction at which the crew module flies back to the target – we are always able to narrow our operations to that landing zone."

"If you compare that to the Apollo missions, where the U.S. Navy was deployed all over the Pacific Ocean, this helps both from operational and efficiency standpoints by always targeting the same spot," he said.





(The Apollo 17 lunar command module. Credits: NASA)

Even though it is a first, Frieling and his team in Mission Control have practiced for this moment so many times they feel they can overcome any challenge thrown at them.

"We have done it so many times in practice and in failure scenarios that in many respects it feels like we've done this many times before," he said. "So we expect the unexpected."

#### **Making it look easy**

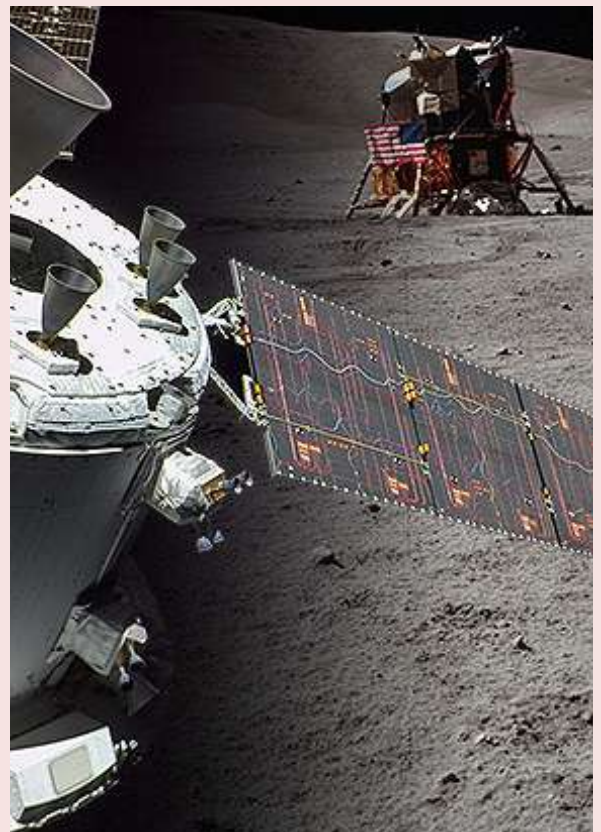
"Apollo made it look easy when it wasn't," said Michael Neufeld, a curator in the space history division of the National Air and Space Museum, in an interview "It looked a lot easier after they had done it six times."

Apollo 17 may have come the closest to reaching operational status of any of the Apollo missions, but that was because the astronauts were highly trained and they also had a bit of luck that nothing seriously failed, Neufeld said. But the stakes were also different. If Artemis 1 fails, it is a setback for the program. On Apollo 17, however, lives were also at stake.

"Any moon landing was an affair requiring all the equipment to work right," said Neufeld. "By the time of Apollo 17, the vehicle was better understood, but the mission was more challenging. They did a lot of things to try to make the landing and the challenges more feasible, but certainly it was never not dangerous at some level."

Instead, Artemis' greatest challenges may be what comes after it lands, as NASA seeks to resume what Apollo started but in a fewer number of steps.

"One of the notable differences between Apollo and Artemis is the maturation of technologies," said Neufeld, referring to the four crewed Apollo missions that came before the first moon landing. "This short course [with Artemis] going from one uncrewed test to one crewed test flight around the moon, and then they are supposed to go directly to a landing? That strikes me as risky. I hope it works."



Artemis I is set to splashdown on the same day, 50 years later, that Apollo 17 landed on the moon, Dec. 11. (NASA/collectSPACE)

# AFTER ARTEMIS 1, NASA WILL NEED TWO YEARS TO SEND ASTRONAUTS TO MOON

The Artemis 1 flight test was completed successfully when the Orion capsule splashed down in the Pacific Ocean on December 11, 2022. What lies ahead now? NASA is now preparing for the Artemis 2 mission, which is scheduled to launch in 2024, but it will not be as simple as it sounds.

Artemis II will launch the crew on an eight-day trip using the massive Space Launch System (SLS) upgraded mega rocket and Orion spacecraft. The US space agency will collect data from the Artemis 1 mission to judge how prepared humanity is to put humans on the moon.



The 2nd mission will be the first important test of the SLS and Orion spacecraft systems with passengers on board. According to the Canadian Space Agency, the mission will target four key readiness metrics: mission planning, system performance, crew interfaces, and guidance and navigation systems.

The crew has not yet been finalized, but it will contain a total of four astronauts, one of whom will be a Canadian. The crew of Artemis II will break the previous record for human travel far beyond the far side of the Moon. The mission will take off from Florida's NASA Kennedy Space Center and land by splashing down in the Pacific Ocean.



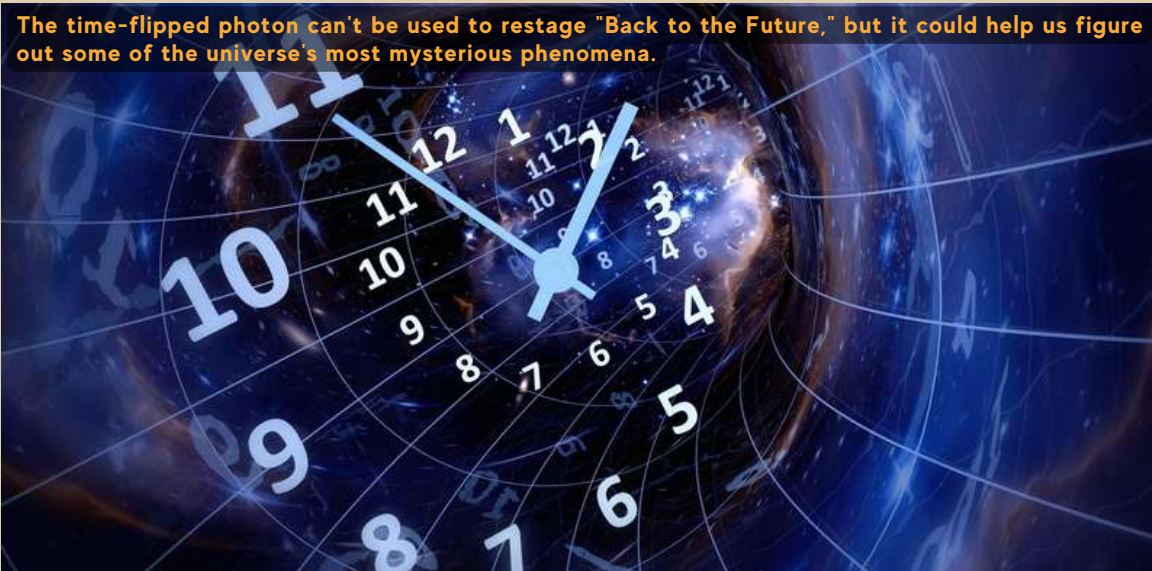
The flight path for Artemis II, according to the CSA, calls for a minimum 8 day mission. Depending on other goals, mission planners might extend the trip for a maximum of three weeks.

The eagerly anticipated Artemis III mission will happen after Artemis II. Humans will be transported to the moon's surface as part of this quest, where they will gather a range of samples to better our understanding of the moon's fundamental features.



# 'QUANTUM TIME FLIP' ACHIEVED BY RESEARCHERS, MOVING LIGHT BACK AND FORTH THROUGH TIME

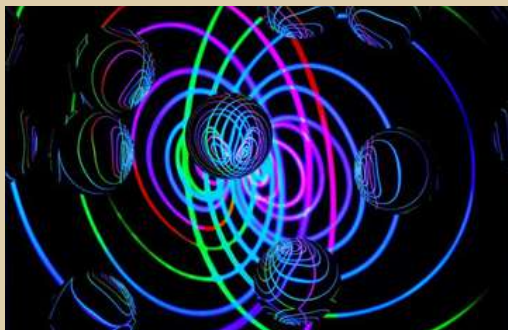
The time-flipped photon can't be used to restage "Back to the Future," but it could help us figure out some of the universe's most mysterious phenomena.



Researchers have achieved a world's first in quantum science, and it is centering on moving light forward and backward through time, regarded as the "Quantum Time Flip." This new achievement in the field of science may help in the development of future quantum computers and learning more about this phenomenon to help the modern world catch up on it. There are more applications to this success in the research, including the possibility to understand the so-called quantum gravity, which has been massively questioned by modern science.

Two separate research from October and November this year successfully demonstrated a "quantum time flip," a world's first in quantum science studies in the world. One research came from a group led by Yu Guo entitled "**Experimental demonstration of input-output indefiniteness in a single quantum device.**"

The other is led by an international team led by Teodor Strömberg, centering on the "**Experimental superposition of time directions.**" Both studies were published on the preview server arXiv, and are yet to be peer-reviewed.



It centered on splitting a photon using a special optical crystal where they managed to make it exist in the forwards and backwards time state.

The research centered on a phenomenon called "quantum time flip" that centers on two principles, one called the "quantum superposition" which enables these particles to exist in different states—and the second one known as charge, parity, and time-reversal (CPT) symmetry that has particles that obey the same laws of physics even when flipped, like a mirror.

## Quantum Time Flip May Help in Future Applications

According to the reports and researchers, this quantum time flip achievement is a massive milestone in learning more about the unified theory of quantum gravity. It also has the potential to help in the development of future quantum computers for the world to use.

## Quantum Science and its Study

Quantum science is massive in the present world, especially as researchers are more intrigued in making it work in the present and unlocking its capabilities that could lead to the future where people may access the advancements it brings.

One of the most prominent studies behind it is with the **quantum internet project** where researchers successfully sent information between two unconnected nodes for the first time. This research aims to deliver a new network connection to the public, where massive data can transport in an instant over a wireless mode.

The application of quantum physics in different industries is gaining massive traction now, especially as it can greatly improve this from the ground up. One of its **possible applications is for the health tech and care industry** where it can diagnose diseases when the scientific advancement is made available to it.

