# Minor Planets and Formations of Our Solar System

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## Introduction

In a belt between the orbits of mars and jupiter, known as the asteroid belt, millions small, rocky, irregularly shaped objects orbit the sun. Though majority of these are confied to a narrow region, some travel elongated orbits that take them past the orbit of jupiter. These objects are called asteroids, minor planets or planetoids. Scientists think that these are fragments that failed to form a planet.

The Sicilian astronomer Father Guiseppe Piazzi discovered the first astioroid in 1801. He named it ceres. After this, a number of such objects were discovered, and William Herschel called them "asteroids", meaning star like. More than twenty thousand asteroids have been individually identified so far. The actual number of asteroids is estimated to be in millions.

In the asteroid beld, you find objects as large as ceres (the largest asteroid, 940 kilometers across) as well as dust particles. Some of them may have moon to A moon the asteroid Ida was discovered by the spacecraft Galileo.

**Stray asteroids :**

Smaller asteroids may be knocked out of there orbits by a collision, or by the effect of the gravitational force of Jupiter or mars. For example, the moons of mars are thought to be asteroids that were 'captured' by the gravitational pull of mars. An off-course asteroid can heard towards the earth too. If it is large enough its collision with earth would have disastrous consequents in fast, some meteorites found on the earth have composition similar to those of asteroids. Scientists think that these could have been stray asteroids that fell on the earth. Scientists keep a lise watch an asteroids, not only to learn more about them, but also just in case one more heads our way!

In February 2001, the NEAR (Near earth asteroid Renderzvous) spacecraft landed on the asteroid irons. Scientists hope to learn a lot more about asteroids from the data collected by this mission.

## Meteoroids, Meteors Meteorites

Apart from planets and asteroids, small pieces of rock travel though space. These rocks are pragmements from as an asteroids, a comet, a moorn, mars and so on. They are called meteoroids. Sometimes a meteor, as friction heats it up so much that quite often the meteoroid vaporizes completely. The hot vapors give off light before cooling down, causing a streak of light to be seen in the night skey. A streak of light caused by a vaporizing meteroroid is called a meteor or a shooting star.

You should not confuse a shooting star with a star. A shooting star in neither a ball of hydrogen and helium as stars are, nor is its light due to neclear reactions. A shooting star is just a piece of matter that gives off light. As it burns in the earth's atmosphere.

Sometimes, a meteoroid entering the earth's atmosphere is so large that it does not vaporize completely before hitting the ground. a meteoroid that hits the ground is called a meteorite. Fromt he study of meteorites, scientist draw inferences about the composition of our solar system at the time of its formation. This is because most of the meteorites are fragments of asteroids, which have remained relatively unchanged since the time of formation of our solar system. Meteorites hit the moon's surface quite frequently because there is no atmosphere on the moon to burn the falling pieces of matter. Although a large number of meteoroids enter the earth's atmosphere every day,they are in general very small (less than a gram in mass) and therefore they vaporize. So we donot have meteorites is large enough, it can cause a lot of damage in a populated area. It is believed that a meteorite, about 10 km across, hit the earth 65 million years ago. The impact was responsible for the extinction of a variety of life forms, including dinosaurs, such powerful impacts can also create big craters. Soil carried by the wind and rainwater can fill up a crater over time However, the large craters remain one such crater is the lunar crater near Aurangabed Maharashtra. It is about 1.85 km wide and has a lake at its base, called the lunar lake.

**Comets :**

Comets are objects which movely in highly elongated orbits around the sun. Comets are small in comparison to the planets (a few hundred metres to a few hundred kilometers across). They are made up of frozen gases and rock. Their long tails, which appear as they approach the sun, characterizes comets. As they come close to the sun, the frozen gases and rock. Their long tails which appears as they approach the sun, characterizes comets. As they come close to the sun, the frozen gases vaporize and start glowing. They are blown away and carry with them solid dust particles, thus creating the comet's tail. A comet's tail always points away from the sun.

