A STUDENT-RUN MAGZINE TO PROMOTE FREE THINKING

Nomizo

Ponder deep to see over head

From Earth's core to the Unobservable Universe, Discover the depths of the Reality.

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ISSUE 2 • FEBRUARY 2021

About US

Hello, Nomizo is a student-run magazine which intends to spread the idea of free thinking to everyone. We will be uploading this magazine monthly and will try to bring new features every time; our main aim is to create a platform where students can introduce new ideas to their community and an atmosphere where efforts and learning is always appreciated. Our belief is that our world is an open book written in words of science but only visible to a determined observer and we want to create a community of such people.

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FEBRUARY

The Roman month Februarius was named after the Latin term Februum, which means "purification", via the purification ritual Februa held on February 15 in the old lunar Roman calendar. January and February were the last two months to be added to the Roman calendar, since the Romans originally considered winter a month-less period, which means that winter had no months. Many times, the February month was reduced to 23-24 days and then an extra month was added to realign the year with the seasons or simply the extra month was inserted as a measure to make the calendar year correspond to a solar year.

Under the reforms that installed the Julian calendar, system of developing an inter-calary month, i.e. an extra month, by reducing the length of February month was abolished and leap years occurred regularly every 4th year under which February gained an extra 29th day. Simultaneously, thereafter February remained as the 2nd month of the calendar. The later arrived Gregorian calendar was not too different from this calendar.

This month is also called as Solmonath (mud month) and Kale-monath (named for cabbage) in old English terms, helmikuu meaning ‘month of the pearl’ in Finnish, luty in Polish and Ukrainian, sechko meaning month of cutting wood in Macedonian, unor meaning month of submerging in Czech and svecan meaning the month of cutting down of trees in Slovene.

Done a lot about the past, let’s peek into the fascinating facts revolving around February.

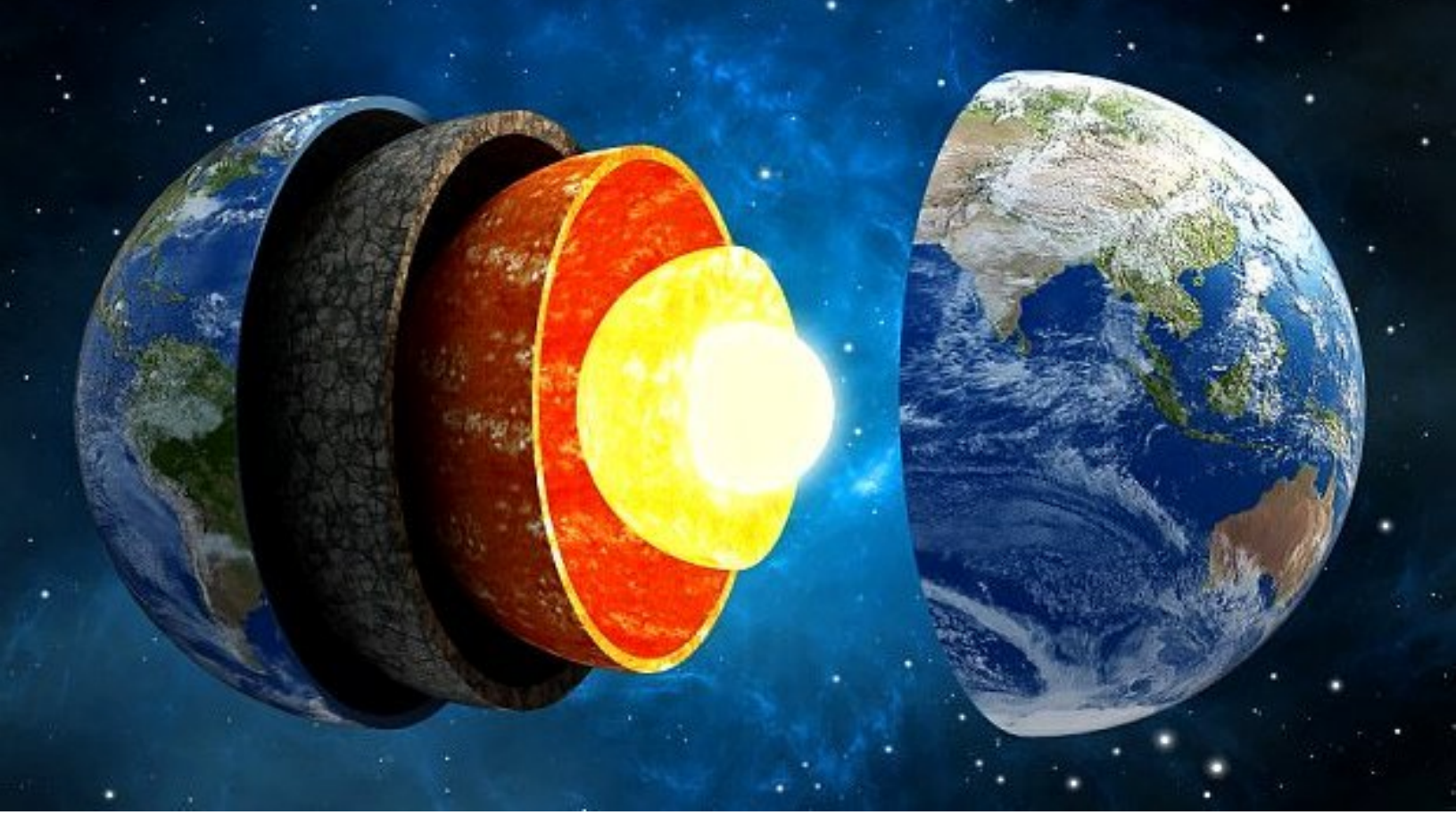
Having only 28 days, February is the only month which can pass without a single full moon or a single new moon. Or simply it means that it is possible that a person is not able to see a single full moon or a single new moon in the February month. This enthralling thing last happened in 2018 and will next happen in 2037 in the case of full moon and in the situation of a new moon, in 2014, February month had no new moons and in the future it will again happen in 2033. So next time be sure to verify this fact!

February is also the only month of the calendar that, once every six years and twice every 11 years consecutively, either back into the past or forward into the future, has four full 7-day weeks. This last happened in 1965, 1971, 1982, 1993, 1999 and 2010. And will again happen in 2027. 1 more thing to look upon is that 2021 also agrees with the above given fact. Just open your calendar and check you'll be enthralled!

Last but not the least, February is also called as the month of love which is suspected to be originated from St. Valentine, a Roman who was martyred for refusing to give up Christianity. He died on February 14, 269 A.D., the same day that had been devoted to love lotteries.

Sources:https://en.wikipedia.org/wiki/February

ST. VALENTINES



EARTH'S CORE

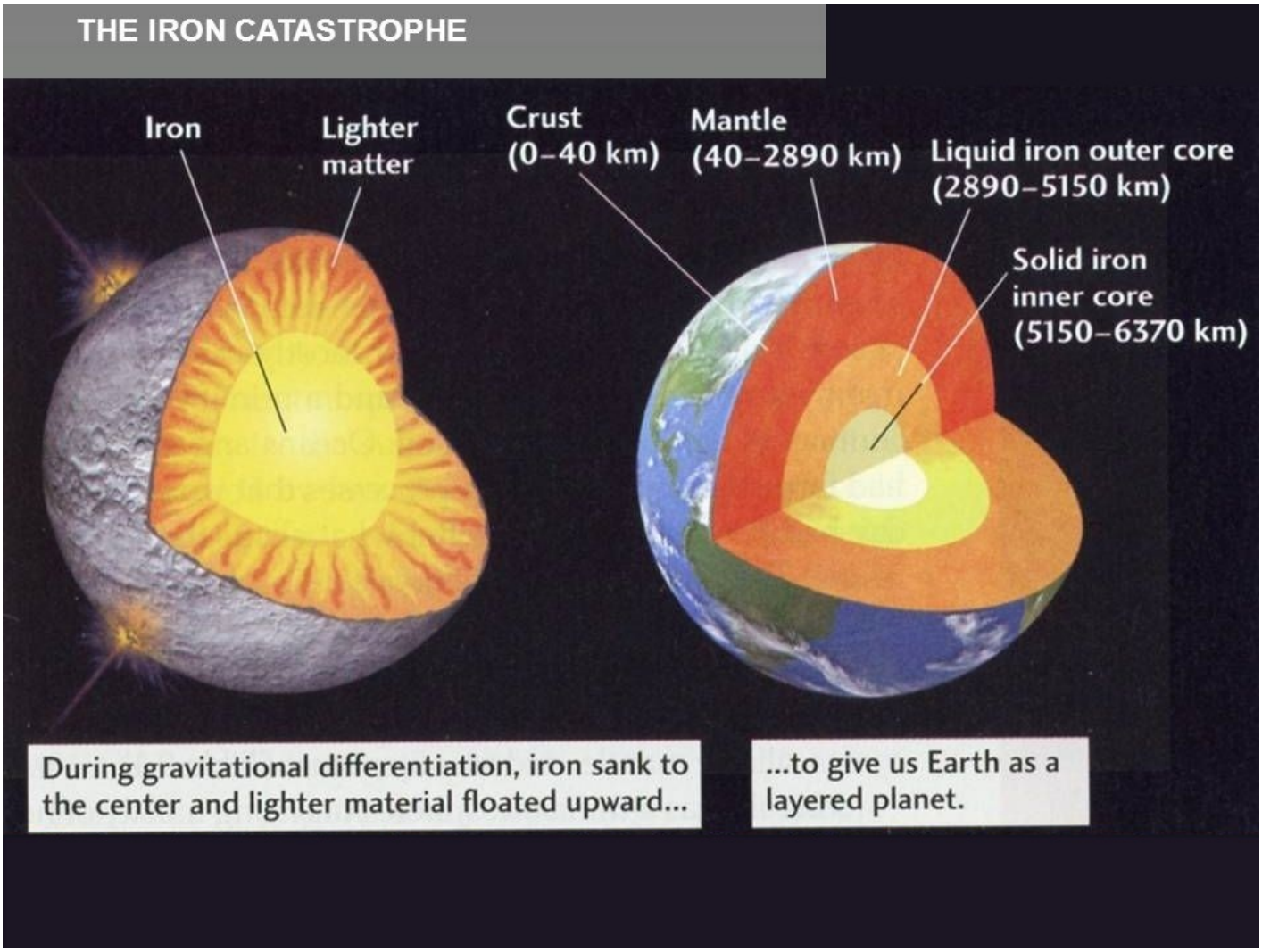
By Vedant Kabra

We live on this massive orange-shaped Earth whose radius is approximately 6371 km. But do we have actually wondered what lies beneath us? Our earth, internally, has been divided in 4 parts, namely, the cool brittle crust, almost solid mantle, liquid outer core and solid inner core. Earth's core is the center-most part of our planet and here we would be discussing more about it.

So what do we exactly mean by core? And what are the different physical and chemical characteristics of that area? Let's look into the matter more deeply...

The history behind this core's formation is linked to the formation of our planet. When Earth was formed about 4.5 billion years ago, it was a uniform ball of hot rock. Radioactive formation (the collision, accretion, and compression of space rocks) caused the ball to get even hotter. Eventually, after about 500 million years, our young planet's temperature heated to the melting point of iron—about 1,538° Celsius. This pivotal moment in Earth's history is called the iron catastrophe.

The iron catastrophe allowed greater, more rapid movement of Earth's molten, rocky material. Relatively buoyant material, such as silicates, water, and even air, stayed close to the planet's exterior. These materials became the early mantle and crust. Droplets of iron, nickel, and other heavy metals gravitated to the center of Earth, becoming the early core. This important process is called planetary differentiation and led to the formation of core.



But this is a story of much delayed time. You might be wandering that how the idea of the core came or simply how was it just revealed?

We can estimate Earth's mass by observing the effect of the planet's gravity on objects at the surface. It turns out that the mass of the Earth is 5.9 sextillion tonnes: that's 59 followed by 20 zeroes. There's no sign of anything that massive at the surface. The density of the material at the earth's surface is much lower than the average density of the whole earth which suggests that something is much denser in this earth. So if there is nothing so heavier and denser on the surface then it could be safely concluded that most of the earth's mass was concentrated in the Centre of the planet.

So now the question came that which heavy materials make up the core? The answer came as iron whose figures still can make up a debate. Now the reason behind this answering is also fascinating.

The main evidence for this is the huge amount of iron in the universe around us. It is one of the ten most common elements in our galaxy, and is frequently found in meteorites.

Given how much there is of it, iron is much less common at the surface of the Earth than we might expect. So the theory is that when Earth formed 4.5 billion years ago, a lot of iron worked its way down to the core. That's where most of the mass is, and it's where most of the iron must be too. Iron is a relatively dense element under normal conditions, and under the extreme pressure at the Earth's core it

would be crushed to an even higher density, so an iron core would account for all that missing mass.

So here till now we have discussed about the formation of core which included the development of its idea and the science applied behind its formation with its actual reason.

Now we will be talking more about its content and physical features, which obviously are estimations because we don't have the technology to dig too deep in the ground.

The earth's core is divided into two separate regions: the liquid outer core and the solid inner core.Earth's inner coreis the innermost geologic layer of the planet Earth. The ball-shaped core lies beneath the cool, brittle crust and the mostly-solid mantle. The core is found about 2,900 kilometers (1,802 miles) below Earth's surface, and has a radius of about 3,485 kilometers (2,165 miles). The inner core is believed to be composed of an iron–nickel alloy with some other elements. The temperature at the inner core's surface is estimated to be approximately 5,700 K (5,430 °C; 9,800 °F), which is about the temperature at the surface of the Sun. The liquid outer core surrounds the inner core and is believed to be composed of iron mixed with nickel and trace amounts of lighter elements. The Nickel iron alloy of the outer core is very hot, between 4,500° and 5,500° Celsius (8,132° and 9,932° Fahrenheit). The liquid metal of the outer core has very low viscosity, meaning it is easily deformed and malleable. It is the site of violent convection. The churning metal of the outer core creates and sustains Earth's magnetic field.

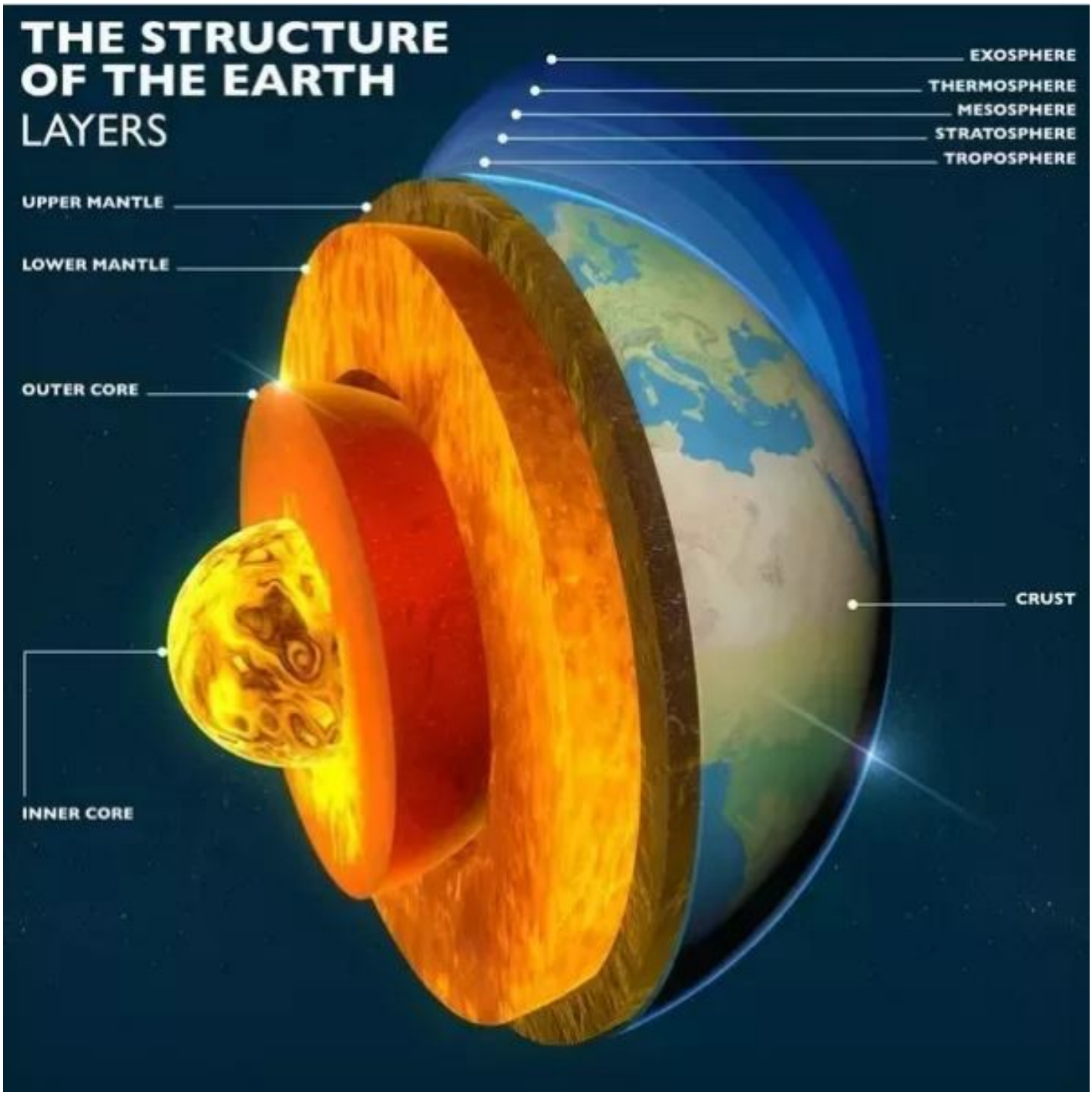
But nowadays scientists have found that our inner core is doing something strange which will obviously fascinate all of you. Some of its key features are:

·Geoscientists recently discovered that the inner core itself has a core—the inner inner core. This strange feature differs from the inner core in much the same way the inner core differs from the outer core. Scientists think that a radical geologic change about 500 million years ago caused this inner inner core to develop. They think the iron crystals may even have a completely different structure, or exist at a different phase.