For now, researchers are on the verge of answering the theories behind quantum science and its branches, especially as studies are inching closer to unlocking its potential. The international team which was able to achieve the complicated quantum time flip is not yet done, as they are yet to prove it for the world to see and soon utilize.

# **THE LAST MARS PHOTO FROM NASA'S INSIGHT LANDER BEFORE IT DIES ON MARS**

**"My power's really low, so this may be the last image I can send," InSight's latest report reads.**

NASA launched the Mars lander InSight (its name is short for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport) in May 2018, with the lander touching down on Mars in the plains of the Elysium Planitia in November of that year.

InSight's mission was ambitious: To understand the interior of Mars like never before by using a seismometer to measure marsquakes and burrow a heat probe (nicknamed the "mole") beneath the Martian surface. The heat probe, however, was never able to get deep enough to meet its goals.

Still, InSight succeeded in tracking marsquakes, with scientists even this week announcing it detected its biggest quake on Mars ever. InSight has detected more than 1,300 marsquakes since it landed in 2018.



This photo shows the full image of Mars from NASA's InSight Mars lander released on Dec. 19, 2022. It may be the final photo the lander ever beams home. (Image credit: NASA/JPL)

Yet over the last four years, dust has built up on the lander's large, round solar arrays, limiting the amount of power InSight could generate over time. InSight completed its primary two-year mission in 2020, with NASA granting an extension through December 2022 if the lander could live that long. The lander is now generating just 20% of the power it had after landing.

Last month, NASA gave the InSight lander just weeks to live on Mars.



## PERSEVERANCE ROVER KEEPS DROPPING EARLY CHRISTMAS PRESENTS ON MARS.

**The sample tube contained the longest Mars rock sample collected by the Perseverance rover yet.**

On Friday (Dec. 23), NASA announced that Perseverance successfully dropped its second rock sample tube on the Martian surface. And while it's not the first Mars sample Perseverance has dropped for a potential future mission to bring to Earth in 2033, it certainly is the biggest.

The longest rock core collected by Perseverance is a sample called "Mageik," which the rover drilled out of the rock "Amalik" this fall from the "Enchanted Lake" region of ancient delta in its Jezero Crater landing site.

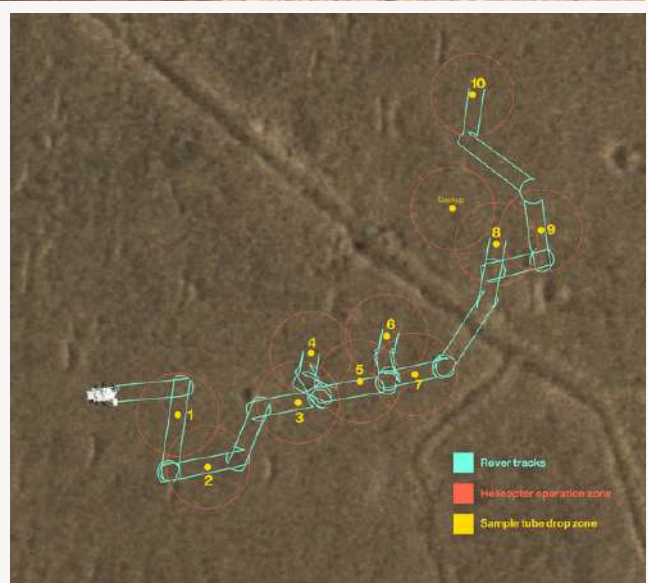
"The tube itself is about the size of a marker, and I measured the rock core sample inside at 7.36 cm (about 2.9 inches)," NASA wrote as Perseverance on Twitter. Perseverance dropped its first sample tube at a nearby spot on Wednesday (Dec. 21).



This photo from NASA's Mars rover Perseverance shows its second sample tube on the Martian surface, in the rover's shadow. NASA announced it was deposited on Dec. 23, 2022. (Image credit: NASA/JPL-Caltech)

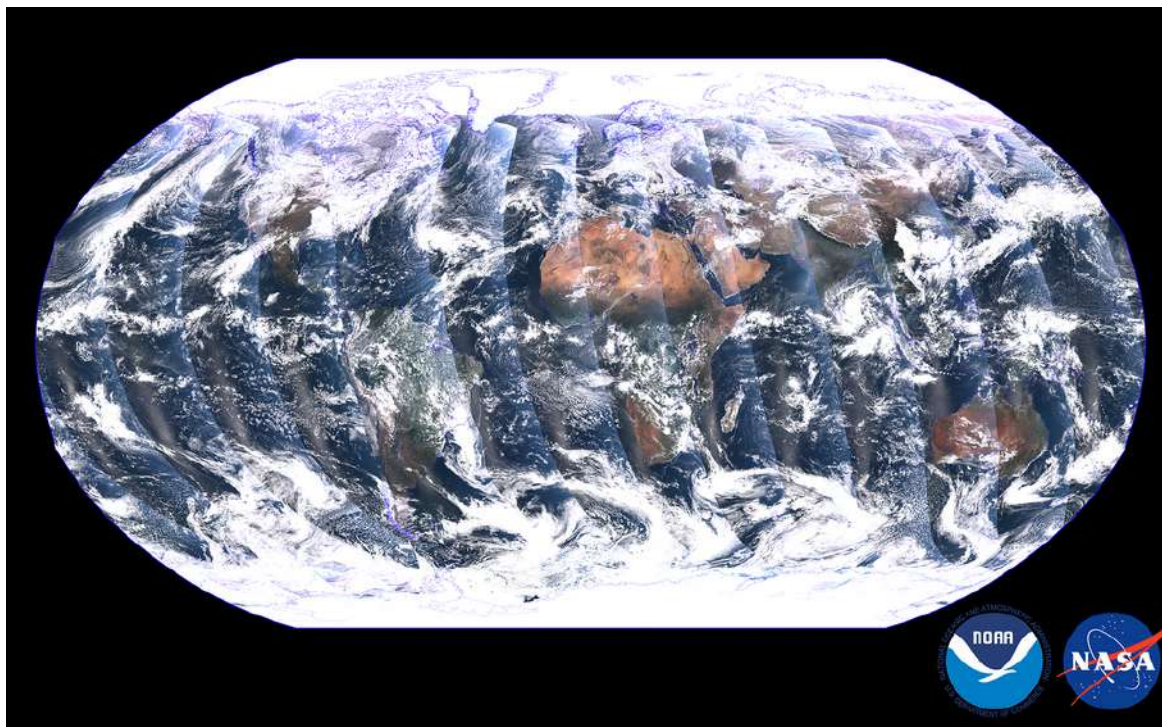
Perseverance is dropping 10 sealed tubes containing Mars rock samples, which resemble miniature lightsabers from Star Wars, for potential collection by a future Mars Sample Return mission. That mission and an orbiter could launch to Mars by 2028 and return the sample tubes to Earth five years later. If all goes according to plan, Perseverance or two small helicopters will deliver Mars samples to a lander that would then launch them into space so that a waiting orbiter can collect them for the trip back to Earth.

The samples Perseverance is dropping are backups. The rover collected twin samples at each drill site, storing one inside its body while dropping the other in case a backup is needed. Perseverance is expected to deliver the ones it carries to the waiting lander if the nuclear powered lasts long enough to reach the Mars Sample Return lander at the end of the decade.



This map shows where NASA's Perseverance Mars rover is taking to drop 10 samples that a future mission could pick up. (Image credit: NASA/JPL-Caltech)





The Earth images that make up this mosaic, and a few closeups, were taken on Dec. 5 and Dec. 6 by an instrument called the Visible Infrared Imaging Radiometer Suite (VIIRS) aboard the satellite, which launched on Nov. 10 from the Vandenberg Space Force Base on Nov. 10. (The spacecraft was previously known as JPSS-2.) VIIRS collects images in both the visible and infrared light spectra, allowing scientists to see details of Earth's surface.

Polar-orbiting satellites observe the entire planet twice each day, unlike geostationary satellites.

## THE 1ST FULL VIEW PICTURE OF EARTH FROM THE NOAA-21 SATELLITE



The southern tip of Florida and Caribbean as seen between Dec. 5 and Dec. 6, 2022. (Image credit: NOAA STAR VIIRS Imagery Team)

VIIRS provides vital information to scientists about Earth's oceans, atmosphere and land. It can detect differences in the ocean's color, telling scientists where phytoplankton are, or whether dangerous algal blooms have formed along human-settled coasts. The instrument's atmospheric data can help scientists forecast and monitor storm movement.

NOAA-21 is the second operational satellite in a series called the Joint Polar Satellite System, which provides global, pole-to-pole images. The last JPSS satellite, now known as NOAA-20, launched in November 2017. Before that, the NOAA-NASA Suomi National Polar-Orbiting Partnership (Suomi-NPP), which provided a blueprint for the JPSS, launched in 2011.

The satellites orbit pole-to-pole, observing the entirety of Earth's surface twice per day. It cruises 512 miles (824 kilometers) above Earth at 17,000 mph (27,360 kph) and crosses the equator 14 times per day. And they all carry a VIIRS instrument.



## **NASA WANTS IDEAS TO BOOST HUBBLE SPACE TELESCOPE INTO A HIGHER ORBIT**

**A study by SpaceX to use private spacecraft to reboost the Hubble Space Telescope has NASA weighing options to give Hubble new life.**

NASA is looking deeper into the possibility of using a private spacecraft to lift the Hubble Space Telescope to new heights, giving the influential space observatory a new lease on life.

On Dec. 22, the space agency issued a Request for Information regarding a non-exclusive SpaceX study earlier this year that suggested how the Hubble Space Telescope could be "reboosted" into a higher orbit. Since the start of Hubble's operations in 1990, the orbit of the space telescope 335 miles (540 kilometers) above Earth has been decaying. Reboosting it to an orbit that is both higher and more stable could add years to Hubble's operating lifetime delaying the point at which NASA must deorbit or dispose of the telescope.