**Periodicity of comets :**

Many comet righting have been recorded in history. The appearance of these fiery balls in the sky alarmed the people of the ancient times. In 1705, the English astronomer and mathematician Edmond Halley, a contemporary of sir Issar Newton, published an important work in astronormy. In it he declared that the comets sighted in 1531, 1607 and 1682. Where actually one comet and he predicted that it would return again after 76 years in later 1758 or early 1759. The comet was sighted on Christmas Day 1758, and it returned again in 1835, 1910 and 1986. This comet was named comet Halley or Halley's comet in his honour. Halley's work meant that if comets returned periodically, they must be orbiting sun.

Most comets short periods it. They take a short time to orbit the sun (less than 200 years), while others can take millions of years.

**Importance ot historians :**

Comets have been depicted in ancient works of art like paintings and tapestry, whose remain subject is some other important event such as a war since historians know the number of years taken by a particular comet to return, they can use these works of art to fix the exact year in which the event happened.

## Comets come from the Oort Cloud and the Kuiper Belt

Where do comets come from? Why do sorne comets have short periods, while othes have long periods? It was noticed the comets come from all directions of our solar system. This led the Dutch astronomer join Oort to propose in 1950 that comets mus come from a spherical cloud

surrounding our solar system. This is called the Oort cloud, which is at the outer rigions of our solar system. This is called the Oort cloud, which is at the outer regions of our solar system, at a distance of about 105 Av (about 15 billion km) from the sun. The Oort cloud contains trillions of small, icy objects. These objects are the leftovers fromt he formation of the solar system, which failed to assemble into bigger bodies, and for some reason, they were pushed very far from the sun. While normally these objects orbit the sun very slowly, an event such as a passing star pushes them towards the sun. These objects then start orbiting the sun in highly elongated orbits as comets. Such comets have long periods.

Where do short-period comets come from? In 1951 another Dutchman, Gerard kuipr (pronoun kipper) suggested that short period comets must come from a region closer to the sun that the Ort cloud. He proposed the existence of the kuiper belt, a disc shaped region, which is the horne to many small my objects scientists have now verified the existence of this belt and many small objects in it. It lies beyond the orbit of Neptune. Actually,since consider Pluto as the largest object of this belt.

## What happens when comets come too close to the sun or a large planet?

comets are small bodies and they can be adversely affected by the gravitational pull of the sun or massive planets, like jupiter, if they pass too close to them Usually, comets come no closer than a few million kilometers to the sun. If a cemt's orbit takes it loser to teh sun, it may crash directly into it or break down into pieces. A comet break into piece if it comes close to a large planet too. The portion of the comet nearer the planet or the sun is pulled by a greater force than the portion on the far side. As a result, the comet may break up into pieces. When the comet shoemaker-levy came within 25000 km of Jupiter, it broke into a large number of fragments. In july 1994, twenty one of the largest fragments crashed into Jupiter.

## Scientific interest in comets

Just like asteroids, comets are of great interest ot scientists, since their composition has not changed much from the time of the creation of the solar system. Thus, we can learn a lot about the conditions existing at the time by studying the composition of comets. Studies have shown the presence of carbon, oxygen, nitrogen and hydrogen in the form of carbon minoxide, methane and hydrogen cyanide (HCN) in comets. As these can generate more complex organic molecular some scientists believe that the seed of life come to earth, when comets crashed into it in its early years.

## Formation of our solar system

We know that there are different members of our solar system. But how did they cme together? The birth of our solar system is not yet completely understood. We now describe the most probable sequence of events that might have did to the formation of the solar system.

## Formation of the sun

About 4.6 billion years ago, there existed in a region between stars, a huge cloud of dust and gases, mostly hydrogen and helium. This cloud started comparting and spinning. Contraction caused the matter of the cloud to heat up. Over time, the rotating matter got arranged into a nearly spherical are surrounded by a disc passing through its equilateral plane (Imagine a rotating plate with a spinning ball punched through its centre) Eventually, contraction of the core under gravity raised its temperature high enough for

nuclear reaction (fusion of hydrogen) to start. Thus the sun was born.

