

# Galactica

Astronomy and space Magazine

## What's inside?

Highlights from February

Moon phases and planet visibility

What's awaiting in March

Student's corner

Historical Events happened in March

Events by SPACE

Train your brain

# JWST

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.

# Team

## **Editor in Chief**

Sachin Bahmba

## **Editor**

Ranjith Kumar

## **Assistant Editor**

Paridhi Agarwal

## **Section Editors**

Yogesh Kumar Joshi

## **Art Direction**

Tarun Sharma

## **Contributors**

iAstronomers

Space students

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

# CONTENTS

TOPICS	Page no.
<b>About SPACE</b>	4
<b>Highlights of Feb 2022</b>	5
James Webb space telescope updates	6
Space Travel Gets Real!	7
Starship	8
Successful Launch of PSLV	9
SpaceX Falcon 9 Launches	10
What's New	11
<b>What's up in the sky - March 2022</b>	13
<b>Rocket launches in March 2022</b>	14
One Webb	15
Private Astronaut Mission to ISS	16
Rocket Lab Readies Electron For Lift-Off	17
<b>Astronomical events - March 2022</b>	18
First Day of Spring 2022	19
Venus at greatest western elongation	20
Conjunctions for the month	21
<b>Student's corner</b>	22
<b>Historical events that happened in MARCH</b>	25
<b>Events by SPACE</b>	27
<b>Astrophotographs by Space Team</b>	28
<b>Train Your Brain</b>	30

# 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.**



*Gong Xi Fa Cai*

# HAPPY LUNAR NEW YEAR

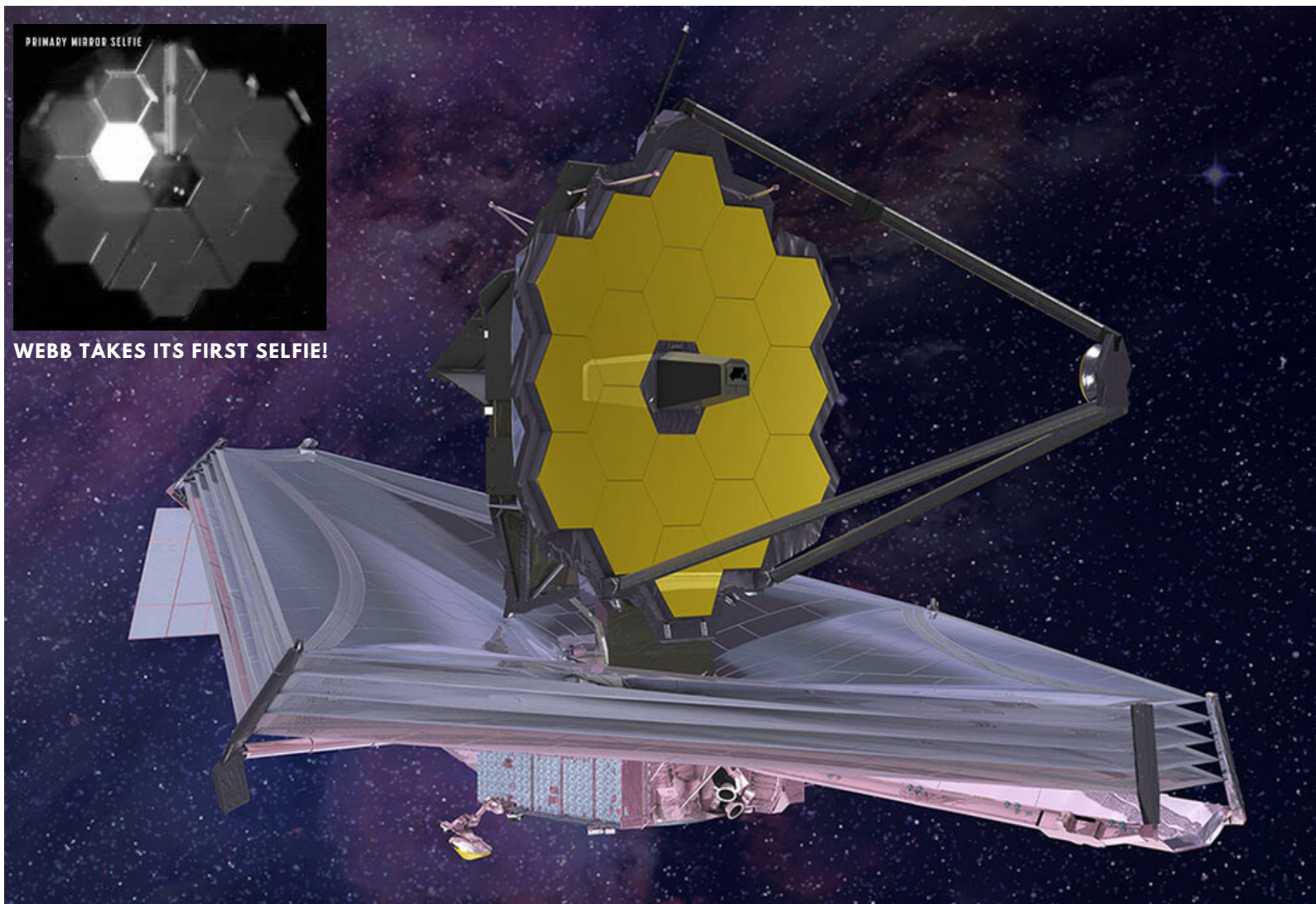


**Welcome to the  
Year of the Tiger**

Lunar New Year Celebrations continue from the first new Moon of the lunar calendar (which falls on Feb 1 this year) until the Lantern Festival, on the 15th day of the new lunar year.

Our Moon is not just a pretty face; it also helps regulate Earth's tides, and indirectly moderates our climate.

The leading theory of how our Moon formed is that a Mars-sized object impacted Earth around 4.5 billion years ago, causing a massive chunk of debris to form. The moon is an average of 238,855 miles (384,400 kilometers) away from Earth; around 30 Earth-sized planets could fit between us and our satellite companion.



PRIMARY MIRROR SELFIE  
WEBB TAKES ITS FIRST SELFIE!

# JAMES WEBB SPACE TELESCOPE UPDATES

by James Webb Blog  
Photos by NASA

3rd February-Photons Incoming: Webb Team Begins Aligning the Telescope. This milestone marks the first of many steps to capture images that are at first unfocused and use them to slowly fine-tune the telescope.

10th February-Webb Is Chilling Out! The long process of aligning the telescope mirrors has started, almost all of the components on Webb's cold side are still continuing to cool.

11th February-Photons Received: Webb Sees Its First Star - 18 Times

Moving forward, Webb's images will only become clearer, more detail-laden, and more intricate as its other three instruments arrive at their intended cryogenic operating temperatures and begin capturing data. 17th February-Webb's Fine Guidance Sensor Is Guiding!

After starting the mirror alignment with Webb's first detection of starlight in the Near-Infrared Camera (NIRCam), the telescope team is hard at work on the next steps for commissioning the telescope.

18th February-Webb Team Brings 18 Dots of Starlight Into Hexagonal Formation.

The Webb team continues to make progress in aligning the observatory's mirrors.



Webb gets ready to focus!



Virgin Galactic is reopening space tourist ticket sales for a limited time

# SPACE TRAVEL GETS REAL

## A new hobby for the rich?

Starting Wednesday (Feb. 16), aspiring space tourists can once again book a trip to the final frontier with Virgin Galactic

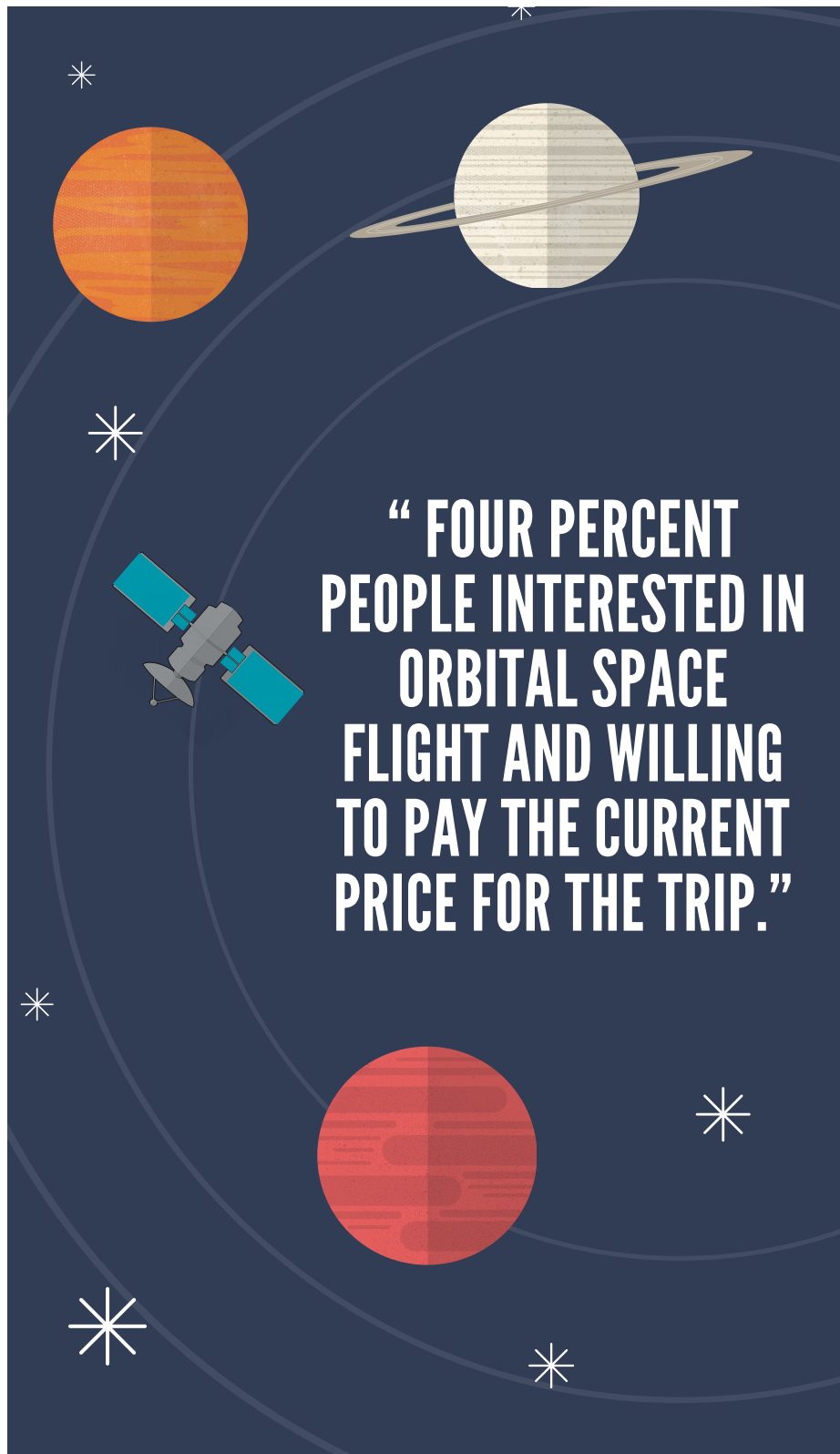
The company announced Tuesday (Feb. 15) that it will temporarily reopen its waiting list for customers ahead of providing commercial service. The seat deposit is \$150,000, and the total ticket price is \$450,000.

As of November 2021, Virgin Galactic had a reported 700 or so customers in its pool, with the plan to start flying them on commercial flights in late 2022. At the time, Virgin Galactic said it planned to have 1,000 people ready for flights by then, and the company appears to be sticking to that timeline.