·On September 27,1971, a nuclear bomb exploded on Russia's Novaya Zemlya islands which facilitated the work of many geoscientists. The blast sent waves so deep that they discovered that our core which is a roughly moon-size ball of iron floating within an ocean of molten metal is free to turn independently from our planet's large-scale spin, a phenomenon known as super-rotation. Capitalizing on the signals, John Vidale said that the inner core just rotates a bit faster than the whole earth!!!If his rate's right, it means that if we stood on a spot at the Equator for one year, the part of the inner core that was previously beneath us would wind up under a spot 4.8 miles away.

·As the entire Earth slowly cools, the inner core grows by about a millimeter every year. The inner core grows as bits of the liquid outer core solidify or crystallize. The crystallization process is very slow, and the constant radioactive decay of Earth's interior slows it even further. Scientists estimate it would take about 91 billion years for the core to completely solidify—but the sun will burn out in a fraction of that time (about 5 billion years).

So I would like to end the journey of core here, there's a lot to talk more about this area which is the deepest part of our whole planet earth. Meanwhile, geoscientists are working very hard in uncovering the secrets but as they slowly fetch one or the other result, the situation gets more complex and complicated. But the truth lies that there are many mysteries under us which are yet to be enclosed. Only time can tell us when will be actually knowing it, till then we can just wait.



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MARIANA TRENCH

By Shivam Patel

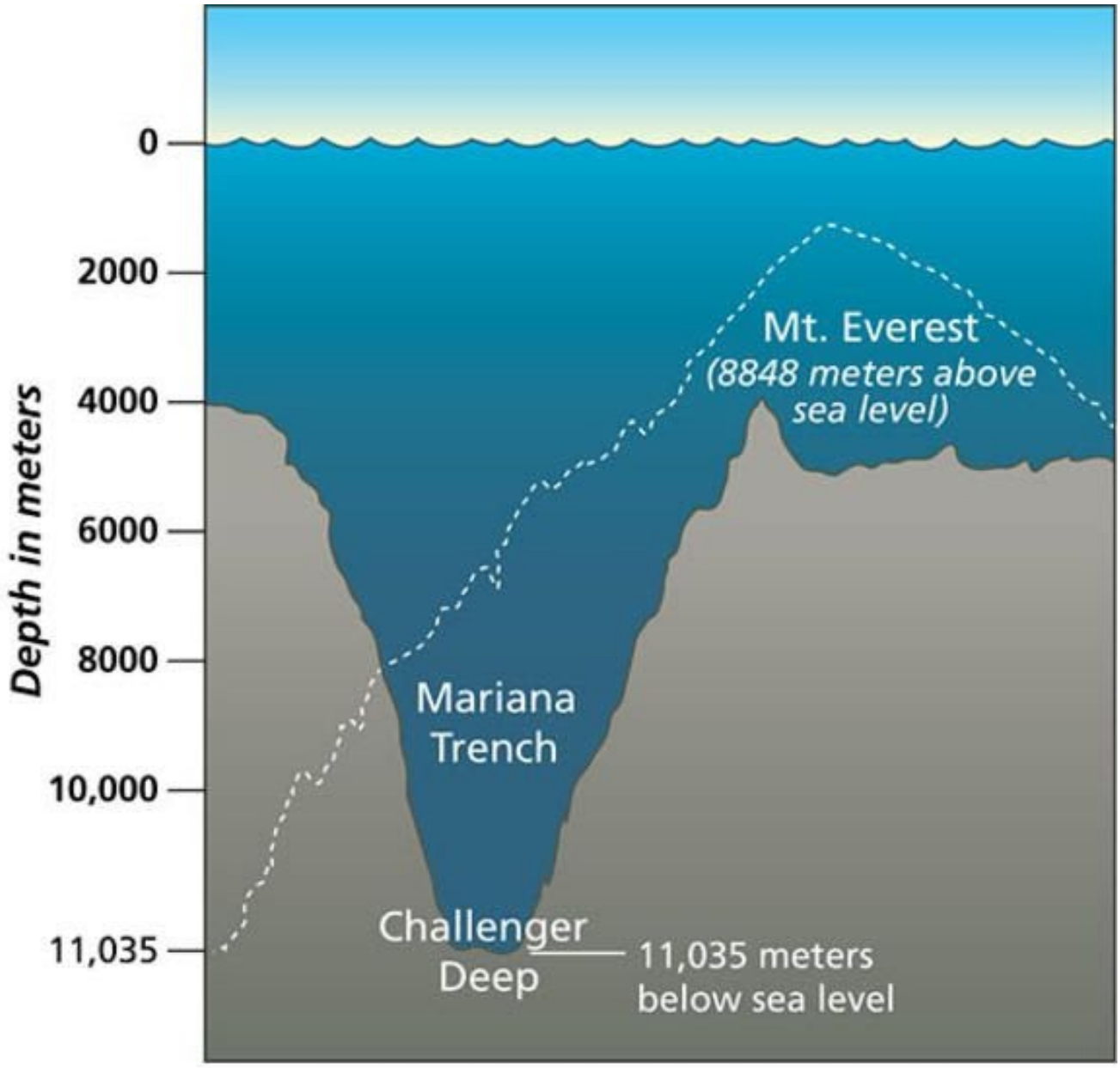
Having talked a lot about our core, now let's shift to 1 more fascinating place named Marianna trench. So, why Marianna trench only? The reason is, the lowermost part of the earth is of course the core, but we aren't completely sure about its statistics as they, till now, have come just by indirect methods and we don't have any such sample to confirm it, whereas this Marianna trench is the lowermost passage known to human beings! Till now only 3 people have been to this deepest area in the Ocean.

Let's peek more into this topic. The Mariana Trench is a crescent-shaped trench in the Western Pacific, just east of the Mariana Islands near Guam. The trench is named after these nearby Mariana Islands, which are named Las Marianas in honour of Spanish Queen Mariana of Austria, widow of Philip IV of Spain. The Mariana Trench is part of a global network of deep troughs that cut across the ocean floor.

The surroundings of the trench are known for many unique environments & ecosystems. The Mariana Trench contains the deepest known points on the Earth, vents bubbling up liquid sulfur and carbon dioxide, active mud volcanoes and marine life adapted to pressures 1,000 times that at sea level.

The Challenger Deep, which is the deepest known point in the Earth's seabed hydrosphere, is a part of Mariana Trench. In 2010, the Challenger Deep was pegged at 36,070 feet (10,994 metres), as measured with sound pulses sent through the ocean during a 2010 survey by the National Oceanic and Atmospheric Administration (NOAA).

made the first recordings of its depth. One fascinating fact about the Challenger Deep is, if we placed Mount Everest into the trench at Moreover, the depression is named after the British Royal Navy survey ship HMS Challenger, whose expedition of 1872–1876 this point, its peak would still be underwater by more than two kilometres.Surprisingly, the second-deepest place is also in the Mariana Trench. The Sirena Deep, which lies 124 miles (200 kilometers) to the east of Challenger Deep, is a bruising 35,462 feet deep (10,809 metres).



By this time, you must be really curious to know more. Moreover, there might be many questions popping up in your mind.

One of the first questions that comes in our mind is, "How was the Mariana Trench formed?"

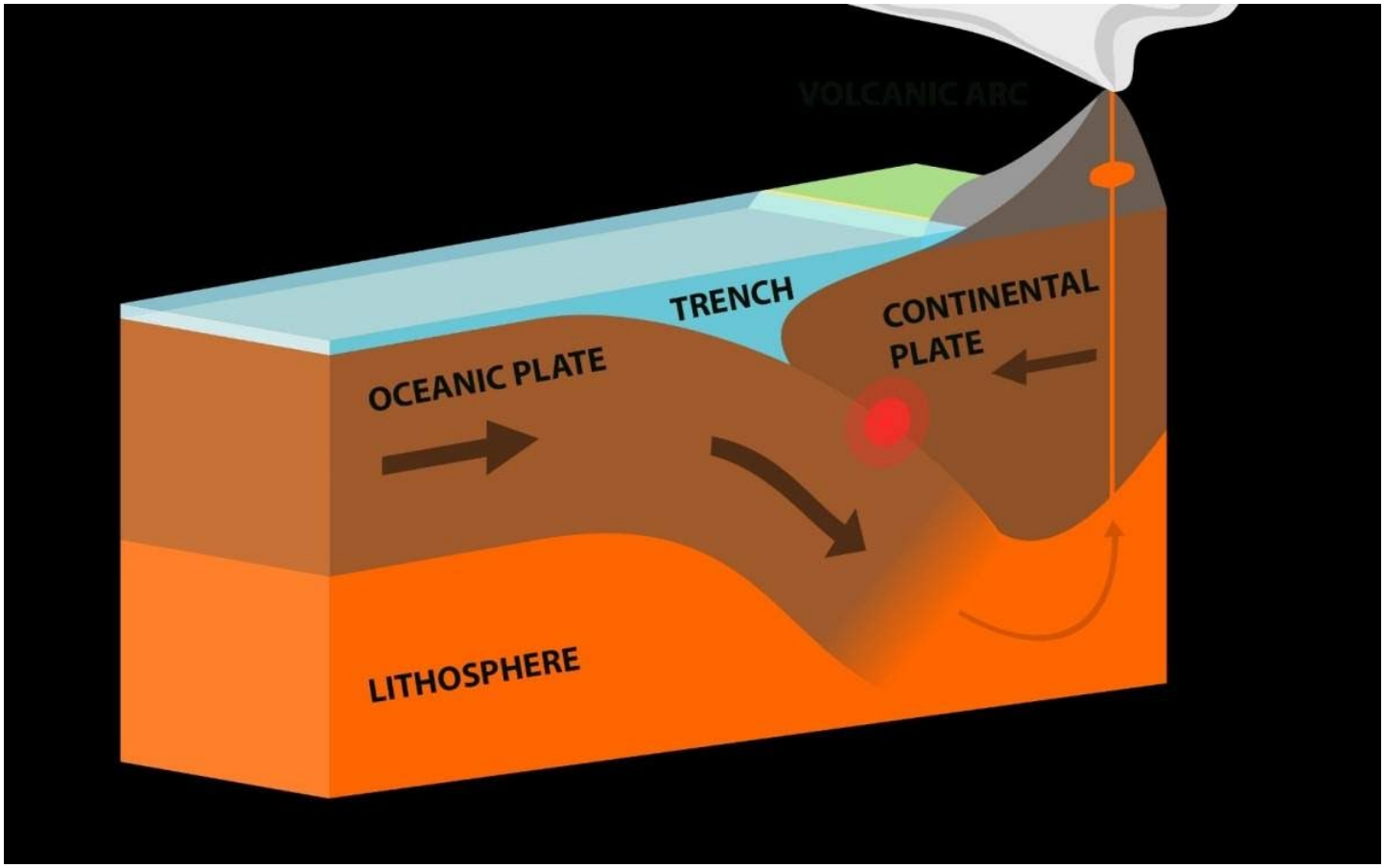
Trenches are formed when two tectonic plates collide. At the collision point, one of the plates dives beneath the other into the Earth's mantle, creating an ocean trench. The marvellous Mariana Trench was created in the same way.

Another question that might come in our mind is, "Is the trench the closest point to the centre of the Earth?"

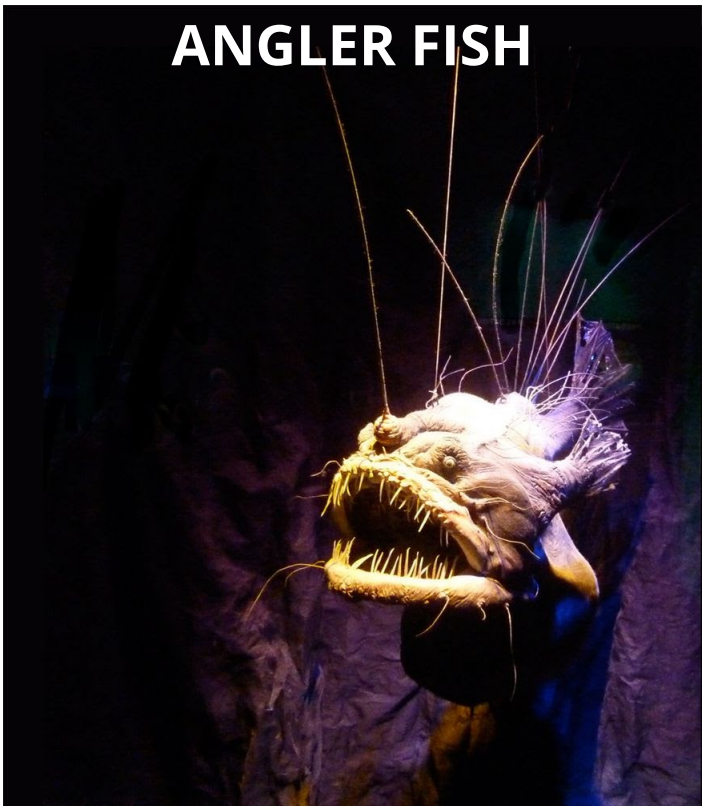
The Answer is, No. As deep as the trench is, it is not the spot closest to the center of Earth. Because the planet bulges at the equator, the radius at the poles is about 16 miles (25 km) less than the radius at the equator. So, parts of the Arctic Ocean seabed are closer to the Earth's centre than the challanger deep.

After knowing so much about the features of Mariana Trench, you might not be interested to know more about the physical features of trench. Your mind might have wandered off. It could be thinking, "I have heard that many creatures live in the deepest parts of the Trench. How is that even possible? I want to know more about the Life in the Trench."

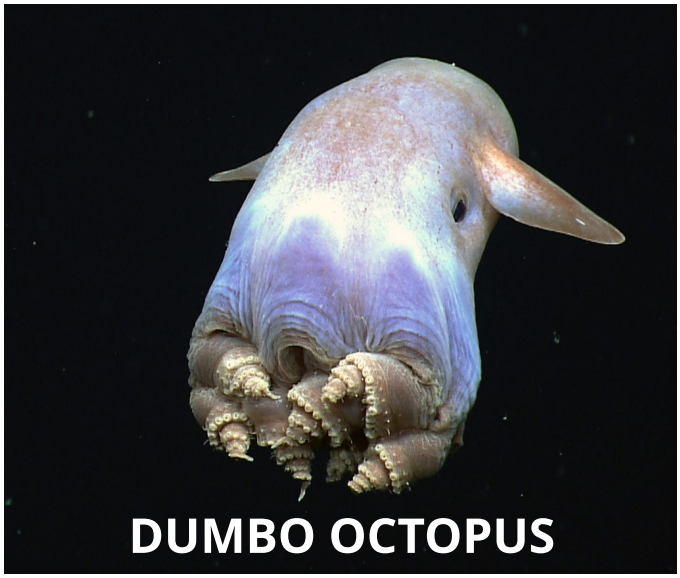
The Answer to this is quite surprising. I will talk about the ecosystem of the Trench for the rest of this article. Recent scientific expeditions have discovered diverse life in these harsh conditions. The deeps are teeming with life. Animals living in the deepest parts of the Mariana Trench have adapted in several ways to survive in complete darkness and extreme pressure.



