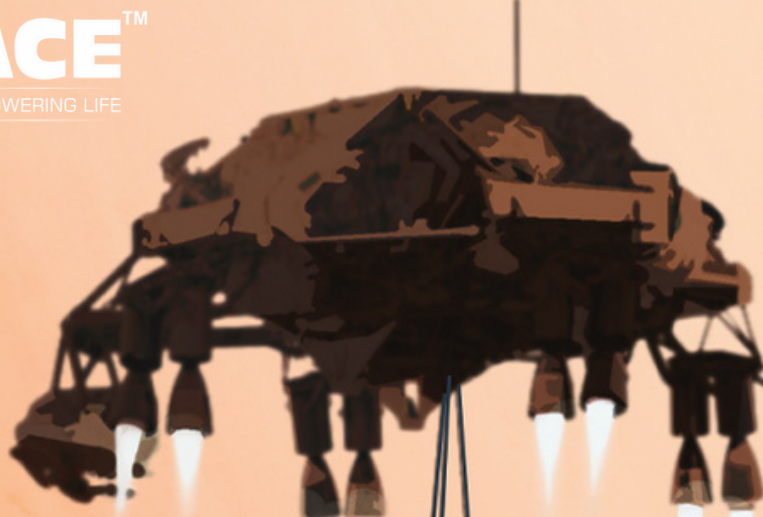




SPACETM
EMPOWERING LIFE

MAY 2022
ISSUE IV



What's Inside?
Highlights From April
Moon Phases And Planet Visibility
What's Awaiting in May
Student's Corner
Historical Events Happened In May
Events By SPACE
Train Your Brain

Galactica

Astronomy and Space Science Magazine



www.space-india.com

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

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ABOUT SPACE

SPACE is the pioneer organization working towards development of science and astronomy in India. It aims to create a scientifically aware society and contribute to the technological and social development of the country.

SPACE organization belongs to an astronomical league, diligently working towards development in astronomy and space science through astronomical tutorials, modules, curriculum for education requirements of schools & students in India. We constantly engage in offering introductory astronomy, science about space, astrophysics, telescopes and internet astronomy to masses.

Vision: To popularize hands on space science & STEM Education through various fun filled pioneering concepts, services and programs.

Mission: To develop and popularize space science & STEM Education in India and establish a global association with national & international space science agencies, societies, amateur, professional organisations, government agencies and space observatories.



**Mr. Sachin Bahmba
CMD, Space**

CMD'S MESSAGE:

Space and Astronomy is the future for the young generation of our country. This is a great means to inculcate scientific temperament among the masses. Such astronomy sessions will provide a hands on learning platform to students wherein they explore the real world of science. I wish for the young students to let their ambitions soar and think big as they are the future of our country.

HIGHLIGHTS OF MAY 2022



Hickson Compact Group 40 Credits: Hubblesite.org

THE ISOLATED MENAGERIE OF FIVE GALAXIES IS CAUGHT IN A GRAVITATIONAL DANCE

In a lonely patch of the universe, five tightly grouped galaxies engage in a leisurely dance. Called the Hickson Compact Group 40 (HCG 40), this eclectic bunch includes three spiral-shaped galaxies, an elliptical galaxy and a lenticular (lens-like) galaxy. In about 1 billion years, they will collide and merge to form a giant elliptical galaxy. For its 32nd birthday, Hubble captured these galaxies at a very special moment in their lifetimes as they fall together and continue their dance, but before they merge.

Scientists have cataloged more than 100 such compact galaxy groups, but HCG 40 is one of the most densely packed. Tight groups like this may have been more common in the early universe when their superheated, infalling material may have fueled very energetic black holes called quasars. Studying nearby groups like HCG 40 helps astronomers learn about how galaxies formed.

NASA is celebrating the Hubble Space Telescope's 32nd birthday with a stunning look at an unusual close-knit collection of five galaxies, called The Hickson Compact Group 40.

This menagerie includes three spiral-shaped galaxies, an elliptical galaxy, and a lenticular (lens-like) galaxy. Somehow, these different galaxies crossed paths in their evolution to create an exceptionally crowded and eclectic galaxy sampler.

Caught in a leisurely gravitational dance, the whole group is so crowded that it could fit within a region of space that is less than twice the diameter of our Milky Way's stellar disk. Though such cozy galaxy groupings can be found in the heart of huge galaxy clusters, these galaxies are notably isolated in their own small patch of the universe, in the direction of the constellation Hydra.

One possible explanation is that there's a lot of dark matter associated with these galaxies. If they come close together, then the dark matter can form a big cloud within which the galaxies are orbiting. As the galaxies plow through the dark matter they feel a resistive force due to its gravitational effects. This slows their motion and makes the galaxies lose energy, so they fall together. Therefore, this snapshot catches the galaxies at a very special moment in their lifetimes. In about 1 billion years they will eventually collide and merge to form a giant elliptical galaxy.

Astronomers have studied this compact galaxy group not only in visible light, but also in radio, infrared, and X-ray wavelengths. Almost all of them have a compact radio source in their cores, which could be evidence for the presence of supermassive black holes. X-ray observations show that the galaxies have been gravitationally interacting due to the presence of a lot of hot gas among the galaxies. Infrared observations reveal clues to the rate of new star formation.

Though over 100 such compact galaxy groups have been cataloged in sky surveys going back several decades, Hickson Compact Group 40 is one of the most densely packed. Observations suggest that such tight groups may have been more abundant in the early universe and provided fuel for powering black holes, known as quasars, whose light from superheated infalling material blazed across space. Studying the details of galaxies in nearby groups like this help astronomers sort out when and where galaxies assembled themselves, and what they are assembled from.

Hubble's unique capabilities in observing visible and ultraviolet light are a critical scientific complement to the infrared-light observations of the recently launched Webb Space Telescope, which will begin science observations this summer.

CELEBRATING HUBBLE'S 32ND BIRTHDAY
WITH AN ECLECTIC GALAXY GROUPING

SPACE X, AXIOM LAUNCH FIRST PRIVATE MISSION TO ISS

"We're taking commercial business off the face of the Earth and putting it up in space," said NASA chief Bill Nelson.

Ax-1 launched on April 8, with the crew originally scheduled to spend eight days aboard the ISS before returning. However, due to unfavorable weather conditions for splashdown in either the Atlantic or the Gulf of Mexico, the mission's return was postponed multiple times. SpaceX, coordinating with NASA and Axiom, delayed the undocking from its original schedule to April 24, with the Crew Dragon capsule departing the ISS on Sunday evening. The delays meant the Ax-1 crew ended up spending 15½ days on the orbiting research laboratory.

Axiom's first astronaut mission marks SpaceX's sixth human spaceflight to date, previously launching four NASA missions and the private Inspiration4 mission. In total, SpaceX has flown 22 astronauts to orbit since its first crew launch in May 2020 – with further government and private flights planned for later this year.

While space tourism is an emerging sub-sector of the space industry, Axiom's private passengers do not put themselves in that category. Each of three passengers had research missions they conducted on behalf of other organizations, including work with the Canadian and Israeli space agencies and health studies for Mayo Clinic, Cleveland Clinic, and the Montreal Children's Hospital. After Ax-1, Axiom plans to continue flying passengers to the ISS, with the company last year expanding its deal with SpaceX to cover three more missions.

Axiom has declined to specify how much the private astronauts pay for a trip, as well as financial details of its deal with SpaceX. NASA is paying Elon Musk's company about \$55 million per astronaut to fly to the space station – giving an idea of the steep cost of a private flight to orbit. Axiom calls these private flights "precursor missions," as the unicorn space company is building habitable modules that will connect to the ISS, as well as operate independently in orbit.



The 11-person crew aboard the station comprises of (clockwise from bottom right) Expedition 67 Commander Tom Marshburn with Flight Engineers Oleg Artemyev, Denis Matveev, Sergey Korsakov, Raja Chari, Kayla Barron, and Matthias Maurer; and Axiom Mission 1 astronauts (center row from left) Mark Pathy, Eytan Stibbe, Larry Conner, and Michael Lopez-Alegria. Credits: NASA

Comeback to Earth

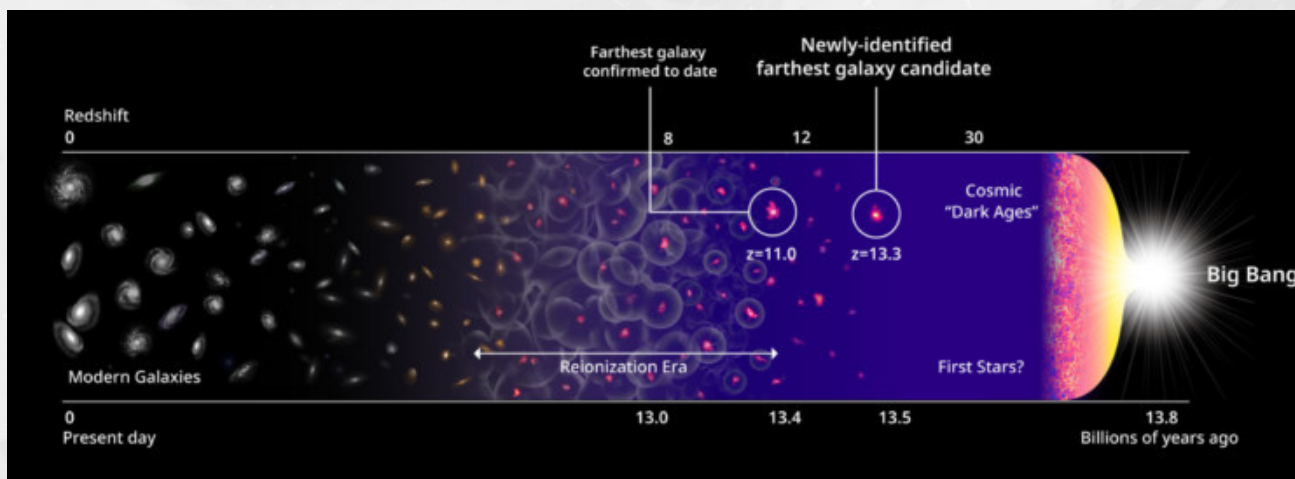
SpaceX safely returned its Crew Dragon spacecraft from orbit on Monday, carrying the private crew of Axiom Space's Ax-1 mission back from the International Space Station.

Crew Dragon capsule Endeavour splashed down off the coast of Jacksonville, Florida in the Atlantic Ocean.

"Welcome back to planet Earth. The Axiom-1 mission marks the beginning of a new paradigm for human spaceflight. We hope you enjoyed the extra few days in space and thanks for choosing to fly SpaceX," the company's mission control said on a livestream of the splashdown.

The Ax-1 mission was commanded by retired NASA astronaut Michael Lopez-Alegria, with real estate investor Larry Connor as the pilot, and Canadian investor Mark Pathy and former Israeli fighter pilot Eytan Stibbe as mission specialists. Lopez-Alegria is Axiom's vice president of business development, while the other three are passengers whose trips were paid for by other organizations.

ASTRONOMERS CAPTURE FARTHEST GALAXY EVER, 13.5 BILLION LIGHT-YEARS AWAY



Earliest galaxy candidates and the history of the Universe. | Credit: Harikane et al., NASA, ESA, and P. Oesch (Yale University)

A team of international astronomers has discovered what is believed to be the most distant galaxy ever observed. Called HD1, it is 13.5 billion light-years away, 100 million light-years farther from Earth than the last record-holder.

The current record holder for the most distant galaxy is GN-z11, a galaxy 13.4 billion light-years away discovered by the Hubble Space Telescope in 2016 and is considered to be at about the farthest detection point for the storied space telescope. This is not to be confused with the farthest-away star that has ever been observed, which is named Earendel and was recently captured by Hubble thanks to a perfect alignment of celestial bodies that created a powerful gravitational lens.

HD1 is a candidate for the earliest and most distant galaxy and was discovered after more than 1,200 hours of observation data that was captured by a combination of the Subaru Telescope, VISTA Telescope, UK Infrared Telescope, and the Spitzer Space Telescope.

"It was tough work to find HD1 out of more than 700,000 objects," Yuichi Harikane, the astronomer who discovered HD1, says. "HD1's red color matched the expected characteristics of a galaxy 13.5 billion light-years away surprisingly well, giving me some goosebumps when I found it."

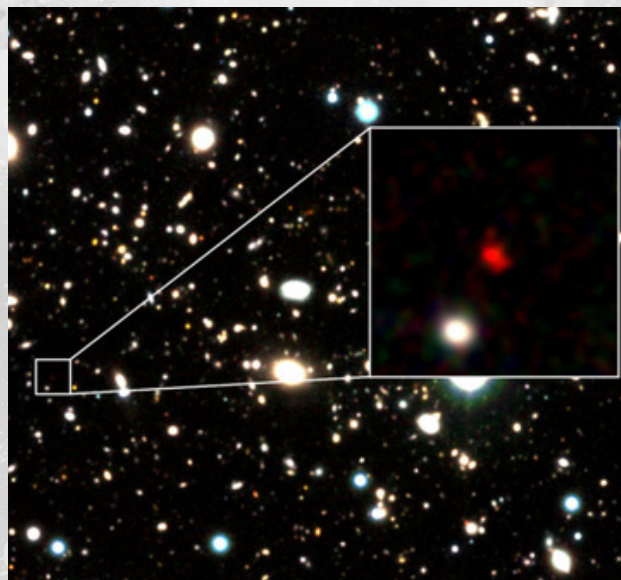
After its initial discovery, the team performed follow-up observations with the Atacama Large Millimeter/submillimeter Array (ALMA) to confirm the findings. The original image above was released by the National Astronomical Observatory of Japan (NAOJ), ALMA's partner in East Asia.