"At Virgin Galactic, we believe that space is transformational," Virgin Galactic CEO Michael Colglazier said in a company statement on Tuesday. "We plan to have our first 1,000 customers on board at the start of commercial service later this year, providing an incredibly strong foundation as we begin regular operations and scale our fleet."

Ticket sales open to the general public on Wednesday (Feb. 16). It's unclear how long the buying window will stay open; Virgin Galactic has not yet disclosed an end date.

This isn't the first opportunity to buy seats with Virgin Galactic, as the existing customer pool shows. For example, the company temporarily reopened ticket sales in August 2021, a month after Virgin Galactic's first fully crewed spaceflight with founder Richard Branson on board. That window was the first to feature the \$450,000 price; previously, you could've bought a seat for \$250,000.



**“ FOUR PERCENT PEOPLE INTERESTED IN ORBITAL SPACE FLIGHT AND WILLING TO PAY THE CURRENT PRICE FOR THE TRIP.”**

**LESS THAN 1/4**

Spent more than US\$10,000 annually on vacations.

**US\$ 20 MILLION**

Estimated fare for a full commercial trip.

**ONLY 19%**

Interested in suborbital space travel.



STARSHIP	
HEIGHT	50 m / 164 ft
DIAMETER	9 m / 30 ft
PROPELLANT CAPACITY	1200 t / 2.6 Mlb
THRUST	1500 tf / 3.2 Mlbf
PAYLOAD CAPACITY	100-150 t orbit dependent

# Starship/Super Heavy rocket



On Thursday, February 10, 2022 - 20:00 CST, Space Exploration Technology's (SpaceX) Chief Engineer Elon Musk gave a presentation about the Starship/Super Heavy rocket. The backdrop was the recently stacked launch vehicle, which was completed by the chopstick stacking and catching arms for the first time. To keep track of the first orbital launch, slated for this year, check out our live updates article with information on what is going on in Starbase.

Elon Musk opened the update by welcoming locals, employees, and the press to the Gateway to Mars - Starbase, Texas. He then thanked the surrounding area, including Cameron County, South Padre Island, Brownsville, and Boca Chica Village for their support.





# SUCCESSFUL LAUNCH OF PSLV-C52 WITH EOS-04 SATELLITE

The Indian Space & Research Organisation (Isro) successfully launched the Earth Observation Satellite (EOS-04) onboard the Polar Satellite Launch Vehicle in the wee hours of Monday. The launch carried two other rideshare satellites into orbit as the Indian space agency set in motion work for 2022.

February 14, 2022, the Polar Satellite Launch Vehicle PSLV- C52 successfully launched EOS-04 Satellite from the first launch pad of Satish Dhawan Space Centre (SDSC), SHAR, Sriharikota.

After a smooth countdown of 25 hrs 30 minutes the PSLV- C52 launch vehicle lifted off at 05:59 hrs (IST) in the opening of the launch window. The important flight events, namely, stage & strap-on ignitions, heat shield separation, stages & strap-on separation, satellite injection took place exactly as planned.



After a flight of about 17 minutes 34 seconds three satellites namely EOS-04, INSPIRESat-1 and INST-2TD were injected successfully into a sun-synchronous polar orbit of 529 km. The orbit achieved for the satellites is very close to the intended orbits.

After separation, the two solar arrays of EOS-04 deployed automatically and ISRO Telemetry Tracking and Command Network (ISTRAC) at Bangalore has assumed the control of the satellite. In the coming days the satellite will be brought to its final operational configuration following which it will begin to provide the data.



# SPACEX FALCON 9 ROCKET LAUNCHES IN FEBRUARY

Falcon 9 is a partially reusable two-stage-to-orbit medium-lift launch vehicle designed and manufactured by SpaceX in the United States. The latest version of the first stage can return to Earth and be flown again multiple times.

Falcon 9 Block 5

Feb 1st-  
Launch Mission CSG-2  
Type: Earth Science CSG-2 is an Earth observation satellite for the Italian Space Agency, part of a reconnaissance constellation using synthetic aperture radars operating in the X-band.  
Launch Location - Cape Canaveral, FL, USA.

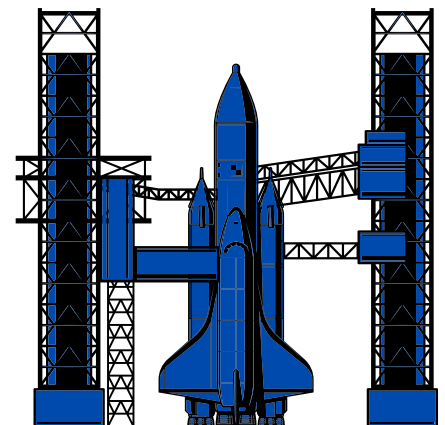
Feb 3rd-  
Launch Mission NROL 87  
Type: Government/Top Secret  
Classified payload for the U.S. National Reconnaissance Office.  
Launch Location- Vandenberg SFB, CA, USA.

Launch Mission Starlink Group 4-7  
Type: Communications  
A batch of 49 satellites for Starlink mega-constellation - SpaceX's project for space-based Internet communication system.  
Launch Location- Kennedy Space Centre, FL, USA.



Feb 21st-  
Launch Mission-Starlink Group 4-8  
Type: Communications  
A batch of 46 satellites for Starlink mega-constellation - SpaceX's project for space-based Internet communication system.  
Launch Location - Cape Canaveral, FL, USA.

Feb 25th-  
Launch Mission Starlink Group 4-11  
Type: Communications  
A batch of 46 satellites for Starlink mega-constellation - SpaceX's project for space-based Internet communication system.  
Launch Location- Vandenberg SFB, CA, USA.



# WHAT'S NEW

## Huge eruptions from the sun

Earlier this week, the sun erupted with a huge explosion, blasting solar particles millions of kilometers into space. The team for the ESA/NASA Solar Orbiter spacecraft says the blast is the largest solar prominence eruption ever observed in a single image together with the full solar disc.

## Asteroids are dangerous, but they might also be the key to life on Earth

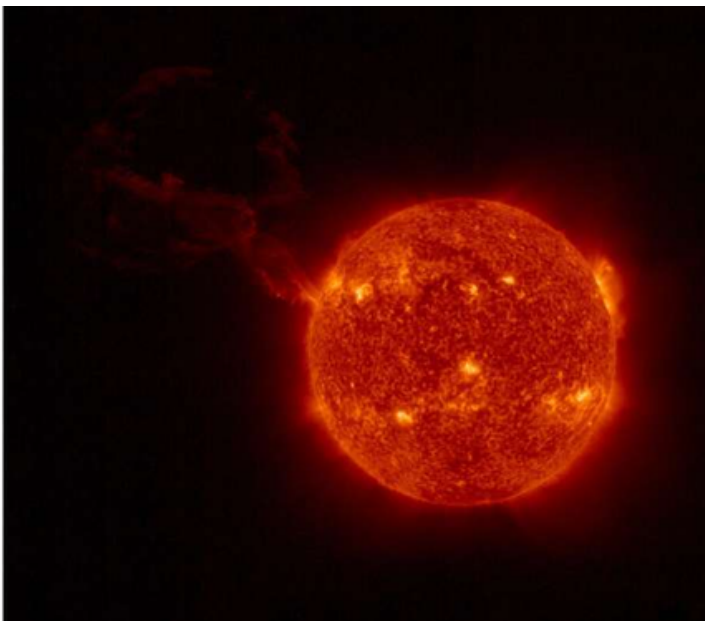
Trying to piece together the appearance of life on Earth is a little like looking through a kaleidoscope. There are competing theories for where Earth's water came from, and there's incomplete evidence for how the moon formed and what role it played in life's emergence. There are a thousand other questions, each with competing answers. Sometimes, contradictory research is published within days of each other.

Asteroids are one of the moving pieces in the kaleidoscope. An asteroid impact caused the most dramatic extinction in Earth's history. But they may have delivered some of Earth's water and the basic chemistry for life. Their impacts may have created niches for life, too. Asteroids are dangerous but also beneficial. Like many things in nature, it's all about the amount.

## New detection method for quasars in the early universe

Astronomers from Leiden Observatory have developed a new method to find distant quasars and better distinguish them from other objects that look like them, using machine learning techniques. The research result has been accepted for publication in the journal *Astronomy & Astrophysics*. It is the last article to be co-authored with Maolin Zhang, the promising Leiden Ph.D. student of Chinese origin who died in a fire at his home in 2019.

A quasar is an extremely bright active center of a galaxy, powered by a supermassive black hole that can be up to a billion times heavier than the sun. Some supermassive black holes in the centers of galaxies are inactive, like the black hole in our Milky Way, but many are active, surrounded by a swirling disk of superheated gas.





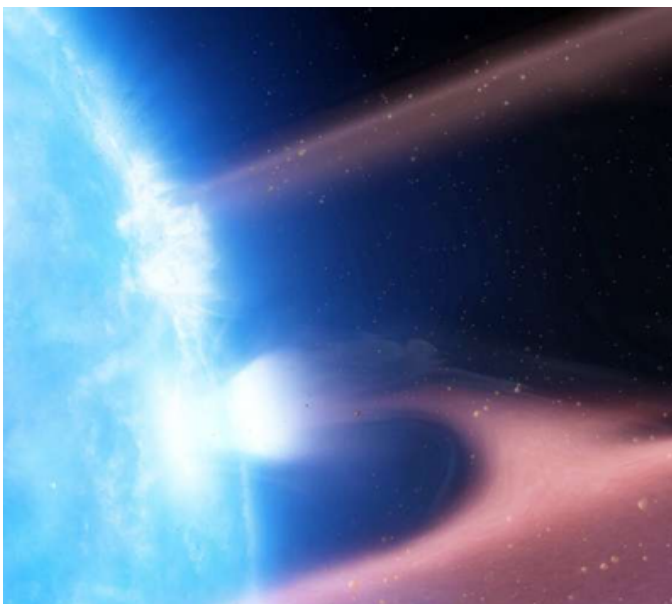
### Future Plans for the ISS!

NASA Administrator Bill Nelson announced today the Biden-Harris Administration's commitment to extend International Space Station (ISS) operations through 2030, and to work with our international partners in Europe (ESA, European Space Agency), Japan (JAXA, Japan Aerospace Exploration Agency), Canada (CSA, Canadian Space Agency), and Russia (State Space Corporation Roscosmos) to enable continuation of the groundbreaking research being conducted in this unique orbiting laboratory through the rest of this decade.

### Experiments in Antarctica

Scientists have deployed a network of seismometers onto Antarctica's Brunt Ice Shelf in an experiment that will test the instrument's ability to operate on icy moons in the solar system.

Twenty state-of-the-art seismic 'Nodes' (the world's smallest and lightest land seismometers) have been deployed onto the ice shelf around the British Antarctic Survey's (BAS) Halley VI Research Station, along with one 'short period' (SP) sensor. This is the first time that either of these instruments have been used in Antarctica, an environment which is the closest analogue of an icy moon found anywhere on Earth.



### Observing the surface of a white dwarf

The moment that debris from destroyed planets impacts the surface of a white dwarf star has been observed for the first time by astronomers at the University of Warwick.

They have used X-rays to detect the rocky and gaseous material left behind by a planetary system after its host star dies as it collides and is consumed within the surface of the star.