## Formation of the planets

When the matter in the disc cooled down enough, gases condensed to form liquid and solid particles. While these particles were revolving round the sun with the disc, they were also moving randomly and colliding with each other within the disc. These particles are called planetesimats. Occasionally, after a collision, these particles stuck to each other, forming bigger particles. The chance of a such thing happening is good if the particles collide gently. With each other. Imagine canon pieces with a bit of glur on there sides. If your gently flick a piece towards another, there is a good chance of their sticking together. In the same way, bigger masses wer formed by the gentle collisions of planetesimats. The gravitational pull exerted by the bigger masses on nearby particles pulled them in to form even bigger masses. In this way, most of the remaining matter in the disc got swept in to form nine large bodies the planets. The nine planets did not capture all the mases of the disc. Smaller bodies were also formed, sense of which become bound to a planet by gravitation. As you might have guessed, these are the moons of the planets.

## Formation of the asteroid belt

In the region between Mass and Jupiter, the particles failed to assemble into a planet size lump. It appears that Jupiter had already formed before the matter int he region colud come together to form a planet. Jupiter being massive (remember its mass is more than double the total mass of the remaining eight planets), exerted great gravitational force on these particles and disturbed their paths violently. The collisions between these particles were therefore violint– Instead of bringing the particles together, the collisions caused the particles ot move apart (just like carom pieces which scalter on a hard collision). These particles formed the asteroids in a belt between Mars and Jupiter.

## Other solar systems

Are there solar system other than our own?

Yes there are. In recent years. Scientists have found that some stars have planetary systems. Do these include planets on which there is life? Scientists are trying to find that out. The project Set I (search for extra terristial Intelligence) is looking at the possibility of tehre are other intelligent beings in the universe, they might be using radio signals to communicate, which we can detect. For this, the huge amount of radio signals that exist because of various sources are recorded and analysed to detect-extracterrestial communications. Normally, the job would need a huge, powerfull computer. Instead of single large computer. Pls of ordinary people participating in this project are being used to analyse small portions of the recorded signals, whenever there PCs are free. The results are than sent back to the Set I team iva the internet. In this way the Set I team hopes to detect any extraterrestrial intelligent life form that might exist.

## Evaluation of the Earth's Structure

Did the earth have to core–mantle–crust structure from the very beginning? No when the earth was formed from a collection of planetesinals, it was more or less a homogeneous structure. The planetesinal that came together to form the earth were quite cold and therefore initially the earth's temperature was also quite low. But the earthe was not as compact as it is today and comprised of planet estimates was converted into heat. Thus, the earth temperature stacted increasing. Another important factor responsible for the heating of the earth was the

radioactive delay of elements like uranium, thorium and unstable isotopes elements like potassium inside it the energy released in these delays was obserbed by the earth, increasing its temperature. Also, the earth contracted due to its own gravitation and was heated in the process. It appears that about 800 million years after its formation, the temperature become so high that most of the earth melted.

Once the earth melted, it recognized itself heavy inaterials like iron and nicked collected in the central region, forming the core. The lighter material rose to the outer regions. The outermost liquid layer of the earth cooled and solidified. This layer become the crust of the earth. The particular molten material between the core and the crust become the mantle. This process of melting and reorgnization of the earth according to the density of materials is called differentiation.

## Conclusion

There are billions of minor planets present in our universe. As of December 2015 there are 155.144 numbered planets and 246,516 unnumbered. Most are not particularly not worthly. Only 19712 minor planets have been given names. Five minor planets have been accepted as dwarf planets by the IAU and hundreds more are likely to be dwarf planets. As of December 2045 list of dwarf planets are Pluto, cues, Eris, Haunea and Make the formation of the solar system began 4.6 billion years ago with the gravitational collapse of a small past of a giant molecular loud. Most of the collapsing mass collected in the centre, forming the sun, while the rest lcattend into a protoplanetary disk out of which the planets, moon, asteroids and other small solar system bodies formed.

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