"We found a weak signal at the frequency where an oxygen emission line was expected. The significance of the signal is 99.99%," Akio Inoue, a professor at Waseda University, who led the ALMA observations, says. Statistical significance is a level at which the probability of the discovery is true and not made due to sampling error.

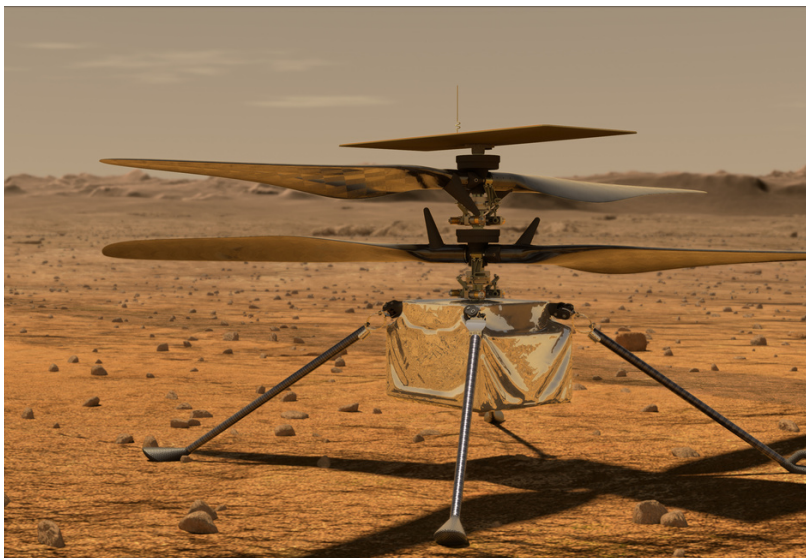
"If this signal is real, this is evidence that HD1 exists 13.5 billion light-years away, but we cannot be sure without a significance of 99.999% or more," Inoue says.

The astronomers say that it is difficult to explain HD1 with the current theoretical models of galaxy formation. Additionally, the observational information on HD1 is limited and the galaxy's physical properties are not yet known. HD1 has been selected for the first cycle of observations from the James Webb Space Telescope, a sign of the astronomical importance of the finding.

"If the spectroscopic observation confirms its exact distance, HD1 will be the most distant galaxy ever recorded, 100 million light-years further away than GN-z11," Harikane says. "We are looking forward to seeing the Universe with the James Webb Space Telescope."



(Image credit: Space.com)

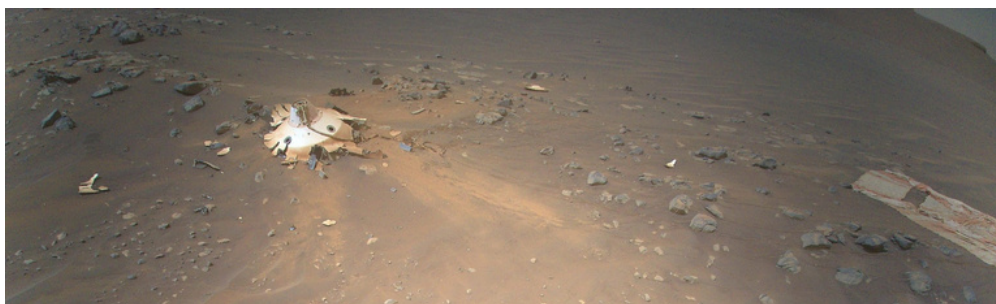


NASA'S INGENUITY HELICOPTER SPOTS BEAUTIFUL SPACECRAFT WRECK ON MARS

INGENUITY is the first helicopter to fly on another planet, revealing the Martian surface from the air and some of the human-made objects on it – in unprecedented detail. Now **NASA's Mars drone has captured something new:** A spacewreck, the dusty ruins of a parachute and the burnt metal of a spacecraft are shown embedded in the ruddy Martian soil, with scattered pieces of shell and machinery littering the space around it. The ruins are not evidence of a failed landing, however – instead, they are intimately tied to Ingenuity's existence on Mars itself.

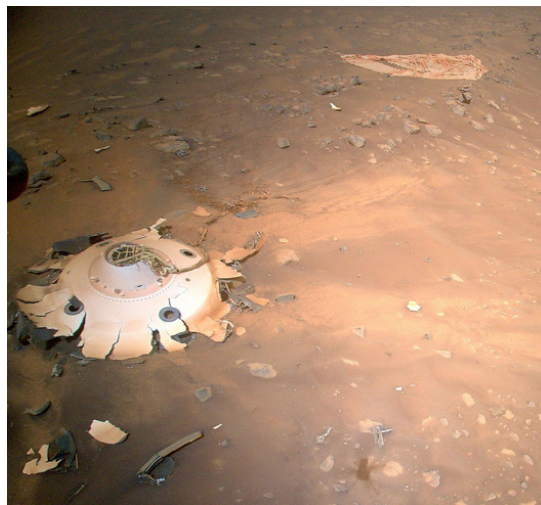
WHAT'S New: Ingenuity took the pictures on April 19, the one-year anniversary of Ingenuity's first takeoff into the Martian sky. The series of ten aerial color images show the remains of the touchdown gear that floated Perseverance and Ingenuity down to Mars on February 18, 2021.

On this auspicious anniversary, Ingenuity took a journey to its genesis and visited these iconic relics from NASA's most highly documented Mars landing shortly before Martian noon. For the helicopter's 26th flight, the JPL team tasked Ingenuity with collecting multiple-angle views of the landing site. The footage will help engineers learn what went right during Perseverance's landing and give them vital information to repeat the stunt in future missions.



The panorama view is other-worldly, reminiscent of former industrial boom towns like the shores of the Aral Sea in the Middle East, or a factory city turned ghost town in the United States Midwest.

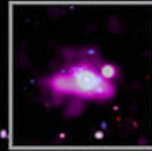
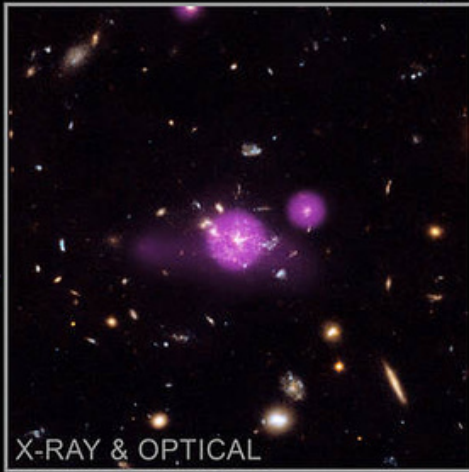
In the below image, Perseverance's landing gear is seen popping white against the Mars soil, but it is slowly being subsumed by dust. In the background, the rover's parachute can be seen in a crumpled heap.



In the below image, the full scale of the wreckage shows how great the impact was that the Mars rover made on the planet's surface.



WHAT'S NEXT: Perseverance recently sped along Jezero Crater to a region called Three Forks. There it will seek out rocks that have signs of microbial life, which may have flourished billions of years ago on Mars thanks to its ancient lakes and rivers.



X-RAY & OPTICAL

(Image credit: NASA.gov)

Feasting Black Holes Caught in Galactic Spiderweb

Often, a spiderweb conjures the idea of captured prey soon to be consumed by a waiting predator. In the case of the "Spiderweb" protocluster, however, objects that lie within a giant cosmic web are feasting and growing, according to data from NASA's Chandra X-ray Observatory.

The Spiderweb galaxy, officially known as J1140-2629, gets its nickname from its web-like appearance in some optical light images. This likeness can be seen in the inset box where data from NASA's Hubble Space Telescope shows galaxies in orange, white, and blue, and data from Chandra is in purple. Located about 10.6 billion light years from Earth, the Spiderweb galaxy is at the center of a protocluster, a growing collection of galaxies and gas that will eventually evolve into a galaxy cluster.

To look for growing black holes in the Spiderweb protocluster a team of researchers observed it for over eight days with Chandra. In the main panel of this graphic, a composite image of the Spiderweb protocluster shows X-rays detected by Chandra (also in purple) that have been combined with optical data from the Subaru telescope on Mauna Kea in Hawaii (red, green, and white).

Most of the "blobs" in the optical image are galaxies in the protocluster, including 14 that have been detected in the new, deep Chandra image. These X-ray sources reveal the presence of material falling towards supermassive black holes containing hundreds of millions of times more mass than the Sun.

The Spiderweb protocluster exists at an epoch in the Universe that astronomers refer to as "cosmic noon". Scientists have found that during this time – about 3 billion years after the big bang – black holes and galaxies were undergoing extreme growth.

The Spiderweb appears to be exceeding the lofty standards of even this active period in the Universe.

The 14 sources detected by Chandra imply that about 25% of the most massive galaxies contain actively growing black holes. This is between five and twenty times higher than the fraction found for other galaxies of a similar age and with about the same range of masses.

These results suggest that some environmental factors are responsible for the large number of rapidly growing black holes in the Spiderweb protocluster. One cause may be that a high rate of collisions and interactions between galaxies is sweeping gas towards the black holes at the center of each galaxy, providing large amounts of material to consume. Another explanation is that the protocluster still contains large quantities of cold gas that is more easily consumed by a black hole than hot gas (this cold gas would be heated as the protocluster evolves into a galaxy cluster).

A detailed study of Hubble data may provide important clues about the reasons for the large number of rapidly growing black holes in the Spiderweb protocluster. Extending this work to other protoclusters would also require the sharp X-ray vision of Chandra.

NASA FINDS SOUND TRAVELS SLOWER ON MARS THAN EARTH

When the Perseverance rover landed on Mars in February 2021, it brought with it a suite of instruments, including the typical cameras and the less typical lasers. But it also brought something else – the first microphone to function and record on the Red Planet.

MEASURING THE SPEED OF SOUND ON MARS - Long ago, Mars lost most of its atmosphere. Once, the Red Planet's old atmosphere allowed liquid water to pool on the surface of the planet – potentially sustaining life on the surface. But thanks to the force of solar winds buffeting the planet, most of that protective atmosphere is gone now. Today, Mars is encased in a tenuous carbon dioxide atmosphere less than one percent the pressure of Earth's at sea level. This unusual (for us at least) atmosphere is what gives the Red Planet its unusual acoustic properties, the Nature paper explains.



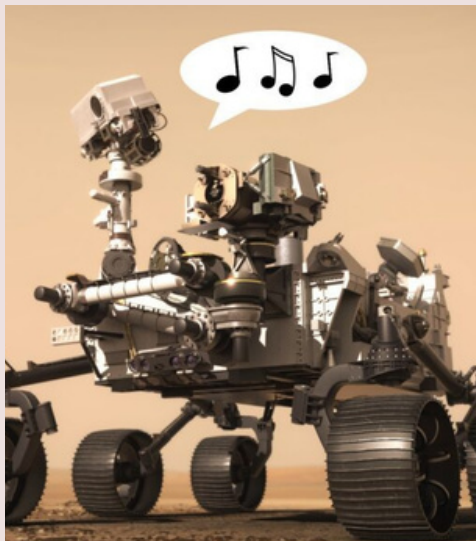
(Image credit: NASA.org)

THE DISCOVERY – Because of Perseverance's unique toolkit, for the first time, NASA scientists have the ability to listen to sounds on Mars and compare their properties. The discovery stems from scientists on Earth listening to the pew-pew of Perseverance's lasers cracking into rocks – they realized these sounds seemed governed by different laws than the sound of Perseverance's copter companion Ingenuity's rotors whirring.

Already, measurements by Ingenuity had put the speed of sound on Mars at 240 meters per second – about 100 meters per second slower than the speed of sound on Earth (347 meters per second). These sounds, according to the paper, are also 20 decibels weaker in volume than sounds on Earth.

But Perseverance's laser sounds are swifter than Ingenuity's whir. The sound of the laser pulse moves 10 meters per second faster – 250 meters per second. The reason why seems to be to do with the sounds' acoustics: The lasers are high-pitched, but the rotor whir is low-pitched.

"On Earth, the sounds from an orchestra reach you at the same speed, whether they are low or high," Maurice says in an interview with Agence France-Presse. "But imagine on Mars, if you are a little far from the stage, there will be a big delay." So you would hear the oboe far sooner than the tuba, to follow the analogy. This means future Mars astronauts could experience unusual audio dissonance – they will hear higher-pitched sounds sooner than lower-pitched sounds, even if they come from the same place.