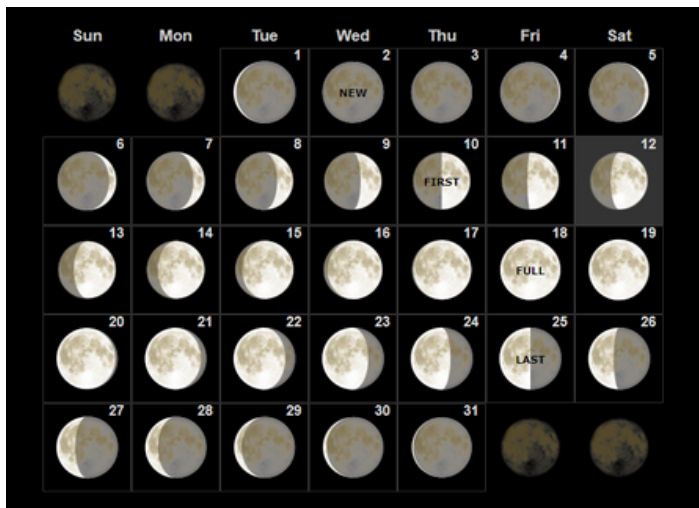
# WHAT'S UP IN THE SKY - MARCH 2022

## 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.

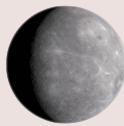
So, What Moon phase is best for stargazing? "The New Moon and the days immediately before and after new moon(Crescent phases)" are among the best times for stargazing. Whereas, The Remaining phases like Full Moon, waxing or waning gibbous, the first or third quarter Moon offer a time to zoom and witness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



## PLANETS VISIBILITY

### Mercury

Mercury can be seen early morning during the first week of March



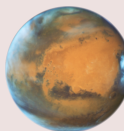
### Venus

Bright morning planet, rising over two hours before sunrise. 50% phase around 20 March.



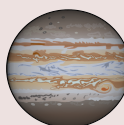
### Mars

Morning object, slowly brightening during the later days of the month. Sits close to Saturn and Venus at end of month.



### Jupiter

Solar conjunction on 5 March. Hence, Jupiter not visible for the rest of the month.



### Saturn

Poorly positioned morning planet. Near Venus and Mars at end of March.



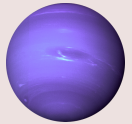
### Uranus

Best at the start of March and will be lost by end of the month.



### Neptune

Neptune in conjunction with the Sun on 13 March and not visible this month.

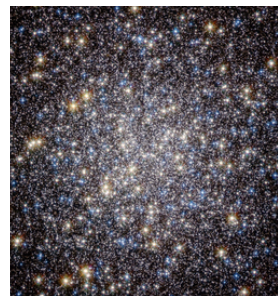


## BRIGHT DEEP SKY OBJECTS

The Andromeda Galaxy, also known as M31, or NGC 224 which is at 2.5 million light-years from Earth. It is the most distant object visible with the naked eye and the closest major galaxy to the Milky Way. It can only be seen if you have a really dark sky. With the naked eye, Andromeda will be extremely faint.



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.

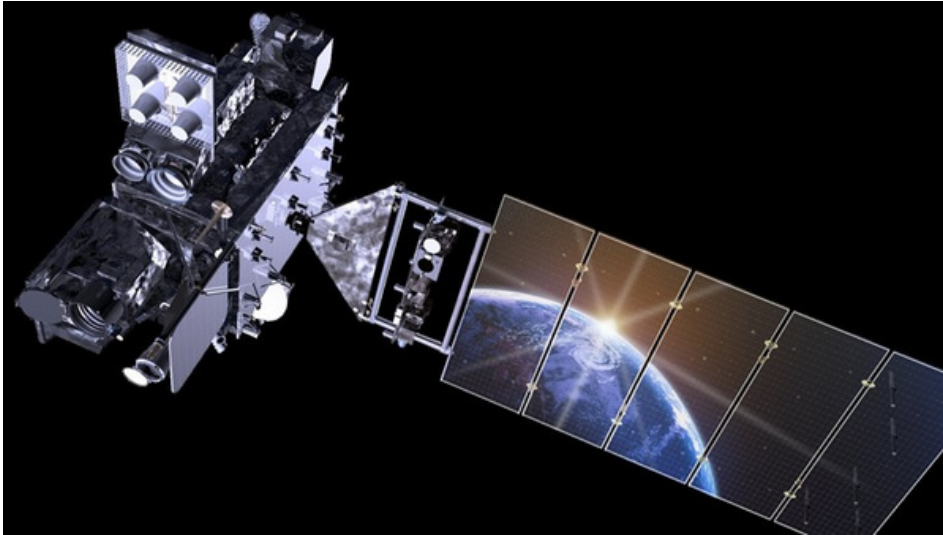


The Orion Nebula is a diffuse nebula situated in the Milky Way, being south of Orion's Belt in the constellation of Orion. It is one of the brightest nebulae and is visible to the naked eye in the night sky. It is 1,344 ± 20 light-years away and is the closest region of massive star formation to Earth.



# ROCKET LAUNCHES IN MARCH 2022

## NASA TO LAUNCH NEW WEATHER OBSERVING SATELLITE INTO SPACE



(Image credit: Lockheed Martin)

### MARCH - 01

GOES' geostationary status (in which the satellite is always in the same position with respect to the rotating Earth) allows it to hover over one position on the Earth's surface and provide constant vigil for the atmospheric "triggers" for severe weather conditions such as tornadoes, flash floods, hail storms and hurricanes.

The launch with NOAA's GOES-T weather satellite will mark the 92nd flight of an Atlas 5 rocket since August 2002, and the eighth flight to use the "541" version, following two previous GOES satellites, NASA's Curiosity and Perseverance Mars rovers, and three spy satellite launches for the U.S. government. The GOES-T satellite, with a launch weight of more than 11,000 pounds (5 metric tons) fully fueled, was built by Lockheed Martin and arrived in Florida from its Colorado factory in November. Technicians at Astrotech tested the satellite to make sure it survived the cross-country journey, then loaded liquid propellants into the spacecraft for its main engine.

After three burns with the Centaur's RL10 engine, the Atlas 5 will deploy the GOES-T satellite in an elongated orbit ranging between 5,515 miles (8,876 kilometers) and 21,925 miles (35,286 kilometers). The orbit will be tilted at an angle of 9.4 degrees to the equator.

GOES-T's own propulsion system will circularize the satellite's orbit more than 22,000 miles (nearly 36,000 kilometers) over the equator. At that altitude, in geosynchronous orbit, the satellite's movement will match the Earth's rotation, giving the spacecraft a constant view of one hemisphere.

GOES' geostationary status (in which the satellite is always in the same position with respect to the rotating Earth) allows it to hover over one position on the Earth's surface and provide constant vigil for the atmospheric "triggers" for severe weather conditions such as tornadoes, flash floods, hail storms and hurricanes.



(Image credit: United Launch Alliance)

## *Arianespace is launching 36 OneWeb communication satellites on a Soyuz 2.1b rocket.*



(Image credit: Oneweb.net)

### **About Soyuz 2.1b rocket**

The Soyuz rocket (also known as R7) has been the workhorse of the Soviet/Russian space program since it first flew in 1966. The Soyuz version currently being used for most satellite launches is a four-stage launch vehicle, that consists of:

- four side boosters
- a central core
- an upper stage which is common to all Soyuz rockets
- an optional Fregat upper stage (used on this mission).

**March 5:** The OneWeb 14 satellites will go to a 1,200 km polar orbit, and will lift off from the Baikonur Launch Cosmodrome, in Kazakhstan. OneWeb 14 will boost the number of OneWeb satellites launched to 454.

Despite Soyuz being a Russian rocket, the launch provider is still Arianespace. Ariane subcontracts ROSCOSMOS to launch a Soyuz on their behalf.

### **What Is OneWeb?**

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

OneWeb plans to have 648 satellites in their constellation, providing them with the 600 satellites needed for global coverage and an additional 48 on-orbit spares in case a satellite fails.

These satellites are in a 1,200 km low-Earth polar orbit, which is significantly lower than the global internet services available today. The current satellite internet solutions orbit 35,786 km above the Earth, in geostationary orbit. However, the orbit of OneWeb's satellites is still significantly higher than the 550 km orbit that SpaceX's Starlink satellites use. OneWeb is expecting the final 648 satellite constellation to provide download speeds of roughly 50 Mb/s.

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



(Image credit: Airbus)

### **What Is A OneWeb Satellite?**

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

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

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

# THE FIRST PRIVATE ASTRONAUT MISSION TO THE ISS



(Image credit: SpaceX)

Months before they launch on the first private astronaut mission to the International Space Station, the AXIOM-1 crew received approval from Nasa's international partners to do the journey. The Axiom Mission 1 or Ax-1, is targeted to launch on March 30, from Launch Complex 39A at Kennedy Space Center in Florida.

The four-member crew will be the first batch of private astronauts to board the flying laboratory and work onboard for eight days before returning to Earth. The Ax-1 crew will fly on Crew Dragon Endeavour to and from the space station after being launched on top of a SpaceX Falcon-9 rocket.

"This represents another significant milestone in our efforts to create a low-Earth orbit economy. I wish these Axiom crew members safe travels, and I hope they find their time in space productive and enjoyable," Phil McAlister, director of commercial spaceflight at Nasa said in a statement.

The four astronauts include Michael López-Alegría, Larry Connor, Mark Pathy, and Eytan Stibbe, who are scheduled to spend eight days aboard the orbiting laboratory conducting science, education, and commercial activities before their return to Earth.

The private astronaut mission will lay the foundation of the transition of the mission from Nasa to commercial operators as it lays out plans to de-orbit the International Space Station by the end of this decade.

## What will they do in space?

Nasa has said that as of yet the proposed mission activities are still under review and will be approved prior to flight. Axiom had previously said that their research will provide data on space travel's impact on senescent cells and heart health, pre and post-mission high-resolution MRIs to study the effects of the spaceflight environment on spinal and brain tissue.

They will also work to unravel the mysteries surrounding chronic pain and sleep disturbances during space travel, Spaceflight-Associated Neuro-Ocular Syndrome (SANS), which manifests through changes in visual acuity experienced by many astronauts on long-duration space flights. Their eight-day-long research in zero-gravity will cover fields of astrophysics, agriculture, optics, communication, biology, healthcare, neurology, and ophthalmology.



Axiom Mission 1 astronauts Michael López-Alegría, Larry Connor, Mark Pathy and Eytan Stibbe. (Photo: Nasa)



# ROCKET LAB READIES ELECTRON FOR LIFT-OFF



(Image credit: NASA)

## Mission Profile

The spacecraft will launch on Rocket Lab's Electron rocket from its Launch Complex 1 in New Zealand carrying CAPSTONE within its Lunar Photon upper stage, currently scheduled for no earlier than March 2022. After launch, Lunar Photon will perform a series of orbit-raising maneuvers to put CAPSTONE into a trans-lunar trajectory. Once released from Lunar Photon, CAPSTONE will travel three months under its own propulsion to insert itself into the NRHO. In this orbit, CAPSTONE will come within about 1600 km of one lunar pole and then pass roughly 70,000 km above the other pole every seven days. It will continue in this orbit for at least six months, testing communications with LRO and ground stations on Earth.

