Small Bodies in our Solar System

Comets, Asteroids & Meteoroids

* A Small Body is any object in the solar system that is smaller than a planet or moon, such as a comet, an asteroid, or a meteoroid.

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Comets

Among the most brilliant and most rare objects in the night sky. These soaring beacons with their beautiful tails come from the outer realms of the Solar System. In ancient times, people often thought their appearance in the sky was an ominous (bad) sign.

What are comets?
A comet is a small world which scientists sometimes call a planetesimal. They are made out of dust and ice, kind of like a dirty snow ball.

Where do they come from?
Comets come from two places: The Kuiper Belt and the Oort Cloud.

Imagine a place far, far away at the very edge of the Solar System. A place where millions of comets can be seen swishing around in every direction. These icy comets are orbiting the Sun in two different places, both of which are very distant. One place is called the Oort cloud, and the other is called the Kuiper Belt.

Why do Comets leave their home in the Oort Cloud or Kuiper Belt?
A comet will spend billions of years in the Kuiper Belt or Oort Cloud. Sometimes two comets will come very close to each other, or even crash into one another. When this happens the comets change directions. Sometimes their new path will bring them into the Inner Solar System. This is when a comet begins to shine. Up until now the comet has been among millions of others exactly the same, but as they approach the warmer Inner Solar System they begin to melt leaving behind magnificent tails.

Comets travel in a highly elliptical orbit from the Outer to the Inner Solar System. Unfortunately, comets don't live very long once they enter the warmer part of the Solar System. Just like a snowman melts in the
summer, comets melt in the Inner Solar System. Although it is the most glorious part of their lives, traveling through the Inner Solar System eventually kills them. After several thousand years they melt down to a little bit of ice and dust, not nearly enough to leave a tail. Some even melt away completely.

Many people think that a comet's tail is always following behind it, but actually the coma, or tail, can either be behind the comet or in front of it. Which way the tail is pointing depends on where the Sun is. That's right, the Sun's heat and radiation produce a wind called the **solar wind**. As a comet gets close to the Sun it begins to melt. The gas and dust that melt off are blown away from the Sun by the solar winds. So if a comet is traveling towards the Sun then the tail will follow behind, but if the comet is traveling away from the Sun the tail will be in front of the comet.

**Parts of a Comet**

**Nucleus**: The “dirty snowball” part of the comet; the solid, central mass made of ice, frozen carbon dioxide and other frozen gasses.

**Coma**: The large cloud of gas that melts from the nucleus due to heat from the Sun.

**Tail**: The tail is actually two tails- the Ion Tail and the Dust Tail.
Famous Comets:

Halley’s Comet

Halley’s Comet is perhaps the most famous comet in history. It was named after British astronomer Edmund Halley, who calculated its orbit. He determined that the comets seen in 1531 and 1607 were the same objects that followed a 76-year orbit. Unfortunately, Halley died in 1742, never living to see his prediction come true when the comet returned on Christmas Eve in 1758. Each time this comet’s orbit approaches the Sun, its 9-mile nucleus sheds about 6 meters of ice and rock into space. This debris forms an orbiting trail that, when falling to Earth, is called the Orionids meteor shower. Comet Halley will return to the inner Solar System in the year 2061.

Comet Hale-Bopp

The unusually bright comet delighted observers on its last approach near Earth in 1997. Hale-Bopp is not expected to return to the inner solar system until near the year 4300.
Asteroids

What are asteroids?
Asteroids are small rocky objects in the Solar System. They orbit the Sun like planets, but they are a lot smaller than planets.

Asteroids are left over materials from the formation of the Solar System. These materials were never incorporated into a planet because of their proximity to Jupiter’s strong gravity.

Asteroids do not have enough gravity to pull themselves into a ball-shape, so they are irregularly shaped. They are sized from a few meters up to 1,000 kilometers in diameter.

Where are asteroids located?
Most asteroids are found between the orbits of Mars and Jupiter in the Asteroid Belt.

Some asteroids actually cross Earth’s orbit; these are called Apollo Asteroids. Scientists are particularly interested in Apollo Asteroids because they are more likely to make impact with Earth.

There are two other groups of asteroids called Trojan Asteroids. These are found within the orbit of Jupiter- one group is ahead of Jupiter in its orbit, and the other is behind Jupiter in its orbit.