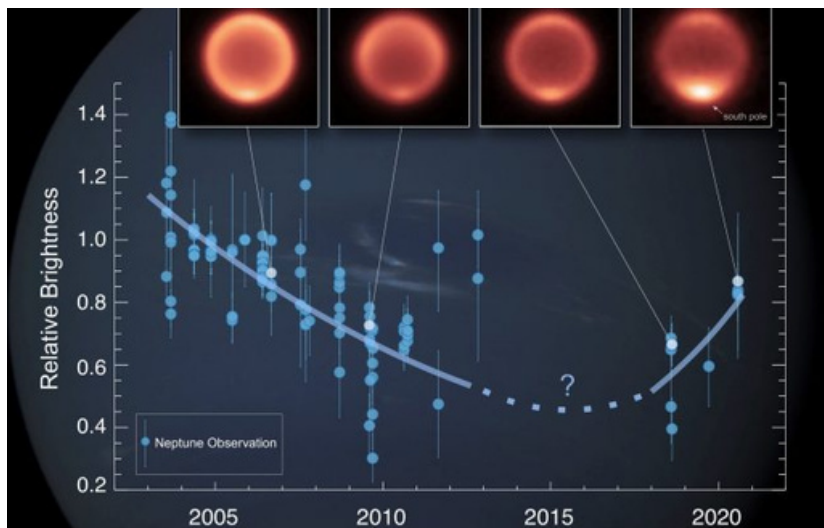
WHY 10 METERS A SECOND MATTERS – While 10m/s may not sound like much of a difference, the Centre National de la Recherche Scientifique, says it would actually cause two astronauts to have trouble understanding each other if they tried to have a conversation while both were standing just 15 feet apart.

There are a few other unusual quirks about Martian sounds – for instance, the distance sounds actually carry. According to NASA, low-pitched sounds on Mars begin to dim down at just 26 feet from their source. High-pitched sounds might not even make it that far and remain audible.

"Mars is very quiet because of low atmospheric pressure," says Baptiste Chide in a statement. Chide is a researcher at Los Alamos National Laboratory in New Mexico and a co-author of the study.

"But the pressure changes with the seasons on Mars," he adds. In Fall, the pressure changes and so sounds on the planet may be different, too.

"We are entering a high-pressure season," Chide says. "Maybe the acoustic environment on Mars will be less quiet than it was when we landed."



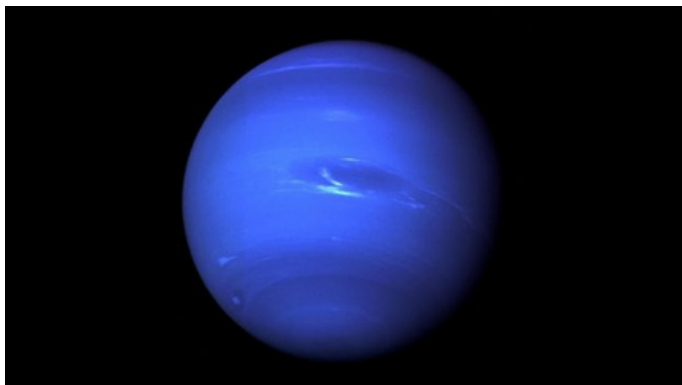
Instead of seeing the planet warm as summer dragged on, the average temperature on the planet dropped 8 degrees Celsius. That might not sound like a lot, but keep in mind the summer lasts about 40 Earth years – the temperature dropped precipitously when it was supposed to be inching upward. At the same time, the team noted a rapid increase in heat over Neptune's south pole, and that's where it's staying.

NEPTUNE IS GETTING HELLA COLD, AND ASTRONOMERS ARE FRANKLY PUZZLED

A recent analysis of nearly 20 years' worth of thermal-infrared observations has revealed that the most distant planet in our solar system is unexpectedly cooling down and scientists aren't entirely sure why.

Like Earth, Neptune has an axial tilt that causes seasonal changes on the planet. But because the planet is so far away from the sun, its seasons are much longer than Earth's. It takes Neptune 165 Earth-years to complete its orbit around the sun, meaning each season lasts roughly 40 years.

An international team of researchers looked at thermal infrared data collected by both Earth- and space-based observatories, including Chile's European Southern Observatory's Very Large Telescope and Gemini South telescope; Hawaii's Subaru Telescope, Keck Telescope, and Gemini North telescope; as well as NASA's Spitzer Space Telescope, which ended operations in January 2020.



SUN STORMS MERCURY WITH A PLASMA WAVE



A gigantic plasma wave that launched from the sun smashed into Mercury Tuesday (April 12), likely triggering a geomagnetic storm and scouring material from the planet's surface.

The powerful eruption, known as a coronal mass ejection (CME), was seen emanating from the sun's far side on the evening of April 11 and took less than a day to strike the closest planet to our star, where it may have created a temporary atmosphere and even added material to Mercury's comet-like tail, according to spaceweather.com.

The plasma wave came from a sunspot – areas on the outside of the sun where powerful magnetic fields, created by the flow of electric charges, get knotted up before suddenly snapping. The energy from this snapping process is released in the form of radiation bursts called solar flares or as waves of plasma (CMEs).

Unlike Earth, however, Mercury doesn't have a very strong magnetic field. This fact, coupled with its close proximity to our star's plasma ejections, means it has long been stripped of any permanent atmosphere. The atoms that remain on Mercury are constantly being lost to space, forming a comet-like tail of ejected material behind the planet.

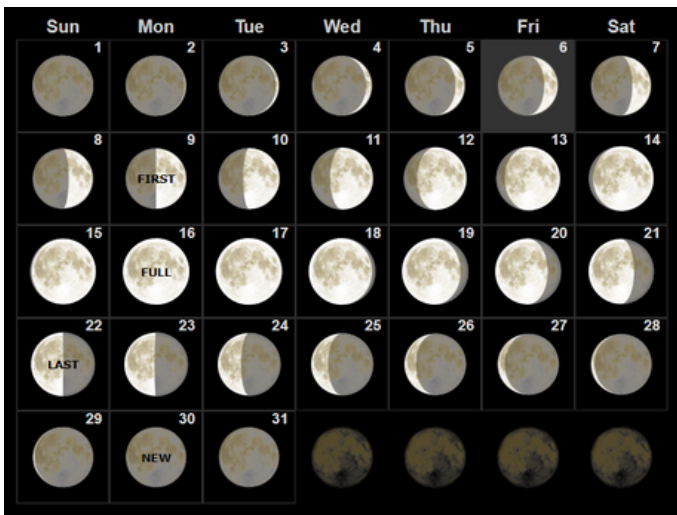
WHAT'S UP IN THE SKY - MAY 2022

LUNAR CALENDAR

IMPORTANCE OF MOON PHASES FOR STARGAZERS

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

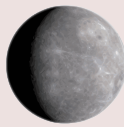
So, What Moon phase is best for stargazing? "The New Moon and the days immediately before and after new moon(Crescent phases)" are among the best times for stargazing. Whereas, The Remaining phases like Full Moon, waxing or waning gibbous, the first or third quarter Moon offer a time to zoom and witness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



PLANETS VISIBILITY

Mercury

Impressive evening planet at start of May, near the Pleiades open star cluster.



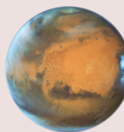
Venus

Bright morning planet, low before sunrise. Near Mars, Jupiter and Saturn throughout the month.



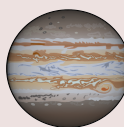
Mars

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



Jupiter

Morning planet, near Venus on 1st May and Mars on 29th May. Can be seen throughout the month.



Saturn

Prominently visible through the whole month in the eastern direction before sunrise.



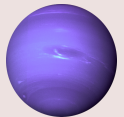
Uranus

Uranus lines up with the Sun on 5th May and not visible this month.



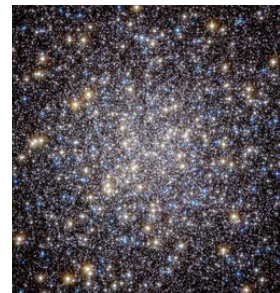
Neptune

Neptune is a morning planet, but not visible this month.



BRIGHT DEEP SKY OBJECTS

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



The Hercules Cluster in the constellation Hercules also known as M13 is considered to be the finest globular cluster in the northern half of the heavens. It's found in a star pattern called the Keystone a lopsided square between the two brightest stars of northern spring and summer, Vega and Arcturus.

The M81 and M82 galaxies are a pair of galaxies located in the constellation, Ursa Major. M81 (Bode's Galaxy) is a spiral galaxy that lies approximately 11.8 million light-years away, while M82 (The Cigar Galaxy) is an irregular galaxy at roughly the same distance away from Earth.



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

ROCKET LAUNCHES IN MAY 2022

United Launch Alliance Atlas V

DATE: May 19, 2022

VEHICLE: United Launch Alliance Atlas V

MISSION: A United Launch Alliance Atlas V rocket will launch Boeing's CST-100 Starliner spacecraft on its second uncrewed mission to ISS, following a partial failure in December 2019.

LAUNCH SITE: Cape Canaveral Space Force Station in Florida.



(Image credit: Ulalaunch.com)

CST-100 Starliner spacecraft

A United Launch Alliance (ULA) Atlas V rocket will launch Boeing's Crew Space Transportation (CST)-100 Starliner spacecraft on its Orbital Flight Test-2 (OFT-2) to the International Space Station. OFT-2 is the second uncrewed flight of the Starliner that will demonstrate the spacecraft's human transportation capabilities. This test flight is the last major step before the Atlas V and Boeing's Starliner capsule take American astronauts to the International Space Station as part of NASA's Commercial Crew Program.

Tianzhou resupply ship to the Chinese space station

DATE: May, 2022

VEHICLE: The Long March 7 carrier rocket

MISSION: Tianzhou 4, the country's fourth cargo space vehicle, is set to dock with China's Tiangong space station that has been in low-Earth orbit about 400 kilometers above the ground since April 2021.

LAUNCH SITE: Wenchang Space Launch Center.

Tianzhou

The Tianzhou is a Chinese automated cargo spacecraft developed from China's first prototype space station Tiangong-1 to resupply its modular space station.

Last month, Tianzhou 2 fell back to Earth with most of its body burnt up during reentry, while Tianzhou 3 is still connected with the station.

The Tianzhou-4 cargo vessel is set to deliver supplies for the upcoming Shenzhou-14 manned mission, which will send another three Chinese astronauts to the space station



(Image credit: CNSA)

MKA-R, top secret mission, Russian military radar satellite

DATE: May, 2022

VEHICLE: Angara 1.2

MISSION: Due to the classified nature of the MKA-R mission, no details are reported about this military radar satellite.

LAUNCH SITE: LC-35/1, Plesetsk Cosmodrome, Russian Federation.



Angara 1.2

The Angara rocket family was created in 1992 and is an entirely Russian launch vehicle. Previous Russian launch vehicles have used parts or equipment from other former Soviet Union countries. Angara 1.2 is a small-lift launch vehicle that is capable of placing 3,000 kg to LEO. The rocket has two stages, both of them use kerosene as fuel and liquid oxygen (LOx) as oxidizer.

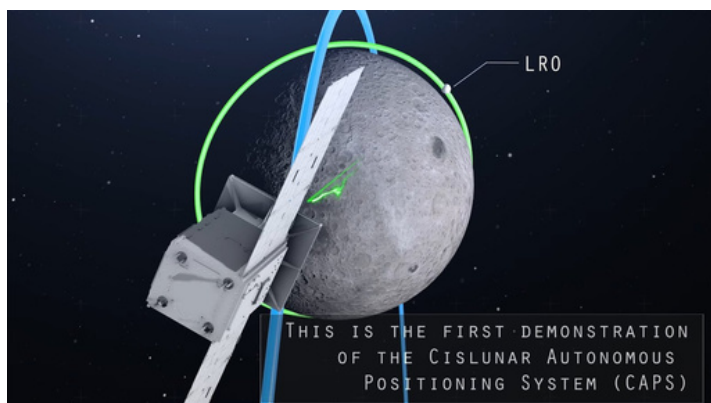
NASA's CAPSTONE Prepares to Enter Unique Orbit

CAPSTONE is commercially owned and operated by Advanced Space in Westminster, Colorado. It represents an innovative collaboration between NASA and industry to provide rapid results and feedback to inform future exploration and science missions. "CAPSTONE is a lunar orbiter that will test and verify the calculated orbital stability planned for the Gateway space station. CAPSTONE is due to launch on 5 May 2022".

A microwave oven-sized CubeSat weighing just 55 pounds will serve as the first spacecraft to test a unique, elliptical lunar orbit as part of the "Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment" (CAPSTONE). As a pathfinder for Gateway, a Moon-orbiting outpost that is part of NASA's Artemis program, CAPSTONE will help reduce risk for future spacecraft by validating innovative navigation technologies and verifying the dynamics of this halo-shaped orbit.