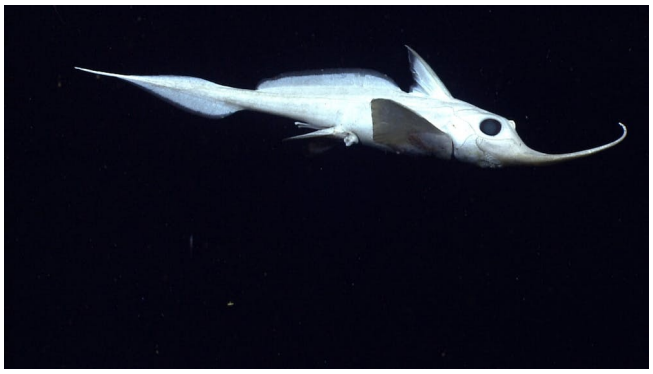
The first challenge animals encounter as they move deeper is the complete darkness. Some deep-sea fishes, like the stout blacksmelt, have giant eyes to capture the faintest glimmers. Others have abandoned vision. The tripod fish, named for its elongated fins that allow it to perch on the seafloor, relies on touch and vibrations to sense its prey. Still others emit their own light by a process known as bio-luminescence. These lights can be used as headlights, as in lantern fish, or to attract mates or prey. Some animals have evolved and became transparent.



The darkness also causes a second problem. Lack of sunlight means no algae or plants to support the food chain, so food is scarce. Some microbes rely on chemicals, such as methane or sulfur, while other creatures gobble marine life lower on the food chain. Other deep-sea animals must survive on the decaying scraps of dead organisms from the upper layers of the ocean which sink to the bottom.



Because of its extreme depth, the Mariana Trench is cloaked in perpetual darkness and the temperature is just a few degrees above freezing. The water pressure at the bottom of the trench is crushing eight tons per square inch—or about a thousand times the standard atmospheric pressure at sea level. Pressure increases with depth.To understand it better, let's compare their adaptations with ourselves. All animal cells are enclosed by fatty membranes. They must be in a liquid form so that we can transfer materials in and out of the cell. The fluidity also helps in transmitting the nerve signal. However, under the conditions of the depths, these membranes would solidify and we cannot function. Therefore, deep-sea animals must adapt their membranes to keep them liquid. They do so by having loads of unsaturated fats in their cell membrane. Unsaturated fats remain liquid at low temperatures and keep the membranes loose. This enables them to perform all their body functions properly.



Lastly, I would like to end this article with some Mind-Boggling facts about Mariana Trench:

- The trench is believed to be one of the most ancient seabeds on the planet at approximately 180 million years old.
- The United States has jurisdiction over the Mariana Trench.
- The Mariana trench is named a National American Monument. President George W. Bush signed the act naming the trench as a National Monument in 2009.
- A research team led by Newcastle University shows that human-made chemicals that were banned in the 1970s are still lurking in the deepest parts of the ocean.
- The first time humans descended into the Challenger Deep was more than 60 years ago. In 1960, Jacques Piccard and Navy Lt. Don Walsh reached this goal in a U.S. Navy submersible, a bathyscaphe called the Trieste. After a five-hour descent, the pair spent only a scant 20 minutes at the bottom and were unable to take any photographs due to clouds of silt stirred up by their passage.
- In 2012, James Cameron manned the Deepsea Challenger and reached the seabed but was unable to capture any photos due to a hydraulic fluid leak.
- Although Mariana is known as the trench, there are real mountains here. Scientists have discovered 4 mountain peaks, each with a height of more than 2.5 kilometres.

DEEP WATER JELLYFISH

AMPHIPOD CRUSTACEAN

Sources & Credits: bbc.com, livescience.com, wikipedia.com, deepseachallenge.com

DIVERSITY IN LIVING ORGANISMS ON THE CRUST

By Prathay Gohil

What is Biodiversity exactly?

If we look around us we will find a large variety of living organisms, it can be potted plants, birds, insects, our pets, or other animals and plants, there also might be organisms which are not visible to us with our naked eyes but they exist all around us. If we increase the area of observation, then the range and variety of organisms increases. This refers to Biological Diversity or in short Biodiversity.

Biodiversity is everywhere, both on land and in water. It includes all organisms, from microscopic bacteria to more complex plants and animals. In scientific language, Biodiversity is a term which describes every living organism within a single ecosystem or habitat, including numbers and diversity of species and all environmental aspects such as temperature, oxygen and carbon dioxide levels and climate.

Types of Biodiversity

Usually three levels of biodiversity are discussed—genetic, species, and ecosystem diversity.

Genetic Diversity:

Genetic diversity is defined as the variation in the amount of genetic information within and among individuals of a population, a species, an assemblage, or a community. These variations can evolve as a result of many different processes, such as mutation, and physical or behavioral isolation of population. It is the product of recombination of genetic

material in the process of inheritance. It changes with time and space. Sexual reproduction is important in maintaining genetic diversity as it gives unique offspring by combining genes of parents.

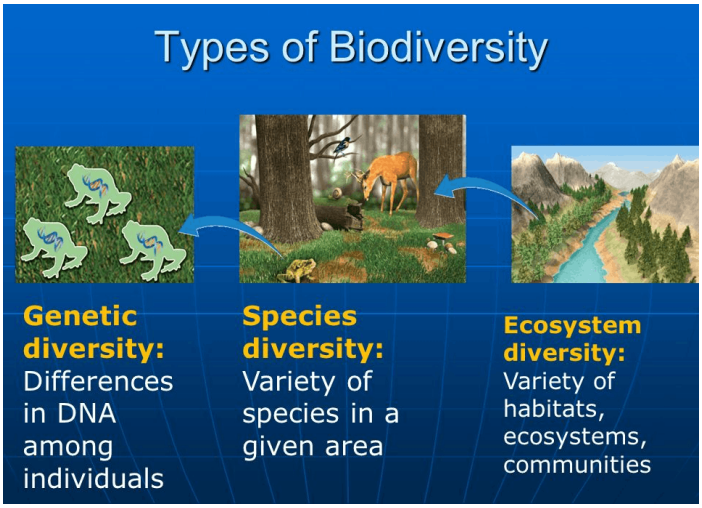
Genetic diversity gives rise to different physical attributes to the individual and capacity to adapt to stress, diseases and unfavourable environmental conditions. Environmental changes that are natural or due to human intervention, lead to the natural selection and survival of the fittest. Hence, due to genetic diversity, the varieties that are susceptible, die and the ones who can adapt to changes will survive.

Species Diversity:

Species diversity is the variety of species within a habitat or a region. Species are the fundamental units of biological classification and thus the normal measure of biological diversity. For instance, you will not find only one species in a swamp. For example in a Louisiana swamp, you might find the American alligator, Great Blue Herons, Great Egrets, pelicans, loons, cuckoos, hawks, owls, and the Bald Eagle — all of which are different species of birds — alligator snapping turtles, wild pigs, nutria — also known as river rats — river otters, and more. That's not even taking the numerous fungi and microbes that still live in the swamp into account. The number of species is possibly closer to the thousands in one Louisiana swamp! Species richness is the term that describes the number of different species in a given area. The world total is calculable at 5 to 10 million species, though just 1.75 million are named scientifically up to now.

Ecological Diversity:

Ecological diversity is the complex network and dynamic interplay between various species found in local ecosystems. It implies that various species have to learn how to live



biodiversity. This takes into account how these various organisms influence each other in terms of matter, nutrients, and even energy. An ecosystem consists of organisms living together in an area of many different species and their interactions through the flow of energy, nutrients and matter. The sun's radiant energy is transformed by plants to chemical energy. Via decomposing organisms, fungi extract energy, which releases nutrients back into the soil. An ecosystem is therefore a set of living elements (microbes, plants, animals and fungi) and non-living elements (climate and chemicals) linked by the flow of energy. Ecological diversity focuses on how these diverse organisms interact with each other in the same ecosystem, and how they affect each other either positively or negatively.

How many species are there on the planet?

To date, nearly 1.8 million species of animals and plants have been scientifically described, and new species are reported every day, with 12,000 to 25,000 new species introduced to the list every year. While the "discovery" of mammals and birds constantly catches the public eye, it appears to draw less interest from insects and the like. The estimated number of undiscovered species ranges from three to seven million, of which insects and other small creatures make up the lion's

share. We lose about 150 species a day on average - that's about 55,000 a year! Owing to human encroachment of their environments, many animals will be extinct even before we have realized the true abundance of biodiversity that we are killing. Once a species is lost, it is gone forever.

Why is biodiversity so important and worthy of protection?

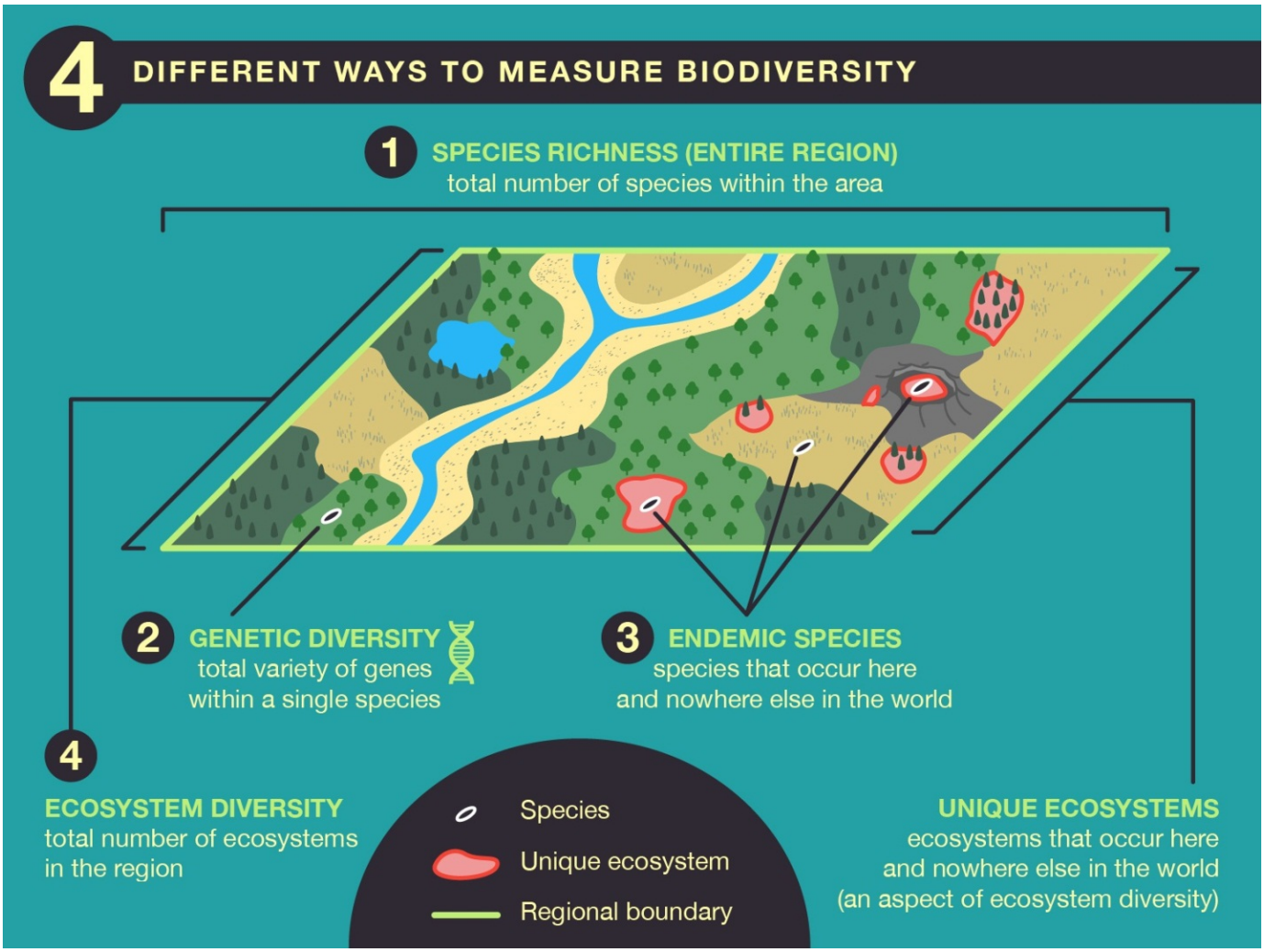
●Economic- Biodiversity offers raw materials to humans for consumption and production. Many livelihoods rely on biodiversity, such as those of farmers, fishermen and timber workers.

●Ecological life support-Biodiversity offers functioning ecosystems that provide oxygen, clean air and water, plant pollination, pest control, wastewater treatment and many ecosystem services.

●Recreation-Many outdoor activities, such as bird watching, hiking, camping and fishing, depend on our unique biodiversity. Our tourism industry also relies on biodiversity.

●Scientific-Biodiversity represents a wealth of systematic ecological data that help us to understand the natural world and its roots.

●Cultural- The aesthetic values of our natural ecosystems and landscapes contribute to a highly urbanized population's mental and spiritual well-being. There is a dynamic Aboriginal relationship with the land and the sea, and its animals and plants. The land and sea have profound spiritual, economic, social, protective and recreational significance to these people.



The United Nations declared 2010 to be the International Year of Biodiversity to celebrate life on earth and underscore its precious nature.

Why are so many species disappearing?

Researchers have identified the given five important drivers of biodiversity loss:

●The loss and deterioration of habitat, which is any thinning, fragmentation, or destruction of an established natural habitat, decreases or removes most species' food source and living space. Species that are unable to migrate are often wiped out.

●Invasive species-May out compete native species for food and habitat, which triggers population declines in native species. Invasive species may arrive in new areas through natural migration or through human introduction.

●Over exploitation-Results in certain species being depleted to very low numbers and others being led to extinction.

●Pollution leads to the depletion of biodiversity by causing exposed species to have health issues. In certain cases, exposure may occur at doses that are high enough to directly kill or cause reproductive problems that endanger the survival of the species.

●Climate change associated with global warming-Fossil fuel combustion releases greenhouse gases that accelerate the atmospheric absorption of infrared radiation (heat energy) and trap the heat, affecting temperature and precipitation patterns.

Any loss or degradation in the state of biodiversity will threaten all the values outlined above and affect human well-being.

Biodiversity contributes to many aspects of human well-being, both directly and indirectly, including protection, basic materials for good living, health, good social ties, and freedom of choice and action. Hence we should take a step forward and protect and conserve biodiversity.

Anyone can raise awareness: Demonstrate to your relatives, friends and acquaintances the impacts of deforestation. Tell people about the danger of extinction and raise public discussion. Review your own consumption habits and lifestyle.

Your contributions toward protecting biodiversity are limited only by your imagination!

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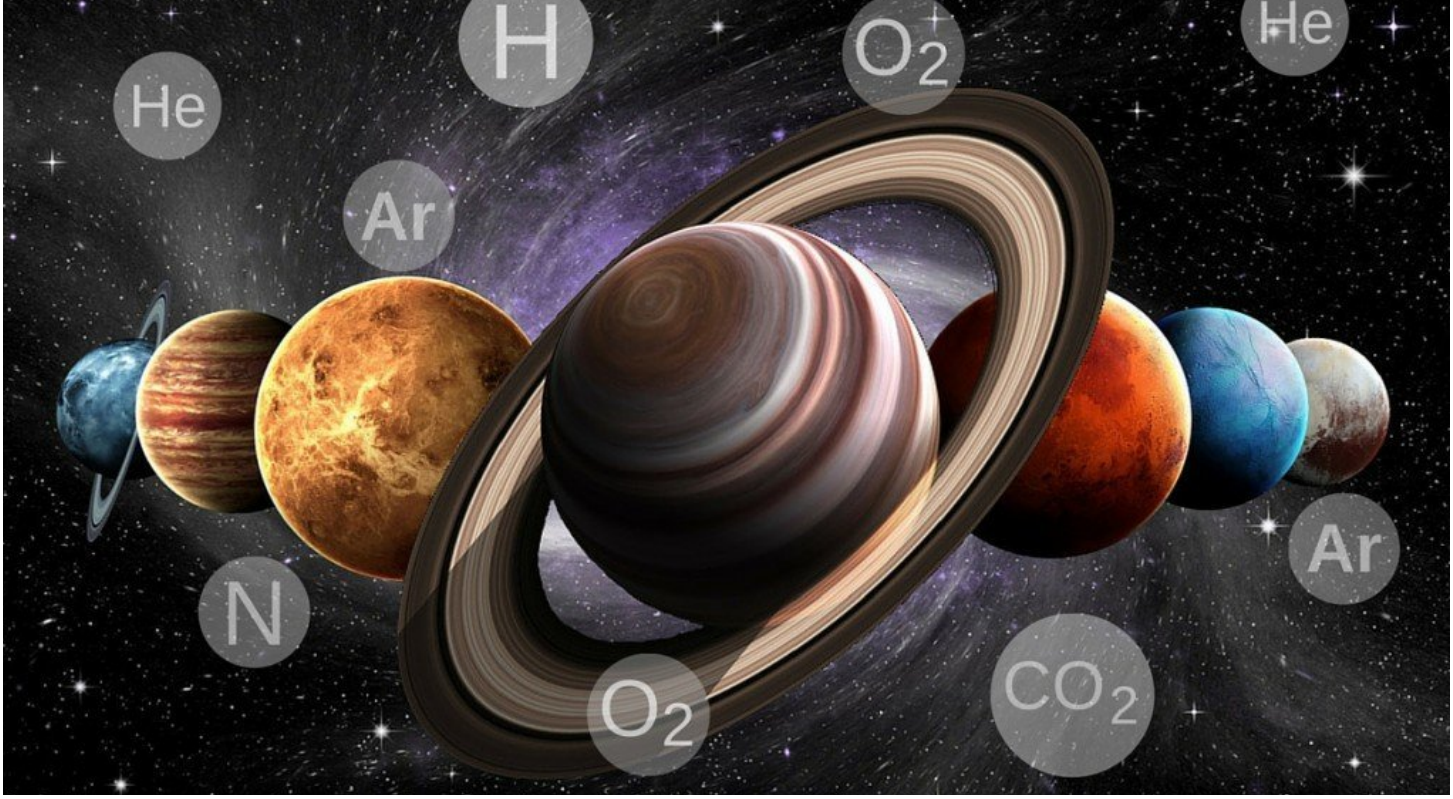
https://www.examrace.com/Study-Material/Geography/Environmental-Geography/Biodiversity-YouTube-Lecture-Handouts.html



ATMOSPHERES OF OTHER PLANETS IN SOLAR SYSTEM

By Dhruvil Patel

The Solar System and the planets are included in one of the most fascinating subjects of the multiverse of Science. Planets, who would not wish to discover abundant information on them?!!!

