Our Universe

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Introductory Remarks

- **Origin of the Universe**
  - The theory which is universally accepted in the origin of the universe is – **Big Bang Theory** which is also called the extended universe hypothesis.
  - Evidence given by **Edwin Hubble in 1920** that the universe is expanding.
  - After deep reflection on this, it can be understood that the distance between galaxies is increasing but expansion is not being created within the galaxies.
- **Galaxy**
  - A group of millions of stars that form a band is called a galaxy. Our solar system is a part of this galaxy.
  - In ancient India, it was imagined as a flowing river of light in the sky.
  - The galaxy is a complete system of billions of stars, clouds and gases. Millions of such galaxies form the universe.
  - Our galaxy's name is **"Milky Way galaxy"** and in hindi – **"Akashganga"**

Formation of Stars

- Stars were formed about 5-6 billion years ago.
- The energy center system of the universe was completely different as compared to today.
- With the accumulation of energy and matter in the universe, variations in gravitational forces arose.
- Accumulation of these substances led to formation of stars and clusters of stars.
- The galaxy was formed from an innumerable group of stars.
- The universe came into existence through the continuous formation of galaxies.
- Galaxies made up of groups of stars are so huge that their distance is measured in thousands of light years.
- A galaxy is a group of innumerable stars whose diameter can be between 80 thousand to 1 lakh 50 thousand light years.
- This huge center of the universe, which originated from hydrogen, is the Nebula.

Our Solar System

- The literal meaning of ***"Solar System***", it means – The way the Sun and the Sun's center system work is called the ***Solar System***.
- The solar system, many shiny objects are visible, similar to diamonds, these are called ***Celestial bodies. Our solar system originated about 5-5.6 billion years ago.***
- Sun, Moon and all objects are part of the celestial bodies. During the day, other celestial bodies are not visible due to direct sunlight falling on the Earth.
- The sizes of these celestial bodies range from small to large and are filled with gas, which are also called stars.
- In this solar system, if you look at the Moon on a monthly basis, you see a change in its size every day.
- On the night of the full moon, there is a ***full moon.*** The night of the new moon after fifteen days is called ***Amavasya (New Moon).***

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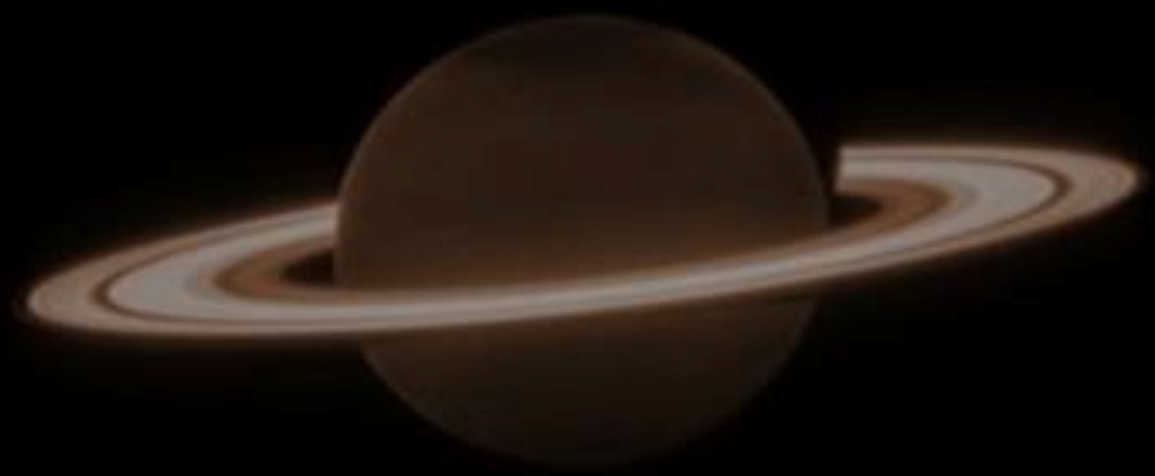

- *In mythological Roman stories, the Sun God was called "Saul" and the person related to the Sun was called Sauer, hence the Sun's family is called solar system.*
- *The Sun is the center of the solar system, it is made of hydrogen and helium gas, its pulling force holds the solar system together.*
- *It emits heat to the Earth, is the closest star to the Earth.*
- *It is about 15 crore kilometers far from the Earth.*
- According to the distance of the planets from the Sun, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune.
- All the eight planets of the solar system revolve around the Sun by moving on a fixed axis (path), we call that fixed path an *orbit.* Mercury is closest to the Sun and completes its revolution around the Sun in only 88 days.
- Pluto, which was previously a part of the 9th planet of the solar system, was named a "dwarf planet" in August 2006 by the International Astronomical Organization along with another discovered celestial body (2003 UB313 Cirrus).