What is the Asteroid Belt?
The Asteroid Belt is divided into an inner belt and an outer belt. The inner belt, which is made up of asteroids that are within 250 million miles (402 million km) of the Sun, contains asteroids that are made of metals.

The outer belt, which includes asteroids 250 million miles (402 million km) beyond the Sun, consists of rocky asteroids. These asteroids appear darker than the asteroids of the inner belt, and are rich in carbon.
How many asteroids are there?
26 very large asteroids have been discovered, which is probably most of the big ones, but there are still millions of smaller ones that we have yet to see because they are too tiny—only a mile or so across.

If we stuck all the asteroids together, how big would the new planet be?
If all the materials of all the asteroids were squashed up into one planet it would be smaller than our moon.

Some Famous Asteroids:

Ceres is the second largest known asteroid in the solar system. It is located in the Main Belt. It is about 620 miles wide and contains about 25% of the mass of all the asteroids combined.

Ida is a neat little asteroid about 36 miles wide. It is unique because it has its own little moon called Dactyl.
Meteoroids

You have probably heard of a “shooting” or “falling star”, but have you ever seen one? If you have ever spent any amount of time looking up at the night sky, then you probably have - a flash of light streaking high above through the darkness for just a moment, disappearing just as quickly as it appeared - sometimes so quick that you cannot be sure if you have really seen something or imagined it. You might think that your eyes are playing tricks on you, but shooting stars are definitely real! A “shooting star” is actually a meteoroid entering Earth's atmosphere.

What are Meteoroids?

Sometimes asteroids collide with each other and pieces of them break off. These small pieces of broken-off rock are called meteoroids. They travel around the Solar System, and on occasion they may cross paths with Earth and hit the planet.

How are Meteoroids different from Asteroids?

Meteoroids are irregularly shaped, just like asteroids; however, meteoroids are only small fragments of rock, and they do not orbit the Sun. Meteoroids can range in size from a few centimeters to a few meters.

Meteors and Meteorites

Tiny particles, like grains of sand or pebbles on a beach, like to crash into the atmosphere at amazingly fast speeds; but don’t worry - they are not big enough to harm you! When small meteoroids fly through the Earth’s atmosphere, they usually burn up due to friction and create a streak of light. We call these streaks in the sky meteors, or “shooting stars,” but they clearly are not real stars.

If the rock is sufficiently large, part of it may survive the flight through the atmosphere and fall to the ground. These pieces are then called meteorites. A meteorite is a meteoroid that hits Earth’s surface. Scientists estimate that about 5 to 10 tons of meteoric material hits Earth daily.

So, while they are in space we call them meteoroids, while they are flying through the atmosphere as “shooting stars,” we call them meteors, and if they hit the Earth, we call them meteorites.

Martian Meteorites?

Sixteen meteorites have been found in Antarctica that are believed to have originated on the planet Mars. Gases trapped in these meteorites match the composition of the Martian atmosphere as measured by the Viking spacecraft, which landed on Mars in the mid-1970s.
Big Impacts

Near the Grand Canyon in Arizona is Meteor Crater. It was formed about 50,000 years ago when a meteorite about 30 meters wide and weighing 100,000 tons struck the Arizona desert at an estimated speed of 20 kilometers per second (12 miles per second).

What is a meteor shower?

Comets leave trails of debris in their wake as they travel through the inner part of the Solar System. When Earth passes through these trails of dust and ice on its orbit around the Sun, the particles hit the Earth and burn up in the atmosphere; these events can be observed from the surface of Earth as meteor showers.

Watching a meteor shower can be one of the most enjoyable things about observing the night sky, waiting with tense excitement to see the next shooting star. The best meteor shower is the Perseids - not just because it has the most meteors (although it does have as many as 100 per hour) - but because you can sit out in the garden during the warm summer night to watch them, rather than having to wrap up in your scarf, bobble hat and wooly mittens during the middle of winter, as you would have to for watching the Geminids in December!

During a meteor shower, all of the meteors appear to be falling from the same point in the sky; this is called the radiant point. Meteor showers are named after the constellation that the radiant point is in. For example, the Geminids Shower will be shooting away from the constellation, Gemini (The Twins), whereas the Perseids Shower appears to be falling from Perseus (The Hero).