So the time has arrived to allow ourselves to indulge in this enthralling topic.

MERCURY

the first planet in our solar system, has an atmosphere that is generally not considered as an atmosphere and the reason behind this is that the air layer is extremely thin. To be more specific, Mercury has a thin exosphere made up of atoms blasted off the surface by the striking meteoroids and the solar wind. Oxygen is 42% in the very thin air layer (exosphere) of Mercury. So, Oxygen holds the maximum amongst all other elements of Mercury's air. Sodium (Na) and Hydrogen (H) hold 29% and 22% respectively. While other gases hold 7% of the thin air layer.

And here comes an interesting fact that the temperature of Mercury is both extremely hot and cold. It is so because at day time, Mercury, being closest to the sun, has a high temperature of nearly 430°C. Well then just question yourself, how possibly could there be an extremely cold temperature of a celestial body, nearest to the hottest star of the solar system? The answer to this mind-catching question is that heat cannot be trapped in such an exosphere. Heat simply escapes. So at night, the temperature falls to -180°C.

VENUS

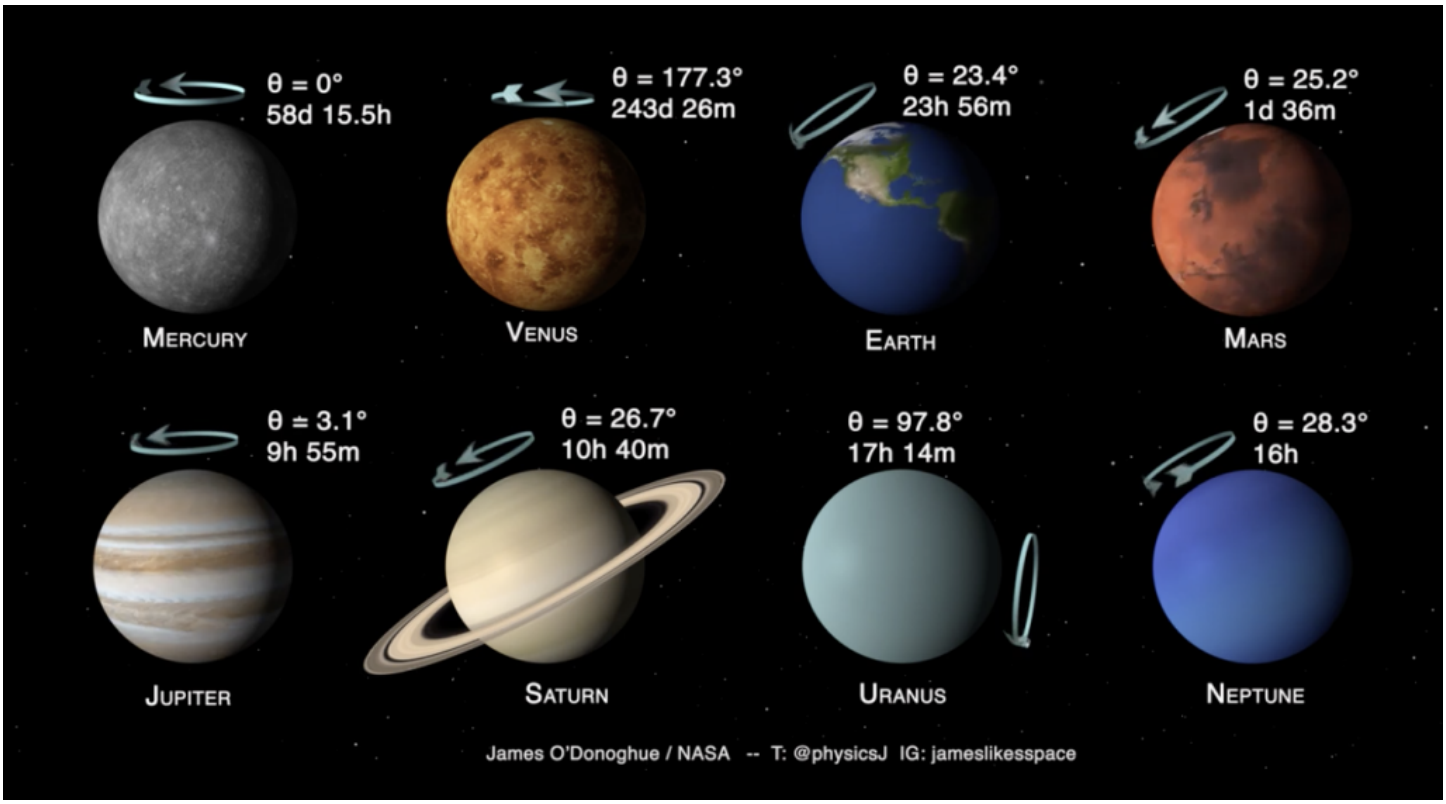
Being the Earth's closest neighboring planet and second planet from the sun and the hottest one too,it has got an atmosphere, hot and thick, abundant in Carbon dioxide (CO_2). The amount of Nitrogen gas (N_2) is too low as compared to that of Earth. While about other gases, Helium, Neon, etc., they hold one percent of the atmosphere of Venus. And sometimes your mind must be swimming in thoughts of why isn't there life on Venus. This should not be a doubt because the temperatures of this planet are high enough to melt Lead.

Space missions to Venus have discovered that the surface of the planet is covered with volcanoes, craters and humongous lava plains. Verna 7 was the first spacecraft who could possibly make a smooth landing on the surface of Venus, on 15th December 1970. NASA sent two pioneer spacecraft on Venus in the year 1978. Lately, scientists have discovered the existence of the Ozone layer in the atmosphere of Venus.

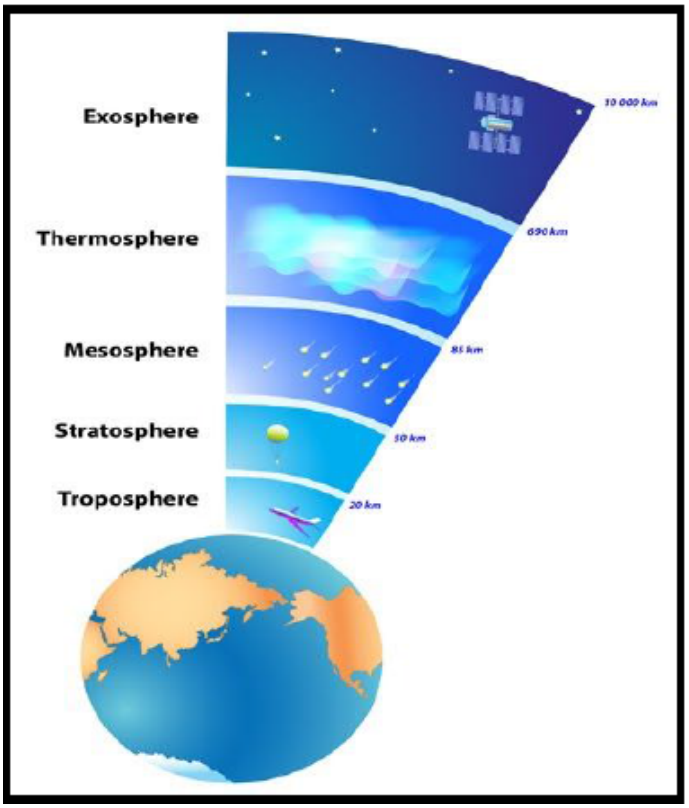
EARTH

Being the third planet from the Sun,it has the only atmosphere in which the existence of living creatures like, bacterias, plants, animals, and some curious species, namely humans, are possible. Nitrogen, the element to which Earth possesses the maximum amongst all other existing elements, conquers the Earth by 78% of the air. Oxygen is the foremost consequential element required by humans to make their survival. Ergo, oxygen makes its numbers upto 21% in the air.

Well, Carbon too plays a vital role for the existence of life on Earth or we can also say that, for life on Earth, Carbon is an indispensable element. This is the only planet which humans could understand pellucid.



There are 5 layers of the atmosphere of Earth, namely, Troposphere, Stratosphere, Mesosphere, Thermosphere, Exosphere. Out of these, the Exosphere possesses the widest range of nearly 10000 km. The one reason why earth doesn't get heated too early is the Ozone layer. The Ozone layer blocks the harmful U V radiations and ergo the temperature doesn't rise as much as the two we have seen earlier. Information about the atmosphere of Earth is perpetual...



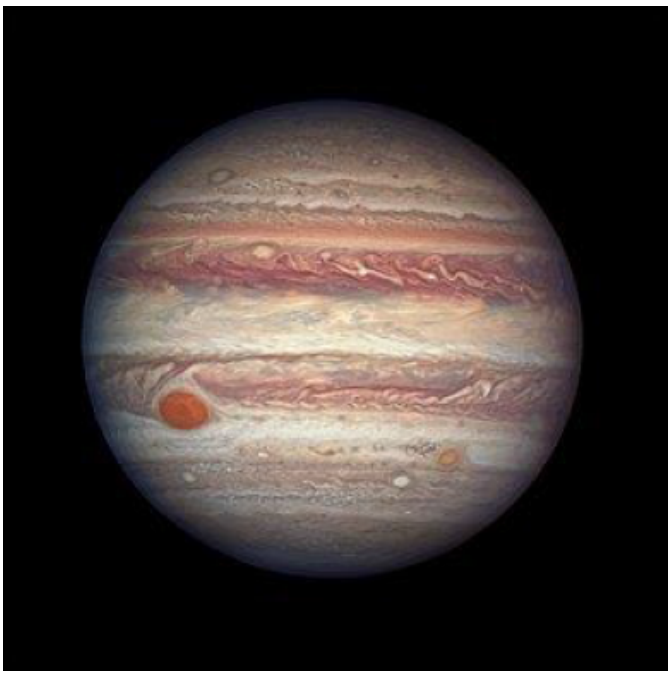
MARS

Commonly Mars is also called the red planet, which is the fourth planet from the Sun, and the last terrestrial planet, possesses an atmosphere which has more than 95% of Carbon dioxide. It is estimated that the air layer on Mars is very thin as compared to that of Earth. And after reading The Martian, you must have thought about life on Mars! But this is unfortunately next to impossible as the amount of Oxygen is less than 1% in its atmosphere. Nitrogen and Argon, respectively, consume 3% and 1.5% of the air layer of mars. Other gases make up less than 0.5% in Mars' atmosphere. Mars too has an atmosphere that possesses the Ozone layer.

Hats off to ISRO, who made a spacecraft of only $73 million, who landed successfully on Mars. This spacecraft by ISRO, namely Mangalyaan, is the least-expensive Mars mission to date.

Coming to the Gas Giants,

JUPITER



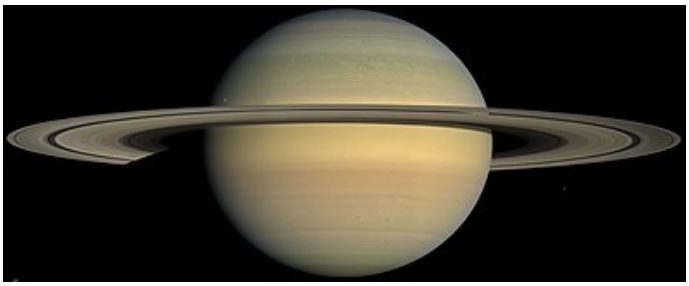
Jupiter is the first member of the Gas Giants, and fifth from the Sun. It is a humongous planet, specifically, the largest planet in our solar system. Like the Sun, Jupiter has an atmosphere of mainly molecular Hydrogen and Helium. Water, methane and Carbon

dioxide are also present in the atmosphere of Jupiter, but in very tiny amounts. Jupiter has zones and belts in its atmosphere. Zones have lighter bands and darker bands. Each hemisphere of this planet has six bands with wind prevailing at very high velocity in an opposite direction.

"The Great Red Spot'', located below the equator, is a prominent feature of this planet's atmosphere. The reason behind the Great Red Spot is a large tempst prevailing in its atmosphere at a specific area.

SATURN

Saturn is the most beautiful planet in our solar system and is the sixth planet from the Sun. It has an atmosphere in which the winds prevail so ferociously that it reaches 1800 kilometers per hour at the equator.

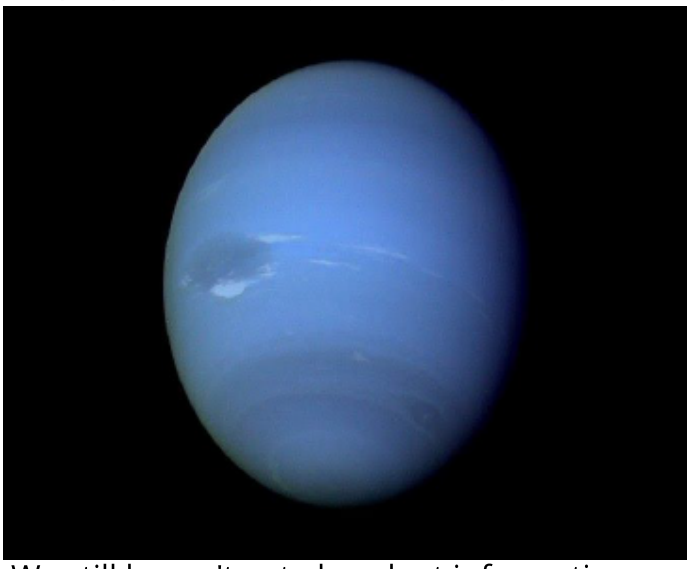


There are white storms which break through the cloud layers. And these tempests can be greater than Earth. The temperature of the planet holds a range of 70°C to -178°C.

There is a fact about the beauty of Saturn that the seven iconic rings at the equator are made up of ice and rock—rock size may vary as it can either be as small as sand granules or larger than your house.

URANUS

Being the third planet of the Gas Giants and seventh from the Sun, has a cold and thick atmosphere, which mainly has molecular Hydrogen. Other elements like Helium, and compounds like Methane are also seen in its atmosphere. Methane is the compound which is the reason why Uranus seems blue. There is no proportion of Oxygen on this planet.



We still haven't got abundant information about the Uranian atmosphere, though a spacecraft, Voyager 2, has found a little on this. The temperature of Uranus is one of the coldest records, -224°C. This is so, because the heat of the Sun rarely—or not at all—reaches there.

NEPTUNE

Being the last Planet in the Gas Giants and the solar system as well,it has an atmosphere which has abundant hydrogen, 80%. The colour of Neptune is blue, of course, the same as that of Uranus. Methane servers this colour. Helium occupies 19%of its atmosphere.

The temperature records have shown the results nearly about -210°C. The planet is the furthest planet from the Sun, ergo, its warmest temperature record shows -210°C. The distance from Earth to Neptune is 30 times that from Earth to Sun. Much cannot be said about its atmosphere, as we have very little knowledge, obtained about Neptune through our spacecraft. furthest planet from the Sun; therefore, its warmest temperature record shows -210°C. The distance from Earth

to Neptune is 30 times as from Earth to Sun. Much cannot be said about its atmosphere, as we have very little knowledge, obtained about Neptune through our spacecraft.