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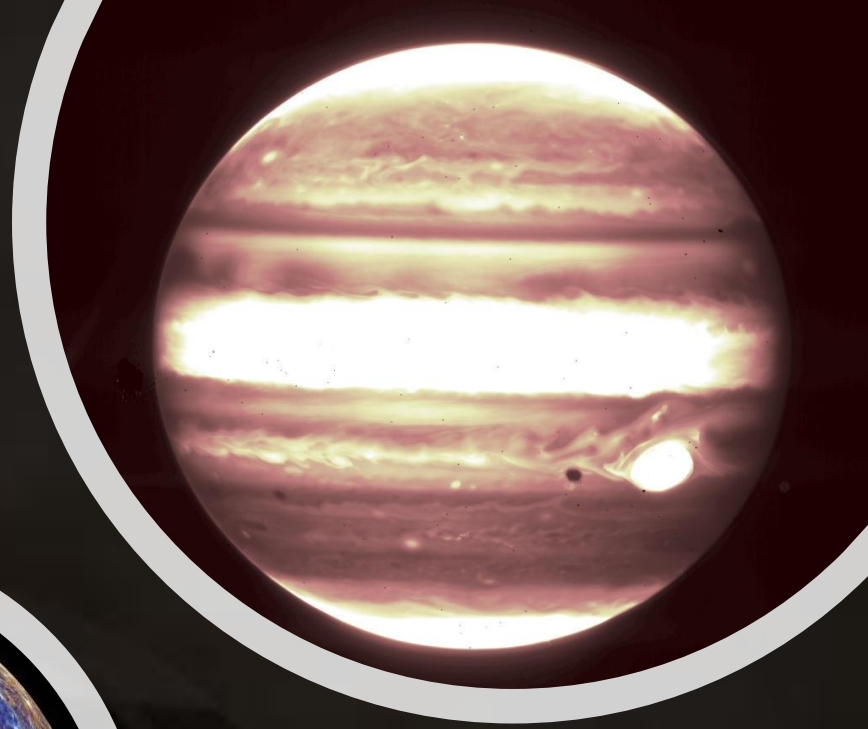
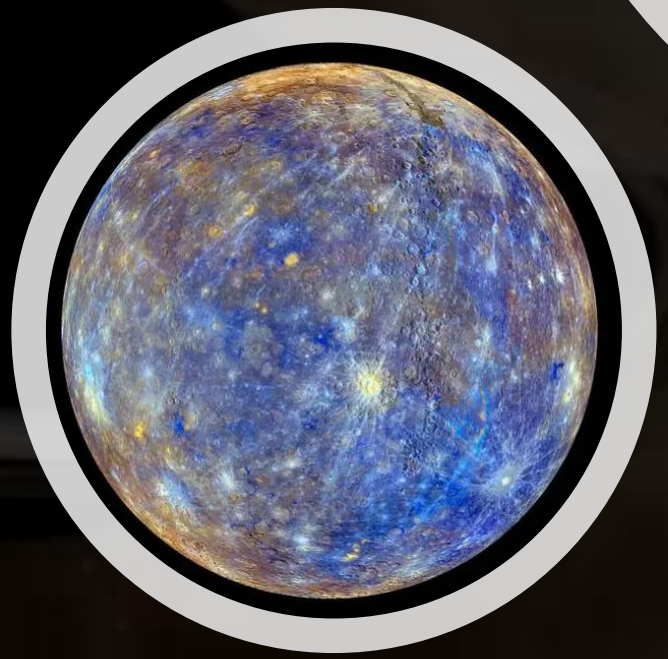
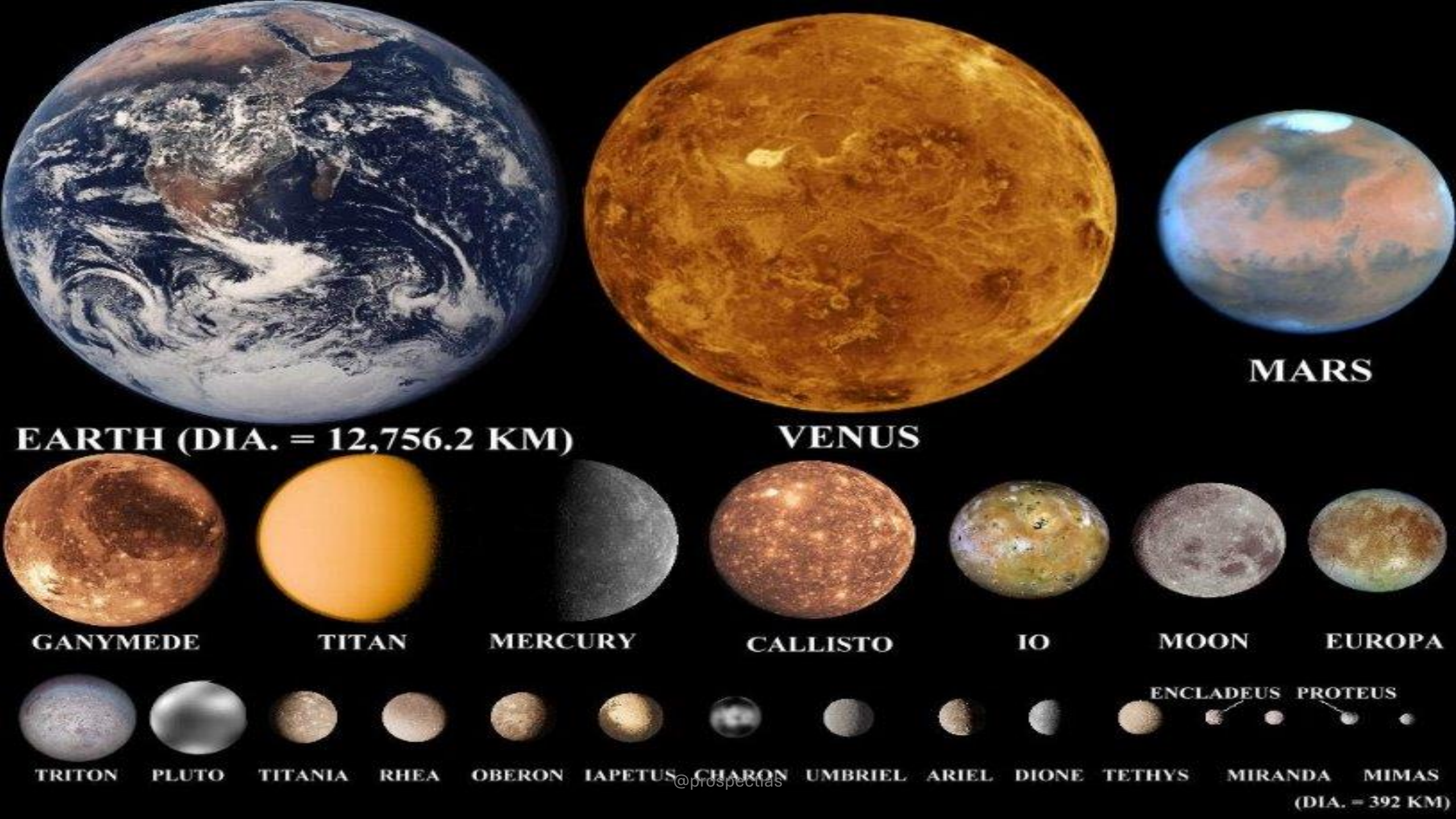
- In our solar system, there is Sun (star), 8 planets, 63 satellites, millions of small objects – such as asteroids, fragments of planets, comets, large amount of dust particles and gas.
- Inner Planets – Mercury, Venus, Earth and Mars are inner planets, they are within the asteroid belt.
- These planets are also called **terrestrial planets**, that is, like the Earth, these planets are also made of rocks and solid matter.
- Outer Planets – **Saturn, Neptune, Uranus, Jupiter** are the outer planets.
- There is more formation of gases in the structure of these planets and they are called Jovian planets. **(Jovian means like Jupiter**).