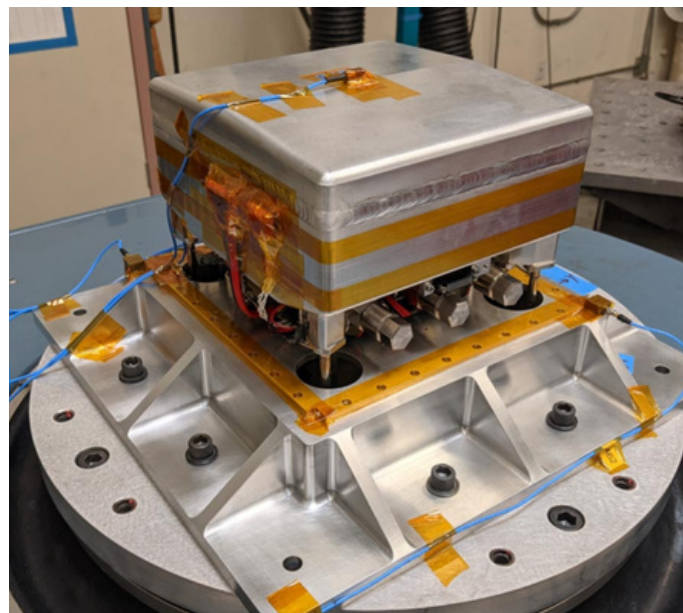
The Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment (CAPSTONE) is a technology demonstration designed to go into a near-rectilinear halo orbit (NRHO) around the Moon.

The primary objectives of the demonstration are to reduce risk for future spacecraft by validating innovative spacecraft-to-spacecraft navigation technologies. Verifying the feasibility of entering into and operating in the NRHO; characterizing the dynamics of the orbit; and serving as a precursor to the Gateway lunar orbiting outpost.

NASA's Lunar Reconnaissance Orbiter (LRO), in orbit around the Moon since 2009, will serve as a reference point for CAPSTONE to test its navigation technologies. 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.

## Spacecraft and Subsystems

CAPSTONE is a 12-unit CubeSat measuring 34 x 34 x 61 cm and having a total mass of about 25 kg. The spacecraft is supplied power by solar panels and provided propulsion by a monopropellant hydrazine system. An S-band antenna array is used for communication with LRO and an IRIS X-band radio is used for primary communication and navigation with NASA's Deep Space Network.



CAPSTONE's propulsion system undergoes environmental testing. (Image credit: Stellar Exploration Inc.)

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

# ASTRONOMICAL EVENTS - MARCH 2022

## VENUS DICHOTOMY

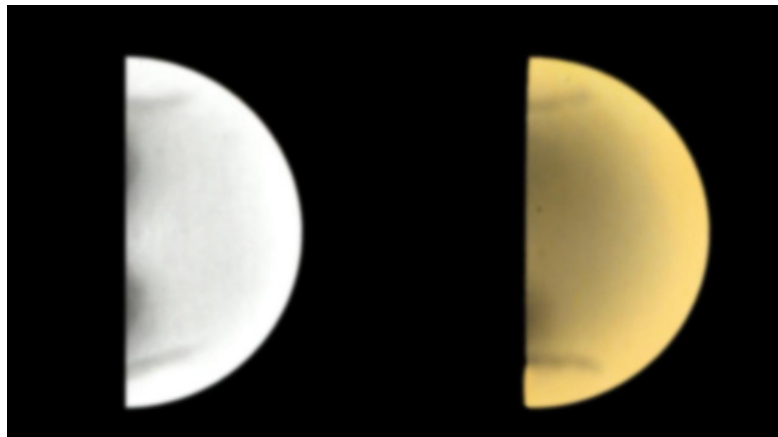
In Astronomy, The term dichotomy means "the phase of the moon or an inferior planet in which half of its disk appears illuminated".

### Date: 21st March - Early Morning

Venus will be at dichotomy, which means that half of its Earth-facing side will be illuminated by the sun.

### Phases of Venus

Venus orbits the Sun, circling interior to Earth every 225. In its smaller orbit, Venus speeds around the Sun more quickly than Earth does. This means that Venus is sometimes relatively close to Earth; other times it's on the other side of the Sun. It's this change in relative positions that causes the phases of Venus.



(Image credit: British astronomical association)

### The Dichotomy of Venus - History

The mystery associated with the Venusian Dichotomy was probably first termed by Patrick Moore in 1956, though the problem was realised almost one-and-a-half centuries before this. It is also known as the Schröter Effect, being based on the visual discrepancy of the exact observed time of planet's visual half-phase or dichotomy.

In August 1793, Johann Schröter (1748-1816) had discovered that the observed time of the 50% phase with Venus did not correspond to the predicted time. Schröter saw some phase deformity of the southern limb, which remaining concave, he said, until about eight days before or after each solar conjunction, but later thought this average difference was six days. (Some popular references even still wrongly state eight days.) Modern apparent values, based on several dozen amateur observed dichotomies, now suggest perhaps four days early or later. Differences depend on which side of the particular elongation occurs.

Some strongly suggest that this effect is merely an optical illusion, yet it is odd that the effect is neither aperture, field orientation nor magnification dependent. A possible proof of this optical effect, in what seems a partly unconvincing argument, was presented in Sky and Telescope on August 1994 – exactly 201 years later after the effect was first observed. This suggested this was due to the composition of the Venusian atmosphere. However, any proper causal explanation of this odd effect has yet to be satisfactorily determined.

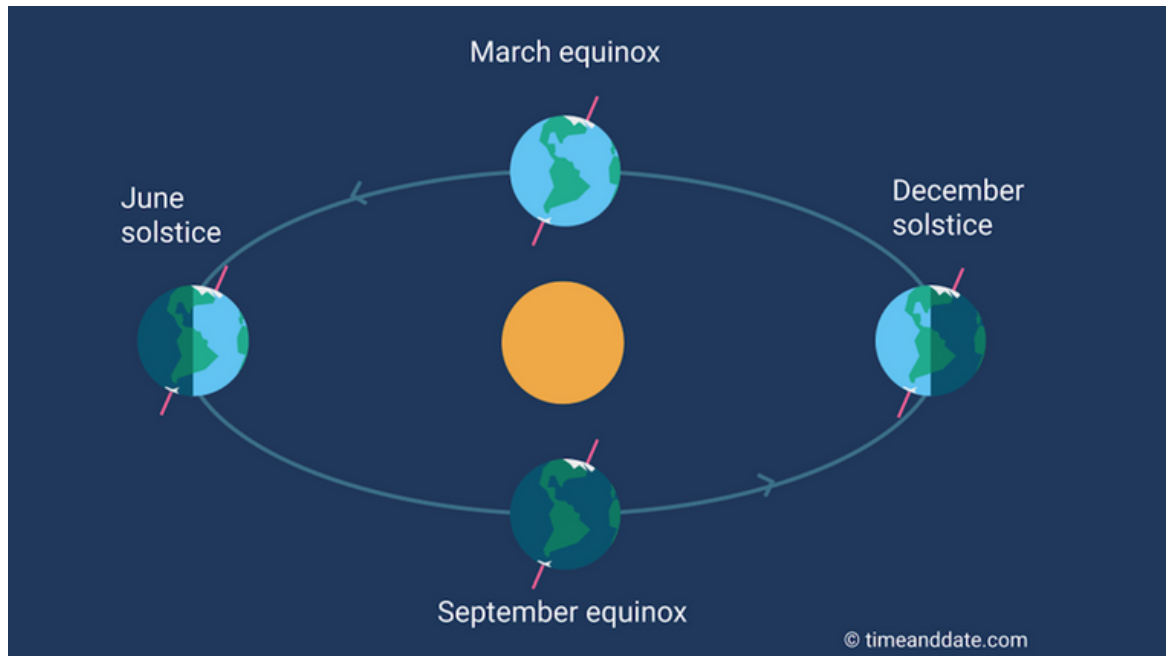
How dichotomy occurs is very easy to understand using simple geometry. It happens at the time when the planet's position lies at right angles to the Earth and Sun. This is approximately during the time of maximum elongation, which happens somewhere between elongations of  $45^\circ$  and  $47^\circ$ . One very common misconception is that dichotomy corresponds exactly with the greatest elongation East (or West) of the Sun. This is not quite true, whose simple reason is that the observed disparity is caused by the slightly dissimilar eccentricities of the two independent planetary orbits of Venus and Earth. When Venus has its greatest elongation wither east or west of the Sun, predicted times of the true dichotomy can be either slightly early or later than expected. Often these variations never exceed more than one day, but this is independent of the four-day difference between the observed and predicted dichotomies.

For reasons, which are still uncertain, predicted times of the Dichotomy of Venus or Schröter Effect are never the same as the observed event. Differences average about four to six days earlier or later than expected, depending on the Sun's side that the morning or evening elongation of Venus takes place.



# THE SPRING EQUINOX

In 2022, the spring equinox occurs on Sunday, March 20. This event marks the astronomical first day of spring in the Northern Hemisphere and the start of the spring season.

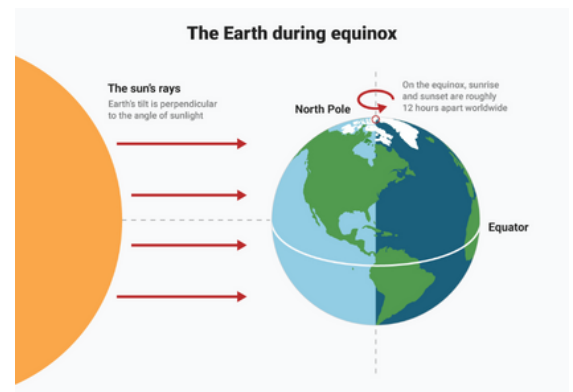


(Image credit: timeanddate.com)

## What Is the Spring Equinox

In the Northern Hemisphere, the March equinox occurs when the Sun crosses the equator line, heading north. This event marks the start of the spring season in the northern half of the globe. After this date, the Northern Hemisphere begins to be tilted more toward the Sun, resulting in increasing daylight hours and warming temperatures. In the Northern Hemisphere, this date marks the start of the spring season.

In the Southern Hemisphere, the March equinox marks the start of autumn, while the September equinox marks the start of spring.



**"The word equinox comes from the Latin words for "equal night"—aequus (equal) and nox (night).**

**On the equinox, the length of day and night is nearly equal in all parts of the world."**

## What Happens on the March Equinox

On the March equinox, the Sun crosses the celestial equator going south to north. It's called the "celestial" equator because it's an imaginary line in the sky above the Earth's equator.

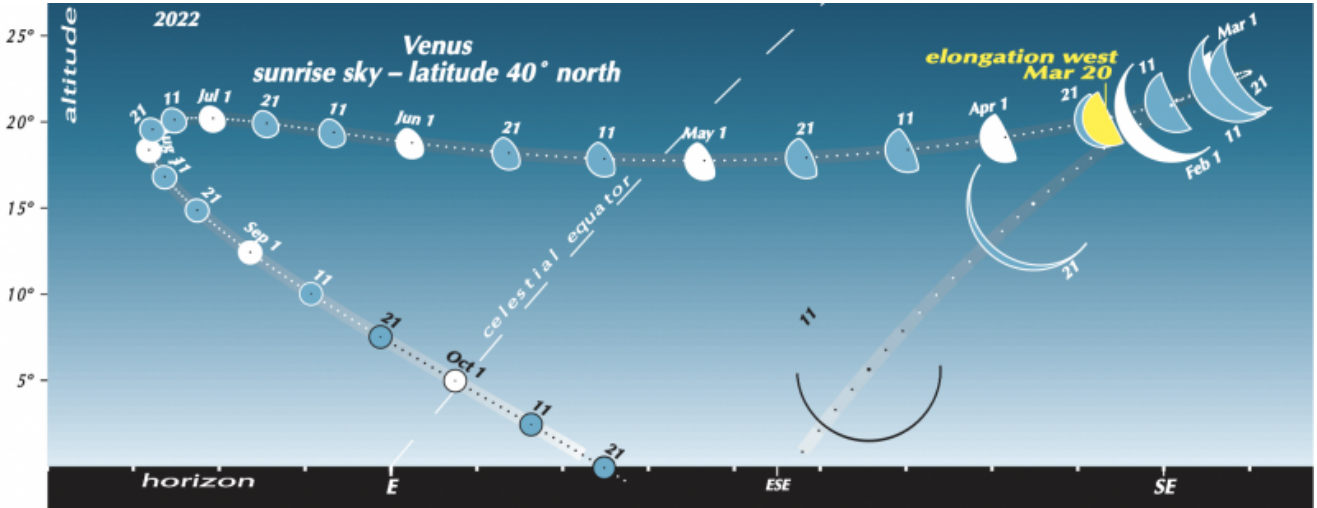
If you were standing on the equator, the Sun would pass directly overhead on its way north.