TITAN

It is the satellite of Saturn, and is the second largest moon (satellite) in the entire solar system. It is the only moon—there are over 400 in the solar system—which has an atmosphere. Its temperature shows nearly -179°C.

A surprising fact, that Titan is the only celestial body in our solar system which has surface liquid—lakes, seas, oceans, and so on—just like Earth. But nevertheless, its atmosphere is thicker than Earth.

This concludes the entire overview of the atmospheres of all planets in our solar system.

Image Credit:
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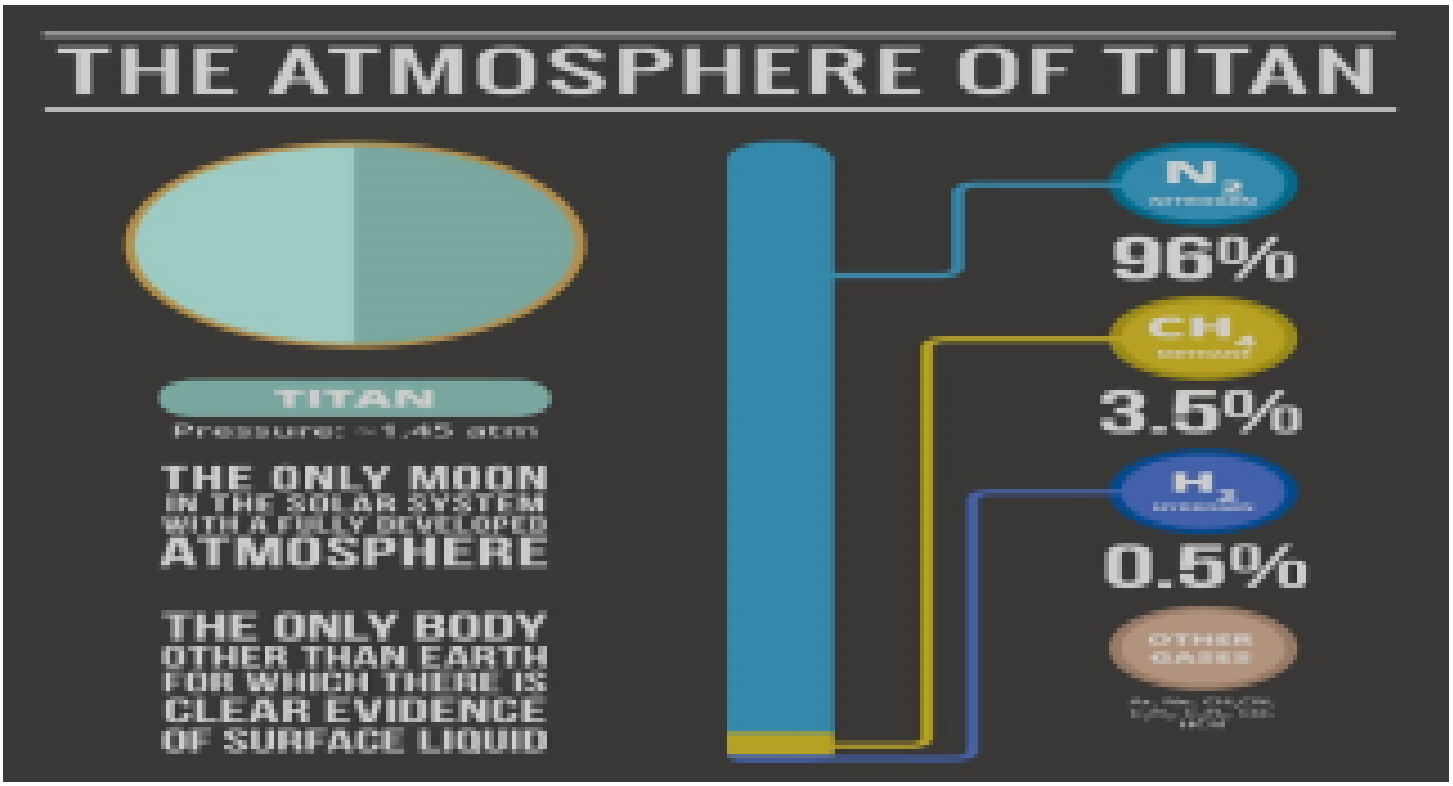
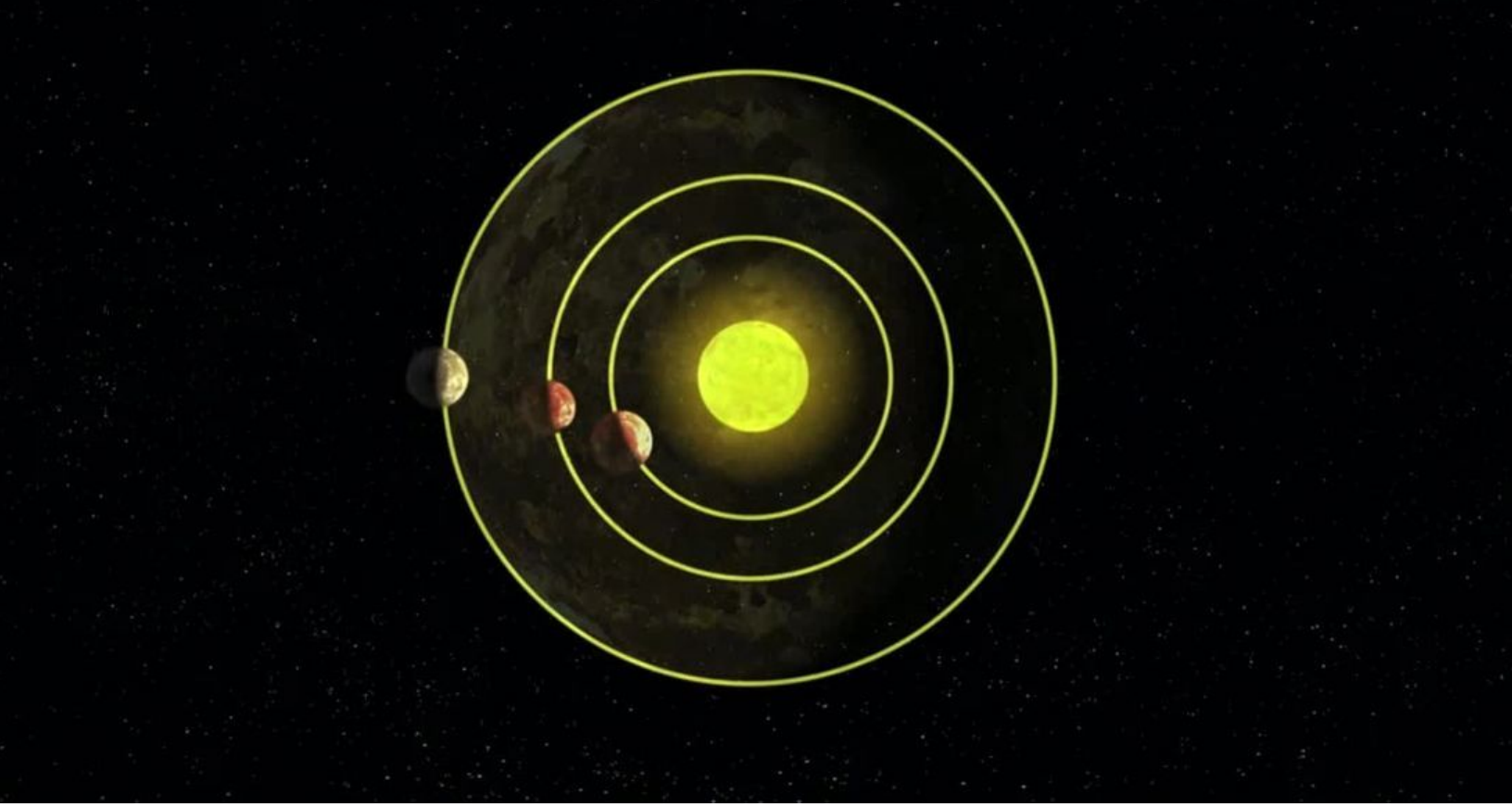




NEARBY SYSTEMS

By Maharshi Pandya

NASA's Kepler mission which was launched on 7 March 2009, found more than 2600 exoplanets and also made a list of potential 3000 exoplanets (planets outside our solar system). NASA's TESS (Transmitting Exoplanet Survey Satellite) now continues to carry the hunt forward. While Kepler primarily searched within one particular patch of the sky, TESS is observing the entire sky for more exoplanets. TESS was launched on 18 April 2018. But that's not all, another Space telescope named James Webb Space Telescope is right now set to be launched on October 31, 2021.

How do we spot planetary systems?

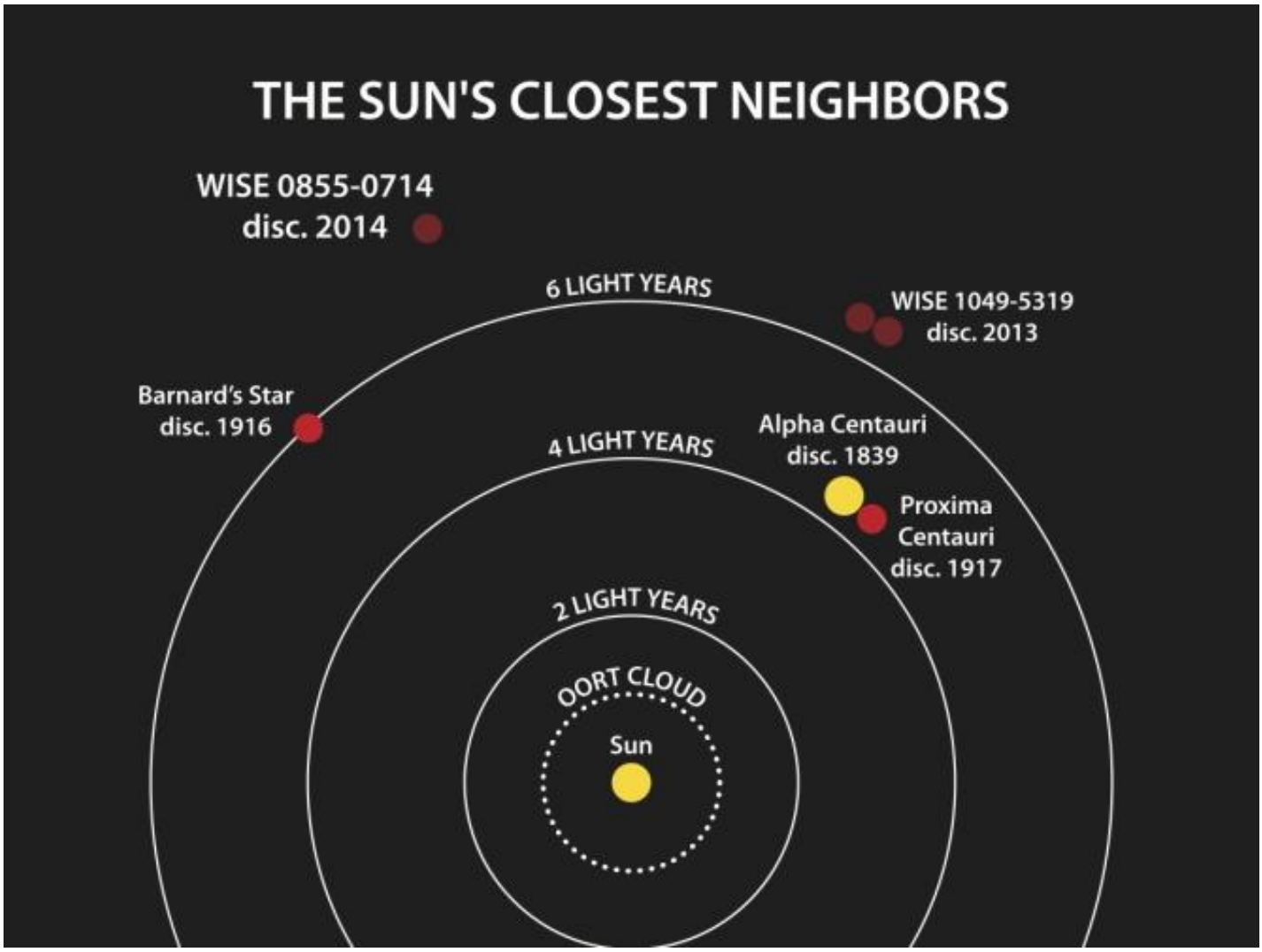
There are many ways space organizations use to find planetary systems. The most used one is by measuring light coming from the stars. When a planet passes in front of the star it is called transit. While doing that, it blocks a certain amount of light from the star. If there is a periodic decrease in the amount of light from a star we can say that there is a probability of there being an exoplanet there. The planets that orbit around other stars are called exoplanets.

What are we looking for?

We are looking for exoplanets in the habitable zone with respect to their right because in such planets, there is a possibility to find liquid water on their surface which would increase their chances of being habitable.

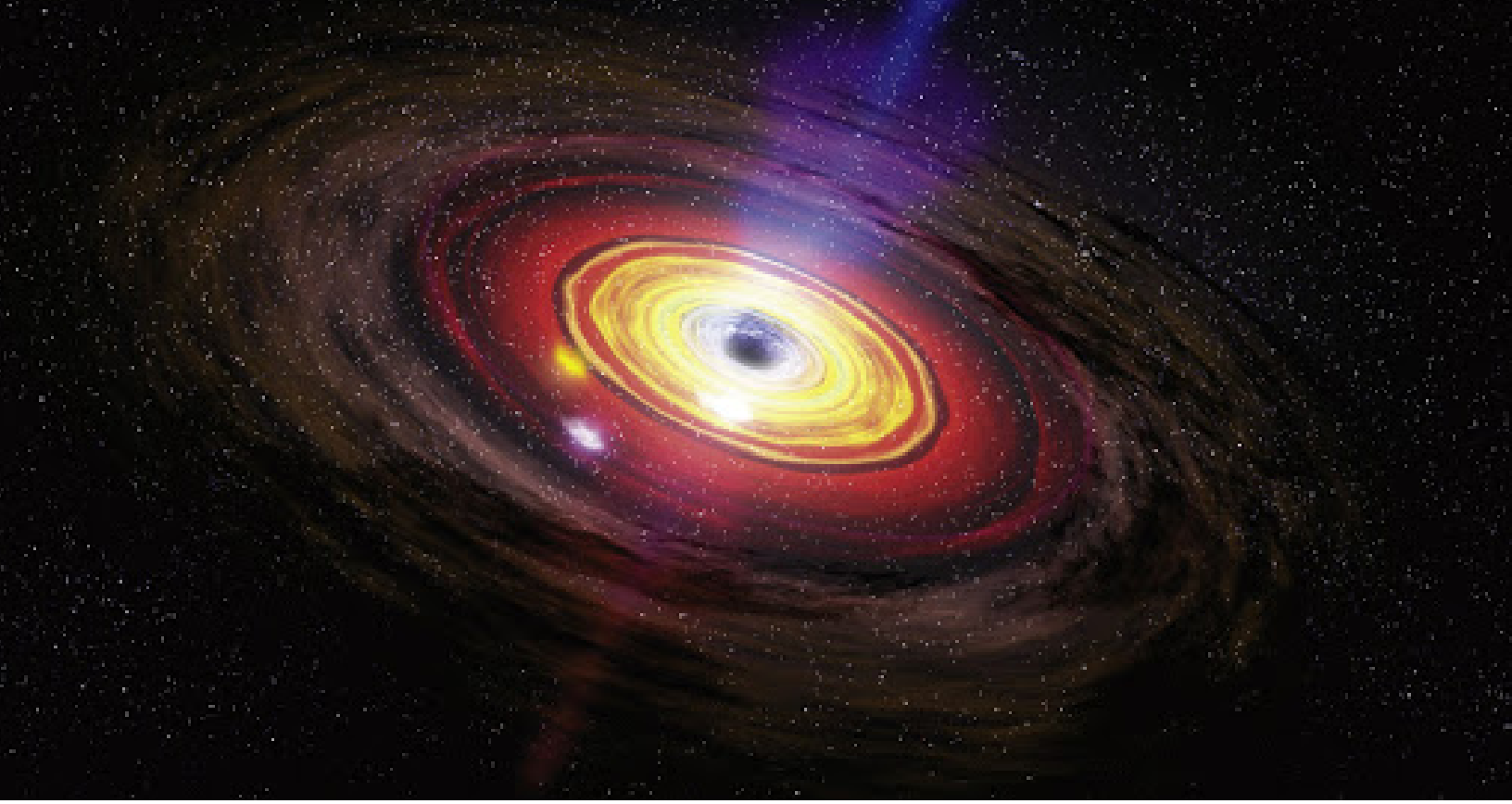
Systems near Us

Out of the systems discovered near us is Alpha Centauri. It is a triple star system located only a little over 4 light years from Earth. The stars in the system are named Alpha Centauri A and B (AB for short) which orbit relatively close to each other. Alpha Centauri A is considered to be a near twin of our Sun as they are very



similar even in age. On the other hand Alpha Centauri B is smaller and dimmer but still quite similar to the Sun. The third star, Alpha Centauri C also known as Proxima is a much smaller red dwarf which orbits around the pair AB in a much larger orbit takes it 10 thousand times more farther from the AB pair than the Earth-Sun distance. The Chandra data revealed that the conditions for life in terms of X-rays bombardment is much better around Alpha Centauri A and only a little worse around Alpha Centauri B but on the other hand it is much worse in the case of Proxima which is a red dwarf known to send out frequent dangerous flares of X-ray radiation and is likely hostile against life.In another planetary system known as TRAPPIST-1, which was first discovered in 1999, they found 3 planets around its star using the Transiting Planets and Planetesimals Small Telescope (TRAPPIST) in Chile. In honor of this telescope, scientist started calling the star TRAPPIST-1. The Hubble Space telescope was used to find that the TRAPPIST-1 a and c were unlikely to have hydrogen-dominated atmospheres like the ones found in gas giants and this showed there being a possibility that these planets could be rocky and hold onto water. The result was published in July 2016. Furthermore, by using NASA's Spitzer telescope and ground based telescope it was found that there are seven planets in the system and three of them were in theoretical "habitable zone". This discovery was announced on February 22, 2017. Well, that's it for now but we will talk about some other systems in the next article.