During its five space shuttle missions to the service Hubble, NASA used the shuttle to reboost the telescope. The last shuttle servicing mission to Hubble was in 2009. NASA retired its shuttle fleet in 2011.



The idea to raise Hubble to a higher orbit using a Dragon spacecraft at no cost to the government was first developed between SpaceX and Polaris Program, a private program of space missions using SpaceX's Dragon and Starship vehicles funded by billionaire Jared Isaacman. The unfunded agreement between SpaceX and NASA to study the feasibility of reboosting Hubble was then signed in September 2022.

The SpaceX study was designed to help NASA, which currently has no plans to operate or fund a new Hubble servicing mission, determine the commercial possibility of such a mission. The SpaceX study also aimed to lay out the technical challenges of such a servicing endeavor.

The fact the study is non-exclusive means that other companies are free to propose their own Hubble servicing studies based on the use of different rockets or spacecraft.

These studies will collect data from Hubble itself and from SpaceX's Dragon spacecraft to assess the possibility of safely rendezvousing and docking with the space telescope before shunting it to a higher stable orbit. The studies are expected to take around 6 months to complete.

"This study is an exciting example of the innovative approaches NASA is exploring through private-public partnerships," associate administrator for the Science Mission Directorate at NASA Headquarters in Washington, Thomas Zurbuchen, said in a statement. "As our fleet grows, we want to explore a wide range of opportunities to support the most robust, superlative science missions possible."

The operation to reboost Hubble would demonstrate how older satellites and spacecraft could be given extended operating lives, especially those in near-Earth orbits like the space telescope.

The operation to reboost Hubble would demonstrate how older satellites and spacecraft could be given extended operating lives, especially those in near-Earth orbits like the space telescope.

"SpaceX and the Polaris Program want to expand the boundaries of current technology and explore how commercial partnerships can creatively solve challenging complex problems," said Jessica Jensen, vice president of Customer Operations & Integration at SpaceX. "Missions such as servicing Hubble would help us expand space capabilities to ultimately help all of us achieve our goals of becoming a space-faring, multiplanetary civilization."

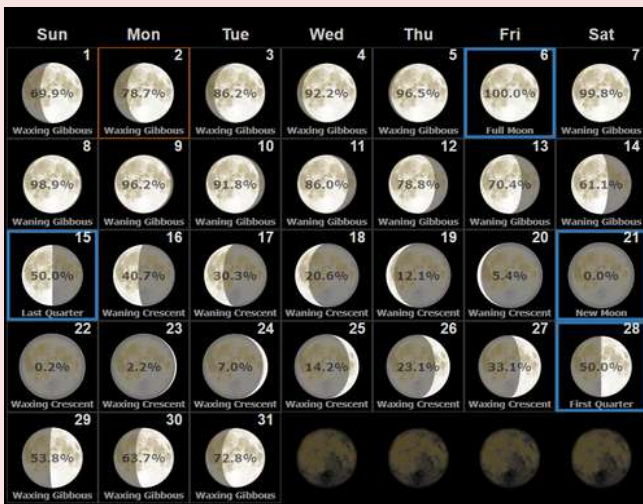
# WHAT'S UP IN THE SKY - JANUARY 2023

## LUNAR CALENDAR

### IMPORTANCE OF MOON PHASES FOR STARGAZERS

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

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



## PLANETS VISIBILITY

### Mercury

A great planet for evening viewing. Mercury nears Venus on 1st of January, after that it is hard to see.



### Venus

Near Mercury on 1st January and Saturn on 22nd January. Best at the end of the month.



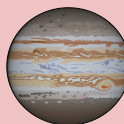
### Mars

Well-positioned evening planet. One can find Mars in east-southeast direction.



### Jupiter

Evening planet best at the start of the month, then losing altitude. Moon close on 25th and 26th January.



### Saturn

Evening planet. Best viewing at the start of the month. Near Venus on 21st and 22nd January and the Moon on 23rd.



### Uranus

Well-placed evening planet shining at mag. +5.7. Occulted by the Moon on 1 January.



### Neptune

Deteriorating evening planet, close to Jupiter.



## BRIGHT DEEP SKY OBJECTS

The Triangulum galaxy, also known as Messier 33, is sometimes said to be the farthest object visible with the unaided eye (Mag 5.7). The Triangulum galaxy, named for its location in the constellation Triangulum, is the 2nd-nearest spiral galaxy to our Milky Way, after the Andromeda galaxy. It's about 2.7 million light-years from Earth.



M34 is a fine large open cluster located in the constellation of Perseus. At magnitude +5.5, it's visible as a faint smudge to the naked eye and is easily identifiable with binoculars, where the brightest members are resolvable. A small telescope reveals up to 20 bright stars embedded in nebosity with about 80 members visible in large scope.

M52 is also one of the very richest open clusters in the Messier catalog, with a star density near the center of 1.5 stars per cubic light-year. The cluster itself is 22 light-years across. M52 lies within the circumpolar constellation of Cassiopeia. The Milky Way passes through here and the region is especially rich in open clusters.



The Orion Nebula, designated as Messier 42, is a diffuse nebula situated south of Orion's Belt in the constellation of Orion. It is one of the brightest nebulae visible to the naked eye in the night sky with an apparent magnitude of 4.0. It is 1,344 light-years away and is the closest region of massive star formation to Earth.



# ROCKET LAUNCHES IN JANUARY 2023

## MITSUBISHI HEAVY INDUSTRIES | H-IIA 202 | IGS RADAR-7

Mitsubishi Heavy Industries is scheduled to launch an H-IIA 202 rocket as part of the IGS Radar-7 mission. The launch window for the Government/Top Secret mission is on 25/01/2023 at 01:00 UTC from Tanegashima, Japan. Don't miss this exciting rocket launch!

### Mission: IGS Radar-7

The IGS-Radar 7 is a Japanese radar reconnaissance satellite. The satellite is operated by the Cabinet Satellite Information Center. The satellite serves both Japan's national defense and civil natural disaster monitoring.



### Rocket: H-IIA 202

H-IIA (H2A) is an active expendable launch system operated by Mitsubishi Heavy Industries (MHI) for the Japan Aerospace Exploration Agency. The liquid-fueled H-IIA rockets have been used to launch satellites into geostationary orbit, to launch a lunar orbiting spacecraft, and to launch Akatsuki, which studied the planet Venus. Launches occur at the Tanegashima Space Center.

### Agency: Mitsubishi Heavy Industries

Mitsubishi Heavy Industries, Ltd. is a Japanese multinational engineering, electrical equipment, and electronics company headquartered in Tokyo, Japan. MHI is one of the core companies of the Mitsubishi Group.

MHI's products include aerospace components, air conditioners, aircraft, automotive components, forklift trucks, hydraulic equipment, machine tools, missiles, power generation equipment, printing machines, ships, and space launch vehicles. Through its defense-related activities, it is the world's 23rd largest defense contractor measured by 2011 defense revenues and the largest based in Japan.

The first picture shows the LEGO model of the H-IIA 202 rocket. Since this is a Government/Top Secret mission, the images of the rocket have not been released yet. Here is the picture of A Japanese H-IIA rocket carrying the NASA-Japan Aerospace Exploration Agency (JAXA), Global Precipitation Measurement (GPM) Core Observatory is seen as it rolls out to launch pad 1 of the Tanegashima Space Center, Thursday, Feb. 27, 2014, Tanegashima, Japan.

# ABL SPACE SYSTEMS IS PREPARING FOR THE MAIDEN FLIGHT

**The launch vehicle RS1 rocket will lift off from the Pacific Spaceport Center in Alaska on 25th Jan 2023 that will carry two satellites for Omniteq (Varisat-1A and Varisat-1B).**

On its maiden launch, the RS1 rocket will carry two satellites (Varisat-1A and Varisat-1B) for Omniteq to their designated orbit with a 350 km apogee, a 200 km perigee, and an inclination of 87.3 degrees. Varisat-1A&B are technology demonstration satellites that are composed of two identical 6U CubeSats. The total mass of each satellite is about 11 kg.

The spacecraft will be demonstrating a new HF marine data communications capability. The satellites are gravity gradient and aerodynamic drag stabilized and have six deployable solar array panels. There is no propulsion on the satellites.

## What Is RS1?

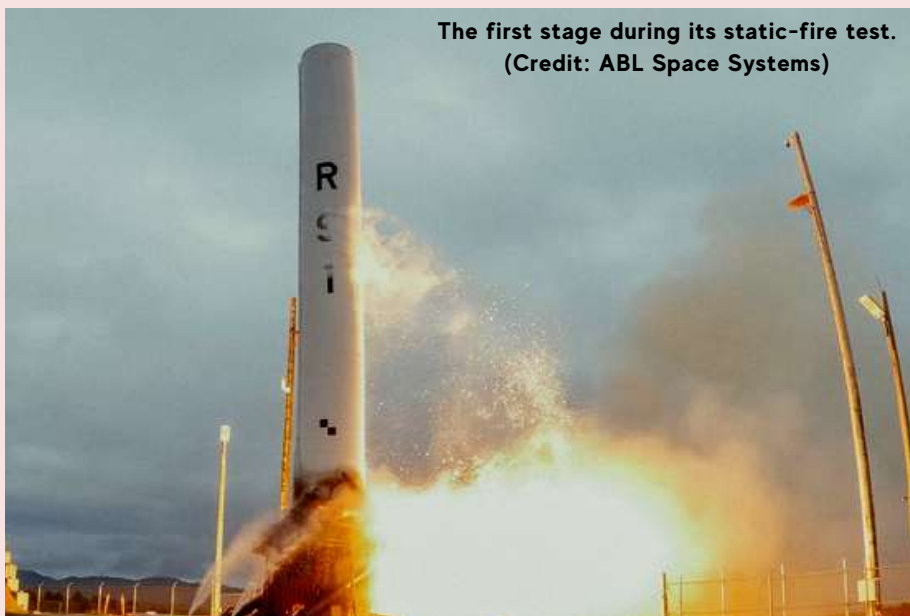
ABL's RS1 is a ground-launched small-lift rocket consisting of two stages. When fully integrated, RS1 has a length of about 26.8 m (88 ft) and a diameter of 1.8 m (6 ft). The rocket's design is deliberately simple, which allows the company to rapidly produce reliable, low-cost, and simple in operation launch vehicles. The company's philosophy is perfectly described by the slogan on its website "Even rockets can be simple".