The orbit, formally known as a near rectilinear halo orbit (NRHO), is significantly elongated. Its location at a precise balance point in the gravities of Earth and the Moon, offers stability for long-term missions like Gateway and requires minimal energy to maintain. CAPSTONE's orbit also establishes a location that is an ideal staging area for missions to the Moon and beyond. The orbit will bring CAPSTONE within 1,000 miles of one lunar pole on its near pass and 43,500 miles from the other pole at its peak every seven days, requiring less propulsion capability for spacecraft flying to and from the Moon's surface than other circular orbits.

After a three-month journey to its target destination, CAPSTONE will orbit this area around the Moon for at least six months to understand the characteristics of the orbit. Specifically, it will validate the power and propulsion requirements for maintaining its orbit as predicted by NASA's models, reducing logistical uncertainties. It will also demonstrate the reliability of innovative spacecraft-to-spacecraft navigation solutions as well as communication capabilities with Earth. The NRHO provides the advantage of an unobstructed view of Earth in addition to coverage of the lunar South Pole.



(Image credit: NASA)



To test these new navigation capabilities, CAPSTONE has a second dedicated payload flight computer and radio that will perform calculations to determine where the CubeSat is in its orbital path. Circling the Moon since 2009, NASA's Lunar Reconnaissance Orbiter (LRO) will serve as a reference point for CAPSTONE. The intention is for CAPSTONE to communicate directly with LRO and utilize the data obtained from this crosslink to measure how far it is from LRO and how fast the distance between the two changes, which in turn determines CAPSTONE's position in space.

This peer-to-peer information will be used to evaluate CAPSTONE's autonomous navigation software. If successful, this software, referred to as the Cislunar Autonomous Positioning System (CAPS), will allow future spacecraft to determine their location without having to rely exclusively on tracking from Earth. This capability could enable future technology demonstrations to perform on their own without support from the ground and allow ground-based antennas to prioritize valuable science data over more routine operational tracking.

Mission objectives:

- Verify the characteristics of a cis-lunar near rectilinear halo orbit for future spacecraft
- Demonstrate entering and maintaining this unique orbit that provides a highly-efficient path to the Moon's surface and back
- Demonstrate spacecraft-to-spacecraft navigation services that allow future spacecraft to determine their location relative to the Moon without relying exclusively on tracking from Earth
- Lay a foundation for commercial support of future lunar operations
- Gain experience with small dedicated launches of CubeSats beyond low-Earth orbit, to the Moon, and beyond.

AURORA PROPULSION TECHNOLOGIES ANNOUNCES UPCOMING LAUNCH OF AURORASAT-1 SATELLITE

A Rocket Lab Electron rocket will launch the AuroraSat-1 mission. The launch date is currently targeted for May 2022.

AURORASAT-1

This fast pace was achieved by collaborating with SatRevolution and Momentus Space which ensured the most efficient use of our internal resources. It also gave us an opportunity to benchmark our vast network of New Space connections.

AuroraSat-1, a 1.5U CubeSat, launches to Low Earth Orbit in early 2022. The satellite's primary payloads are ARM-A and APB modules. We're proud that these modules are true to our original goal of providing reliable, volume and weight efficient propulsion and deorbiting capabilities.

ARM-A - Worlds smallest water thruster for satellite maneuvering

Aurora Resistojet Module is a product line that gives a spacecraft propulsion-based mobility control. AuroraSat-1 includes a small version of our attitude control variant of Aurora Resistojet Module. This module consists of 6 resistojet thrusters giving the CubeSat speedy detumbling capabilities and full propulsion-based attitude control. The propellant is a water-based mixture with a freezing point of well below negative 10 degrees centigrade.

APB - Plasma brake for deorbiting responsibly after the mission

Aurora Plasma Brake is a revolutionary deorbiting device. Plasma brake does not use any propellant, instead it utilizes the interaction of ionospheric plasma and a charged microtether to generate Coulomb drag. This is similar to atmospheric drag-based devices, but unlike them, microtether is safe to other spacecraft and the Coulomb drag is orders of magnitude stronger than atmospheric drag. This difference in deaccelerating forces is even larger as the orbital altitude increases. AuroraSat-1 includes a twin Aurora Plasma Brake module, which has for testing purposes two independent deployable spools of microtether in addition to all the control electronics. We are confident that this technology will be a gamechanger in the deorbiting area especially on orbits where aero drag deorbiting is infeasible.



(Image credit: Aurorapt.fi)

SPACE POCKET IS RIDE-SHARING WITH AURORASAT-1

AuroraSat-1 has an extra passenger: the Space Pocket is a revolutionary ride-sharing solution for sending samples into Earth orbit for inspiration and for science! The AuroraSat-1 mission is also Space Pocket's maiden voyage: we carry a carefully selected test payload into space! Non-space companies can send their product into space sustainably by ride-sharing in a real satellite. Space Pocket has been developed by Avaru Space in collaboration with Aurora Propulsion Technologies.

AURORASAT-2

AuroraSat-2 mission is for customer IOD in LEO onboard a 3U satellite, also the newest generation of ARM-C integrated for In-Orbit Demonstration.



(Image credit: Nanosats.eu)



(Image credit: NASA.gov)

Boeing Orbital Flight Test 2

The Boeing Orbital Flight Test-2 is a planned repeat of Boeing's failed first Orbital Flight Test of its Starliner spacecraft. The uncrewed mission is part of NASA's Commercial Crew Program. The Starliner OFT-2 mission is planned to last five days, during which the Starliner spacecraft will demonstrate rendezvous and docking capabilities with the ISS, followed by undocking and landing in the White Sands Missile Range.

This is the first flight of Starliner after the December 2019 OFT-1 flight failed to rendezvous with the station due to software problems. On 6 April 2020, Boeing announced that they would repeat the Orbital Flight Test to prove Starliner meets all of the contractually required test objectives. Boeing proposed another uncrewed flight test of the spacecraft's systems and NASA accepted the proposal from Boeing as part of the original fixed-price contract, at an estimated out-of-pocket cost to Boeing of US\$410 million. The mission was planned to use the hardware, Starliner spacecraft, and Atlas V originally planned for use on the Boe-CFT crewed flight test. OFT-2 was scheduled to launch on 30 July 2021, but an unrelated problem at the ISS delayed the schedule to 3 August. Starliner valve problems occurred prior to the 3 August attempt and were later determined to be so serious that the launch was delayed indefinitely. NASA and Boeing plan to launch OFT-2 on 19 May 2022.

Payload: The capsule will carry approximately 245 kg (540 lb) of supplies and test equipment to simulate future missions with astronauts and their cargo on board.

Mission: The second Atlas V N22, designated AV-082, was intended to launch the Starliner spacecraft on its second uncrewed test flight to the International Space Station. The capsule is intended to dock with the space station, then return to Earth to land in the Western United States after an orbital shakedown cruise ahead of Boeing Crewed Flight Test.

OFT-2 is the second flight of an Atlas V without a payload fairing and with a dual-engine Centaur upper stage. The dual-engine Centaur uses two RL10s and is required for Starliner flights in order to provide a launch trajectory that allows a safe abort at any point in the mission.

Boeing modified the design of the Starliner docking system after the OFT-1 flight, adding a hinged re-entry cover for additional protection during the capsule's fiery descent through the atmosphere similar to the one used in the SpaceX Dragon 2 design. This will be tested on the OFT-2 mission.

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

ASTRONOMICAL EVENTS - MAY 2022

ETA AQUARIDS METEOR SHOWER

The Eta Aquarids peak during early-May each year. Eta Aquarid meteors are known for their speed. These meteors are fast-traveling at about 148,000 mph (66 km/s) into Earth's atmosphere. Fast meteors can leave glowing "trains" (incandescent bits of debris in the wake of the meteor) which last for several seconds to minutes. In general, 30 Eta Aquarid meteors can be seen per hour during their peak.



(Image credit: Earthsky.org)



(Image credit: Timeanddate.com)

Where Do Meteors Come From?

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

The Comet

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

Comet Halley takes about 76 years to orbit the sun once. The last time comet Halley was seen by casual observers was in 1986. Comet Halley will not enter the inner solar system again until 2061.

Comet Halley was discovered in 1705 by Edmund Halley. Edmund Halley predicted the orbit of the comet through past observations of comets, suggesting that these sightings were in fact all the same comet. Halley is perhaps the most famous comet—it has been sighted for millennia. This comet is even featured in the Bayeux tapestry, which chronicles the Battle of Hastings in 1066.

The Radiant

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

Viewing Tips

The Eta Aquarids are viewable in both the Northern and Southern hemispheres during the pre-dawn hours. The Southern Hemisphere is preferable for viewing the Eta Aquarids. The Northern Hemisphere has an hourly rate of only about 10 meteors. This is due to the viewing location of the radiant from different latitudes.

The constellation of Aquarius—home to the radiant of the Eta Aquarids—is higher up in the sky in the Southern Hemisphere than it is in the Northern Hemisphere. In the Northern Hemisphere, Eta Aquarid meteors can more often be seen as "earthgrazers." Earthgrazers are long meteors that appear to skim the surface of the Earth at the horizon.

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

TOTAL LUNAR ECLIPSE OF MAY 16, 2022

A total lunar eclipse will take place on 16 May 2022, the first of two total lunar eclipses in 2022. A second eclipse will happen on 8 November. The eclipse will be a dark one with the northern tip of the Moon passing through the center of the Earth's shadow.

Lunar Eclipse Basics

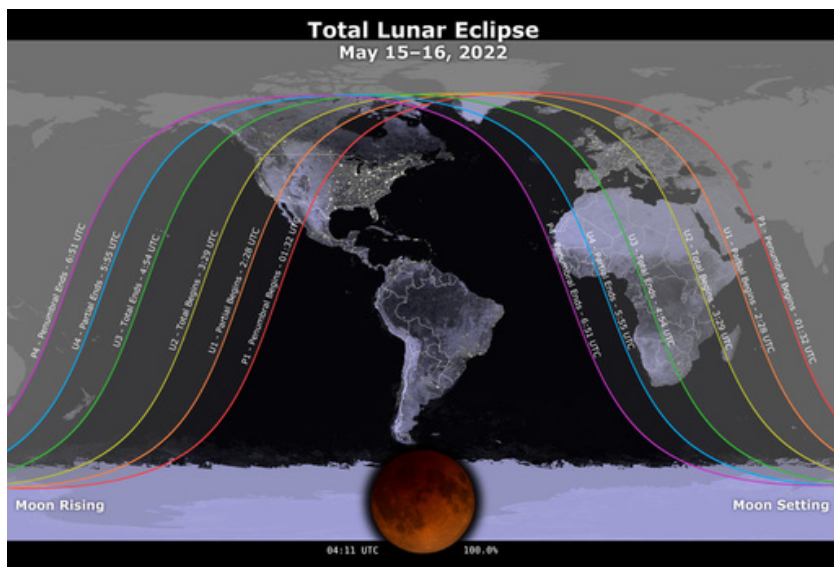
When the Sun shines on our planet, the Earth casts a shadow into space. When the Moon's orbit intersects with the Earth's shadow and passes through it, this is known as a lunar eclipse. A lunar eclipse only happens when the Moon is at the full Moon lunar phase.

Before diving into the three different kinds of lunar eclipses, let's break down the different parts of Earth's shadow; the lighter outer part is known as the penumbra, and the darker inner part is known as the umbra.

A penumbral lunar eclipse occurs when the Moon passes through the lighter outer part of Earth's shadow. Oftentimes the Moon appears a bit more tan in color, but it can sometimes be hard to notice a color change.

A partial lunar eclipse occurs when the Moon passes part-way into the darker inner area of Earth's shadow. However, the Moon is not fully eclipsed just yet! It usually looks like our friendly neighborhood space rock has a bite taken out of it that grows progressively larger as the eclipse approaches totality.

"A total lunar eclipse occurs when the Moon is fully engulfed by the Earth's shadow. Once totality begins, the Moon can appear reddish due to our atmosphere scattering away the bluer rays of the Sun's light, just like the Sun appears reddish right before sunset".



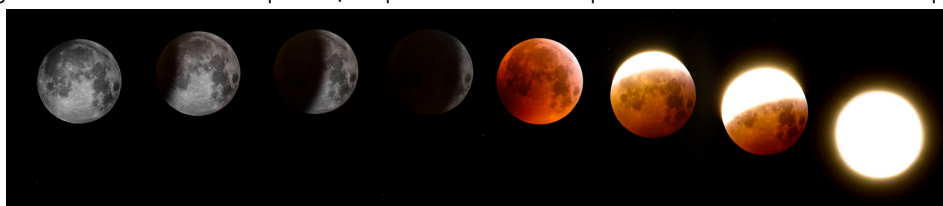
(Image credit: NASA.gov) The eclipse will be completely visible over most of North and South America, seen rising over Northwest North America, and the Pacific Ocean, and setting over Africa, and Europe.

The eclipse will be a dark one with the northern tip of the Moon passing through the center of the Earth's shadow. This is the first central eclipse of Saros series 131.

Saros 131

Lunar Saros series 131, has 72 lunar eclipses. Solar Saros 138 interleaves with this lunar saros with an event occurring every 9 years 5 days alternating between each saros series.