Image Credit
-https://earthsky.org/space/this-date-in-science-discovery-of-proxima-centauri



GALAXIES

By Aryan Patel

So first of all what is a galaxy?A galaxy is a gravitationally bound system of stars, stellar remnants, interstellar gas, dust, and dark matter. But how do we know this?

Origin of Galaxies

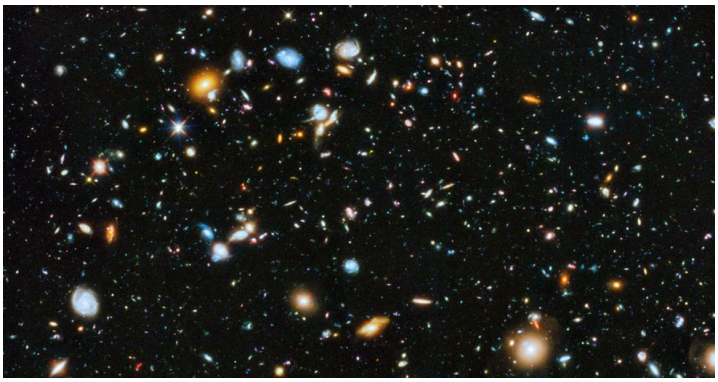
In the early 20th century, there were puzzling objects that filled the sky that came in a variety of shapes. They were called nebulae; nobody really knew what, where and how big they were. Eventually astronomers discovered what they were, and, in a moment, our universe got a lot bigger, a LOT.

In the early 20th century, there were 2 ideas competing, one was that, our milky way was it, the whole universe and everything existed in it. The other was that these spiral nebulae were also galaxies like ours. Harlow Shapley argued that the Milky Way was it while Heber Curtis argued otherwise. Both sides had limited and partial data that turned out false.The final observation that put an end to this debate was by Edwin Hubble and Milton Humason. They observed a spiral galaxy M31 using the most powerful telescope at the time. They found hundreds of stars in it which changed their brightness in a regular manner, they were called Cepheid variables and they were very important as their luminosity helped us pinpoint their distances.

MILKY WAY GALAXY FROM EARTH

The distance they found to M31 was 900,000 light years, which made it pretty clear that they were way outside Milky Way galaxy.

Each galaxy is filled with millions to trillions of stars, gas, and dust. Their range of size can be from around tens of thousands of light years to hundreds of thousands of light years, and that's pretty big.



Types of galaxies

There are four major types of galaxies, spiral, elliptical, peculiar, and irregular. Spiral galaxies are large rotating discs of stars, gas and dust. We live in one.

Some Elliptical galaxies are nearly spiral where others are elongated. We assume right now that elliptical galaxies are a product of galactic collisions (Entire galaxies colliding!) Galactic collisions are absurd, even if galaxies are colliding at hundreds of km per second, they take hundreds of millions of years to complete the event, that's how big galaxies are. Colliding galaxies form all sorts of bizarre shapes.

Although millions or billions of stars are involved in galactic collisions, it's rare that they actually touch each other and that because compared to the space in the galaxies, stars are very minute. Gas clouds though do collide.

Peculiar galaxies aren't exactly shapeless, their shape is weird. We think these might be a result of small galaxies colliding and passing through bigger ones. Then we come to truly shapeless galaxies, irregular galaxies. They are pretty small in shape.

Centre of galaxies

Active galaxies throw out immense light, and from this we can conclude that they have immense energy. So, we ask ourselves the question, what could power these super energetic celestial bodies?The answer is something that has a lot of gravity, and what has a lot of gravity? In 1980s scientists assumed that galaxies have super massive black holes in their centre, the Hubble telescope was built to investigate this idea, and the idea was right. Every galaxy has a huge black hole in the centre, even the smaller ones are millions of times of the mass of the sun, and the bigger ones could be even billions! The black holes in the centre feed on the galaxy itself. It grows as the galaxy grows. The objects that are sucked into the black holes create so much friction that they blast out light across the universe.

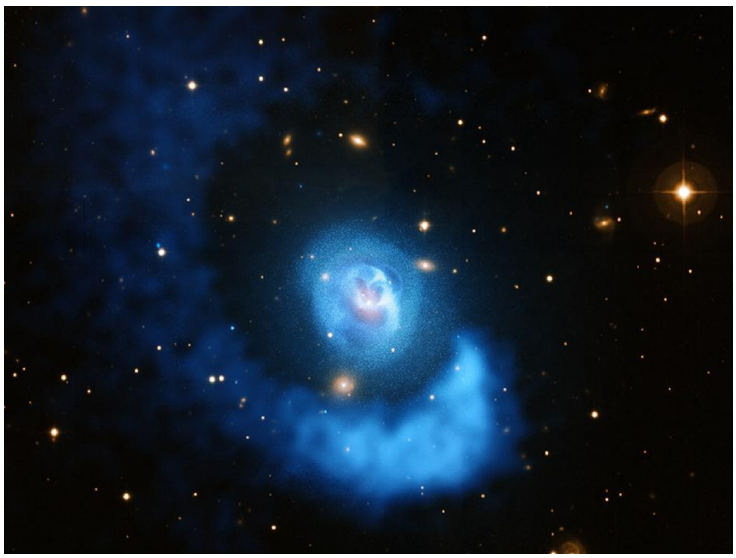
Galactic Clusters

When we look outside a singular galaxy, we can see that galaxies clump together in groups and form clusters. An average cluster can be around tens of millions of light years across and can contain thousands of galaxies. The nearest one to us is the Virgo cluster. Galaxies are bound to their clusters through mutual gravity and rotate in long orbits which can take billions of years to complete. Scientists think that clusters themselves clump together to for superclusters. We are a part of Virgo supercluster which itself is a part of even bigger Laniakea supercluster.

How many galaxies are there?

When we think of these galaxies and cluster and superclusters, a question pops up, how many galaxies are there? In 1990s, scientists pointed the Hubble telescope at the emptiest part of the sky they could, they found out that every point in the data was a whole galaxy! That experiment was repeated in different parts of the sky and the results were same! So, scientists concluded that there are 100,000,000,000 galaxies in just the observable universe. The universe in mind strikingly huge!

SOME GALACTIC CLUSTERS:



LIGHT AND THE DISTANCE IT TRAVELS

By Christopher George

The average Life expectancy for Homo-sapiens is around 73 year. Throughout this time, we spend almost twenty years studying or learning, then at least 40 more working and finally maybe twenty more relaxing and spending our probable last moments in this universe.

How about if we don't do any of that?Let's walk, throughout our life, from the moment we are born to the moment we die. Let's keep walking towards the sky, what do you think will happen?

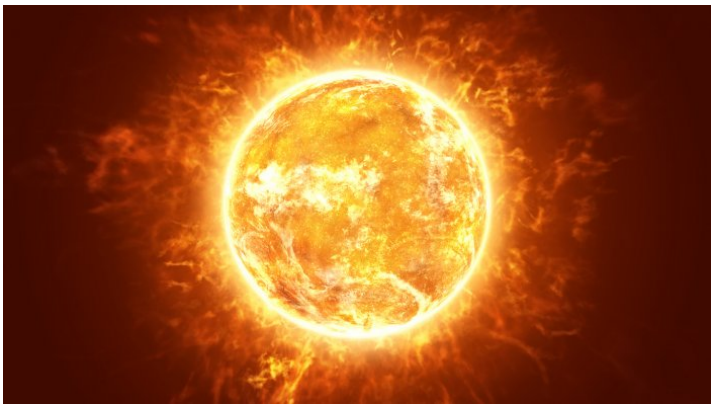
Where would you be able to go?

Will you see the gigantic Sun up close?

Or will we able to see the entirety of the Milky Way in a gigantic manner?

The answer, unfortunately, is none. The total approximate distance you would be able to cover might be only 170,000 Kilometers, Which is not even enough to reach our moon.

Now, let's talk about our dear light. Light travels at the speed of 299,792,458 m/s which is roughly around 300,000 Km per second, all those years of walking and all your whole life, spent in a split second by a mass-less particle.



These are the particles that help us calculate the distances in our universe; Light years, often confused as a unit of time, defines the distances the universe hold and even if you haven't yet realized the majestic size of our universe, you will soon.

Talking about moon, with the modern technological advancements, the fastest mission till now that reach near the moon took 8 hours and 35 minutes to cover the distance. The rocket that achieved this feat was NASA's Atlas V traveling at 16.26 Km/s and in comparison, the fastest vehicle on land can travel up to 20 Km/min(Thrust SSC).

Animations, CGI and paintings have given us quite an insight on how the planets and stars faraway look like, which often creates an illusion in our minds that every single planet discovered, is plain into our sight. May it be a science fiction movie or a beautifully designed picture; they all show us the planets and stars in a gigantic manner. They indeed are huge, magnificent and colossal, but they don't usually appear to us in that way.

We can always blame scientists for saying vague stuff like "there might be life on that planet"; I mean, if you know where the planet is, just look at it and figure it out!

But that's not how it works, why?

Because we don't have the luxury to look at the planets up close, we don't even have the luxury to even look at most of the exoplanets (Planets that exist outside of our solar system).

Exoplanets

One way for us to figure out the existence of an exoplanet is through Transit Method of exoplanet detection; this method relies on the detection of a dip in the brightness of a star which insists that a star might have passed between our line of sight. Through further rigorous calculation taking certain assumptions we can finally characterize planetary masses, radii, densities, atmospheric composition, orbital alignments and much more by simply taking the account of the depth of the dip, the size of the dip, distance of the star, the distortion by the dip, etc.

Of course there are other methods like Radial Velocity Method,Micro-lensing ,and Direct-Imaging.

Now then let's come back to our dear light. Now that you know how really fast light is, let's see why it holds so much importance.

Distance the light travels

You may have heard that speed of light is absolute and that we can never go near it, but why?

Einstein stated that no object with mass can go beyond the speed of light, why can light travel at the speed of light?

Because it simply has no mass, it can only propagate through its momentum. Now why can't anything with mass go beyond?

Because it's basically impossible to feed something so much energy; you still have to take all of this with a grain of salt as the technicalities are slightly different but to get a gist of how important the speed of light is, let's just say that we can't go beyond it.

In order to understand the vastness of the universe, we had to take measure of the fastest possible speed we can physically achieve but we still don't compare it the way we usually compare lengths. As a lot of people, who are familiar with the term Light-year, know that a light year is a distance that even light needs a whole year to complete. Imagine, if one second is equivalent to one whole life's worth of human walking, what about one whole year be?

Anyway, now boom-boom, let's assume we just throw away what Einstein said out of our hypothetical window and make a spaceship

that travel at the speed of light. Now, as I am a teenager and can't travel into the unknown streets of outer space yet (My mum won't allow it, you know), it's all unto you to go and travel to the ends of the Universe. Bon Voyage!

Here you go! You start from earth, and you are already at moon in less than 3 seconds. Eh, we don't want moon, let's go beyond that. 3 minutes in and there you see it, our red faced shy neighbor or maybe 22 minutes depending on when you start your trip. In about 5 to 6 hours you will be able to see the Dwarf Planet Pluto but what about our solar system?

For this calculation, it really depends on us what we consider the end of solar system, let take it the icy region out the heliosphere, The Oort cloud.

Considering the distance of Oort cloud from us to be around 7.4 Trillion Km, Your space ship will take around 285 days to get there.

Proxima Centauri, closest star?

About 4.23 light years, you will need to keep on going and going on that ship of yours for about 4.23 years to get to the closed star even that when traveling at the Einstein-forbidden speed, the light-speed. More-over, we are just getting started; you remember I told you about those 3000 exoplanets?

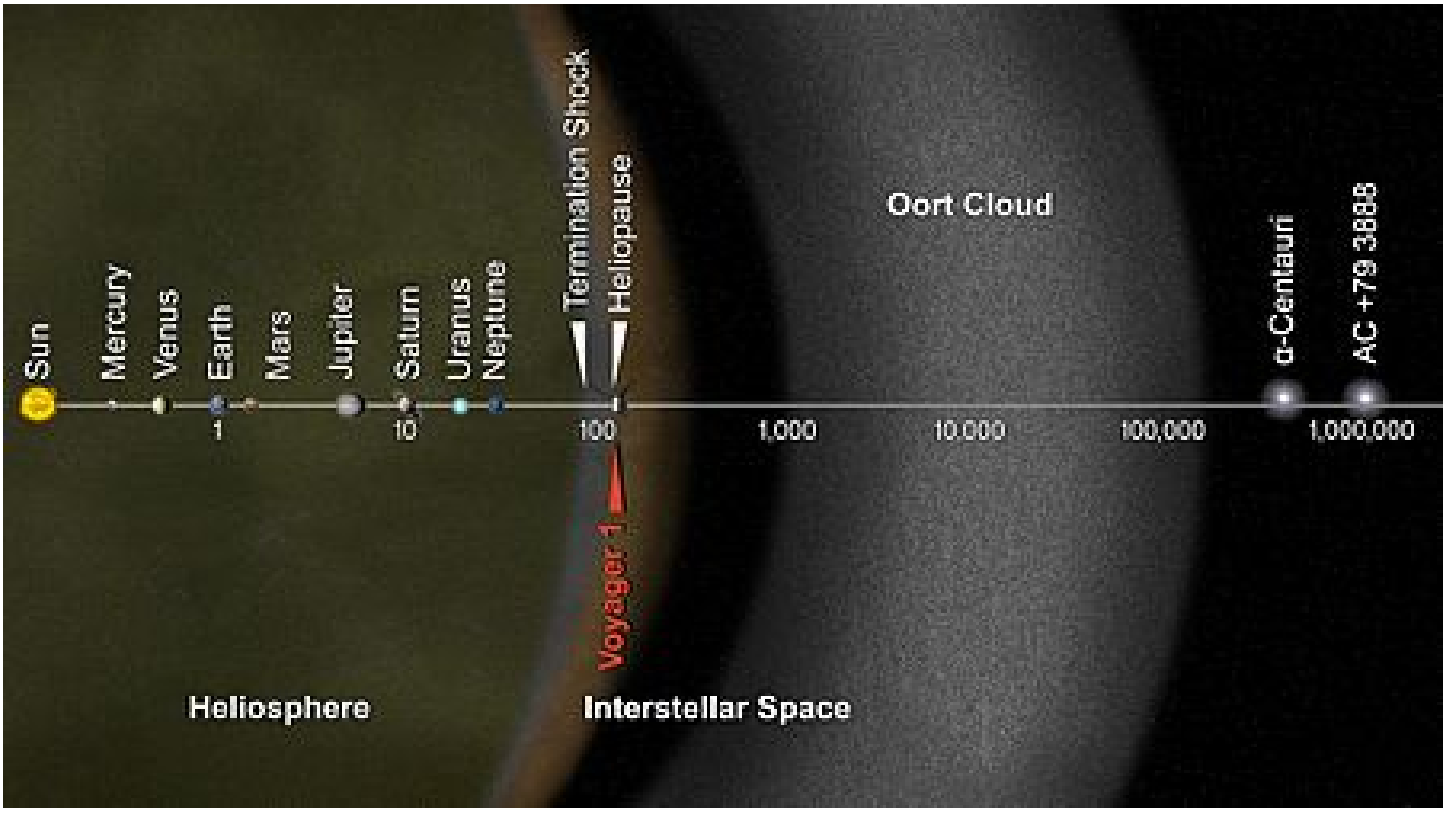
Imagine how unbelievably far they are from us!