Equinoxes are the only two times each year that the Sun rises due east and sets due west for all of us on Earth! While the Sun passes overhead, the tilt of the Earth is zero relative to the Sun, which means that Earth's axis neither points toward nor away from the Sun. (Note, however, that the Earth never orbits upright, but is always tilted on its axis by about 23.5 degrees.)

After the spring equinox, the Northern Hemisphere tilts toward the Sun. Although in most locations (the North Pole and Equator being exceptions) the amount of daylight had been increasing each day after the winter solstice, after the spring equinox, many places will experience more daylight than darkness in each 24-hour day. The amount of daylight each day will continue to increase until the summer solstice in June, during which the longest period of daylight occurs.

# VENUS AT GREATEST WESTERN ELONGATION

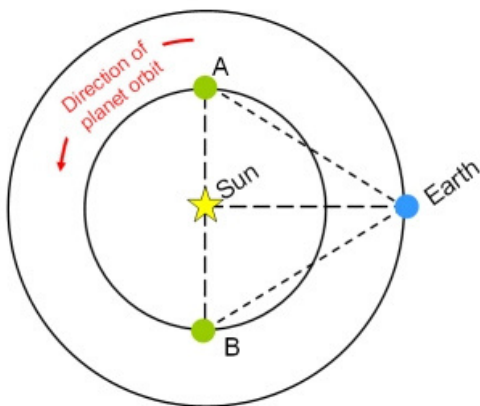
*Best day to observe venus*



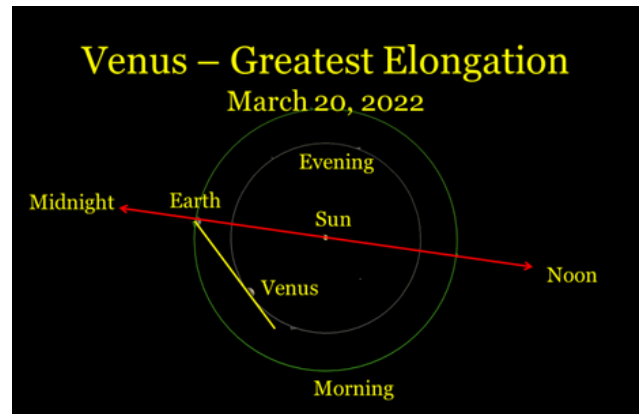
(Image credit: Earthsky.org)

### What's Elongation

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



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



(Image credit: Whenthecurveslineup.com)

### Greatest Western Elongation

On March 20, 2022 Venus will reach its greatest separation from the Sun in its 2022 morning apparition. It will be shining brightly at mag -4.4. Venus is visible as a morning star for around 263 days (about eight and a half months). Its farthest point from the Sun in the early-morning sky is called its greatest elongation west.

**"Maximum & Minimum Angular distance of Venus from the sun (seen from the Earth) at greatest elongation are 47 & 45 degrees respectively."**

# CONJUNCTIONS FOR THE MONTH

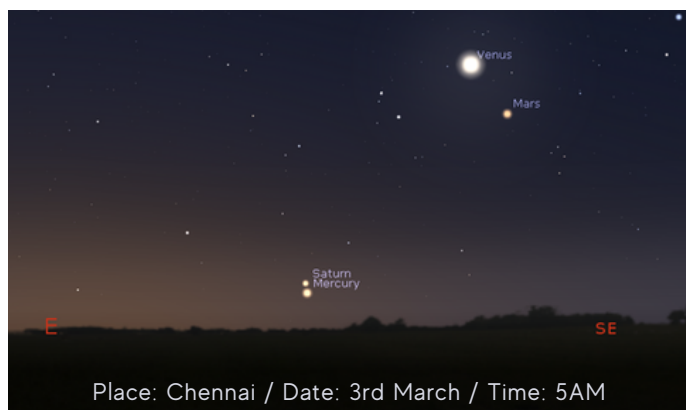
**Conjunction** - Occasionally two or more objects meet up with each other in our sky. Astronomers use the word conjunction to describe these meetings. Technically speaking, objects are said to be in conjunction in that instant when they have the same right ascension on our sky's dome. Practically speaking,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

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

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

## Conjunction of Mercury and Saturn

**Date: 3rd March**, Planets Saturn, & Mercury will align in the early morning sky. Look towards east before sunrise.



Place: Chennai / Date: 3rd March / Time: 5AM

(Image credit: Stellarium)

## Conjunction of Venus, Mars and Saturn

**Date: 25th March**, planets such as Venus, Mars and Saturn will form a compact triangle in the morning sky.

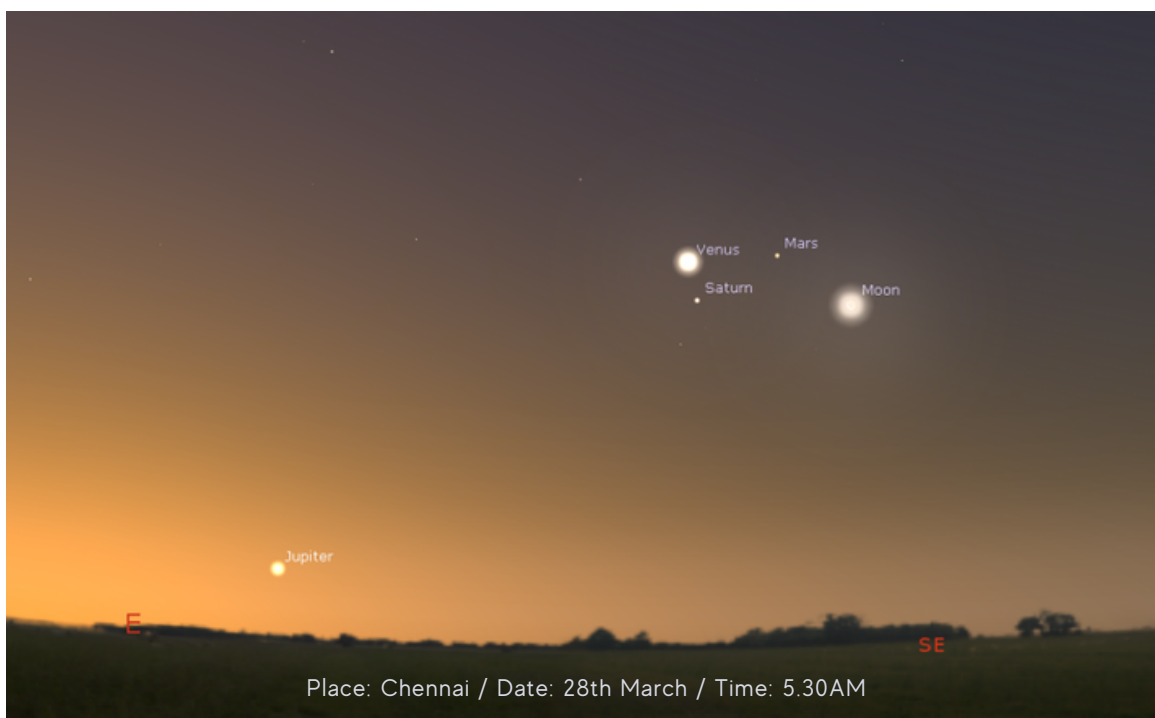


Place: Chennai / Date: 3rd March / Time: 4.30AM

(Image credit: Stellarium)

## Conjunction of Moon with Venus, Mars and Saturn

**Date: 28th March**, planets such as Mars, Saturn and Venus will appear extremely close along with Moon before sunrise.



Place: Chennai / Date: 28th March / Time: 5.30AM

(Image credit: Stellarium)

# STUDENT'S CORNER

## The birth & death of the universe

Abhay Dhanush Sadhu

iAstronomer member, Space India.

There can be many theories but the most commonly accepted one for the creation of our universe is big bang.

**Big Bang:** No one knows how the energy came to create our universe. But first everything in our universe stayed at one point. Then it exploded into big bang and gravity was thus created. Then all the atoms' fusions came into existence after millions of years. Then when first stars were created, they formed early galaxies. Millions of years later our Milky Way galaxy was created.

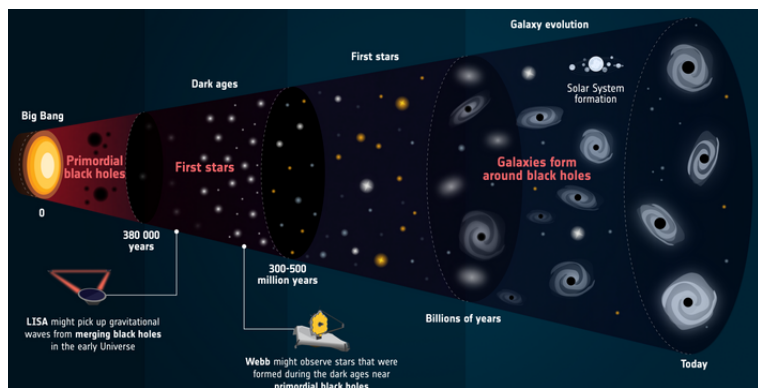
Possible theories in which the universe will end in the next trillions of years.

**The Big Rip:** In this theory, the dark energy will expand the universe which the stars will stop being formed and all the stars will die. The universe now becomes dark and now the black holes will only remain in the universe and also become the only objects to have energy. Slowly a dangerous radiation emitting from the black hole will kill the black holes. The energy in the universe will still remain same because it neither cannot be created or destroyed. In this point of time, the time will completely stop. Even before that, the universe will have completely decayed of all the atoms and there remains only photons, the particles of light. The universe after the death of the last black hole, the universe will freeze and stops the movement of photons because the universe will cool the photons to absolute zero and the time stops.

The universe will tear apart and form another universe because the energy can't be destroyed. So, this is the first theory in which many of the scientists believe.

**The Big Crunch:** In this theory, the dark matter and dark energy somehow weakens and slows the expansion of the universe. Now gravity will be the main force and the universe will shrink in size. The gravity will keep on pulling the universe until it is collapsed like how it was at the big bang [The biggining of the universe]. Still in this theory also, another universe forms because the energy cannot be destroyed.

There could be more ways in which the universe would die. Studying the dark matter and dark energy will dramatically change our understanding of the universe. If the multiverse [multi universe] theory is true, there may be many deaths of many universes. Because of that, more universes will be created because of the left-over energy from the dead universe.



There may be some universes which can end up of big rip and there could be some universes which can end up in big rip. The universes which expand very fast after the big bang, could end up in big rip because of more empty space being created inside them. The universes which expand slowly, there gravity becomes the main force instead of dark energy and the universe starts collapsing until the left-over energy of the universe remains. They could end up in big crunch.

**Conclusion:** Our universe is only 13.7 billion years old and has trillions of years' time to end up either in big crunch or big rip. Most of the scientists believe in big rip because when 2 or more galaxies collide with each other, they could create more empty space in which more energy in the universe get converted in dark energy and the normal original matter in the universe which make stars, planets, black hole, and so on will get transformed into the dark matter which could accelerate the speed of the growth of the universe. So, this is about the death of the universe and how it will happen.