One interesting thing about RS1 is that all its stages are sized to fit in standard shipping containers that could be delivered to the desired launch site. For instance, the first stage can be shipped in a 53' container, whereas the second stage and fairing - in 20' containers. Moreover, the only piece of ground infrastructure required at the launch site is a flat concrete pad with dimensions of 150' x 50'. With this approach, the company will be able to provide responsive launch services by activating launch sites quickly, at a low cost, and with a small team.

The vehicle's structures are entirely metallic and made of high-strength aluminum alloy. The propellant tank architecture represents a common dome and yields minimized structural mass. The vehicle's dry weight is about 3,200 kg (7,000 lb), while its gross lift-off weight is about 6,800 kg (15,000 lb). RS1 is capable of placing 1,350 kg to low Earth orbit (LEO) and 970 kg to a 500 km Sun-Synchronous orbit (SSO).



The E2 engine.  
(Credit: ABL Space Systems)



The first stage during its static-fire test.  
(Credit: ABL Space Systems)

## E2 Engine

E2 engines are the main propulsion source for RS1 that was designed and developed in-house, specifically for this vehicle. They are gas generator cycle, turbopump-fed engines running on kerosene (RP-1 or Jet-A) and liquid oxygen (LOx). The E2 engine is capable of producing 12,100 lbf at sea level and 13,000 in a vacuum.



# SpaceX Launches - January 2023

## SPACEX WILL LAUNCH 114 SATELLITES AS IT'S 1ST MISSION OF 2023

**SpaceX will launch the Falcon 9 rocket at a scheduled time of 8:26 pm IST on 3rd Jan from Space Launch Complex 40 at Cape Canaveral Space Force Station in Florida.**

After an immensely successful 2022, SpaceX is kicking off 2023 with its first mission on January 3. The Elon Musk-led firm will launch its reusable Falcon 9 rocket at a scheduled time of 8:26 pm IST from Space Launch Complex 40 (SLC-40) at Cape Canaveral Space Force Station in Florida. Named Transporter-6, Falcon 9's sixth dedicated small sat rideshare mission, it will see the two-stage rocket lift off with 114 payloads. SpaceX says the payloads include CubeSats, microsats, picosats, and orbital transfer vehicles carrying spacecraft to be deployed at a later time.



The first stage Falcon 9 booster being used for this mission has flown for over a dozen times. According to SpaceX, it has previously supported GPS III-3, Turksat 5A, Transporter-2, Intelsat G-33/G-34 and 10 Starlink missions. Once the booster pushes the second stage laden with the satellites into orbit, it will land on Landing Zone 1 (LZ-1) at Cape Canaveral Space Force Station.



**F9**

One of the primary payloads in this mission is the EOS SAT-1, which has been developed by EOS Data Analytics (EOSDA) and is the first of seven agriculture-focussed satellite constellation, Space.com reported. According to EOSDA's statement, its satellite is designed to scan roughly one million square kilometres of land which would help in examining the health of the crops. This would allow farmers to better design methods to care for their crops and extract other benefits such as reduce carbon dioxide emissions, limit energy consumption and water usage. Once EOSDA's constellation is complete, the satellites would scan around 12 million sq. km every day by 2025.

# A SPACEX FALCON 9 ROCKET WILL LAUNCH THE ONEWEB-16 MISSION ON JAN 9

SpaceX are scheduled to launch a Falcon 9 rocket with the OneWeb 16 payload from Kennedy Space Center, Florida, USA.



## What Is OneWeb?

OneWeb is a planned satellite internet constellation with the goal of providing internet coverage to the entire globe. Similar to SpaceX's Starlink, the OneWeb constellation aims to deliver semi-low-latency internet to locations where ground-based internet is unreliable or unavailable.

OneWeb plans to have 648 satellites in its constellation, providing them with the 600 satellites needed for global coverage and an additional 48 on-orbit spares in case a satellite fails. These satellites are in a 1,200 km low-Earth polar orbit, which is significantly lower than the global internet services available today. The current satellite internet solutions orbit 35,786 km above the Earth, in geostationary orbit. However, the orbit of OneWeb's satellites is still significantly higher than the ~550 km orbit that SpaceX's Starlink satellites use. OneWeb is expecting the final 648 satellite constellation to provide download speeds of roughly 50 Mb/s.

The constellation consists of 18 orbital planes, with 36 satellites in each plane. However, in May 2020, OneWeb submitted an application to the FCC, requesting to increase its constellation size to 48,000 satellites. OneWeb has also announced that the second generation of the OneWeb network will be a global navigation satellite system (GNSS), like GPS.

## What Is A OneWeb Satellite?

Each OneWeb satellite has a compact design and a mass of 147.5 kg. The satellites are each equipped with a Ku-band antenna, operating between 12 and 18 GHz. One interesting note is that these satellites will use a slightly abnormal frequency, eliminating interference with satellites in geostationary orbit.

The OneWeb satellites were built by OneWeb Satellites, which is a joint venture between OneWeb and Airbus.

The satellites are designed to deorbit after 25 years safely. However, this leaves many concerned as this orbital region is already the most crowded with space debris.

## What Is Falcon 9 Block 5?

The Falcon 9 Block 5 is SpaceX's partially reusable two-stage medium-lift launch vehicle. The vehicle consists of a reusable first stage, an expendable second stage, and, when in payload configuration, a pair of reusable fairing halves.



# SPACEX GEARS UP FOR BUSY YEAR OF FALCON HEAVY LAUNCHES

**SpaceX is targeting no earlier than January 12th for the fifth launch of Falcon Heavy, the largest and most powerful commercial rocket in the world.**

As was the case for the rocket's third and fourth launches, the main customer behind its fifth launch is the US military. Deemed USSF-67, the mission is also expected to be very similar to Falcon Heavy's most recent launch, USSF-44. That mission saw the massive SpaceX rocket complete its first direct launch to a geosynchronous orbit ~36,000 kilometers (~22,250 mi) above Earth's surface, where it deployed a pair of spacecraft carrying several rideshare payloads and satellites. Save for the possibility that the US Space Force included secret payloads on USSF-44, the mission appeared to be more of a rocket test and loose collection of experiments than a major military launch.



USSF-67 will likely be similar. According to the US Space Systems Command (SSC), USSF-67 – like USSF-44 – will carry an Aerojet Rocketdyne Long Duration Propulsive EELV (LPDE) spacecraft as a main payload. Aboard LPDE-3A, which is essentially a satellite without a payload, various stakeholders will install an unknown number of experiments, instruments, and smaller satellites that can be activated or deployed once in orbit.

The mission will be Falcon Heavy's second launch since June 2019 and is scheduled to lift off 72 days after the rocket's USSF-44 launch, which finally ended its unplanned 1225-day hiatus. The schedule is reminiscent of 2019, when SpaceX launched its second and third Falcon Heavy rockets 75 days apart. The second of those two missions (STP-2) was primarily a test flight for the US Air Force (now the Space Force) meant to both push Falcon Heavy to its limits with a complex trajectory and demonstrate Falcon booster reusability. To accomplish the latter goal, STP-2 reused two of the three Falcon Heavy boosters that supported the rocket's Arabsat 6A communications satellite launch two months prior. USSF-67 will also reuse both of USSF-44's Falcon Heavy side boosters.

Now, for the second time, there are five Falcon Heavy rockets tentatively scheduled to launch this year (2023). But the situation is not identical.

## GALACTICA

Numerous long-delayed payloads like the first ViaSat-3 and Jupiter-3 satellites and the US military's mysterious USSF-67 and USSF-52 spacecraft are finally on the cusp of crossing their respective finish lines. NASA's Psyche asteroid explorer spacecraft has also survived a continuation review after running into major software issues that precluded a 2022 launch attempt. And Falcon Heavy finally launched USSF-44 a chronically delayed mission in November 2022.



Both of the Falcon Heavy boosters pictured here will be reused to launch USSF-67. (Credit: Richard Angle)

Additionally, four of those five Falcon Heavy launches are tentatively scheduled in the first half of 2023, leaving plenty of margin for major delays in the second half of the year. But until ViaSat-3, Jupiter-3, and USSF-52 actually arrive in Florida and until NASA explicitly confirms that Psyche's technical issues are resolved, any launch targets should be treated with extreme skepticism.

USSF-67 is thankfully much less uncertain. Like Arabsat 6A and STP-2, USSF-67 will reuse both of the Falcon Heavy side boosters recovered after USSF-44. Mirroring USSF-44, SpaceX will also intentionally expend Falcon Heavy's new center booster to launch USSF-67 directly to geosynchronous orbit. Most importantly, LPDE-3A – the only confirmed USSF-67 payload – arrived in Florida in November 2022. USSF-67 prelaunch operations are currently running a day or two behind schedule relative to USSF-44, but all evidence indicates that the mission is on track to launch sometime in January 2023.

## STARLINK SATELLITE SERIES

**Starlink Group 2-2 | Group 2-4 | Group 2-5 | Group 2-6 | Group 5-2 | Group 5-3**

SpaceX will launch six more batches of Starlink satellites in the month of January 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.





# SPACE X'S 2023 PLANS



Apart from dozens of satellite launches, SpaceX will conduct manned missions to send astronauts to the International Space Station (ISS). In mid-February, the company will launch NASA's Crew-6 mission including two NASA astronauts, Stephen Bowen and Woody Hoburg, UAE astronaut Sultan Al Neyadi and cosmonaut Andrey Fedyaev from the Kennedy Space Centre. Notably, Al Neyadi will be the first Arab astronaut launching on a long-term mission to the ISS. Crew-6 will be followed by Crew-7 and two astronauts- NASA's Jasmin Moghbeli and ESA's Andreas Mogensen have been selected as spacecraft commander and pilot, respectively. These two will be joined by two other astronauts whose names and the date of launch are yet to be announced.