Terrestrial Planets

- Terrestrial planets were formed very close to the parent star (Sun) where due to extreme temperatures the gases could not condense.
- The solar wind was more powerful near the Sun.
- Therefore, it was more powerful than the terrestrial planets, due to which it took away more gas and dust from the terrestrial planets, on the contrary, it could not remove the gases from the Jovian planets.
- Due to the smaller size of the terrestrial planets, their gravitational force was also less, as a result of which the gas released from them could not stay on them.


EARTH (DIA. = 12,756.2 KM)
VENUS
MARS
GANYMEDE
TITAN
MERCURY
CALLISTO
IO
MOON
EUROPA
ENCLADEUS
PROTEUS
TRITON
PLUTO
TITANIA
RHEA
OBERON
IAPETUS
CHARON
UMBRIEL
ARIEL
DIONE
TETHYS
MIRANDA
MIMAS
(DIA. = 392 KM)
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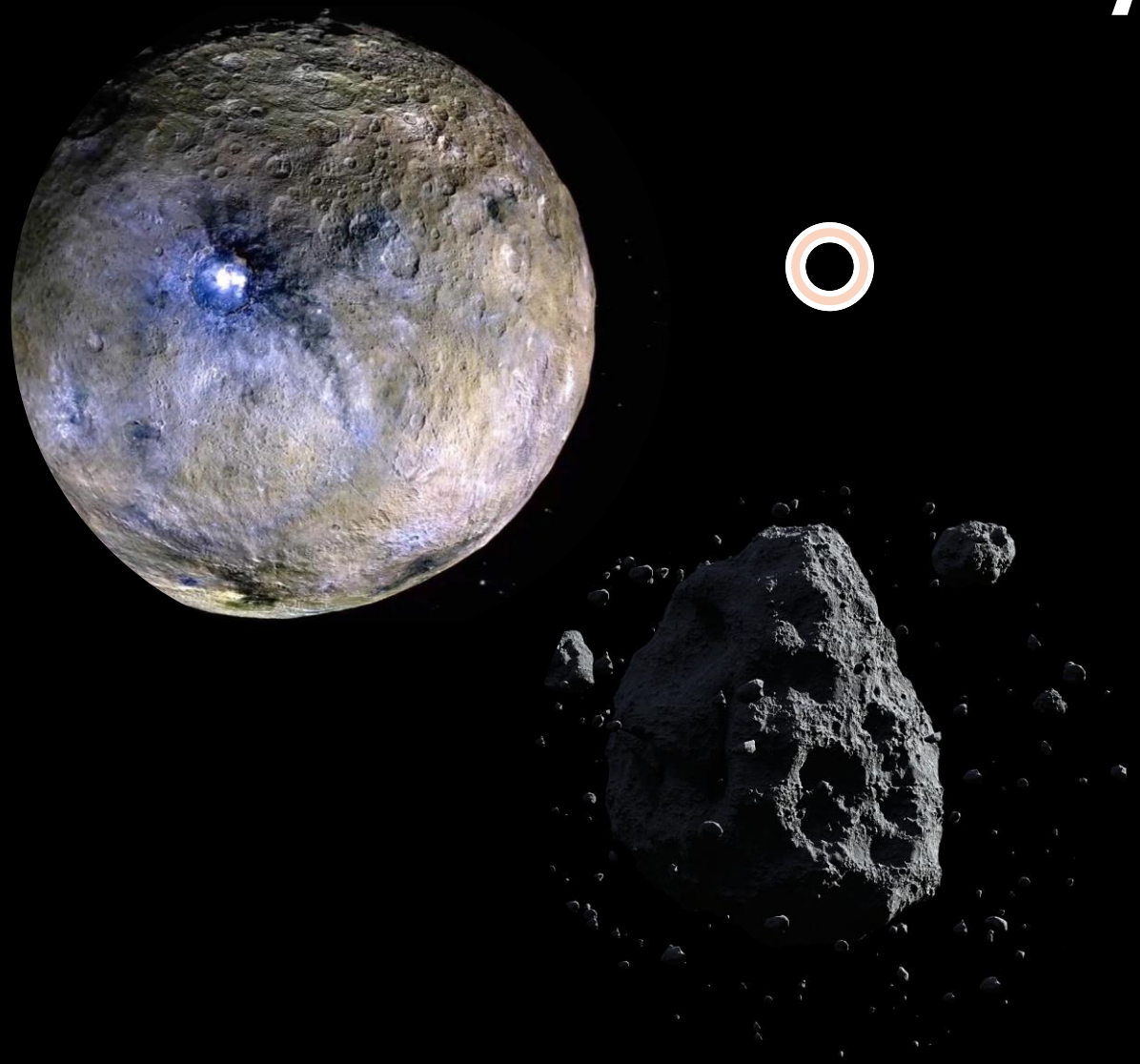
Moon

- Our Earth has only one satellite, the Moon. Its diameter is only one fourth of the Earth's diameter. It appears so big because it is closer than other celestial bodies.
- The Moon is 3,84,400 kilometers away from the Earth. The Moon completes one revolution around the Earth in about 27 days.
- In same time it also completes one revolution on its axis. In 1838 according to Sir George Darwin, the Moon and the Earth were connected like a dumbbell, according to him the Moon was formed from the trench of the Pacific Ocean.
- Immediately after the formation of the Earth, a huge body collided with the Earth, after which today's Moon was probably formed from the scattered substances.
- The Moon originated about 4.44 billion years ago. The second fact says that the Moon originated as a satellite of the Earth from a big collision which is known as "***The Big Splat***".
- *If we talk about the weight of a human being on the Moon, it will be only 1/6th, that is, if someone's weight is 60 kg on Earth, then only 10 kg will remain on the Moon. This happens because our weight will be in proportion to the gravitational attraction of the entire Earth and the gravitational attraction of other planets.*