This eclipse series began in AD 1427 with a partial eclipse at the southern edge of the Earth's shadow when the Moon was close to its descending node. Each successive Saros cycle, the Moon's orbital path is shifted northward with respect to the Earth's shadow, with the first total eclipse occurring in 1950. For the following 252 years, total eclipses occur, with the central eclipse being predicted to occur in 2078. The first partial eclipse after this is predicted to occur in the year 2220, and the final partial eclipse of the series will occur in 2707. The total lifetime of the lunar Saros series 131 is 1280 years. Solar Saros 138 interleaves with this lunar saros with an event occurring every 9 years 5 days alternating between each saros series. Lunar Saros series 131, repeating every 18 years and 11 days, has a total of 72 lunar eclipse events including 57 umbral lunar eclipses (42 partial lunar eclipses and 15 total lunar eclipses).



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 Venus and Jupiter

Date: 1st May, Venus and Jupiter will be seen only 0.25° apart in the dawn sky. It is an opportunity to see both planets in the same telescopic field.



(Image credit: Stellarium)

Conjunction of Venus, Mars, Jupiter and Saturn

Date: 18th May, planets such as Venus, Mars, Jupiter and Saturn will align at almost Equidistant distance before sunrise. Perfect day to capture the planets and observe.



(Image credit: Stellarium)

Conjunction Mercury and Pleiades

Date: 1st & 2nd may, Mercury sets approximately two hours after the Sun at the start of may, that time it will appear near to the Pleiades open star cluster.



(Image credit: Skyatnight.com)

Conjunction of Mars and Jupiter

Date: 29th May, Mars will meet Jupiter in the constellation Pisces. Jupiter will shine brightly at a magnitude of -2.3, so you can observe it easily with the unaided eye. Mars will be a bit dimmer with a magnitude of 0.7.



(Image credit: Stellarium)

STUDENT'S CORNER

The Sphere of Astronomy

Agrata Gupta

iAstronomer member, Space India.

What is Astronomy and why study it?

Many of you must have counted stars in your childhood and wondered.... what can be the possible limit? Where are the boundaries of this expanse above us? If there are more planets like us then where are they? Can we have friends in this vast expanse who could be like us and who could be friendly neighborhoods? If they are not there, can we create neighborhood planets? And, if we are alone then what's our significance in being so unique? Are we also transplanted from some other planet?

So many questions have been baffling scientists and humans alike for so many years. So, here comes a science dedicated to answer these questions in methodical way making breakthrough advancements over a period of time which is called Astronomy. Astronomy is one of the oldest sciences and according to sciencedaily.com, "Astronomy is the scientific study of celestial objects (such as stars, planets, comets, and galaxies) and phenomena that originate outside the Earth's atmosphere (such as the cosmic background radiation). It is concerned with the evolution, physics, chemistry, meteorology, and motion of celestial objects, as well as the formation and development of the universe." So clearly, there is much more to astronomy than possibly we can think of.



The Diverse Fields of Astronomy

Astrophysics: Applying the laws of physics in space

Astrometry: Mapping celestial bodies

Astrogeology: Examining rocks, terrain and material in space

Astrobiology: Searching for life outside Earth

We can divide astronomy into 4 sub-fields:

And we can categorize into 17 branches of astronomy.

Astrophysics - How the laws of physics apply to stars and celestial bodies.

Cosmology - How the universe was created, evolved and its ultimate fate.

Spectroscopy - How light reflects, absorbs and transfers between matter.

Photometry - How luminous astronomical objects are in space based on electromagnetic radiation.

Heliophysics - How the sun's constant and dynamic radiation affects its surroundings in space.

Helioseismology - How the interior structure and dynamics of stars are composed by observing waves from its surface.

Asteroseismology - How to study the internal structure of stars from observing their oscillations.

Astrometry - How celestial bodies are positioned and move in space.

Planetology - How planets form in the solar systems including their composition and dynamics in history.

Exoplanetology - How many and where planets exist outside our solar system.

Astrogeology - How geology relates to celestial bodies like moons, asteroids, meteorites and comets.

Areology - How geology is composed on Mars.

Selenography - How physical features on the moon formed such as lunar maria, craters and mountain ranges.

Exogeology - How geology relates to celestial bodies like moons, asteroids, meteorites and comets.

Astrobiology - How life in the universe evolved, originated and what will be its fate.

Exobiology - How likely and where is life in space.

Astrochemistry - How to study substances in celestial bodies, stars and interstellar space.

The Sphere of Astronomy

Opportunities for Astronomers

There are four major employment pathways for people who are interested to study space sciences in the future.

1. Academia

Numerous astronomers work as professors in diverse number of higher education institutions as a teacher as well as a researcher.

According to the American Astronomical Society (AAS) approximately 55 percent of professional astronomers work as faculty members at colleges and universities.

Astronomy professors do not have to just teach, they also get to do a lot of research work within the University of their own. Observational astronomers, for example, spend 10 to 30 nights per year acquiring observations through spacecraft and massive telescopes, the rest of their days are spent in analyzing this data that they have collected. Theoretical astrophysicists on the other hand, may not even work with observing equipment but conduct a great deal of their astronomy research using supercomputers. Most of the work for an astronomer in this section, mainly consists of analyzing data, interpreting observations, or planning observational programs.

2. The government, observatories, and laboratories

Government and laboratory based research is the second most common pathway taken by people interested in Astronomy. These jobs are quite similar to the academic based jobs and also require a PhD in astronomy usually, for a good job offer.

But, it is also quite different from the academic field in many ways. Astronomers employed in this sector are generally conducting research defined by their employers as opposed to their own personal interest. Another key difference between academia and this section is that the teaching component is not involved at all.



3. Private Sector

Approximately ten percent of astronomers work in the private sector

. In addition to aerospace companies -- which need astronomers to stay ahead of the competition-- consulting firms also hire astronomers, often to fill government contract positions. They generally design and manufacture everything from telescopes to space probes, write software, and do many other tasks in support of governmental labs and space missions, ground-based observatories, and data processing/management offices. These private companies need astronomers who understand and "speak the language" of the customer -- be it a university, governmental or federal agency -- and who can translate the customer's science requirements into technical requirements and specifications as spoken by the AAS.

While employment may be less secure in the private sector due to lack of tenure, this is usually made up for by the promise of higher compensation. Additionally, astronomers without PhDs may find more options in the private sector.

4. Public Sector

Astronomers bring the professional knowledge of the universe to the common public. They do this in a variety of different settings, including everywhere from planetariums and science museums to secondary school teaching and science journalism. Strong communications skills, astronomy knowledge, and a talent for the written words can also be valuable attributes for professionals in these fields. Many professional astronomers employed in the public sector find this work to be uniquely fulfilling.

The Sphere of Astronomy

Astronomy in India

There are various astronomical institutions in India which hire astronomers as professors and employees. Generally these opportunities are provided by Indian Universities as well as governmental institutions such as ISRO and DRDO. People who graduate from India in these field can also get a job at NASA if they have experience and knowledge regarding sophisticated astronomical instrumentation and expertise in computer programming, data handling and other valuable assets along that line. The numerous job roles under this field in India are Astronaut Research Scientist, Astronomy University Faculty and many more.

Astronomy courses offered in India

There is no university in India that offers an undergraduate program in Astronomy. At the Master's and PhD levels, there are several options. Interested people must have B.Sc. in Physics, Chemistry, Mathematics or B.E in Physics or Engineering subjects and apply for a Master's degree program in one of the Indian Institutions.

Top universities in India that offer Astronomy courses

Indian Institute of Astrophysics, Indian Institute of Science Raman Research, Institute Inter-University Centre for Astronomy and Astrophysics, National Centre for Radio Astronomy.

“Asteroid Mining”

Sourajit Mandal

iAstronomer member.

Have you ever thought of making a house with diamonds just to make it stronger? What about owning a private space-station? Or what about never paying an electricity bill but using electricity to its fullest.

Well, these are only a part of some miniscule luxury we can get from asteroid mining.

Asteroid mining is the process of mining asteroids, minor planets and near-Earth bodies for useful materials.

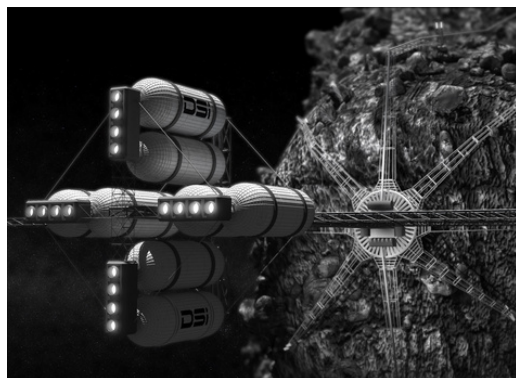
There are 3 types of asteroids:

1.C-type: These are near the sun and mainly made up of Carbon. Traces of oxygen, hydrogen and nitrogen is also found.

2.S-type: These are found far from the sun. These are made up of silicon and oxygen, the most abundant element in the Earth's crust.

3.M-type: These are rich in metals. They are composed of 80% Iron and 20% other metals like gold, nickel, magnesium, platinum and precious metals like osmium, ruthenium, rhodium.

Of the 9000 asteroids located so far according to the NEO database, researchers have only found 12 asteroids that have favorable conditions to mine with the present technology.



It is not as easy task to mine an asteroid. The steps thought so far are:

- 1.Send a space craft to the located asteroid.
- 2.Use thrusters or lasers to slow the asteroid down.
- 3.Shoot the asteroid near the moon to get it into a stable orbit around Earth. This is also the most dangerous step.
- 4.Send another spacecraft with facilities to mine and extract the metal ores from the asteroid.
- 5.Send the collected materials for further use.

Though these steps seem to sound practical, researchers and scientists have faced many challenges. On June 2010, the Hayabusa mission, followed by a second mission, Hayabusa 2 in December 2014 did return with samples of materials collected from near Earth asteroid 162173 Ryugu. However, both the missions conducted were highly expensive. With the huge expenses reaching millions of dollars, the approximate material collected was only 1 gram. Moreover, there have been some failed missions as well.

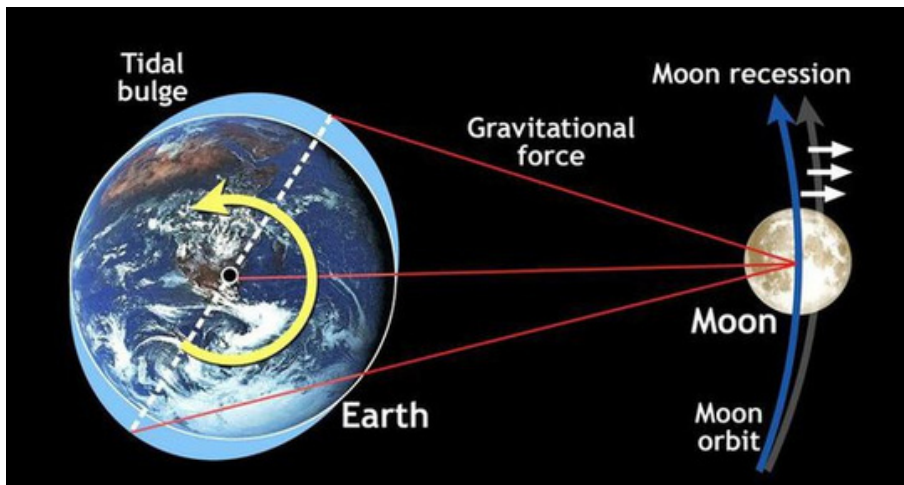
With more research and scientific developments, if cost-effective infrastructure can be built, we can reduce the amount spent in such missions. We can look forward to more successful asteroid mining missions for terrestrial use. This attempt will help to save Earth from the environmental hazards caused by mining minerals and ores from the Earth's crust. Perhaps then, we can also make our lives more luxurious!

Is our Moon going away from Earth?

Vilesh M Panchapeeta
iAstronomer member.

Introduction about Moon: Moon is our natural satellite of the earth. We all know it, but do you know that what work do Moon do for our earth? If no this is for you only, today I am telling you the importance of the Moon. So, lets begin.

How does waves form: In the sea, ocean Waves forms. The waves are formed by Moon. waves form by moon's gravity. It happens by the tidal force of moon's gravity In the image as you can see that because of moon's gravity earth water is going go Towards Moon. In the east and west side where the water's quantity is more, their will be more waves and, in the north, and south places the waves will be less compared to the east and west. As moon moves in it's orbit the waves in different places change. As the tidal force change with the moons Revaluate in its orbit. so, you got to know how waves form in ocean If you think if moon will only give tidal forces you are wrong. Even Sun put tidal force bit. Not too much like moon because it is too far from the earth. Moon is near the earth.



Is moon going away from the earth? If yes why?

Moon put force of earth so that earth maintain Its orbit it also put force On moon. Earth is Massive than moon, Heavier than moon, means earth put more Force now moon is not Stable in its orbit. It is going 3 cm away every year. In the up coming 2 to 3 million years leader moon will be no more for earth it will cross earth's gravitational field. If you think 3.78cm (1.48in) per year is too slow, yes. Its slow but one day in will go out of our earths gravitational field. Moon will start to reevaluating sun and become a planet or a draft planet etc. With in some million years the moon will be not there inside the earths gravitational field.