In addition to this, SpaceX will also conduct its Starship rocket's first-ever orbital launch followed by two crewed launches. The first is for the dear Moon project, which has been sponsored by Japanese billionaire Yusaku Maezawa to take nine eight artists for a week-long trip around the Moon aboard Starship. And the second is the Polaris Dawn which would launch a crew of four private astronauts in the highest orbital mission ever.



**NASA's Wallops Flight Facility will support the launch of Rocket Lab USA's first Electron rocket from Virginia at January mid.**

**Mission Overview:** The "Virginia is for Launch Lovers" mission will deploy satellites for leading radio frequency geospatial analytics provider HawkEye 360. It will be Rocket Lab's first lift-off from Launch Complex 2 at Virginia Space's Mid-Atlantic Regional Spaceport within NASA's Wallops Flight Facility – a launch pad developed to support Electron missions from U.S. soil for government and commercial customers. The launch window has been set following recent progress by NASA in certifying its Autonomous Flight Termination Unit (NAFTU) software, which is required to enable Electron launches from Virginia.

Launch Complex 2 supplements Rocket Lab's existing site, Launch Complex 1 in New Zealand, from which 32 Electron missions have already launched. This extensive launch heritage already makes Electron the most frequently launched small orbital rocket globally, and now with two launch complexes combined, Rocket Lab can support more than 130 launch opportunities every year, delivering unmatched flexibility for rapid, responsive launch for government and commercial satellite operators. The launch pad and production complex for Rocket Lab's large reusable Neutron launch vehicle will also be located at the Mid-Atlantic Regional Spaceport, streamlining operations across small and large launch.

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



# ASTRONOMICAL EVENTS - JANUARY 2023

## THE PERIHELION DAY!!!

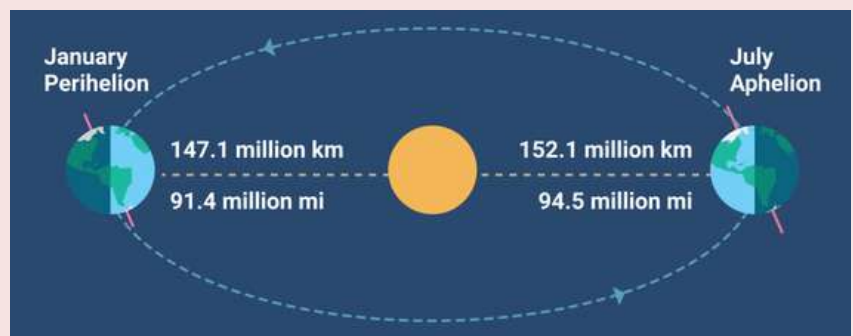
For planet Earth and our star, the Sun, today is like any other day. Earth will travel about 1.6 million miles in its orbit around the Sun today while the solar system as a whole will move 32 million miles around the center of our Milky Way galaxy. It's impressive progress, but there's nothing unusual about it. What is unique about today is that Earth will sit closer to the Sun than on any other day in 2023. **As a result, the Sun will today appear as large as it ever gets in the sky.**

### What do you mean by "Perihelion"?

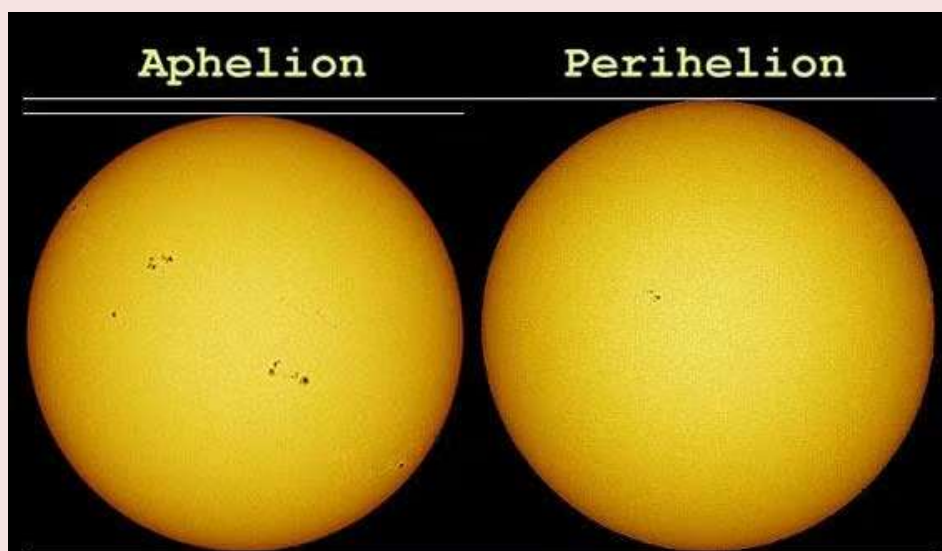
Astronomers call this point in Earth's orbit perihelion—in greek, peri (around) and helios (sun)—hence the term "Perihelion Day 2023." Perihelion is the point in the orbit of a planet, asteroid, or comet that is nearest to the sun.

### When does it happen?

On January 4, at various times based on local time zones, the Earth will be closest to the sun. In India, this will occur around 8.50 IST. This link provides a live stream of the view of Earth from space at this time. At that exact time, the center of the Earth will be 147,098,925 kilometers from the center of the Sun. That's 0.9833 astronomical units (AU).



Earth's movement around the Sun and the distance between the Earth and the Sun during Perihelion and Aphelion (credits: timeanddate.com).



The size of the Sun compared at aphelion (left) and perihelion (right), from 2005. In the photo by Anthony Ayiomamitis, we see that the size of the Sun on Perihelion is more than at Aphelion. At Perihelion, it subtends a angle of 32.53 arcminutes, while at Aphelion the angle is 31.46 arcminutes

### How does it affect us?

At perihelion, the Earth is about 3 million miles (5 million km) closer to the sun than at aphelion. This may not seem like much, but it makes a big difference in the amount of sunlight we receive. The extra sunshine gives us about 7% more daylight hours and raises our average temperatures by about 2°F (1°C).

The change in the distance also affects how long it takes for seasonal changes to happen. For example, spring arrives about a week earlier at perihelion than at aphelion. This is because the extra warmth of perihelion speeds up the Earth's climate cycles.

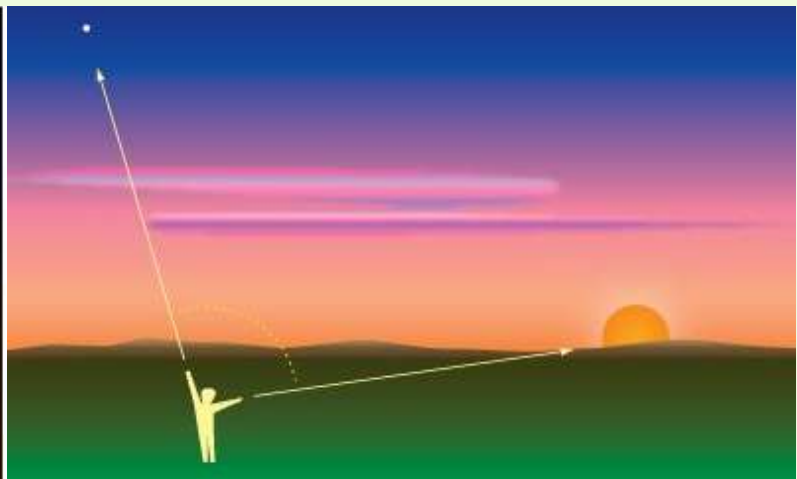
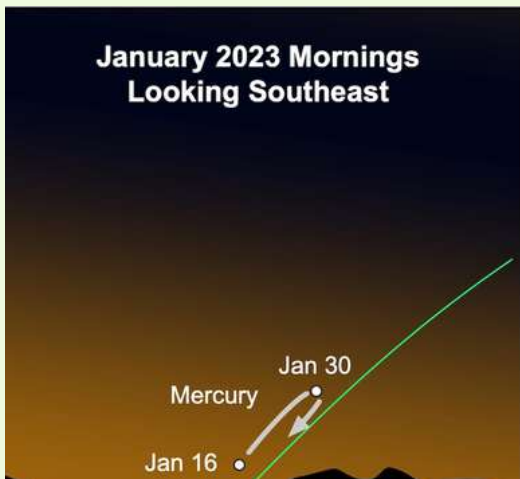
So, while you may not notice any immediate difference when the Earth reaches perihelion, there are some subtle changes happening all around us!

# MERCURY AT GREATEST WESTERN ELONGATION

## *"Best day to observe Mercury"*

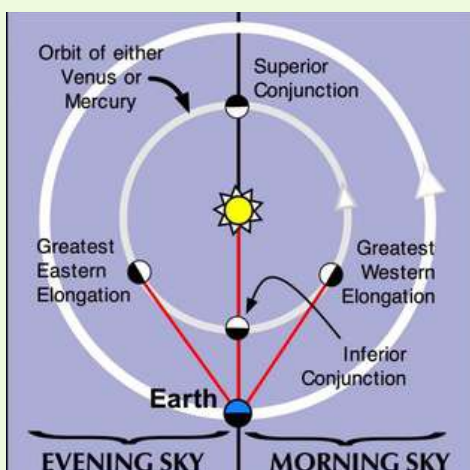
Mercury will reach its greatest separation from the Sun in its Jan-Mar 2023 morning apparition. It will be shining brightly at mag -0.2 and is only about 15 degrees from the sun in the Northern Hemisphere.