## Human Space Exploration

Shrawani Paithankar,

iAstronomer member.

Today we have ISS on outpost in orbit with recent growth of interest in space. We have seen aerospace companies developing spacecrafts to develop an industry called space tourism. We have seen NASA announced finding planets, moons and solar systems and we have seen Companies such as SpaceX pushing their vision of an interplanetary species but what's the point?

Exploration is not just for about curiosity exploration is necessary advancement whether that be for yourself or your planet because human's have explored. We have expanded our scientific knowing and technology. Exploration gives us information which allows us to understand our Universe move with help of technology

We don't know when, or even if, we'll find life beyond Earth, but NASA scientists continue the hunt among the thousands of exoplanets confirmed in the galaxy so far. What's out there? The Exoplanet sky so far.

When we take on the effort to start exploring space, then we can discover new truths about our planet and culture simultaneously. Space exploration very likely see good returns on their investments, as well as good jobs for trained workers.

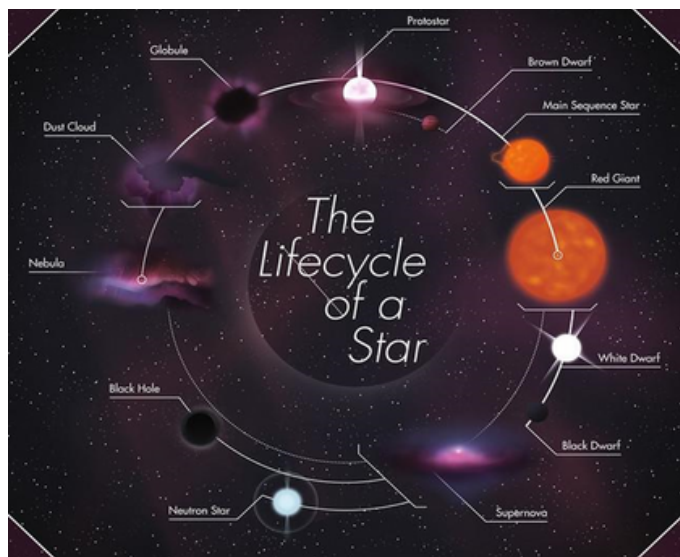
# The Life Cycle of a Star

Daksh Rathi

iAstronomer member.

The Life Cycle of Stars. Stars go through tremendous things in the course of their life. In a star's life they go through seven different phases. These phases can take many years to go through. When a star is made up it starts needing. Gas and dust in space to form what is called a nebula. Nebulae are the birthplace of stars. There are different types of nebulas one being an emission nebula.

Our Sun is a perfect example of a star, and there is an incredible amount of stars in the Universe. It is a star among hundreds of billions of stars within our Milky Way Galaxy, and our galaxy is one of billions of galaxies in the universe. Stars live for a very long time; millions, billions, or tens of billions of years so we can never really observe the life of a star its birth, life, and death. In determining the life cycle of a star, astronomers observe many of the billions of stars around us and see them at different stages of life, therefore piecing together a star's evolution.



A star is born from clouds of gas and dust called nebulae found in interstellar space. Nebulae are composed mainly of Positively charged nuclei usually repel one another, but under the intense heat, the nuclei collide and overcome repulsion causing them to fuse. When fusion starts, the collapsing portion of the original nebula becomes a star. If the star is unable to trigger nuclear fusion, it becomes what is known as a brown dwarf, or a failed star.

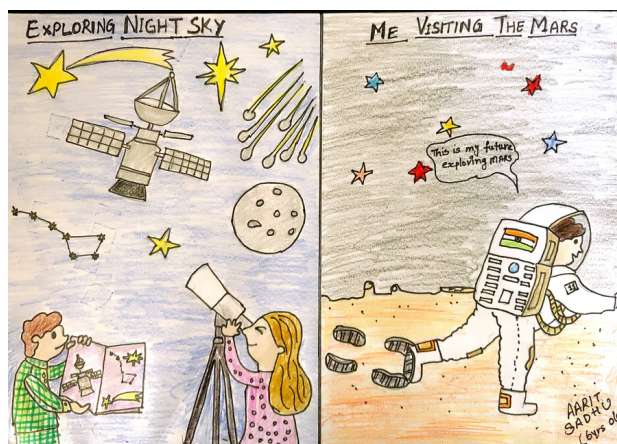
If a star achieves nuclear fusion, it proceeds to use up its hydrogen fuel. A star's fate depends on its mass. Depending on whether a star is of average mass star, much like our Sun, or if the star is of a larger mass star its fate will be different. Average mass stars have a mass similar to our sun, also known as 1 solar mass. Large mass stars have a mass 15 times that of our sun, or 15 solar mass.

Average mass stars follow six major stages. First is its original nebulae condensation.

Then a star glows from the heat of its gravitational unification. A star begins fusing hydrogen in its core (known as a stars main sequence). Once hydrogen in its core is almost completely used up, the star leaves its main sequence (which lasts about 10 billion years), and enters a red giant stage in which its core becomes hotter fusing helium to carbon.

Because of its mass, the star is unable to fuse carbon but does manage to explode a shell of gas called planetary nebula. Finally, the star becomes a dying star shrinking in diameter because it can no longer produce energy, becoming what is called a white dwarf. Massive Stars follow the same pattern till main sequence stage but after main sequence stage they transform into a Red Super Giant phase in which its core becomes hotter fusing helium to carbon after the Red Super Giant stage it does a supernova and either transforms into a black hole or an neutron star .

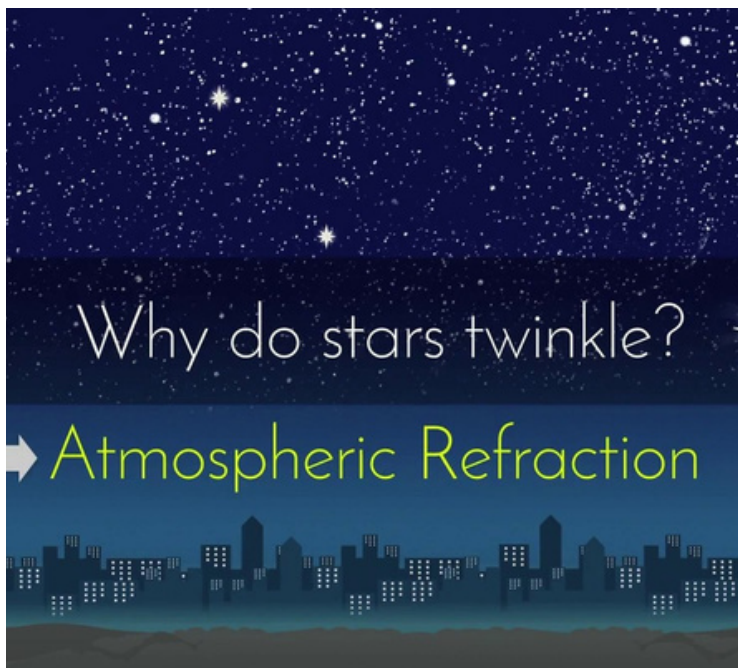
## Drawing by spacians



Aarit Sadhu  
iAstronomer member.



Reya  
iAstronomer member.



## Why only stars twinkle at night?

Naisargi Solanki  
iAstronomer member.

### Introduction

Have you ever wondered how these stars may communicate with you by their twinkling? that we've already written a song about it (twinkle twinkle little star). Why can't we twinkle, why can't the moon twinkle, after all, we're all made up of different elements and gases! This twinkling, also known as Scintillation, is caused by the earth's atmosphere and weather patterns.

Yes, when we look at stars from the surface of the planet, we are also viewing through different layers of the atmosphere. There is also air in this atmosphere that is moving. It moves in a convective (bubble) manner. That is to say, hot air blobs rise, cool, and then fall to be reheated by the warm soil below. Astronomers and engineers who design telescopes are well-versed in the subject. Since, some of these telescopes are built to compensate for the blurring effects of these motions - the atmosphere was tumultuous (a lot of bubbling), and the star's appearance was huge and blobby. This would go on until the cirrus clouds came ahead of the next front. When frozen cirrus clouds form in very calm air, the image will appear tiniest and most steady when you click it.

### Why the Moon or other planet can't twinkle or have its own light?

Stars, on the other hand, shine because they are exceedingly hot. Nuclear reactions deep within the cores of the stars provide them with energy. Hydrogen is transformed into helium in most stars (including our sun), releasing energy that warms the star. The temperature inside is millions of degrees, which is tremendously hot! This causes the star's outer layers to warm, releasing light. To burn, something on fire, such as wood in a fireplace, requires oxygen. The heat of such a fire is intense, but not as intense as that of a star. The majority of stars resembles our sun. In actuality, the sun is a fairly ordinary star.

Because it is close to Earth, it is significantly brighter than the other stars. Even the nearest star (apart from the sun) is a long way off.

The time it takes for light to travel from one point to another can be compared. Light travels 186,000 miles per second, which is quite fast. Despite this, light travels from the sun to the earth in around eight minutes. How long does light from the sun take to reach the nearest star? 4 YEARS!!

### Conclusion

The size of planets, the moon, and the sun, as well as ourselves, prevents them from doing so. Even if the light bends slightly, none of these items are small enough to notice. As a result, they don't twinkle. Moonlight, according to Julie Menard of Washington State University, is simply sunlight that shines on the moon and bounces off. On the moon's surface, light reflects off old volcanoes and lava flows. Why aren't we able to make light in the same way as stars do? According to a previous study, the human body emits visible light that is 1,000 times less strong than the levels to which our eyes are sensitive. Almost all living things, in fact, emit very feeble light, which is assumed to be a result of metabolic events involving proteins. Almost all living things, in fact, emit a faint light that is assumed to be a result of metabolic events involving free radicals. That's why we can see it with UV or infrared lights. Because of the vast layers of the atmosphere, stars do not appear to twinkle.

## Astrophotographs by Students

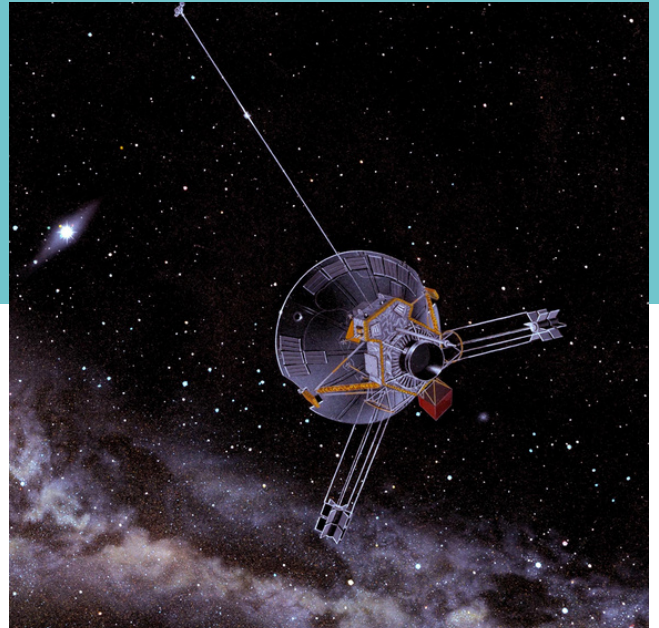




# HISTORICAL EVENTS THAT HAPPENED IN MARCH

## Outer Solar system exploration

# PIONEER IO



Pioneer 10 (originally designated Pioneer F) is an American space probe, launched in 1972 and weighing 258 kilograms (569 pounds), that completed the first mission to the planet Jupiter. Thereafter, Pioneer 10 became the first of five artificial objects to achieve the escape velocity needed to leave the Solar System. This space exploration project was conducted by the NASA Ames Research Center in California. The space probe was manufactured by TRW Inc.