No Moon is equal to No Life!! Is it true?

If you don't know that if no moon no life. But how? Is moon so important for life? Yes. These are some examples for moon that moon is the reason of life existed on earth till now.

- 1) Moon reflect the light from the sun and provide some light at night, now if moon is not there the night will be darker. The animal like owl that hunt at night the moon give the light to the owl, which is efficient for it. If no moon the owl will get extent.
- 2) The moon forms the waves, if no moon no waves. But sun put the tidal force too. But it is not too efficient to form waves.
- 3) But the marine animal that depend on ocean current (waves) will die.! And get extent for ever! means we can't see that animals.
- 4) Moon pull earth and from that our rotation speed will be less. If no moon the earth will start spinning fast, there to four times faster. From that 1 day will be 6 hours to 8 hours in a day from the fast rotation. The wind will be at 480 km per hour means if a with start to move now it will reach 480 km away. It is so strong as all humans will also fly with it & death.
- 5) Earth is tilted 23.5 degree by moon also If there is no moon the axes will fluctuate, and the season will be not like now it would change.
- 6) And moon is proacting us by comet, meteoroids, etc. and the dark spot in moon is of the asteroid fall!

Conclusion:

So, moon is our most important thing on the earth for the life. The small moon the 1/4th of the earth size. It is the most important thing of the earth. Like a small brother of the earth. Moon is moving 3 cm per year. We can't stop it, but we can enjoy our moon now because it is near to earth now!

Life on Saturn's Moons

Badrinath Viswanathan

iAstronomer member.

Is there life out there? is a question that has fascinated and haunted us constantly through the years. Was this one desolate lonely rock among billions of others graced upon by life? Are we really so special and lonely?

This curiosity is a trait shared by us all, right from when we learnt that the Earth was far from being the only planet in which Sun rises and that the Sun was just one among billions of other stars glistening in the night sky. It was a curiosity that bound us humans and helped us move forward. With each new planet or star being discovered, we felt a tiny hinge of hope and awe. Poets, authors and actors exhibited the shared hopes in plays, novels, movies and music.

While we are still searching for life in space, Saturn's largest moon Titan carries colossal hope among scientists for life or potential habitat.

Earliest Life in our Planet

4.3 billion years ago, the Earth was still ravaged by its final stages of its formation that life could not have yet come. Massive collisions were melting the surface, turning the oceans into steam and driving any atmosphere that had accumulated off into space. So around 4 million years ago, a very narrow window of only 100 million years wide, our distant ancestors came to be.

The building blocks of all terrestrial life are organic molecules of which the most important are the amino acids (proteins) and nucleotides (DNA). And organic molecules were far easier to make in some atmospheres than in others. From our fragile knowledge and predictions, labs across the world have tried to replicate the early atmosphere, supply energy and measure the number of organic compounds produced.

But what we needed was a real world to study. One with hydrogen-rich atmosphere, an energy source along with process similar to ones observed on Earth and have or can have the basic organic compounds.

Turning towards Titan

Discovered in 1665 by the Dutch Astronomer Christiaan Huygens, Titan was the first known moon of Saturn. It was a dot of light, a billion miles away. Named after the immortal race of giants from Greek mythology,

almost nothing more of it was discovered for the next 3 centuries except for the fact that it had a curious orange hue. Through the Voyagers 1 and 2 launched in the 1980s we found that the air on Titan is mainly made of Nitrogen (like Earth) along with the organic compounds- methane and tholins. Methane is the simplest molecule from which most of the organic molecules are generated. Finding these simple organic molecules in Titan's upper atmosphere, even if it was only a part per million or billion, was tantalizing. Titan is still the only moon we know of, with a substantial atmosphere.

No world is a perfect replica of any other and Titan was wildly different from primitive Earth as well. The most obvious being the temperature and the energy source. Being so far from the Sun, its surface was far below the freezing point of water. Plainly, there can be no oceans of liquid water on Titan.

Cassini-Huygens

Cassini-Huygens launched in 15th October 1997 intended to view the ringed planet, its ring and its moons. The Huygens probe reached its destination in 2004.

While oceans of liquid water are impossible on Titan, oceans of liquid hydrocarbons are not. Oceans, rivers and seas of hydrocarbons must have accumulated over the lifetime of Titan and were found to be lying beneath the clouds. Because methane exists as a liquid on Titan, it also evaporates and forms clouds, which occasionally causes methane rain. Huygens saw dry shorelines reminiscent of Earth. Large areas of Titan's surface were covered with sand dunes made of hydrocarbon.

But the most startling of all discoveries was that Titan has a surface of hard water ice covered by oceans and lakes of hydrocarbons and possibly a sub-surface of liquid water.

More mysteries and Dragonfly

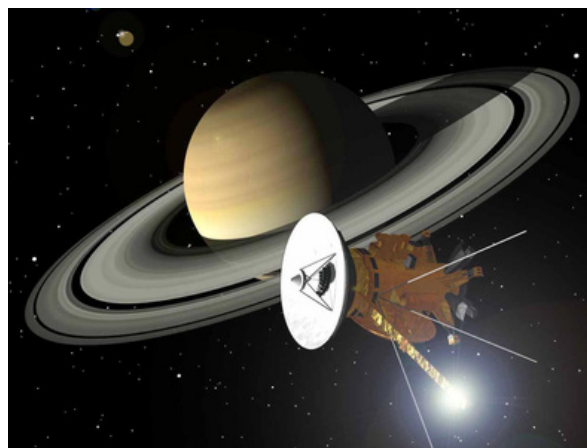
Immense quantities of organic molecules were found to be sedimented on to the surface of Titan including the tholins. In previous laboratory experiments, tholins like these were exposed to liquid water and over time developed into biologically significant molecules like amino acids and nucleotide bases of RNA.

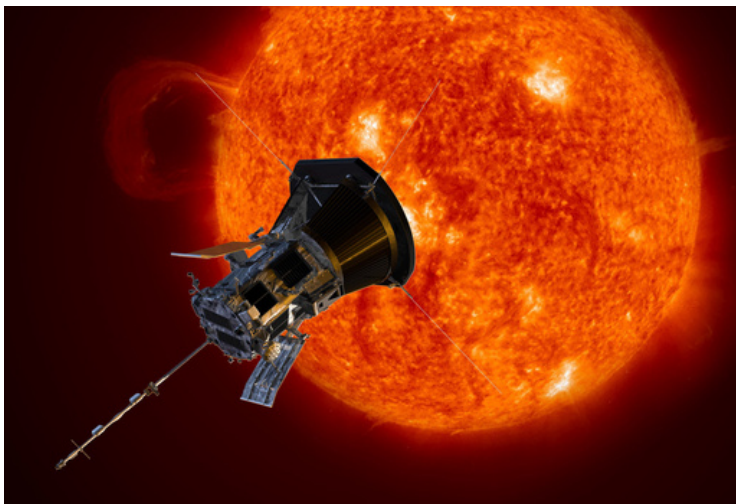
Scientists believe that the tholins could coat the "rocks" of water ice at Titan's surface and could possibly seep through the crust, to the sub-surface. Titan's subsurface ocean might be a place where life as we know could exist. But its surface lakes and seas might be places to look for life as we don't know.

We are made up of 70% of water and all of the biological processes taking place within us is mainly driven by it. But Titan could harbour methane-based cells. A new type of methane-based, oxygen-free life form that can reproduce similar to life on Earth is currently being modelled by a team of Cornell University researchers while they wait for more data.

Conclusion

At Saturn's largest moon, Cassini and Huygens showed us one of the most Earth-like worlds we've ever encountered, with weather, climate and geology that provide new ways to understand our home planet. I was extremely intrigued of this giant moon after reading the book *Pale Blue Dot* by Carl Sagan, the scientist who led most of the discoveries of Titan in the 1980s. And though the book was published in 1994, way before the Cassini was even launched, it gave me enough enthusiasm to catch up on the findings of the next 2 decades over 2 days after finishing the book. As a reverent student of science and a passionate reader of science fiction, Titan made me aware of my small timely life here on Earth.





Parker Solar Probe

Dia Kalra

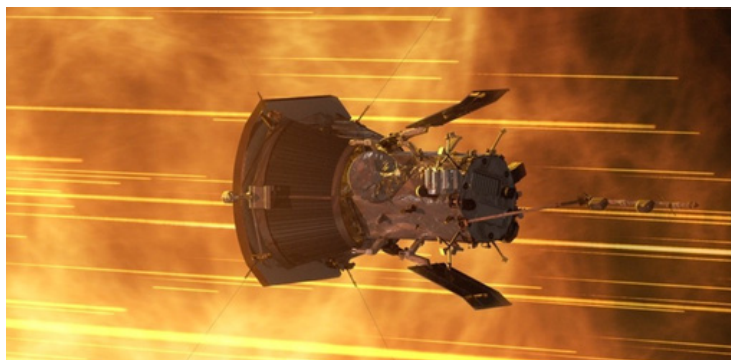
iAstronomer member.

What if I tell you that a machine can be positioned at a place with temperature as high as the sun, you'd laugh at me won't you? Not just you, even I would have considered this a merry child's imagination but on 28th April 2021 this mere thought became a reality.

NASA spacecraft 'touches' the Sun for the first time, "NASA Enters the Solar Atmosphere for the First Time, Bringing New Discoveries", such unforeseeable headlines were flashed on every digital screen when NASA's Parker Solar Probe "touched" the sun - about 8.1 million miles from its surface.

Launched Aboard the World's Second Most Powerful Rocket, Parker Solar Probe is revolutionizing our understanding of the Sun, where changing conditions can propagate out into the solar system, affecting Earth and other worlds. Parker Solar Probe travels through the Sun's atmosphere, closer to the surface than any spacecraft before it, facing brutal heat and radiation conditions to provide humanity with the closest-ever observations of a star.

Flying into the outermost part of the Sun's atmosphere, known as the corona, Parker Solar Probe employs a combination of in situ measurements and imaging to revolutionize our understanding of the corona and expand our knowledge of the origin and evolution of the solar wind. It also makes critical contributions to our ability to forecast changes in Earth's space environment that affect life and technology on Earth. Solar winds and solar flares - swift eruptions of solar radiation - can affect electrical grids and disrupt communication networks on Earth, and the new data from the probe provides an unprecedented glimpse into these solar events.



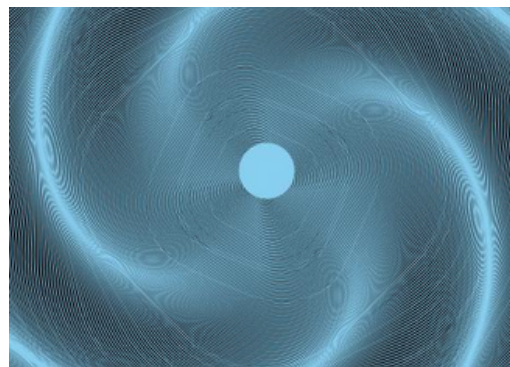
Data collected by Parker Solar Probe in the corona reveals the sun as it's never been seen before, which will help scientists to better understand the roiling forces that generate the enormous quantities of energy powering our sun and other stars. The one who had the wildest imagination in the room received the recognition he deserved.

The Parker in Parker Solar Probe honors astrophysicist Eugene Parker who, in the 1950s, was the first to theorize that the Sun emitted a flow of particles and energy we now call the "Solar Wind." Carrying a million little dreams in its honeycomb chamber, the Parker solar probe has become the true embodiment of the quote "The best way to predict the future is to create it"

Simulating the process of celestial bodies

iAstronomer member.

Have you ever wondered what neutron/ black hole stars merge looks like? Well, there are many simulations and theories involving a lot of complex mathematics. However, using software such as processing, one can simulate the events that are difficult to imagine by human minds. Unlike the other branches of science, predicting the cosmology events costs a lot in the universe, for instance, the speedy moving asteroid coming towards the Earth.



(Neutron star Simulation by iAstronomer member)

In my opinion, processing software is a platform that has a potential to facilitate the researchers to analyze the events by simulating them without need of supercomputer. I always felt graphs as outdated way of representing the information. In contrast, simulation is an innovate way to understand the astronomical process and helps us to see the big picture. For example, checking the possibility of tidal locking between celestial planets.

Although this software wasn't used for this purpose in first place, after experimenting, I realized the true potential of simulation using p5.js. First and foremost it easily to use, and almost instant compiling makes it great choice for astronomical simulations. Developing the functions or libraries might help humans to understand the cosmos better.

Supernova: Most picturesque celestial event

Navya Kiran

iAstronomer member.

A supernova is the most powerful explosion of space caused by the detonation of a massive star. Its deadly radiation can go up to 8 miles per second and can kill anything distant 50 light-years away from it. Our Solar System stretches only 2 light years. That means a Supernova's blast can affect up to 25 Solar Systems in a row. In 1929, two famous astronomers Walter Baade and Fritz Zwicky coined the term "Supernova". This signifies the large and bright (super) temporary new star (novae).

How does a Supernova occur?