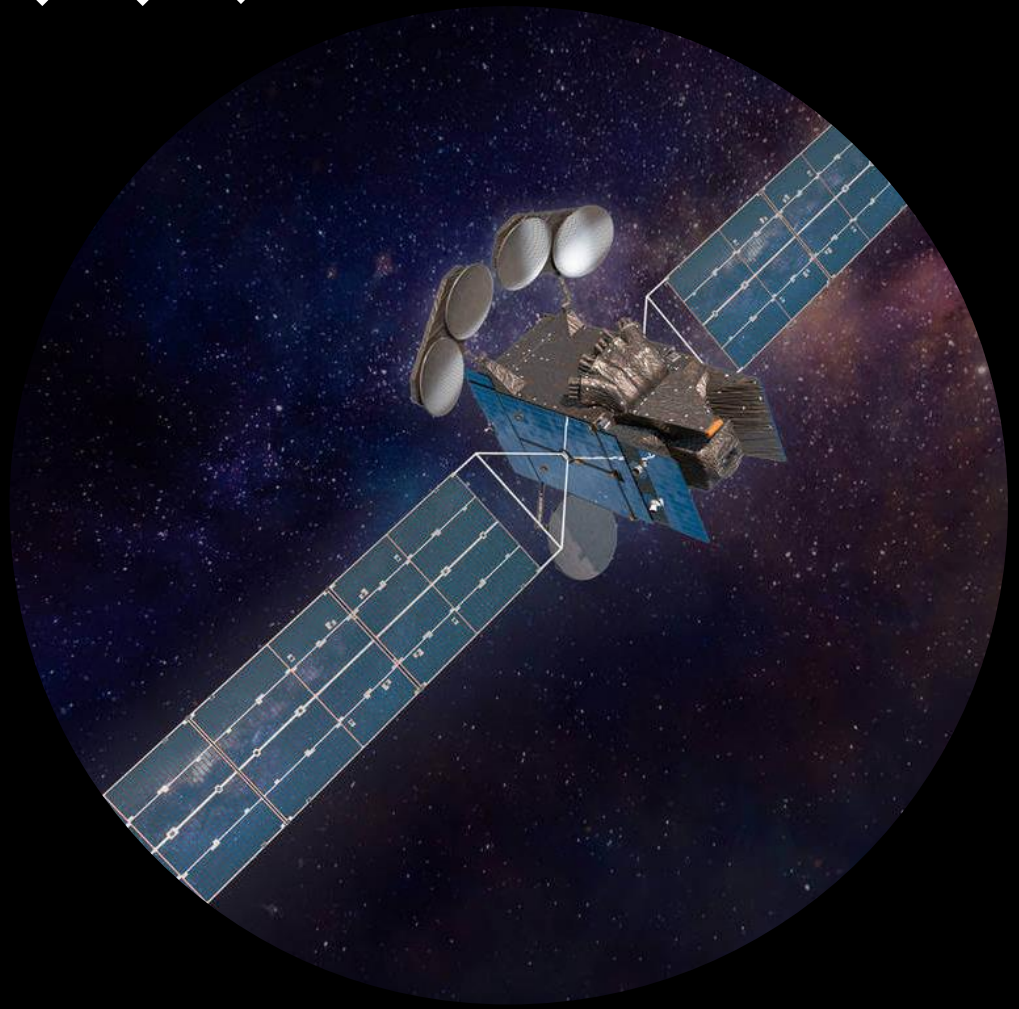
Asteroids



- Countless smaller bodies also revolve around the Sun.
- These bodies are called asteroids.
- This is part of the main planet which broke apart in an explosion many years ago.
- The name of the largest asteroid is “***Ceres***”, it was discovered by Giuseppe Piazzi.

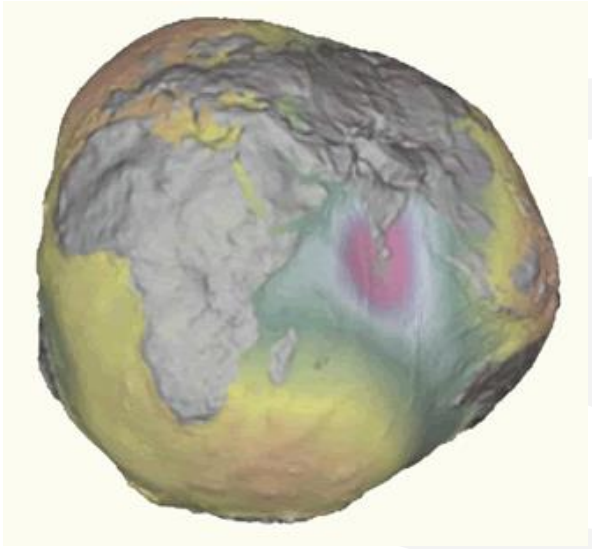
Meteorite

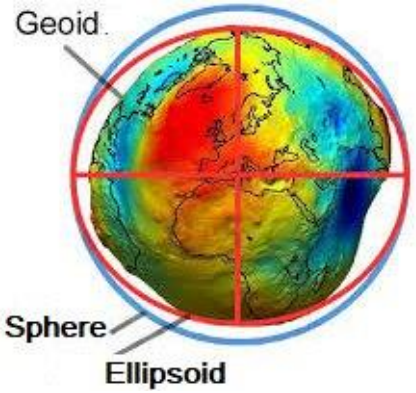
- Small pieces of stone that revolve around the Sun are called **meteorites**.
- As soon as they come close to the Earth, they have a tendency to fall down on the Earth.
- Due to friction with air, they get heated and burn.