Let's take our previous analogy, one human life was for half a light-second, then that will need about 266 Million people! That's 3.8% of our total population, just to reach to the nearest star. What about leaving the Galaxy?

That's 500 light-years or about 31 Billion people worth of walking.

The Edge and Light

As we know, in order for our naked eyes to observe anything, light has to bounce back from that object into our eyes. Thus, for us electromagnetic waves play a very crucial role in order to understand the existence or maybe even know about the existence of something. One example of it is how we came to know about the total amount of normal matter present in this universe, how? Lets keep it for



some another article. For now, all we need to understand that light and the distances in our universe are more related to each other than we think, another example is the exact value the velocity of light holds the limit of causality!

What is causality? In Einstein's General and Special Relativity, he states Causality means that an effect cannot occur from a cause that is not in the past light cone of that event and a cause cannot have an effect outside its future-Light cone, where a light cone refers to the path that a flash of light which is emitted from a single point in space and a single moment of time and is traveling in all possible direction would partake. Thus, Causality, in laymen terms, is the only reference frame of function in which the order or the sequence of events is consistent to all the observers. That's cool but why is it so important? Read this paragraph again and you might get a small glimpse into what causality holds.

Moving forward, this means that light is unbelievably important in modern day physics and that's why it holds so many secrets that a mere article of 1,500 words could never discuss all of that but what we can discuss is how we found out the length of the observable universe with the help of it.

As we are already riding a lot in the temporal dimension, lets ride once again and move back to 1842, when Christian Doppler discovered the idea of Doppler Effect. This phenomenon holds the key to find the size of the observable universe and its age. Well, I won't be explaining it to you now as the subsequent article will hold a much deeper explanation to this idea than I can explain in the given word limit. Let's just establish that Doppler Effect results in Red Shifts and Blue shifts, which tells us whether an object is accelerating away from us or towards us; if you want a deeper understanding of this effect and the causes I would recommend you to go and read the subsequent article first and then read ahead but if you only want to know how and why, let's move forward.

So more or less, this acceleration is measured and then reverse calculated to estimate the age of this universe; Why? If it hasn't clicked yet, then Voila! Our Universe has been expanding since its estimated birth which was about 13.8 Billion years ago. Now, as we have already established that in order to see anything that exist, we have to observe the light from it. Now, this is very important to understand the edge of this universe because as we know it is expanding, this means that the light from very distant objects is always reaching us as time passes by and we are always able to see more of this universe today than we were able to do in the future but to simple give it as value, we just reversed the reverse calculations we did to figure out that the total diameter of the observable universe is about 93 Billion Light years and that's an astonishingly big number and as some of you might have thought, but that's more time for light to travel than anything in our universe got since its existence!

Of course if anything which was 93 Billion Light years away would have emitted a ray of light, it would never reach us. Why? Simply because the age of the universe itself is 13.8 Billion years and light would just not have enough time to travel this much distance but this only arises when we establish that the speed of expansion of the universe in not limited to the limit of causality or as we say limit of light speed because it isn't traveling in space, the space itself in expanding itself in between.

Coming over to our first topic, how is the light from something 93 Billion Light year away reach us for it to consider in the observable universe? The answer is it did not. The light was simply emitted at the time when that object was nearer to us than 13 Billion Light years but with the expansion of The Universe, it is now so far away from us thatthe only way for us to reach that object that I can think of is

through a Wormhole.

Isn't it fascinating how huge our universe can be when a common metaphor on a planet in this Planetary System of this one out of Billions of other galaxy is "The World is a Big Place." And this is just the gist of our observable universe!

Thanks a lot for reading along this article but if you are a little bit concerned about what might lie beyond of our reach then keep on read because the next article will go on to discuss The Non- Observable Universe. Thanks a lot again!

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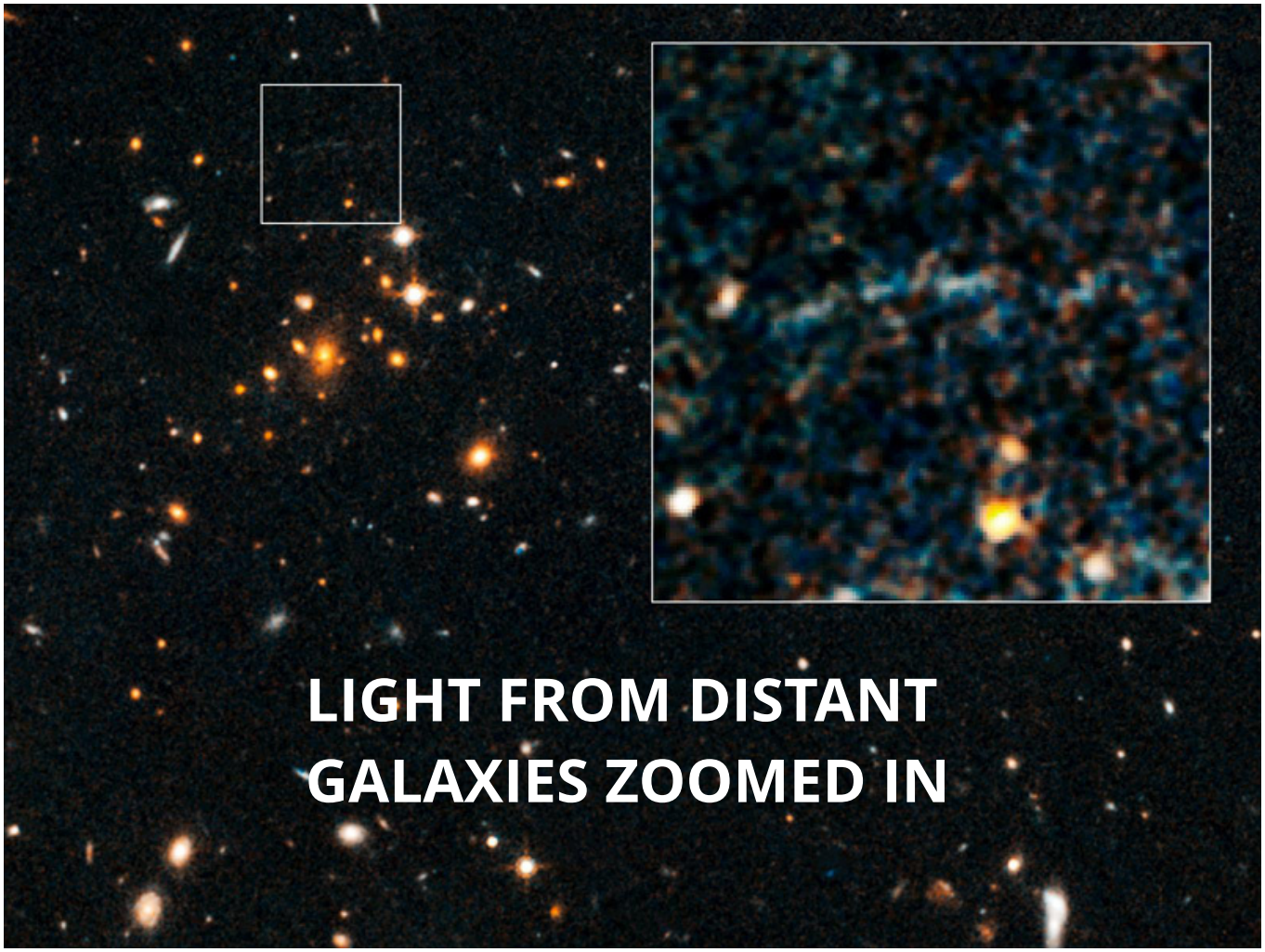
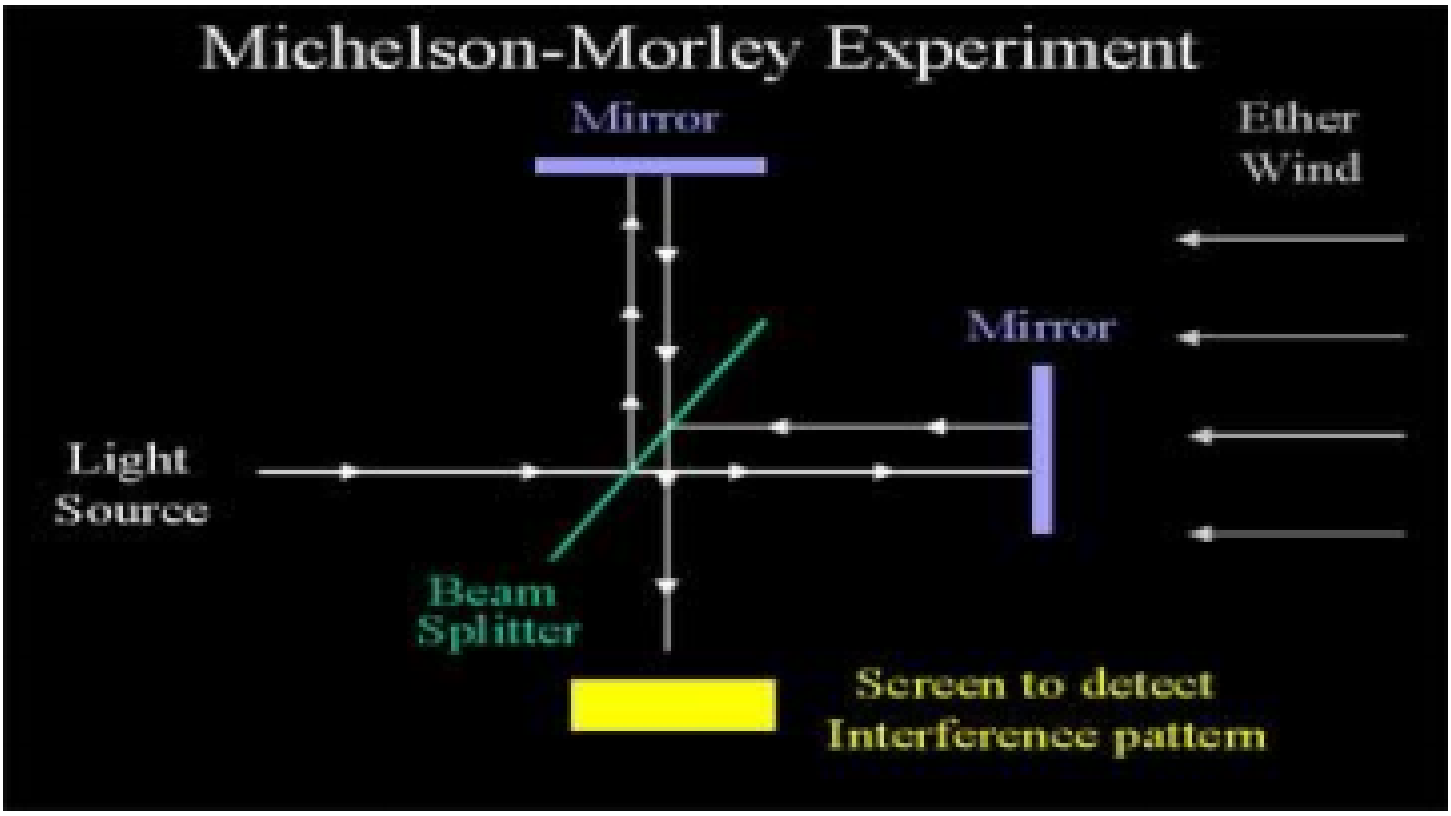


THE NON OBSERVABLE UNIVERSE

By Kavan Lad

Towards the end of nineteenth century, scientists believed that they were close to unraveling the complete mystery about the universe. They thought that the universe exists in a continuous medium called the 'ETHER'. Just as sound waves travel in an existential medium like air, water etc., light waves also travel in ether. But the only thing needed to prove the existence of ether was careful measurements of the elastic properties of the ether (since it was considered a continuous medium). In the excitement to prove this, the Jefferson lab at Harvard University was built entirely without iron nails to not interfere with the magnetic measurements. But unfortunately, they forgot about the iron content in the bricks which was used to make the Lab.

By the end of the century, tests that gave a foundation to prove the idea wrong began to appear. It was expected that light rays travelling through ether would not be same in all direction. A light ray would be travelling in the fixed speed while moving in the direction same as the ether. On the other hand, light ray would be travelling slower when it travels in the direction opposite to that of ether. Yet, a series of experiments failed to prove this idea. The most accurate experiment was carried out by Albert Michelson and Edward Morley at the Case School of Applied Sciences at Cleveland, Ohio in 1887. They compared the speed of light in two beams at right angles to each other. As the earth rotates on its axis and orbits the sun, the apparatus moves through the ether with varying speeds and directions. But they found no daily or yearly differences between the two beams of light. It was as if light travelled at the same speed irrespective of its directions. This formed the base of Albert Einstein's theory to ultimately crush Ether theory.



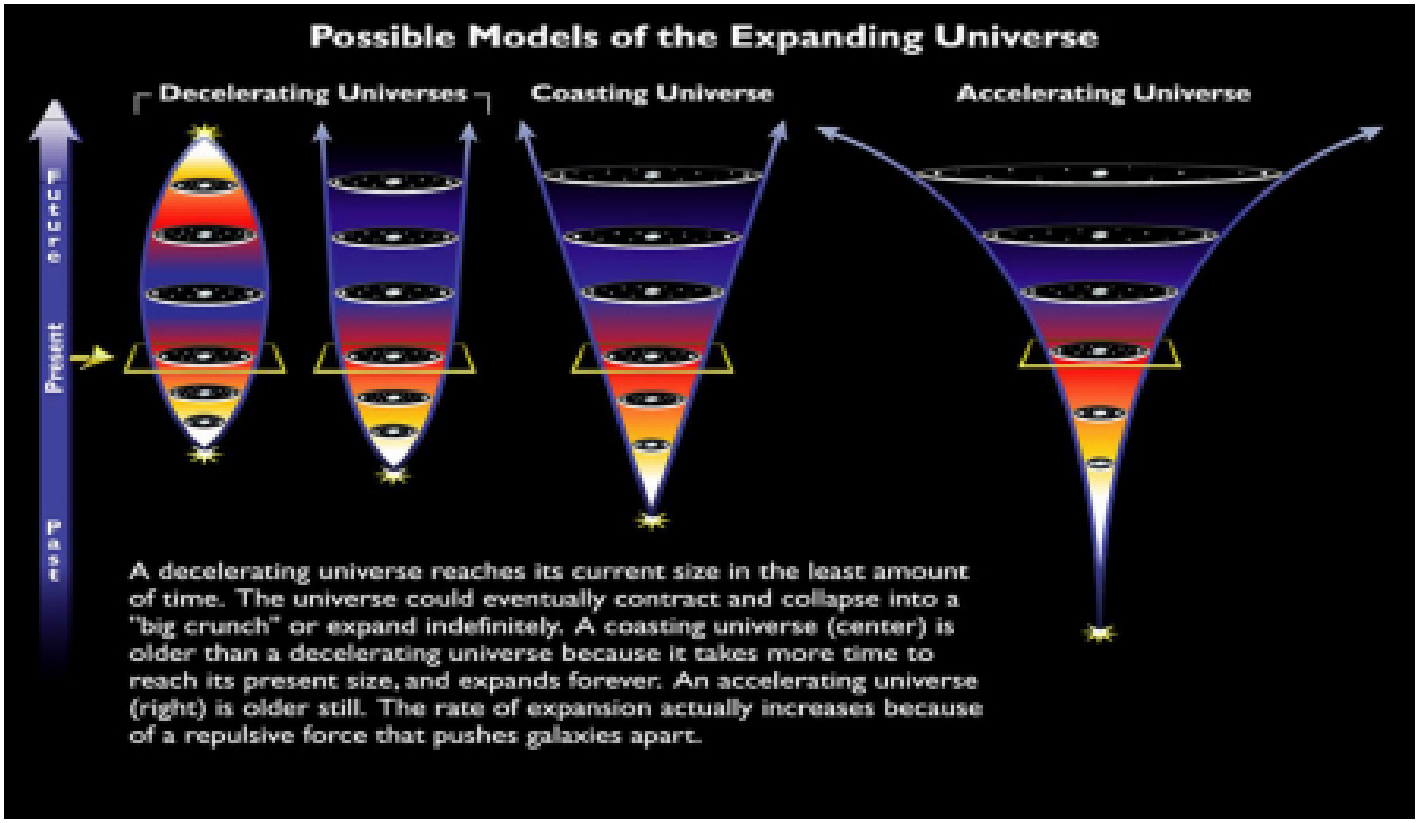
Einstein's paper of 1905 and his ultimatum- the general theory of relativity, which states that laws of nature must be same for all freely moving observers, ultimately crushed the primitive ether theory. There were many tests and experiments that proved to favor Einstein's theory.