A Supernova occurs when a star is at its ending point. During this time, a star which is 100 times bigger than our sun goes KABOOM!! and become a black hole or a neutron star. It occurs by any of the two mechanisms.

1. Sudden gravitational collapse: huge stars burn huge amounts of nuclear fuel at their cores. This creates tons and tons of energy, and the centre gets burning hot. The heat generates pressure, and that pressure prevents the star from collapsing. A star is maintained due to the balance between two opposite forces. The gravitational force squeezes the star into its shape contrasting the outward pressure caused by the nuclear burning core. When the massive star is out of fuel, it cools down. Thus, Gravity wins and the star suddenly BANGS! It happens so explosively that it creates gigantic shock waves which force the outer part of the star to collapse!
2. Collision with a white star: Supernova happens when two stars circle each other and one of those stars is an Earth-sized white dwarf. A white dwarf is a small star of the size equivalent to our sun that runs out of fuel. If one white dwarf collides with another one, the white dwarf can explode producing Supernova.

How's a Supernova important to us?

It is important in four ways to our universe:

1. It is a major source of elements in the interstellar medium like Nickel, Iron, oxygen, Neon, Hydrogen, and Helium. It varies according to different types of supernovas.
2. Remnants of many supernovas consist of many compact objects which trigger the formation of molecular clouds which are sites of new stars and planets orbiting around them.
3. It also produces cosmic rays and gravitational waves.

This celestial event is usually visualized by modern astronomical telescopes. The most recent naked-eye supernova in a milky way was SN 1987 on 24th February that year due to the explosion of a large supergiant star.

According to the Hubble Space Telescope, astronomers say that there's likely to be a Supernova blast in the year 2037. This is likely to be produced by the collapse of red supergiant's.

Conclusion: A supernova is the greatest picturesque celestial event in the life cycle of a huge star. It is not only the source of nuclear ions, elements, and rays in the universe but also affects the components of rocks and water bodies.



Supernovas that have happened so far:

- A. SN 1006= May 1, 1006
- B. SN 1054= July 4, 1054
- C. SN 1604= October 9, 1604
- D. SN 1987= February 24, 1987 (Most recent)

Fun-Fact Time!

- Did you know that these marvellous things are so bright, that they can light the whole universe for weeks or even months!
- The supernova occurs about three times every century in the whole universe inclusive of other galaxies
- Not all stars collapse. Stars which are equivalent to the size of our sun can only turn into a white dwarf. Only the stars that are 100 to 1000 times bigger than our sun can collapse. So, our sun will never collapse!
- Did you know that the Supernova radiations carry some elements like iron which embeds in the deep-sea rock of the Pacific Ocean. Also, nitrate ions found in Antarctic ice are thought to be secondary to one of the earliest supernovas in 1006 and 1054.

Kepteyn-B 'The new planet in which we could live'

Krithik.r

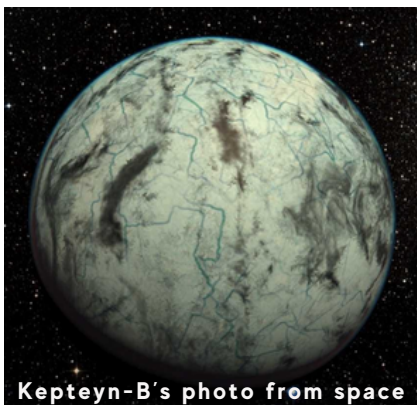
iAstronomer member.

We might wonder, isn't another planet to live other than Earth. But actually, there are few planets in which there are possibilities to live! Astronomers have discovered what appears to be the oldest known alien world that could be capable of supporting life, and it's just a stone's throw away from Earth. The story of this planet - Anglada-Escude was referring to Kapteyn B and its newly discovered sister world, Kapteyn C. These planets orbit the star known as Kapteyn's star.

Kapteyn-B is a planet much bigger the Earth in size. While researching, we came to know that Kapteyn-C is too cold. These 2 astronomers spotted these planets by noticing their tiny wobbles of gravitational induced in the motion of Kapteyn star. These tugs caused some shift in the star's light which were discovered by the HARPS spectrometer which is located at the La Silla observatory in Chile. The team did not expect to find a habitable planet around Kapteyn's star! This planet was so close to Earth that it was visible in amateur telescopes! Anglada-Escude said that "we were surprised to see planets orbiting Kapteyn's star". Previous data's showed some moderate excess of variability, so we were looking for very short-period planets when the signals showed up loud and clear.

The kepteyn's star originally belonged to a dwarf galaxy that our own Milky Way eventually absorbed and disrupted, researchers said, throwing Kapteyn and it's planets into their speedy, elliptical orbit in the galactic halo- the region surrounding Milky Way's famous spiral-armed disc. Kapteyn-B is a planet which is located approximately 12.8 light years away from earth.

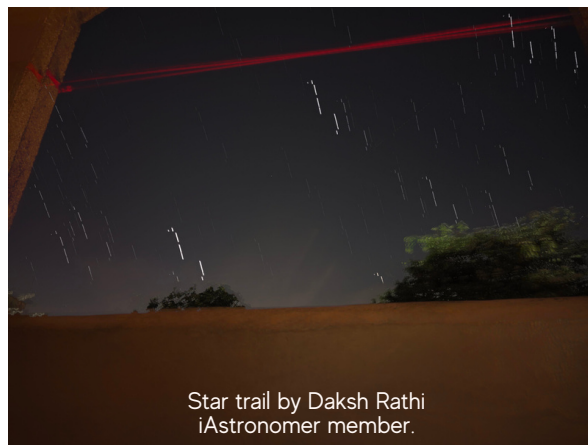
The special feature about this planet is that water can stay in the surface of this planet! This is the main feature which makes it habitable by human being. Kapteyn-B is much larger in size compared to Earth. Kapteyn-B has thick atmosphere which make it warmer and similar to Earth. This planet orbits a red sub dwarf star named Kapteyn's star. 'Jacobus Cornelius Kapteyn' the Dutch astronomer is the discoverer of Kapteyn's star. In 2014, Kapteyn's star was announced to host 2 planets- Kapteyn-B and Kapteyn-C. Kapteyn's star is the closest halo star to the solar system. This star is 12.83 light years away from Earth. Kapteyn star's size is one quarter and one-third the size and mass of sun. Kapteyn-B makes a complete orbit around it's parent star which take 48.62 days. To our surprise, 1 year in Kapteyn-B is just '49' days.



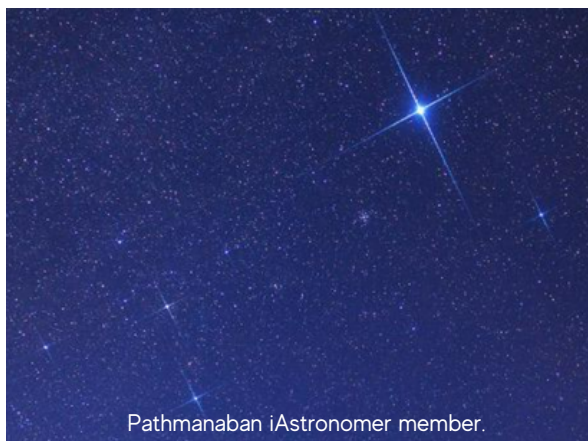
Kepteyn-B's photo from space

Kepteyn-B is an amazing planet. this planet has many special and amazing features in it. We are lucky that this planet is formed as in the future, with the help of well-developed technology this planet can be made habitable by human beings plants and animals. So, there will be a competitor for Earth!

Astrophotographs by students



Star trail by Daksh Rathi
iAstronomer member.



Pathmanaban iAstronomer member.



Telescopic view of Moon by Daksh Rathi
iAstronomer member.



Vanshika sehwat
iAstronomer member.



Adwait
iAstronomer member.

HISTORICAL EVENTS THAT HAPPENED IN MAY



1ST MONKEYNAUTS TO SURVIVE SPACEFLIGHT

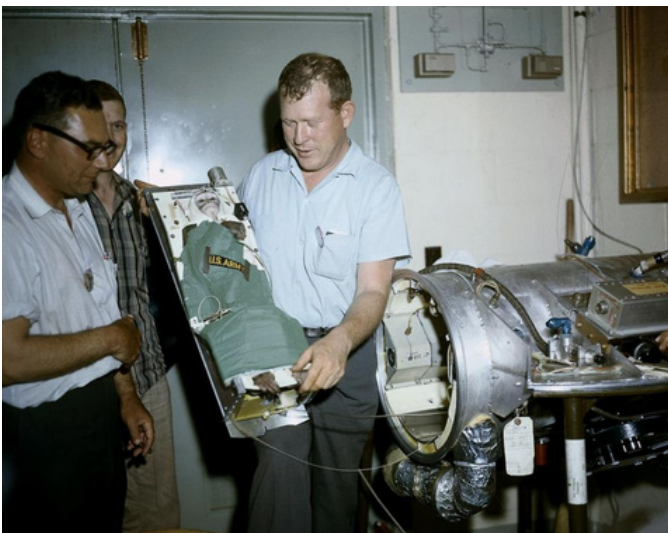
Able and Baker lead the way - Able, a seven pound female rhesus monkey, and Baker, a one pound female squirrel monkey were launched into space on May 28, 1959 in the nose cone of JUPITER Missile AM-18.

May 28, 1959, 40 miles North of Antigua – Two small monkeys splash down in the nose cone of a Jupiter missile. The rocket had traveled 1,700 miles in 15 minutes, and with their successful recovery by the U.S. Navy tug Kiowa, the two “monkeynauts”—nicknamed Able and Baker—became the first animals to return alive from a spaceflight.

The suborbital mission was an important test of the effects of space exposure. The test animals’ physiological reactions were monitored and radioed back to the ground crew. Just one month before, the newly created NASA had publicly revealed the seven would-be astronauts who became the public face of Project Mercury.

At the time, American and Soviet officials were meeting in Geneva to discuss Nikita Khrushchev’s deadline for the Western powers to leave West Berlin. When Brig. Gen. J.A. Barclay radioed Kiowa’s crew to congratulate them on the successful recovery of Able and Baker, he pointedly referred to it as “a free-world first.” The Soviets—who in 1957 were the first to put an animal into orbit, though the dog, Laika, didn’t survive the trip—would soon catch up. In July they successfully recovered two dogs and a rabbit from a similar experiment.

While the flight itself did not harm Able or Baker, they still had the press to contend with. Baker’s reaction to the newsreel cameras and klieg lights crammed into their Washington, D.C., news conference on May 30 led Dr. Donald E. Stulken of the Navy Aviation Medicine Branch to describe her as “the biggest damn ham in the world.” Just a few days later, however, Able would die from a reaction to the anesthesia used while her electrodes were being removed. Baker was unharmed by a similar procedure, and went into retirement at the U.S. Space and Rocket Center in Huntsville, Ala., until her death in 1984. She is buried on the grounds.





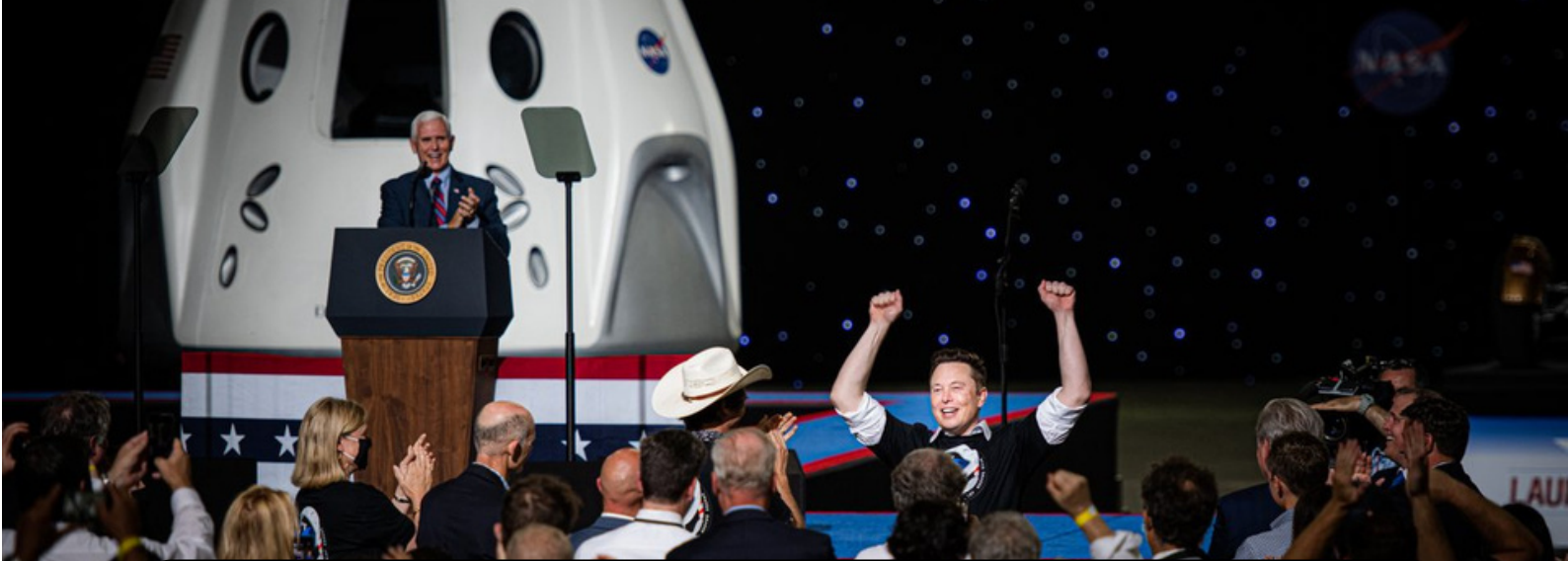
61 YEARS AGO: ALAN SHEPARD BECOMES THE FIRST AMERICAN IN SPACE

In 1961, the United States and the Soviet Union found themselves in a race to put the first human being into space. The United States initiated Project Mercury in 1958 to put the first American into space and selected its first group of astronauts in 1959 to begin training for that mission. The Soviets kept their plans secret but began their own human spaceflight program and selected their own team of 20 cosmonauts in 1960. The Soviets won the race in April 1961 when cosmonaut Yuri A. Gagarin completed a single orbit around the Earth aboard his Vostok capsule. On May 5, 1961, Alan B. Shepard became the first American in space during a suborbital flight aboard his Mercury capsule named Freedom 7. Three weeks later, based on the success of Shepard's brief flight, President John F. Kennedy committed the United States to achieving a lunar landing before the end of the decade.