Through a telescope, Mercury appears 63% illuminated, in a waxing gibbous phase, and 6.7 arcseconds across. Mercury brightens quickly in late January and early February reaching -0.1 magnitude on both sides of greatest elongation. Then, it will reach -1.1 magnitude before slipping away in the morning glare later in February. **Thus, the best day to watch when it is at the greatest western elongation is January 30th.**



**Left picture showing the motion of the mercury from January 16th, showing the elongation on Jan 30th. Elongation angle is the angle between planet and sun as seen from earth (Image credits: Astronomy Education - Uni of Nebraska).**

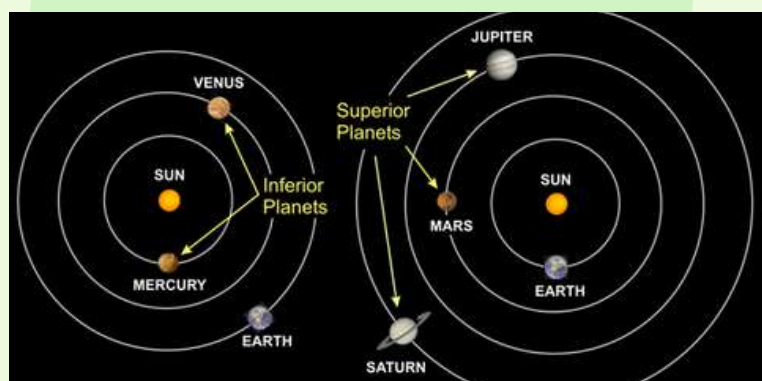
For inferior planets, there is a limit called the greatest elongation. This is the maximum angle that ever occurs between the sun and an inferior planet, and it depends on the planet's distance from the sun. Observing that a planet never has an elongation of 180° means that it must be an inferior planet, and this is how Copernicus knew that Venus and Mercury are closer to the sun than the earth. Further, by using geometry Copernicus was able to determine the distances of these planets from the sun based on their greatest elongations.



**Elongation Configurations of an Inferior Planet. We look at the evening sky for the eastern elongation and in the morning sky for the western elongation.**

### Did you know?

Copernicus used simple geometry to get the relative distances of the planets in Astronomical Units, AU, (the distance from the Sun to the Earth, a quantity he did not know!) He used the measurements of the angle of the greatest elongation and used it to measure the radius of an inferior planet's orbit. Similarly, for Superior planets, he found the time between quadrature and opposition to derive the radius of a superior planet orbit.



(Image credits: Astronomy Education - Uni of Nebraska)



# CONJUNCTIONS FOR THE MONTH

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

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

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

## Conjunction of Moon And Pleiades

On **January 3, 2023**, Moon and Pleiades appear very close to each other in early morning. They will be in the northwestern direction. Moon is at a magnitude of  $-12.40$ , and Pleiades will be at a magnitude of  $1.59$ .



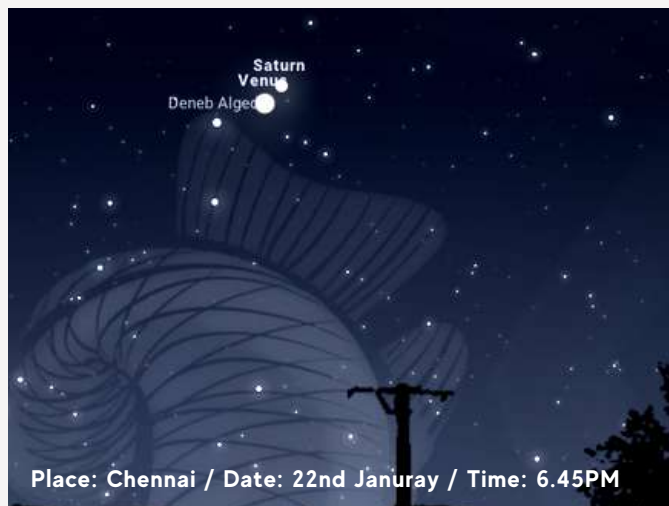
## Conjunction of Moon and Mars

On **January 3, 2023**, Moon and Mars appear very close to each other in late evening. They will be in the northeastern direction. Moon is at a magnitude of  $-12.47$ , and Mars will be at a magnitude of  $-1.14$ .



## Conjunction of Venus with Saturn

On **January 22, 2023**, Venus and Saturn will be close to each other in the late evening and can be seen throughout the night. Venus & Saturn will be at a mag. of  $-3.82$  &  $0.82$  respectively.



## Conjunction of Moon and Jupiter

**Date: 26th January**, Moon will have a closer approach with the Jupiter. The Moon is at a magnitude of  $-11.34$ , and Jupiter at a magnitude of  $-2.07$ . They will be in the western direction as night begins and will cross the sky throughout the night.



# PLANETARY PARADE ON 28TH JAN

This January, we can see four bright planets along with our moon. From January 22nd, the planets will take up turns to be around the moon. Jupiter, Mars, Venus, and Saturn will be decorating the evening sky while Mercury will be seen during the sunrise. Mars is high in the east-southeast approaching the wide and third conjunction with Aldebaran on the 30th. This evening, the planet is  $8.2^\circ$  to the upper left of the star.

The waxing crescent moon, 33% illuminated, is over halfway up in the southwestern sky and over  $10^\circ$  to the upper left of bright Jupiter. The moon and Jupiter are part of the evening planet parade of four bright planets and two dimmer ones. At forty-five minutes after sunset, Venus is to the lower right of the Jupiter-Moon combination. It is over  $10^\circ$  above the west-southwest horizon and  $4.7^\circ$  to the upper left of Saturn. The gap between the two worlds grows over  $1^\circ$  each evening.



Place: Chennai / Date: 28th January / Time: 6.40PM

## QUADRANTIDS METEOR SHOWER

### Origin

The Quadrantids are associated with asteroid 2003 EH1. The asteroid takes about 5.5 years to orbit around the Sun.

### When does it happen?

The Quadrantids are usually active between the end of December and the second week of January, and peak around January 3-4. Unlike other meteor showers, the peak period of the Quadrantids only lasts a few hours.

### What is it?

The shower owes its name to the now-defunct constellation Quadrans Muralis. The constellation was left off a list of constellations drawn out by the International Astronomical Union (IAU) in 1922, but because the shower had already been named after Quadrans Muralis, its name was not changed. The Quadrantids are also called Bootids after the modern constellation, Boötes.



Place: Chennai / Date: 3rd January / Time: 4:50 AM  
Credits: timeanddate.com

### Quick facts

**Period:** 28 Dec–12 Jan

**Peak:** 3–4 Jan. Up to 110 meteors per hour

**Visibility:** Visible from 1.30 AM in Chennai and 12:10 AM from Delhi, It will be active until the dawn breaks around 6:00 AM of the 3rd.

**Parent:** Asteroid 2003 EH1

**Radiant:** Boötes constellation

**Where:** Best visible from Northern Hemisphere.



# STUDENT'S CORNER

## *Food in Space - What's on the Menu*

Sourajit Mandal

iAstronomer member.

Have you ever wondered what is eaten in Space? What kind of food do astronauts eat on long flights? What do they eat to fill up their empty stomach?

Space food is a type of food that has been specially processed to scientifically meet human nutritional requirements. These food items are frozen in time but not in temperature. All the water in them is dried up. In this situation, bacteria have little chance of surviving because most need a moist environment to thrive.

This process is also beneficial because the food does not lose its nutritional value. Water is added to this dried food before eating. The astronauts can also enjoy the delicacy of the food to the fullest. Nowadays, fruits and ice creams such as strawberries, bananas, cinnamon, vanilla ice creams and others are processed in this process and sold in the market as astronaut food. These give citizen scientists and children a chance to experience the food eaten by astronauts.



However, this kind of food also has some disadvantages. This type of food can only survive for about three years. Eating dried food everyday is also not natural enough for astronauts.

Astronauts also do not feel natural enough eating Space food. Nasa and other Space organizations are constantly working to make food for Space more natural and durable for Space.

We should thank the scientists for working tirelessly so that in the future, when Space travel becomes much more common, we can enjoy the same delicacies in Space as on Earth.



# ONE SPOON OF NEUTRON STAR ON EARTH

T. Vetrivel

iAstronomer member.

Neutron stars are gravitational monsters, and orbiting one might not end up well for our planet. But what if we took just a spoonful of it, and transported it to Earth? Such a tiny amount of a neutron star could possibly destroy us all.

When a star about 6 times the size of our Sun explodes in a supernova, it propels its outer layers into space, leaving only a dense collapsing core behind which is eventually called as a neutron star. Neutron stars are very, very dense. They could have the diameter of a small city, but their mass would be 1.4 times the mass of our Sun.



First, we need a spoonful of neutron star particles and bring it back to Earth. A neutron star, nicknamed Calvera which is 617 light-years away from Earth. If we travel in the fastest spaceship we've ever built, it will take 11 million years to reach Calvera.

Imagine we managed to get to the surface of Calvera to Earth, you will be immediately vaporized due to the temperatures being around 1 million degrees Celsius, Fahrenheit at this point, would it even matter? Any part of your craft that wasn't vaporized, would be crushed by the star's intense gravity. But let's not end your story right there. Instead, let's equip you with a super suit that could withstand the intensely hot temperatures and extremely high pressure of neutron star. And here you have a spoonful of Calvera.

Now what If you try to scoop the Sun with a same sized teaspoon, it only weighs about 2 kg [5 lbs] of it. The same amount of a neutron star would weight anywhere from one billion to 6 billion tones. One cannot be able to lift that spoon in the first place. Because the gravity of a neutron star is so intense, it fuses protons and electrons together. Only neutrons are left in the stellar core. When they aren't fused, neutrons don't last too long. After 10 minutes, the scoop of a neutron star would break down into protons and neutrons, and release as much energy as the Sun produces in 2 or 3 seconds.