Facts to Remember

- **Satellite** – It is a celestial body which revolves around the planets in the same way as the planets revolve around the Sun.
- **Man-made satellites are artificial objects.**
- **It has been created by scientists, which is used to send information about the universe.**
- **Moon, Apollo 11, Aryabhata are some of the major satellites of the Earth.**
- In Greek language ‘ge’ means earth and ‘graphia’ means writing geo (ज्यो) meteria (metry) or measurement of the earth, geo (oid) oeides the size of the Earth.
- Jupiter is the largest planet in the solar system.
- The planet Saturn (SATURN) is revolving around the solar system with its ring i.e. bracelet-like cycle.
- Light year is not a measure of time but of distance. The speed of light is 3 lakh kilometers per second.

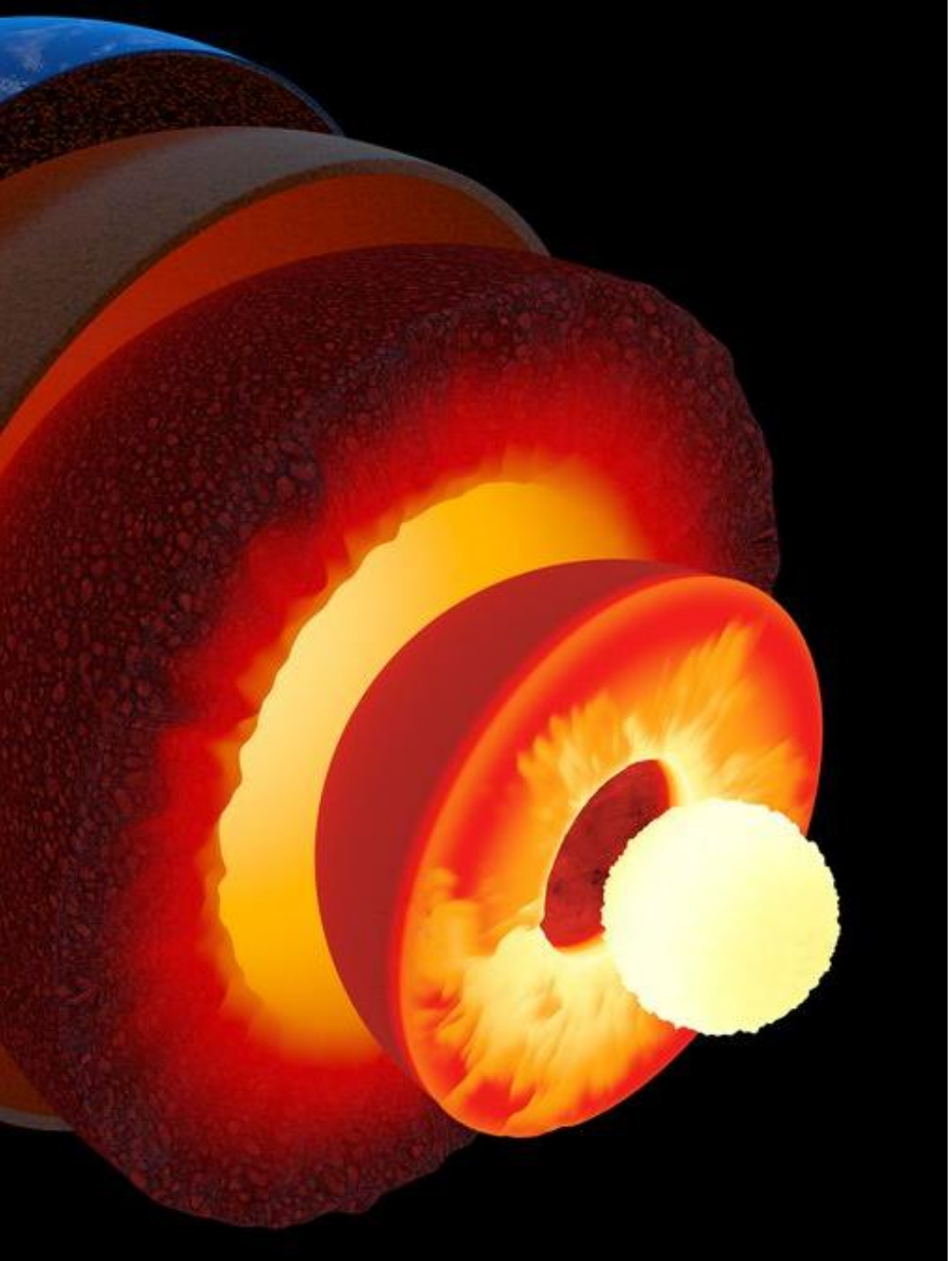





Oblate Spheroid

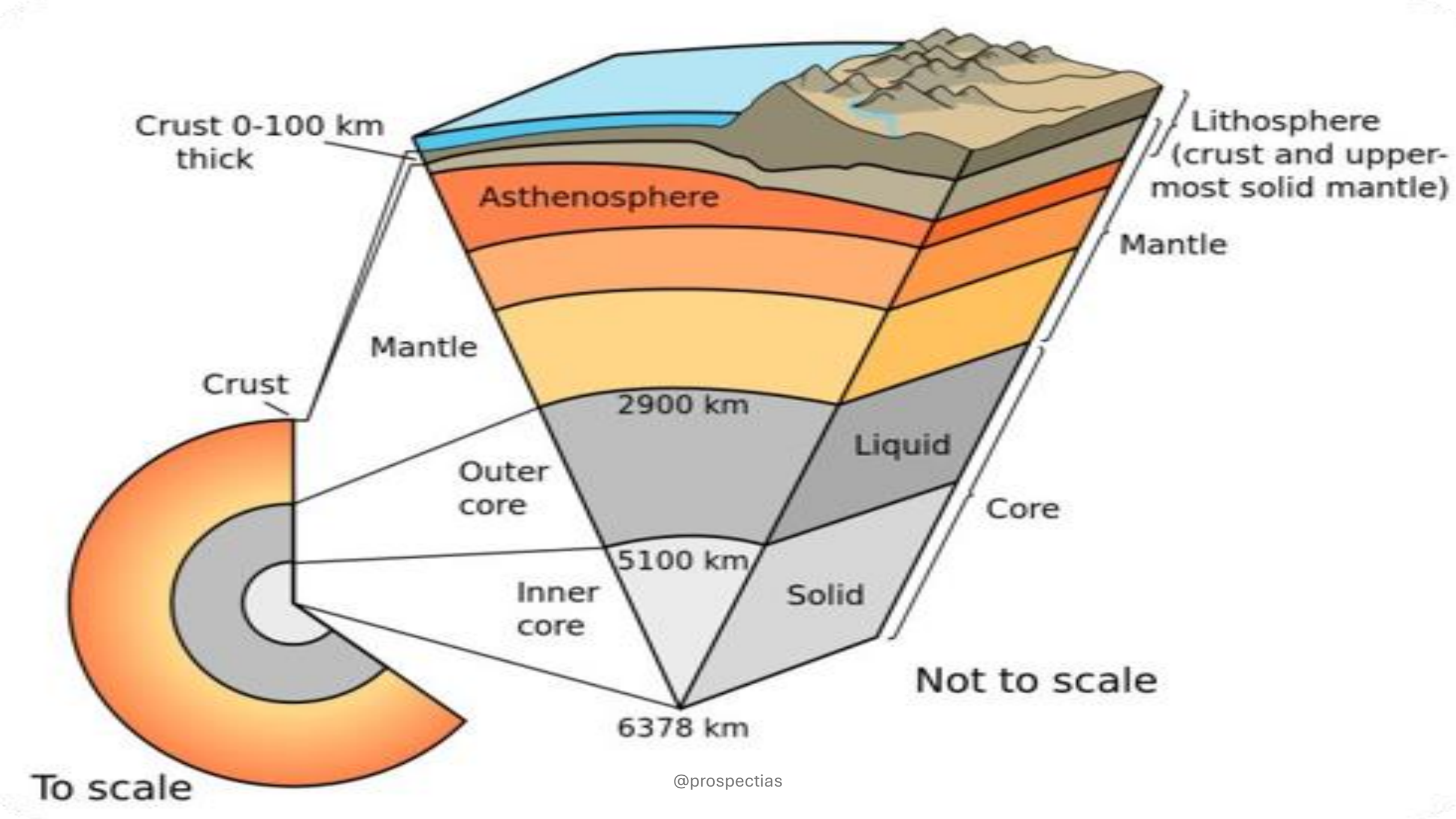
Earth

- **If we look at the Earth, the sky appears blue, the reason for this is the spectrum of white light from the Sun, that is, white light has seven colors and out of these, the blue color breaks up the most and scatters, which we also call scattering of light.**
- Earth is the third planet in terms of distance from the Sun.
- It is the fifth largest planet in size. The Earth is slightly flat near the poles, which is why its shape is called **GEOID.**
- Continuously occurring events have given an organic form to the geographical depiction of the Earth.
- Life also developed during the 460 crore years of Earth's origin.