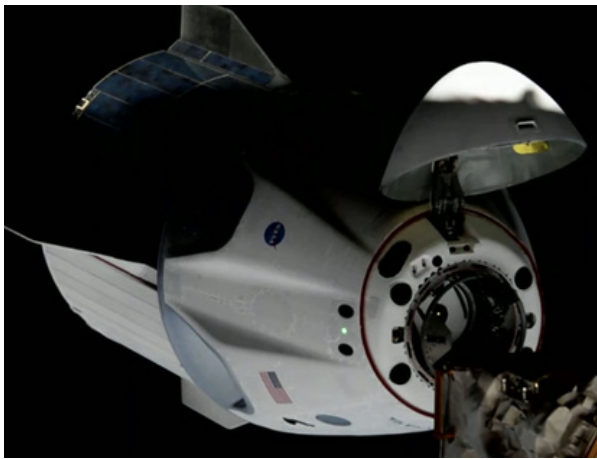
Mission Objective

The main scientific objective of project Mercury was to determine man's capabilities in a space environment and in those environments to which he will be subject upon going into and returning from space. A few of the basic flight problems included: The development of an automatic escape system, vehicle control during insertion, behavior of space systems, evaluation of pilots capabilities in space, in flight monitoring, retrofire and reentry maneuvers and landing and recovery.

During the mission, Shepard communicated with the Mercury Control Center (MCC) at Cape Canaveral. Flight Director Christopher C. Kraft designed the control center to monitor every aspect of the mission. Fellow astronaut Slayton served as the capsule communicator, or capcom, speaking directly with Shepard in Freedom 7. The Redstone rocket's engine shutoff as planned 2 minutes, 22 seconds after liftoff, with the launch escape tower jettisoning immediately thereafter. After another 10 seconds, the spacecraft separated from the booster, and Shepard began to experience weightlessness. At 3 minutes 10 seconds into the flight, Shepard took over manual control of the spacecraft's attitude and found that he could control Freedom 7's orientation with remarkable ease and precision. He conducted visual observations of the Earth below and took some photographs of the cloud-covered Atlantic Ocean. At 5 minutes, 11 seconds, Freedom 7 reached the highest point of its ballistic flight at 116 miles and began descending toward the Earth. Fifteen seconds later the retro-fire maneuver took place. At an altitude of 230,000 feet, Freedom 7 encountered the top layers of the Earth's atmosphere, ending Shepard's time in weightlessness after five minutes. During the deceleration, he experienced g-loads of up to 11 times the force of Earth's gravity, but only for a few seconds. A drogue parachute deployed at 22,000 feet to slow and stabilize the spacecraft, followed by the main parachute at 10,000 feet. A landing bag deployed at the bottom of the spacecraft to further cushion the impact, and after a flight of 15 minutes 22 seconds, Freedom 7 splashed down in the Atlantic Ocean north of the Bahama Islands and 300 miles southeast of Cape Canaveral, completing Shepard's flight as the first American in space.



NASA AND SPACEX LAUNCH ASTRONAUTS INTO NEW ERA OF PRIVATE SPACEFLIGHT



(Image credit: The Verge)

Space history has been made. On 30 May, SpaceX and NASA launched two astronauts to space aboard the Crew Dragon spacecraft, the first time a private company has flown humans into orbit, and the first crewed launch from the US since the end of the space shuttle programme in 2011.

The launch was first set to take place on 27 May, but poor weather caused it to be delayed. By the 30 May backup date, the weather had cleared and NASA astronauts Bob Behnken and Doug Hurley successfully lifted off and headed on their way to the International Space Station (ISS).

It took the Crew Dragon spacecraft about 19 hours to reach the ISS. The spacecraft docked with the ISS autonomously, but before they arrived, Behnken and Hurley had a chance to fly the capsule manually as a test. "It flew just like it was supposed to," said Hurley after the astronauts arrived at the ISS. "It is exactly like the simulator and we couldn't be happier about its performance."

Now that they are safely aboard the ISS, they will continue to perform tests on Crew Dragon. They will remain on the ISS for between one and four months, joining the three astronauts already there in conducting scientific experiments, before getting back into the Crew Dragon to come home. As the Falcon 9 rocket carried the Crew Dragon into orbit atop a plume of flames, it marked a new era of human space flight.



(Image credit: NASA)

EVENTS BY SPACE

MESSIER MARATHON 2022 - STARGAZING AND ASTROPHOTOGRAPHY TRIP

SPACE is proud to announce about the Stargazing and Astrophotography Trip - 2022 which was conducted on 2nd - 3rd April at two locations one Astroport, Sarika and YMCA, Yelagiri hills, Tamil nadu. We also conducted another one at the later location on 8th - 9th April. An expedition where you will spend the night under the pristine dark skies observing and photographing the celestial jewels. The participants observed Deep Sky Objects (DSOs) which include Galaxies, Nebulae, and Star Clusters. In the early morning they observed planets such as Venus, Mars and Saturn through 8inch dobsonian telescope.



HIGHLIGHTS OF THE EXPEDITION

- Orientation to the night sky and basics of star gazing
- Using sky maps and Planisphere
- Constellation watch
- Hands on training on Telescopes and Binoculars
- Introduction to Messier Catalog and planning for the observation
- Deep sky objects observation using 200mm Dobsonian telescope
- Planetary and Lunar observation
- Basics of DSLR, Practical Astrophotography, and Smartphone Astrophotography
- Observation using a computerized telescope
- Observing and capturing Milkyway Galaxy



Participants got captured under the Milkyway Arm



Location; YMCA, Yelagiri Hills



Astrophotographs taken by the participants of our star gazing camp



ASTROPHOTOGRAPHS BY SPACE TEAM

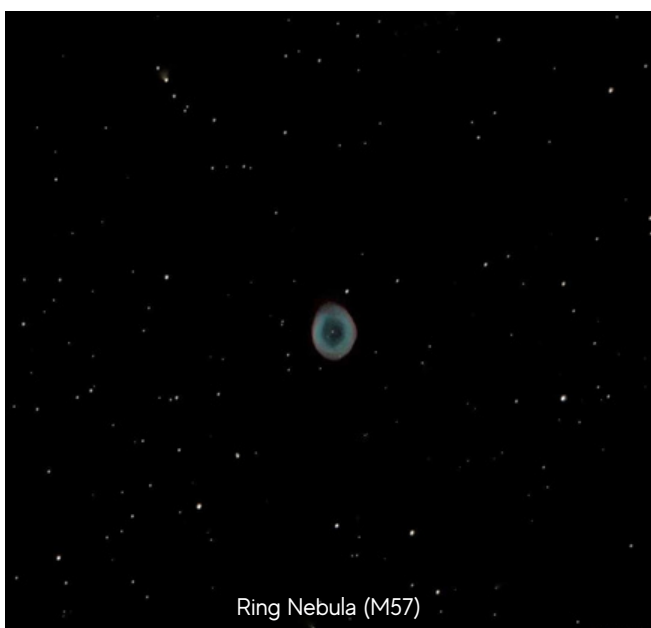


Summer Milkyway Galaxy Arm captured with trees

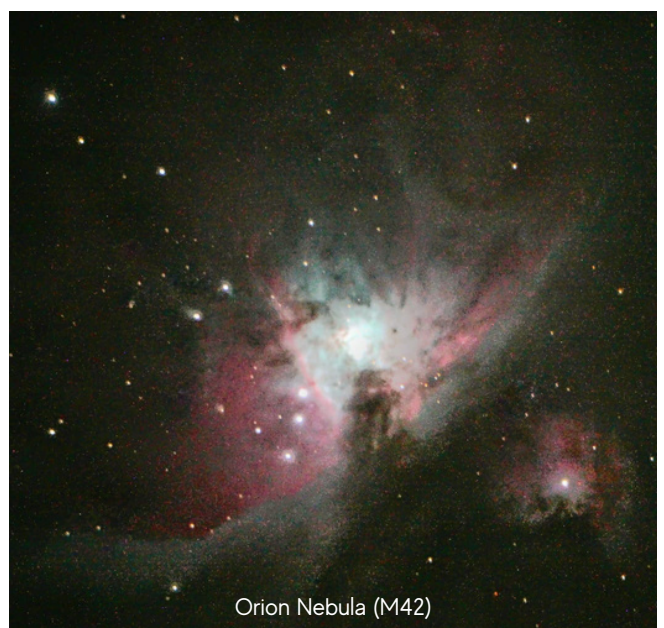


Polar Star Trails

**Captured by SPACE Educator Mr. Ranjith Kumar.



Ring Nebula (M57)

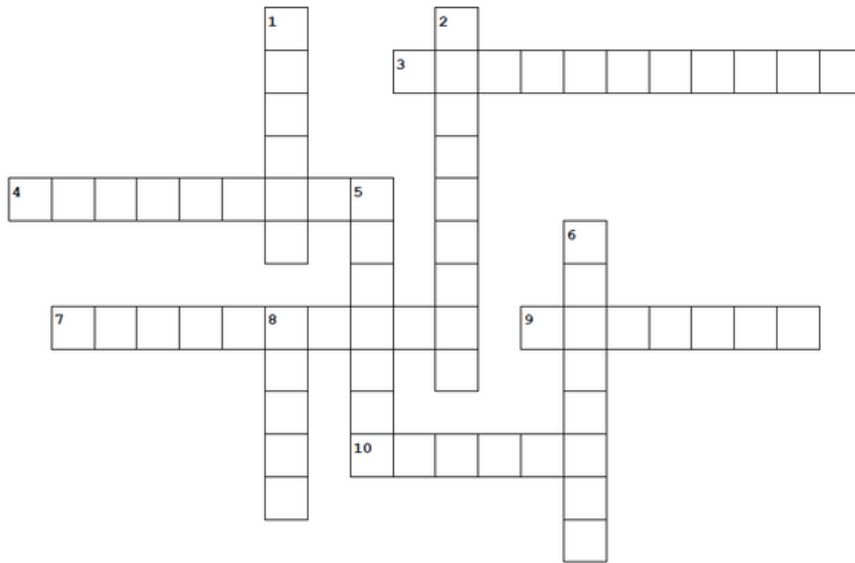


Orion Nebula (M42)

**Captured by Mr. Neeraj Ladia, CEO, Gnomon Astrotech Pvt Ltd.

TRAIN YOUR BRAIN

CROSSWORD



Down

- 1. The name of USA's first space station
- 2. Who was the first US astronaut to orbit the Earth?
- 5. The country from which the highest number of space missions sent out of the earth.
- 6. Name of the China's first space station?
- 8. The first animal to orbit the Earth

Across

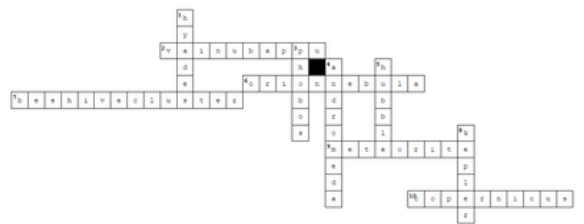
- 3. Which country sent a man into space first?
- 4. The first artificial satellite of India
- 7. The second man to step onto the moon?
- 9. Which mission was designed to explore Saturn?
- 10. The project designed to land humans on the Moon and bring them safely back to Earth.

ASTRONOMY WORD PUZZLE

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

- VIRGO
- LYRA
- AURIGA
- ARA
- CASSIOPEIA
- AQUARIUS
- SCORPIUS
- PERSEUS
- HERCULES
- CANISMAJOR
- TAURUS
- SAGITTARIUS
- ANDROMEDA
- OPHIUCHUS

Answers for last month puzzles.



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

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

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

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



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