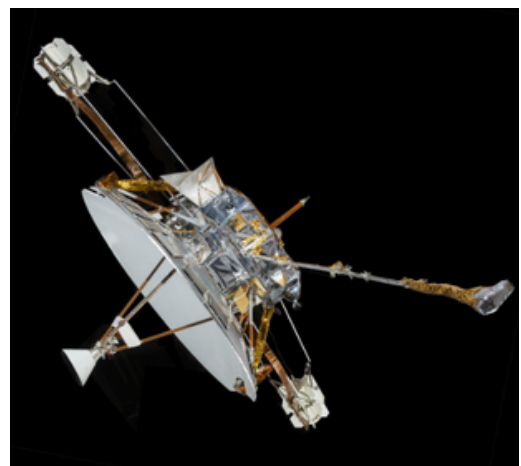
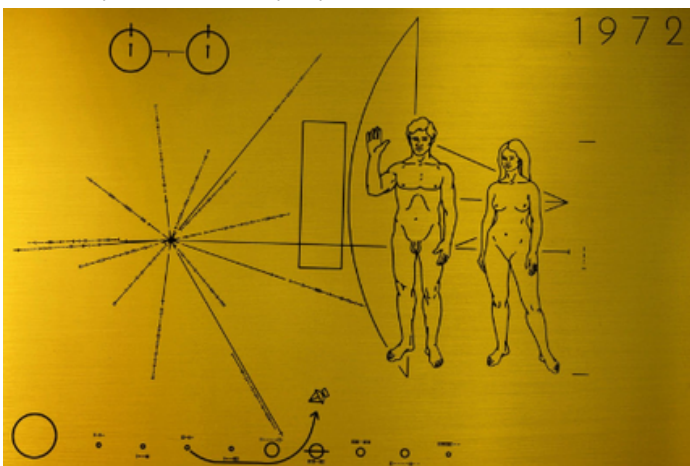
Pioneer 10 was assembled around a hexagonal bus with a 2.74-meter (9 ft 0 in) diameter parabolic dish high-gain antenna, and the spacecraft was spin stabilized around the axis of the antenna. Its electric power was supplied by four radioisotope thermoelectric generators that provided a combined 155 watts at launch.

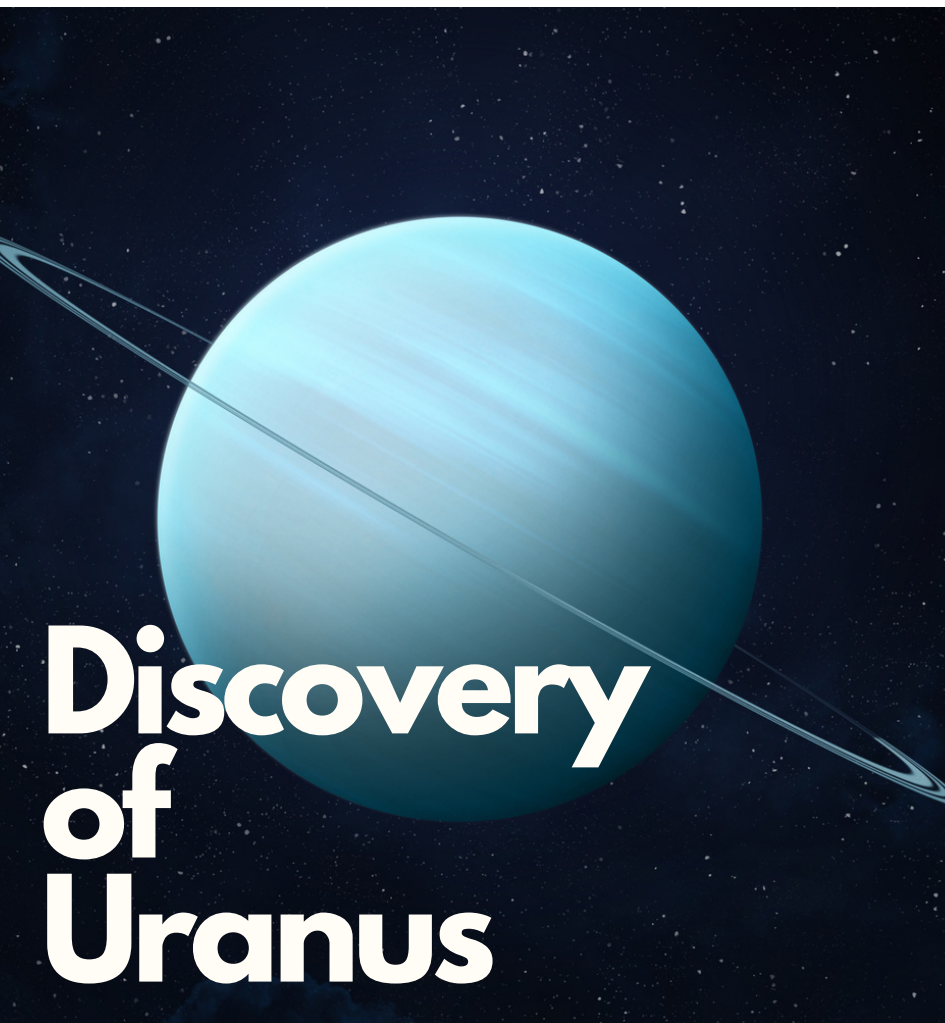
It was launched on March 3, 1972 at 01:49:00 UTC (March 2 local time) , by an Atlas-Centaur expendable vehicle from Cape Canaveral, Florida. Between July 15, 1972, and February 15, 1973, it became the first spacecraft to traverse the asteroid belt. Photography of Jupiter began November 6, 1973, at a range of 25,000,000 kilometers (16,000,000 mi), and about 500 images were transmitted. The closest approach to the planet was on December 3, 1973, at a range of 132,252 kilometers (82,178 mi). During the mission, the on-board instruments were used to study the asteroid belt, the environment around Jupiter, the solar wind, cosmic rays, and eventually the far reaches of the Solar System and heliosphere.

Radio communications were lost with Pioneer 10 on January 23, 2003, because of the loss of electric power for its radio transmitter, with the probe at a distance of 12 billion kilometers (80 AU) from Earth.

### The Pioneer Plaque

The Pioneer Plaque is a physical, symbolic message affixed to the exterior of the Pioneer 10 spacecraft. At the core of this message is a fundamental concept that establishes a standard of distance and time, which, thereafter, is employed by the other components of the plaque.





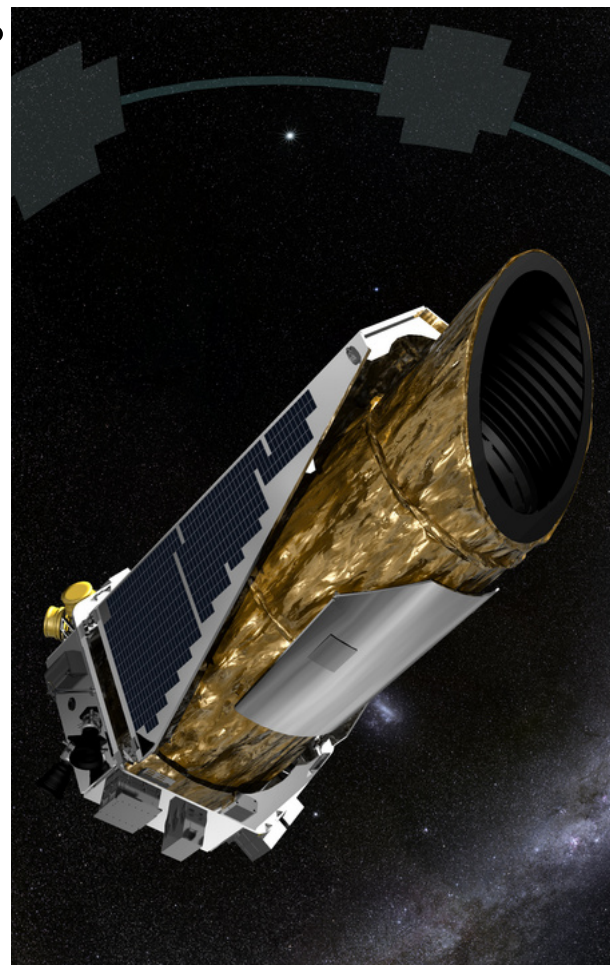
# Discovery of Uranus

Uranus is the seventh planet from the Sun. Its name is a reference to the Greek god of the sky, Uranus, who, according to Greek mythology, was the great-grandfather of Ares (Mars), grandfather of Zeus (Jupiter) and father of Cronus (Saturn). It has the third-largest planetary radius and fourth-largest planetary mass in the Solar System. Uranus is similar in composition to Neptune, and both have bulk chemical compositions which differ from that of the larger gas giants Jupiter and Saturn. For this reason, scientists often classify Uranus and Neptune as "ice giants" to distinguish them from the other giant planets.

As with gas giants, ice giants also lack a well defined "solid surface." Uranus's atmosphere is similar to Jupiter's and Saturn's in its primary composition of hydrogen and helium, but it contains more "ices" such as water, ammonia, and methane, along with traces of other hydrocarbons.

It has the coldest planetary atmosphere in the Solar System, with a minimum temperature of 49 K ( $-224\text{ }^{\circ}\text{C}$ ;  $-371\text{ }^{\circ}\text{F}$ ), and has a complex, layered cloud structure with water thought to make up the lowest clouds and methane the uppermost layer of clouds. The interior of Uranus is mainly composed of ices and rock.

Like the other giant planets, Uranus has a ring system, a magnetosphere, and numerous moons. The Uranian system has a unique configuration because its axis of rotation is tilted sideways, nearly into the plane of its solar orbit. Its north and south poles, therefore, lie where most other planets have their equators. Voyager 2 remains the only spacecraft to visit the planet. Observations from Earth have shown seasonal change and increased weather activity as Uranus approached its equinox in 2007. Wind speeds can reach 250 metres per second (900 km/h; 560 mph).



**The Kepler Space Telescope is a retired space telescope launched by NASA in March 2009 to discover Earth-size planets orbiting other stars. Named after astronomer Johannes Kepler, the spacecraft was launched into an Earth-trailing heliocentric orbit.**

# EVENTS BY SPACE

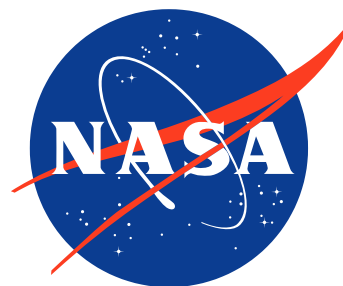
## SALLY RIDE EARTHKAM - CAPTURING YOUR FAVORITE PLACE OF EARTH FROM ISS

Sally Ride ISS EarthKAM is an international educational programme of NASA through which students can receive stunning images of the Earth from a digital camera mounted at a nadir pointing window in the International Space Station (ISS). This programme was started by Dr Sally Ride, the first American woman in space and was originally called kidSat. SPACE India brings this unique workshop to our schools, with the enthralling experience of imaging Earth from a unique perspective of space. Description of Activity

Every year 4-5 EarthKAM missions take place in which SPACE India holds workshops where students are guided by SPACE educators to select locations of geographical and environmental interest, based on weather and orbit checking, and through a software, interface submit requests which are sent to ISS. ISS captures images of the locations and makes high-quality images available for download. Images have been taken of regions of interest in geography, environment, ecology and natural disasters.