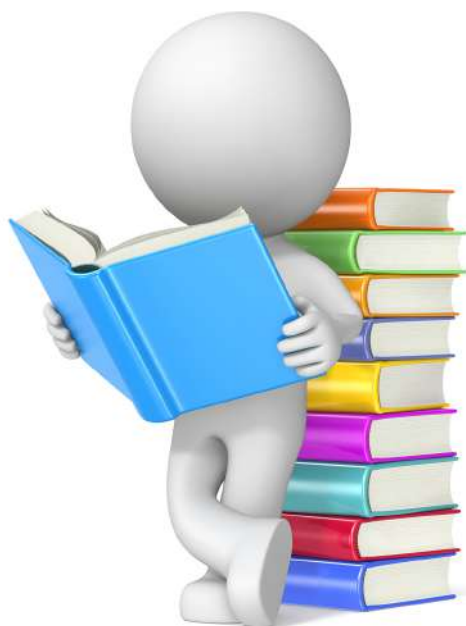
Good thing you didn't have enough time to bring that stuff back to Earth. Leave neutron stars where they belong to, which is far away from us. Just in case, if one comes a little too closer to Earth, jump on a spaceship and escape to another planet outside the Solar System.



# Modern science in Ancient Literature

Nano Chandl

iAstronomer member.



As we know the James Webb space telescope has captured the solar family and it has been released by scientist recently.

The same scenario has been said by an ancient Indian 'MAANIKKAVASAGAR Swamigal' on 9th century in this book 'THIRUVASAGAM' (Tamil Book). We could see this in Thiru Andap Paguthi - Thiruvagam.

The line from the book follows:

**"IL NUZHAI KATHIRIN THUN ANU PURAIYA"**

Meaning: Entering the ray is a thin atom.

Usually we can see our naked eyes in our house, the ray of light coming through the window. Wherein dust particles are moving around.

Human is a miniature of the universe.

## CAPTURES FROM SPACE ASSOCIATED ASTRONOMERS



Ruhika,  
iAstronomer member.

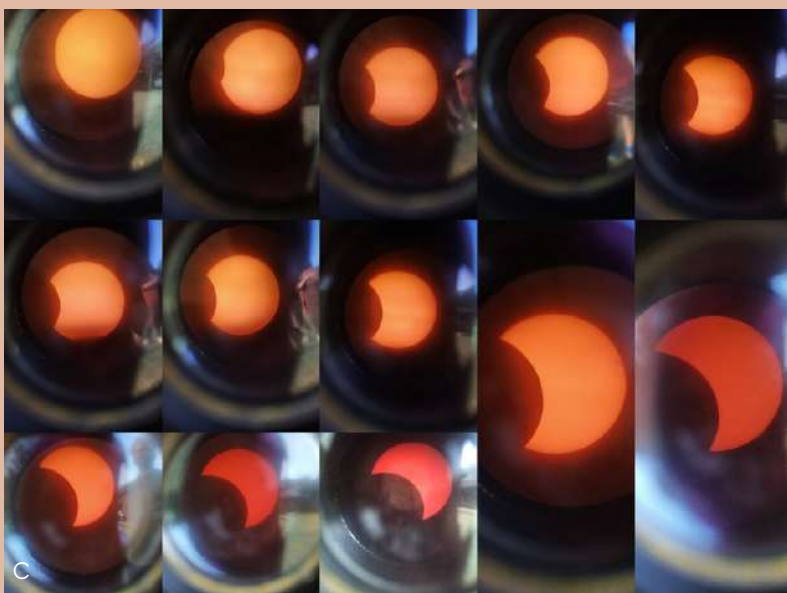


Jwala Ravisankaranand,  
Club student.



The Above two pictures are captured by Vetrivel, iAstronomer member.

# ASTROPHOTOGRAPHS BY SPACE

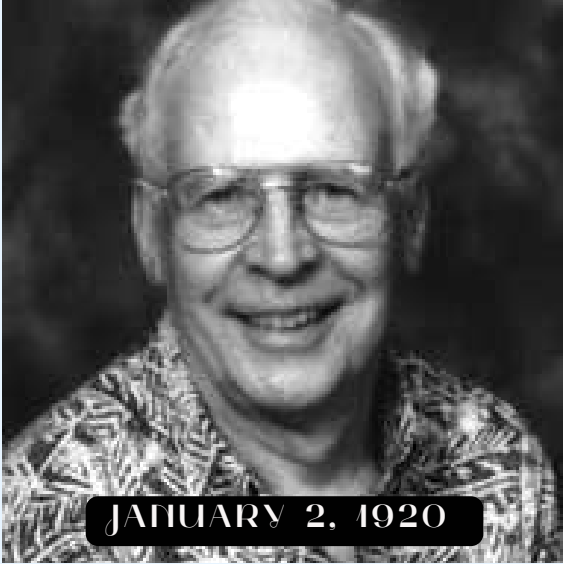


The above pictures A) Star trail, B) Meteor from the Geminids Meteor shower, C) Sun during Partial Solar Eclipse & D) Gibbous Moon are captured by Astroport Educator of SPACE Mr. Deepak Singh.



Jupiter and Mars captured by our Space Educators Mr. Manthan Gandhi, Mr. Himanshu Gautam & Mr. Ankur Chhabra.





# George Herbig

**George Howard Herbig** (January 2, 1920 – October 12, 2013) was the astronomer who pioneered studies of young stars. His research, which spanned more than 70 years, built the foundation on which rests our present-day understanding of the birth of stars and of the properties of young stars. He had an uncanny ability to identify astronomical objects and research topics that would become key elements in the study of early stellar evolution. Herbig, who died on 12 October, was an only child born in modest circumstances in Wheeling, West Virginia. Herbig later moved to Los Angeles, California, where as a teenager he built his first telescope. The nearby Mount Wilson Observatory, housing what was then the world's largest telescope, with a 2.5-meter mirror, fostered his growing interest in astronomy.



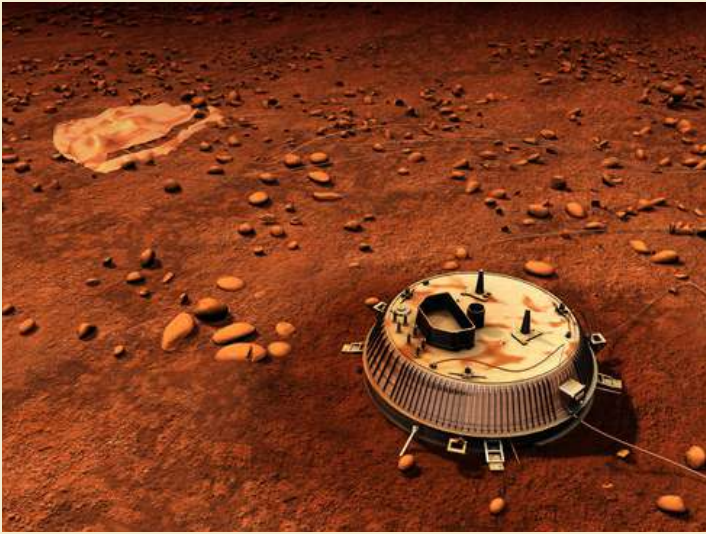
# Stephen Hawking

**Stephen William Hawking** (8 January 1942 – 14 March 2018) was an English theoretical physicist, cosmologist, and author. His contributions to the understanding of gravity, black holes, and cosmology were truly immense. They began with the singularity theorems in the 1960s followed by his discovery that black holes have entropy and consequently a finite temperature. Black holes were predicted to emit thermal radiation, what is now called Hawking radiation. The discoveries of Stephen Hawking shone a light on the darkness of these mysterious astronomical objects, but at the same time raised questions that will continue to trouble scientists for decades to come.



# HISTORICAL EVENTS HAPPENED IN JANUARY

## Oh, Titan! Here We come!



In 2005, European Space Agency's Huygens probe was designed to study the smog-like atmosphere of Saturn's largest moon Titan as it parachuted to the surface. It also carried cameras to photograph the moon's surface. Huygen's traveled to Saturn aboard NASA's Cassini orbiter. It was launched on Oct 15, 1997, and landed on the surface of Titan on January 14th, 2005.

The Cassini-Huygens project was a cooperative project between NASA and ESA (as well as the Italian Space Agency, ASI). NASA supplied the main spacecraft, the orbiter Cassini, and ESA supplied the lander, Huygens.

It provided a detailed study of Titan's atmosphere during its 2.5-hour descent to the surface. It relayed data and images from Titan's muddy surface for another hour and 10 minutes.

Huygens was designed to investigate Titan's atmosphere, including chemical properties, wind, temperature, and pressure profiles from about 100 miles (170 kilometers) down to the moon's surface. The probe was not designed to survive past landing although scientists did not rule out the possibility.



### WHAT DID WE FIND??

- **It landed on a surface resembling sand made of ice grains-** Surface pictures showed a flat plain littered with pebbles as well as evidence of liquid acting on the terrain in the recent past.
- **Existence of liquid hydrocarbon lakes in the polar regions of Titan** - One of Titan's three large seas close to the north pole, known as Ligeia Mare, is filled with pure liquid methane.
- **Titan has a hazy thick atmosphere** due to the presence of aerosols or dust particles. Scientists were also surprised to find that the two noble gases, Xenon and Krypton, were not found.
- **Amino acids** necessary for life were **present** in both gas and solid phases.





# THE GALILEAN MOONS



Painting by Giuseppe Bertini (1858) of Galileo demonstrating his telescope to the Doge of Venice.. Two of Galileo's telescopes. Page from Galileo's notebook about his observations of Jupiter's satellites. Credits: National Geographic, gabrielevanin.it, University of Michigan Special Collections Library.

Peering through his newly-improved 20-power homemade telescope at the planet Jupiter on Jan. 7, 1610, Italian astronomer Galileo Galilei noticed three other points of light near the planet, at first believing them to be distant stars. Observing them over several nights, he noted that they appeared to move in the wrong direction with regard to the background stars and they remained in Jupiter's proximity but changed their positions relative to one another.

He later observed a fourth star near the planet with the same unusual behavior. By Jan. 15, Galileo correctly concluded that they were not stars at all but moons orbiting around Jupiter, providing strong evidence for the Copernican theory that most celestial objects did not revolve around the Earth. In March 1610, Galileo published his discoveries of Jupiter's satellites and other celestial observations in a book titled *Siderius Nuncius*.