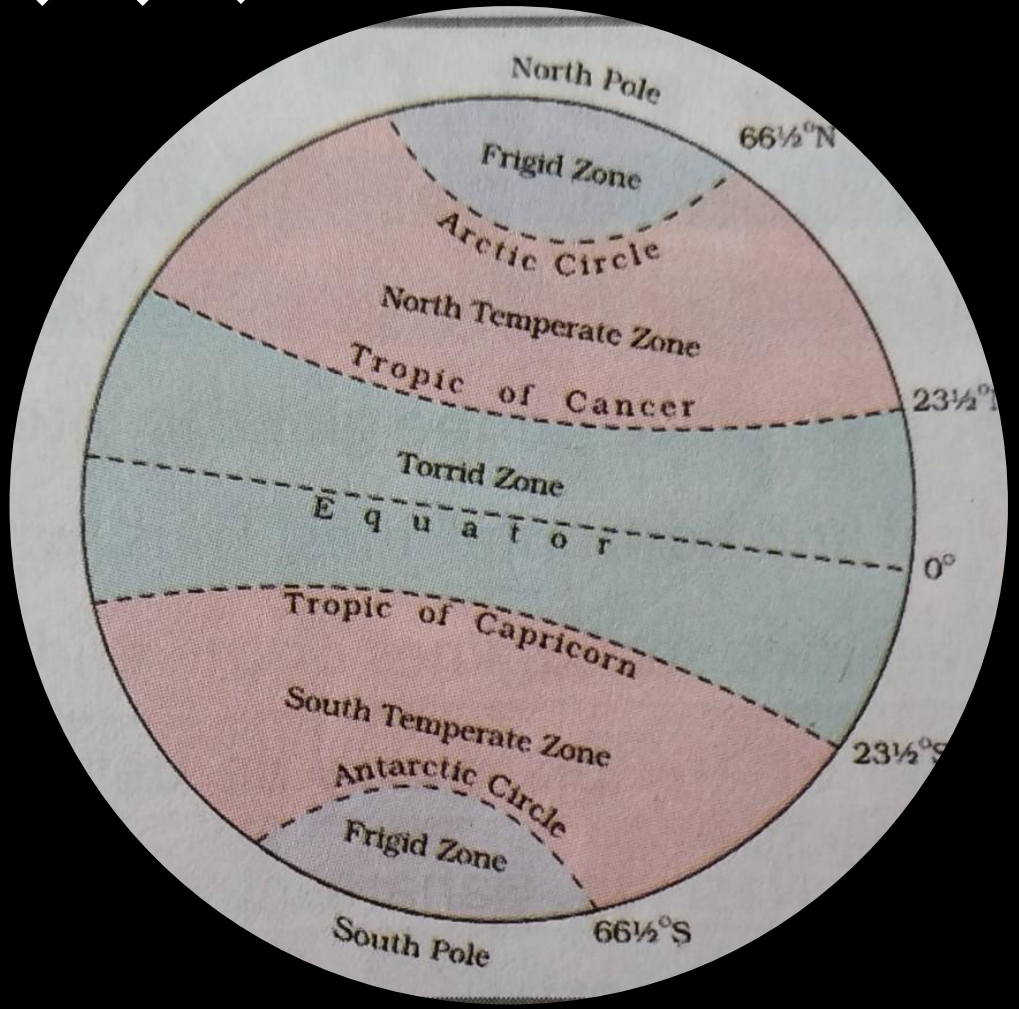


Development of Earth's Lithosphere

- Planets were formed from small units.
- This is how the Earth's lithosphere were formed.
- The heat generated due to the force of gravity caused part of the Earth to form into layers.
- During the formation process, the increase in temperature separated the density due to which the Earth went into liquid state, more dense substances got absorbed inside the Earth and lighter substances remained on the surface.
- Due to separation of light and heavy dense substances, this process is called differentiation.
- Due to the giant impact during the origin of the Moon, the temperature of the Earth increased again, then energy was generated and the second phase of differentiation started, due to which many layers are found till the Earth's surface.
    - Crust
    - Mantle
    - Outer Core
    - Inner Core



Earth's Heat Zones



- The Sun is overhead at all latitudes between the Tropic of Cancer and the Tropic of Capricorn is **TROPIC ZONE**.
- In the Northern Hemisphere, the temperature of the area between the Tropic of Cancer to the Arctic Circle and in the Southern Hemisphere between the Tropic of Capricorn and the Southern Polar Circle remains moderate, which is called the **TEMPERATE ZONE.**
- The area between the Arctic Circle and the North Pole in the Northern Hemisphere and the South Pole in the Southern Hemisphere is very cold. Due to the straight surface, sunlight is less in this area, hence this area is called **TORRID ZONE**.

Latitude and Longitude

- There is actually no axis on the Earth, it is rotating on its axis, it is called the equator.
- The **Northern Hemisphere** is located in the northern half and the **Southern Hemisphere** is located in the southern half.
- All parallel lines in the Northern Hemisphere are called Northern latitude, in the Southern Hemisphere Southern latitude.