**SPACE™**  
EMPOWERING LIFE THROUGH SCIENCE



### History

JoBea Holt an Earth scientist from NASA's JPL had the idea for KidSat and worked with Sally Ride, Elizabeth Stork from Johns Hopkins Center for Talented Youth and JPL engineers to implement it in 1995. Holt directed the KidSat program during its first three shuttle flights and established the process through which students and educators could request images. A Special Section of the IEEE Transactions on Geoscience and Remote Sensing presents the KidSat missions along with the science, engineering and education that were integral to the program. The program allowed middle school students to capture images of Earth using a camera aboard the Space Shuttle.

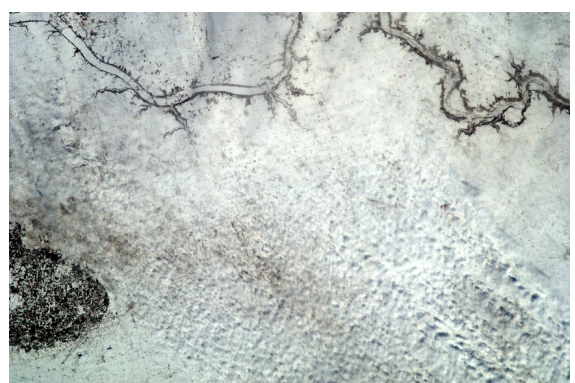
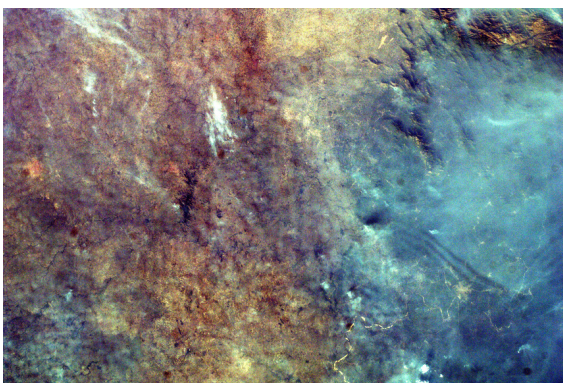
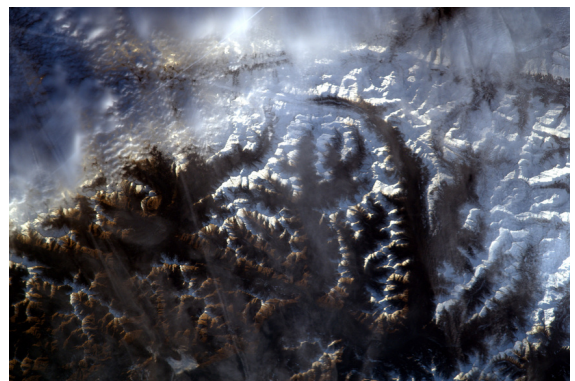
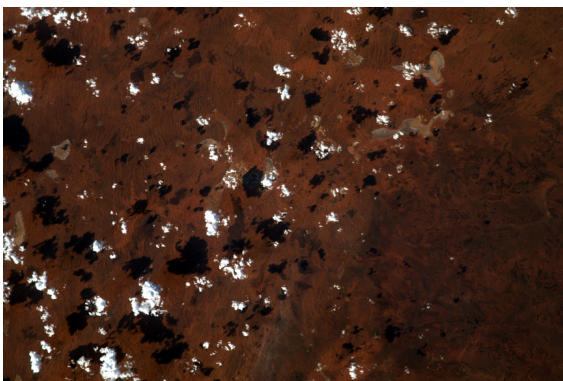
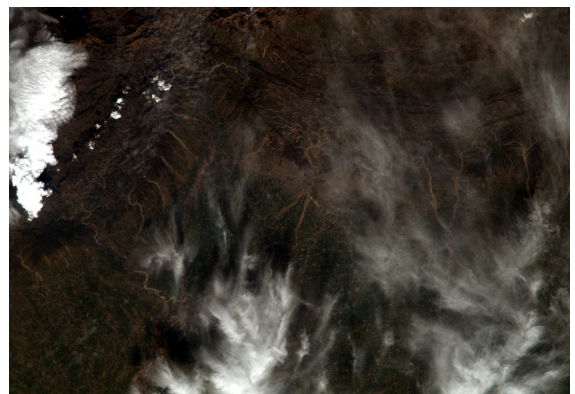
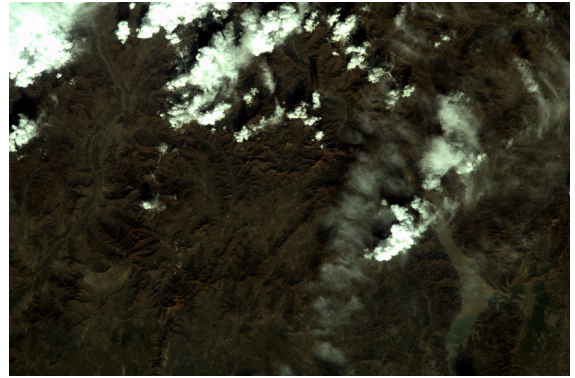
KidSat was renamed EarthKAM (Earth Knowledge Acquired by Middle school students) in 1998 and flew as part of three additional shuttle flights. In 2001, the camera moved to the International Space Station, and the program was renamed ISS EarthKAM. After Ride's death in 2012, NASA renamed the program Sally Ride EarthKAM in her honor.

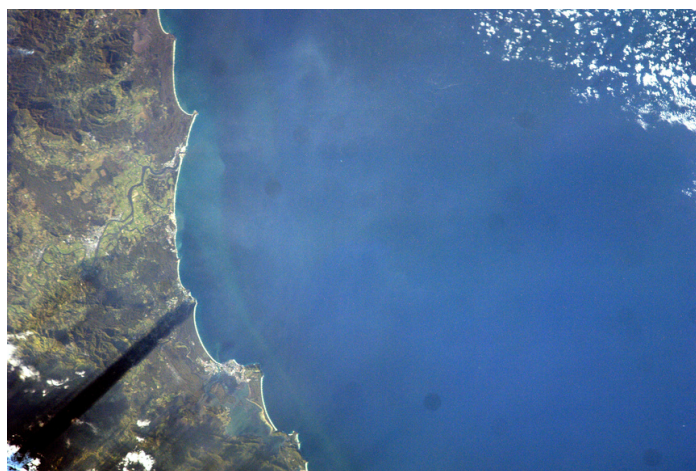
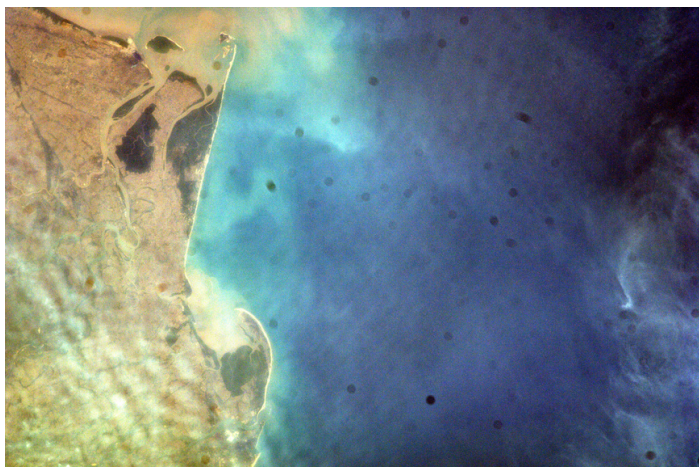


Astronaut Sally Ride



Some of the best images requested by students from the recent EarthKAM mission





## ASTROPHOTOGRAPHS BY SPACE TEAM



Equatorial star trails

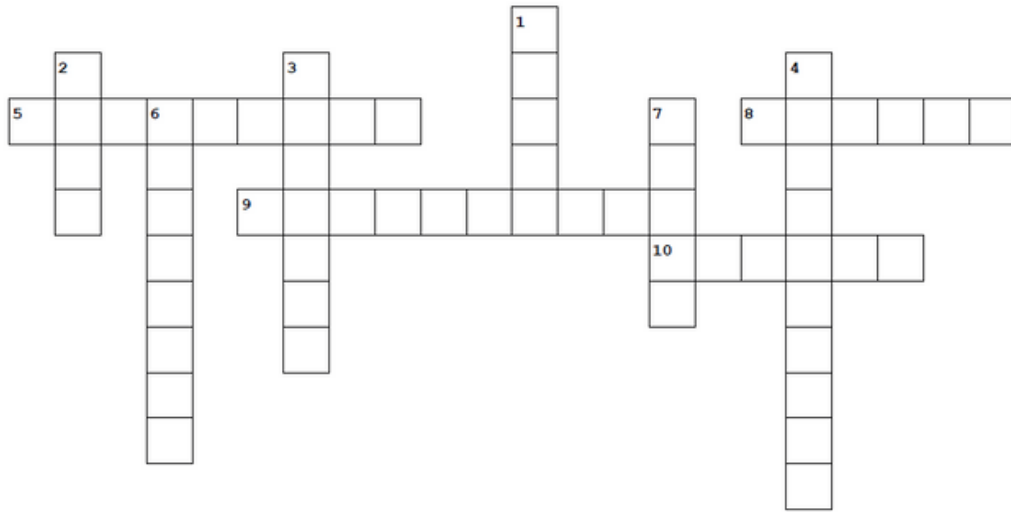


Full Snow Moon

These two astrophotographs are captured by an astronomy educator Ranjith Kumar from space team.

# TRAIN YOUR BRAIN

## CROSSWORD



**Down**

**Across**

1. The biggest constellation in the sky
2. The smallest constellation
3. The brightest star in the constellation of Scorpius
4. The constellation which was named after the mother of Andromeda
6. A prominent pattern or group of stars, typically having a popular name but smaller than a constellation
7. The largest constellation among the zodiac constellation

5. Polaris resides here
8. Which constellation contains the pleiades star cluster?
9. The constellation of the brightest star in our night sky
10. Pollux is the brightest star in the constellation.

## ASTRONOMY WORD PUZZLE

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

- ELONGATION
- ASTEROID
- TELESCOPE
- SPACESHUTTLE
- UNIVERSE
- ROVER
- CLUSTER
- BINOCULARS
- OCCULTATION
- METEOR
- COSMOLOGY
- CONSTELLATION
- ECLIPSE
- ROCKET
- ASTRONOMY

Answers for last month puzzles.



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

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



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

Inviting Astronomy Ambassadors Globally

HIGHLIGHTS OF THE PROGRAM

MEMBERSHIP BENEFITS

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

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



Membership open in all Countries

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

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

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

Buy astronomical products from us

**GSO 8" DOBSONIAN**



200MM APERTURE NEWTONIAN

1200MM FOCAL LENGTH

USER FRIENDLY DOBSONIAN BASE

DIVE INTO THE DEEP SKY OBJECTS WITH LARGER APERTURE

For Orders and Queries  
-91-7338819951 | -91-9212669974  
Visit:  
Delhi | Space Arcade, Janakpuri  
Chennai | Space Chennai, Guindy  
[www.spacearcade.in](http://www.spacearcade.in)

₹ 39000/-  
\*INCLUSIVE OF ALL



₹ 14999/-

**SPACE PROBE 80MM REFRACTOR TELESCOPE**

80MM APERTURE REFRACTOR

FAST F/5 SCOPE TO GO DEEPER IN UNIVERSE

FULLY COATED LENS FOR VISUAL AS WELL ASTROPHOTOGRAPHY

FOCAL LENGTH 400MM

COMES WITH A STURDY EQ MOUNT

FULL SIZE ALUMINIUM TRIPOD

For Orders and Queries

-91-7338819951 | -91-9212669974  
sales@spacearcade.in

<https://www.spacearcade.in>