Einstein's general theory of relativity transformed space and time from a passive background in which events take place to active participants in the dynamics of the universe.

It was previously thought that our universe is static, meaning its shape and characteristics in real time are stationary. Einstein's equations seemed to predict that space is not static, but it is either expanding or contracting. Einstein fudged up his equations and added the cosmological constant that seemed to make the state of universe static. This was one of the great missed opportunities of theoretical physics. If Einstein stuck to his original equations, he could have predicted that the universe is either expanding or contracting.

This paved the way for Edwin Hubble who discovered that the universe was expanding. He looked at the stars of neighboring galaxies and measured their distances through their relative light spectrum. Later, he discovered with the help of Doppler Effect that all the galaxies where red shifted.

Doppler Effect is the relationship between speed and wavelength which can be observed through everyday experiences. Listen to the music being played in an open ground in a car moving through a constant speed. As you approach near the ground where the music is being played, the music will sound with a higher pitch than it is originally. But as you move away from the ground, the music will sound with a lower pitch. The higher pitch corresponds to sound waves with a shorter wavelength (the distance between one wave crest and the next) and a higher frequency (the number of waves per second) and vice versa. This is because, as the car moves closer to the music source, you will be closer when the music source will emit the next wave crest, hence lessening the distance between wave crests.

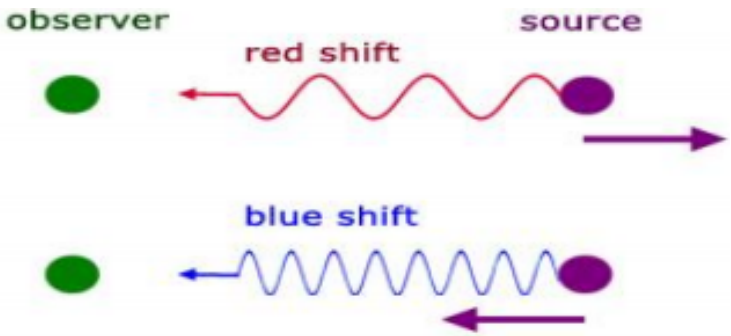


Similarly, as you move away, the wavelength increase and pitch you perceive is lower.

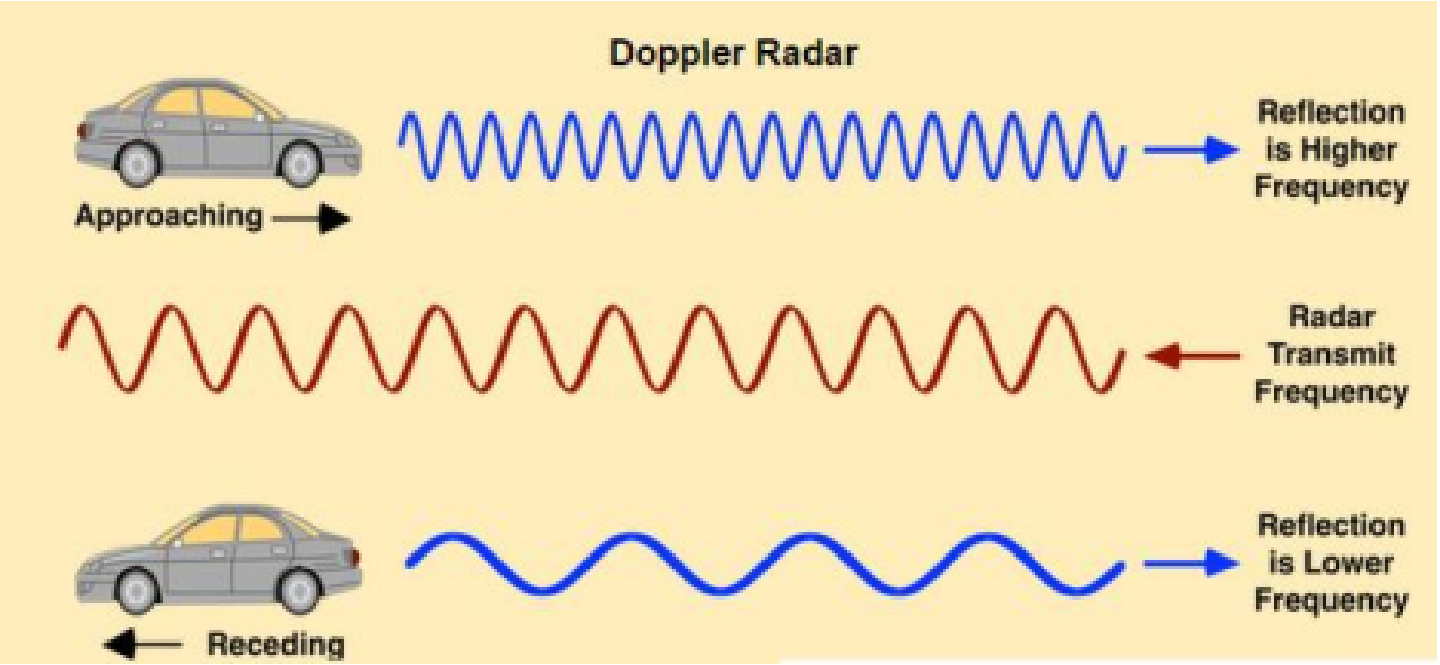
As per Hubble's situation, the galaxies which move away from earth is red shifted and the galaxies which move closer to earth is blue shifted (blue light wavelength is lesser than red light). This way Edwin Hubble through his telescope proved universe is expanding as all galaxies and stars he observed are red shifted. These telescope observations revealed that the farther other galaxies are from us, that faster they are moving away from us. The universe is expanding, with the distance between any two galaxies steadily increasing with time. This discovery removed the need for cosmological constant in the equation. Einstein called cosmological constant as the greatest mistake of his life. So, if the galaxies are moving faster with increase in the distance from us, this also proves that our universe is expanding with constant acceleration.

This also forms the basis of Big bang theory the theory that describes the beginning of our universe. You can read about it in the first issue of our magazine.Now let us jump on the main topic which we are here to discuss, the non-observable universe.

If the universe is expanding with acceleration, then the speed of a celestial object that is very distant from earth would be enormous (maybe near or more than the speed of light). Since we do not know the boundaries of this universe, it may be right to think of the celestial objects that are so much distant that their speed will be greater than light.



DOPPLER EFFECT



If the speed of the object or group of objects or galaxies are faster or near than light from the perspective of our earth, then the light emitted from those objects will not be able to reach us as the wavelength of that light would be stretched so much due to Doppler effect that it will not be visible to us or may not be able to even reach us!! This forms the basis of the Non- Observable Universe.

not be able to reach us as the wavelength of that light would be stretched so much due to Doppler effect that it will not be visible to us or may not be able to even reach us!! This forms the basis of the Non- Observable Universe.

It is predicted that only 4 percentage of our universe is visible to us while the rest 96 percentage is still unseen and undiscovered. This means that the Universe is at least 10^30 (10_{30}) times the size of our observable Universe! And good luck living long enough to even write that number down.

This proves that we Homo sapiens have just started on the quest of solving the ultimate question of our universe- Its origin and fate. There is still a lot to be discovered and a lot of stones unturned on this marvelous journey. So join us in uncovering every fact and theory discovered till this very date!!

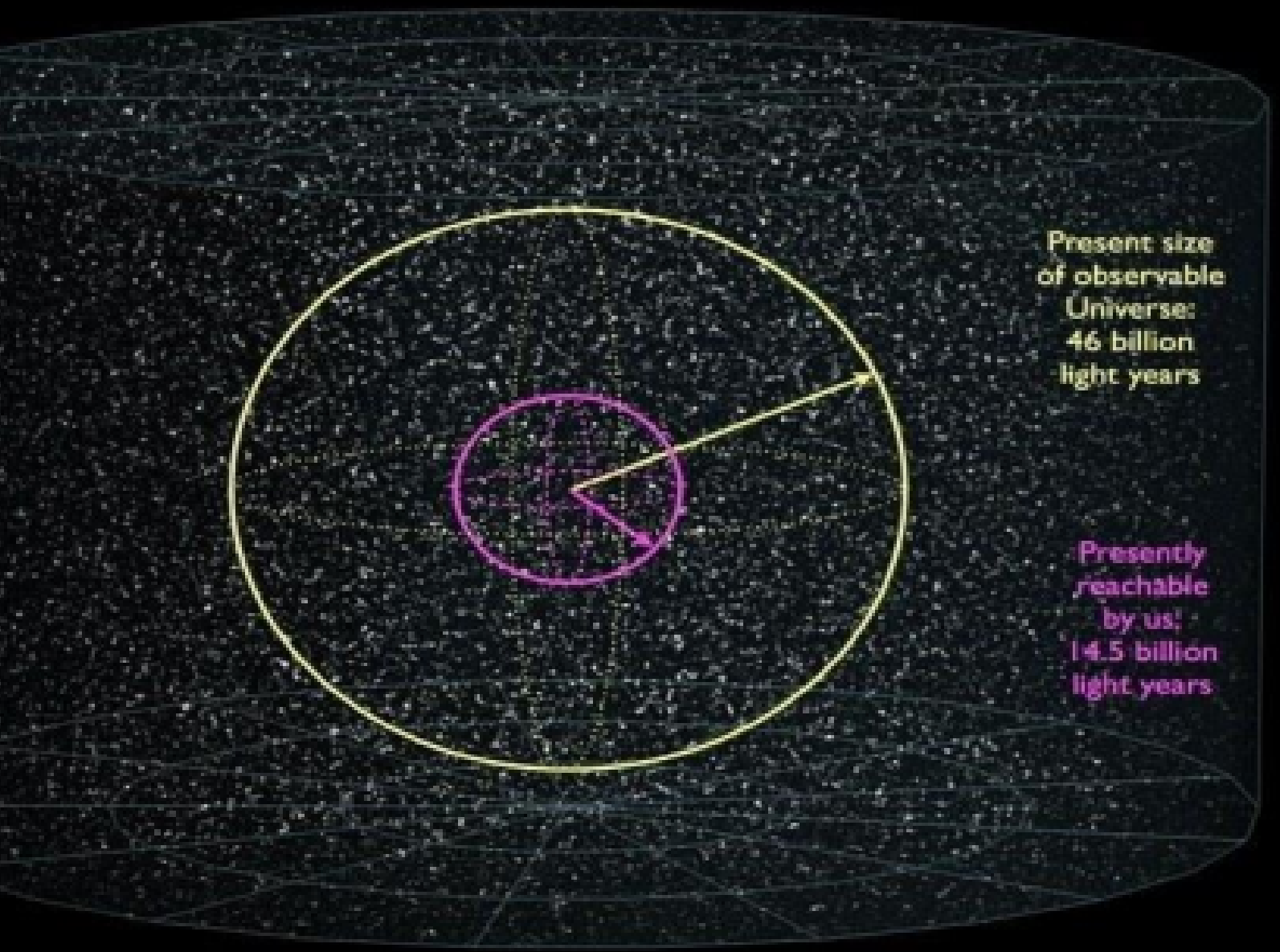
Sources- Stephen Hawking's universe in a nutshell

Image credit-https://www.quora.com/How-big-is-the-observable-universe

http://a-levelphysicstutor.com/wav-doppler.php

http://www.extremetech.com/extreme/238279-oxford-scientists-call-into-question-the-ideathat-the-universes-expansion-is-accelerating

THE NON OBSERVABLE UNIVERSE SIZE



NEWS

1. Antarctic scientists are quite close to spot a perfect location for drilling the country's deep and frozen interior that could reveal the continuous record of the planet's climate going back 1.5 million years.

2. The co-founder of Tesla, Elon Musk, offers $100 million for inventions on Carbon Capture technology. 15 companies will get $1 million for developing ideas.

3. Europe's oldest person, a French nun of 117 years, survived Covid and celebrated her 117th birthday.

4. The Oxford Covid vaccine is less effective against the South African variant.

5. The latest research warns that the noise pollution over made by humans, disturbs the animal kingdom. So, shout less than you do.

6. The new study finds that if a person has taken Asthma drugs quite earlier, then the risk of severe Covid reduces.

7. According to a study, if pet cats are fed meat food and play with them to stimulate hunting, it stops them from killing the wildlife. A cat who plays with a mouse toy will never hunt an alive mouse or any living creature.

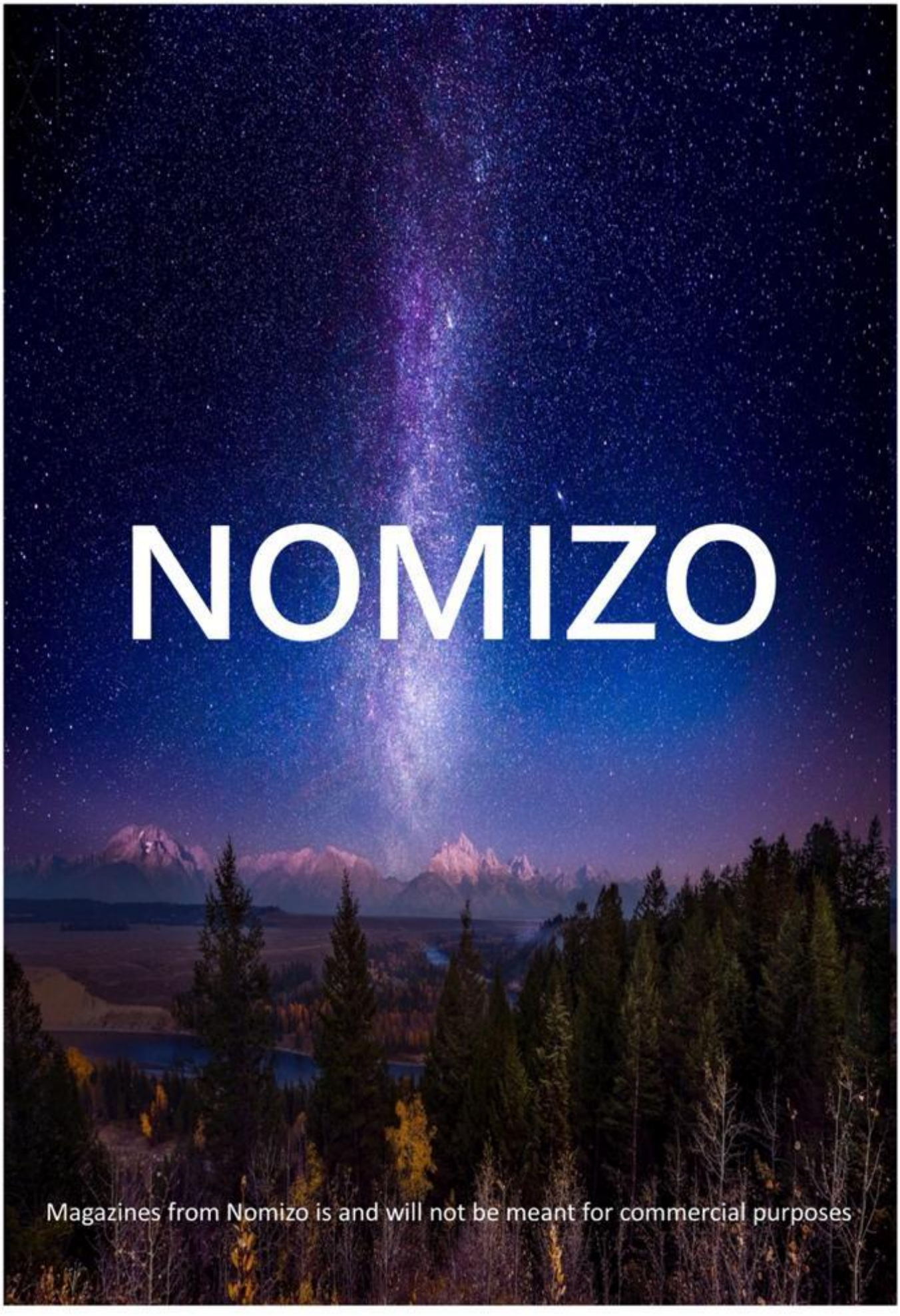
8. "It could take over 6 months to produce the Covid-19 vaccine against the new Covid variants." Says AstraZeneca.

9. The SpaceX starship ends up in a perilous fiery crash anew during the test landing.

10. MIT brainiacs make an engineered spinach that has a single walled carbon nanotube embedded within its leaf mesophyll that is capable of fluorescing with an intensity relative to the level of niroatomics taken up by the roots to send the emails. It can't receive emails, so don't think to throw your phone out of the window.

Some Important Dates

Dates	Description
February 4	World Cancer Day
February 7	Commencement Of Valentine's Week
February 10	World Pulses Day
February 13	World Radio Day
February 14	Valentine's Day
February 21	International Mother Language Day
February 22	World Thinking Day
February 27	World NGO Day
February 28	National Science Day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