Although each of the Galilean satellites has unique features, such as the volcanoes of Io, the heavily cratered surface of Callisto, and the magnetic field of Ganymede, scientists have focused more attention on Europa due to the tantalizing possibility that it might be hospitable to life.

## IO

Io is the most volcanically active body in the solar system. Io's surface is covered by sulfur in different colorful forms. Io's volcanoes are driven by hot silicate magma.



## CALLISTO

Callisto's surface is heavily cratered and is a visible record of events from the early solar system. They indicate a small degree of current surface activity.



## EUROPA

Europa's surface is mostly water ice (has twice as much water as Earth), and it may be covering an ocean of water, could be possible "habitable zone."

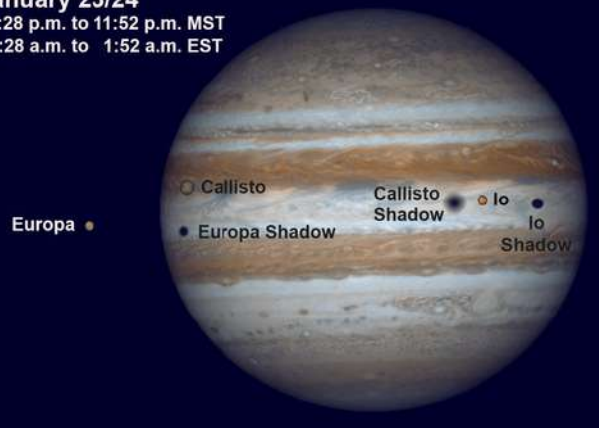


## GANYMEDE

Ganymede is the largest moon in the solar system (larger than Mercury) and is the only moon known to have its own internally generated magnetic field.



January 23/24  
11:28 p.m. to 11:52 p.m. MST  
1:28 a.m. to 1:52 a.m. EST

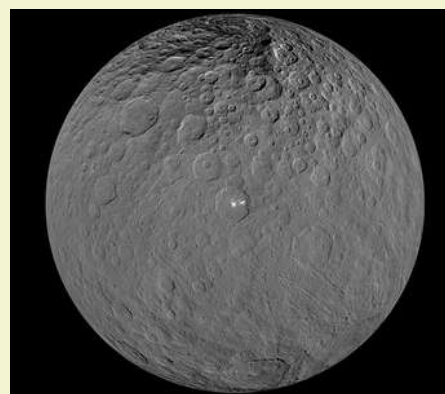
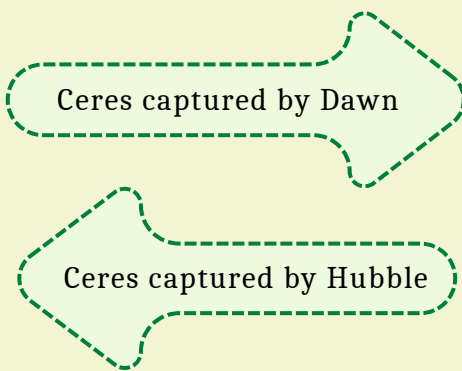
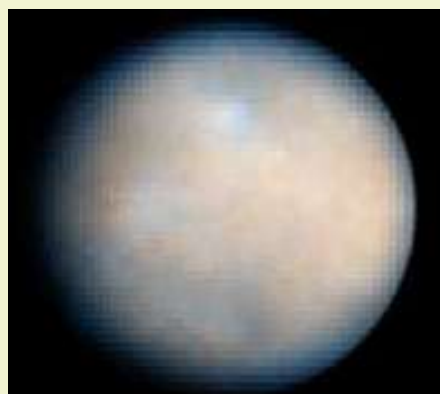




## CERES, AN ASTEROID OR DWARF PLANET?

Italian Giuseppe Piazzi discovered Ceres on January 1, 1801, while he was searching for a star. He first believed that he had discovered a comet, but he was not confident in his belief. By the end of the year, with the help of other astronomers, he had collected enough evidence to call it a planet.

In the following year, additional objects were also found to be orbiting in the same area. Sir William Herschel labeled these objects as asteroids; therefore, Ceres became a known asteroid, not a planet. Ceres was the largest known asteroid in the asteroid belt until 2006. In 2006, the International Astronomical Union formed a new class of solar system objects known as dwarf planets. By definition, a dwarf planet is spherical and travels in an orbit around the Sun and Ceres fits the definition perfectly.



Ceres is located 415 million kilometers from the Sun and revolves around the Sun in an orbit between Mars and Jupiter. It is spherical in shape, unlike the majority of the members of the asteroid belt. Its composition is also slightly different than its neighbors in the belt. Its surface is probably covered with a mixture of water ice, carbonates, and clays. This leads astronomers to believe that it formed differently from the other bodies in the asteroid belt.

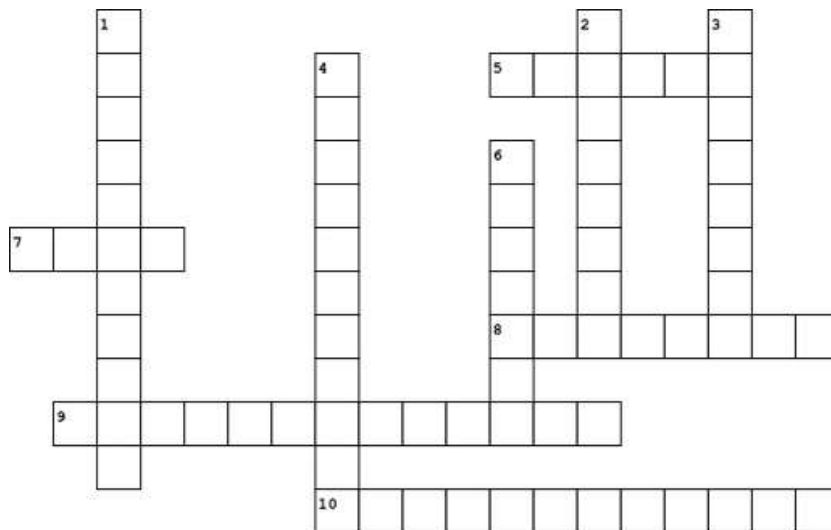
Scientists believe that Ceres has a rocky core and an icy mantle and they also believe that it has a liquid water layer in its interior. This possibility makes Ceres very intriguing to Astrobiologists that are searching for signs of extraterrestrial life. NASA's mission Dawn became the first to visit a dwarf planet and go into orbit around two destinations beyond Earth (Vesta and Ceres). After collecting data Vesta, Dawn will intercept Ceres where it will observe its surface features and collect data about its chemical composition.

In January 2014, emissions of water vapor were detected around Ceres, creating a tenuous, transient atmosphere known as an exosphere. This was unexpected because the vapor is usually a hallmark of comets, not asteroids.



# TRAIN YOUR BRAIN

## CROSSWORD



**Across**

**Down**

- 5. Who is the Goddess of the Moon in Greek mythology?
- 7. What is the plain dark surface of lower elevation on the Moon called?
- 8. What was the first Moon Rover?
- 9. What theory states that the Moon was formed elsewhere and was captured by the Earth's gravity?
- 10. What is the phenomenon when the Moon gets in between the Earth and the Sun?

- 1. What was India's first mission to study Moon in 2008?
- 2. A second full Moon in a month of a common calendar is called?
- 3. What is the surface layer or the Soil of the Moon called?
- 4. Which is the tallest mountain on the Moon?
- 6. Who was the first Italian scientist to observe the craters on the Moon?

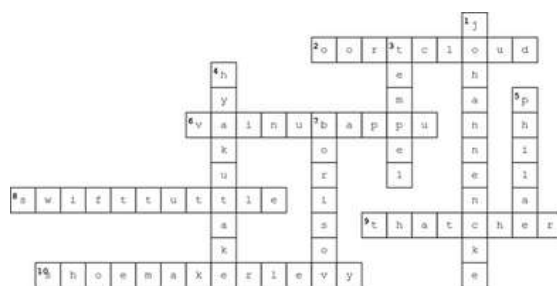
## ASTRONOMY WORD PUZZLE

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

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

- CIGAR
- TRIANGULAM
- PINWHEEL
- TADPOLE
- WHIRLPOOL
- CARTWHEEL
- COMET
- BODE
- ANTENNAE
- BABY BOOM
- SUNFLOWER
- CIRCINUS
- SOMBRERO
- MILKY WAY
- ANDROMEDA
- BLACK EYE

Answers for last month puzzles.



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

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

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

**CELESTRON SKYMASTER 20X80**  
PRISM SYSTEM: ROBBED PRISM  
PRISM GLASS: BAK-4  
APERTURE: 80MM  
EXIT PUPIL: 4MM  
MAGNIFICATION: 20X  
ANGULAR FOV: 5.7 Deg

**CELESTRON SKYMASTER 25X100**  
PRISM SYSTEM: ROBBED PRISM  
PRISM GLASS: BAK-4  
APERTURE: 100MM  
EXIT PUPIL: 4MM  
MAGNIFICATION: 25X  
ANGULAR FOV: 5 Deg

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

**CELESTRON POWERSEEKER 80EQ**  
TYPE: REFRACTOR  
MOUNT: EQ  
APERTURE: 80MM  
FOCAL LENGTH: 800MM

**SPACE PROBE 80EQ**  
TYPE: REFRACTOR  
MOUNT: EQ  
APERTURE: 80MM  
FOCAL LENGTH: 800MM

**REFLECTOR TELESCOPES**



**SPACE LAUNCHER 76MM**  
TYPE: REFLECTOR  
MOUNT: ALT-AZ  
APERTURE: 76MM  
FOCAL LENGTH: 700MM

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

**BRESSER 127EQ NEWTONIAN**  
TYPE: REFLECTOR  
MOUNT: EQ  
APERTURE: 127MM  
FOCAL LENGTH: 800MM

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