# Asteroids, Comets and Meteors

*Note: Much of the text and most all of the photos and diagrams in this handout were taken and adapted from various NASA websites.*

An **asteroid** is a small rocky object that orbits the Sun.

A **comet** is a ball of ice and dust that obits the Sun.

A **meteoroid** is a small piece of an asteroid or a comet.

A **meteor** is a streak of light in the sky that appears when a **meteoroid** burns up upon entering Earth's atmosphere.

A **meteorite** is a meteoroid that does not burn completely up but reaches the Earth's surface.

A **fireball** is an exceptionally bright meteor.

A **bolide** is a fireball that explodes.

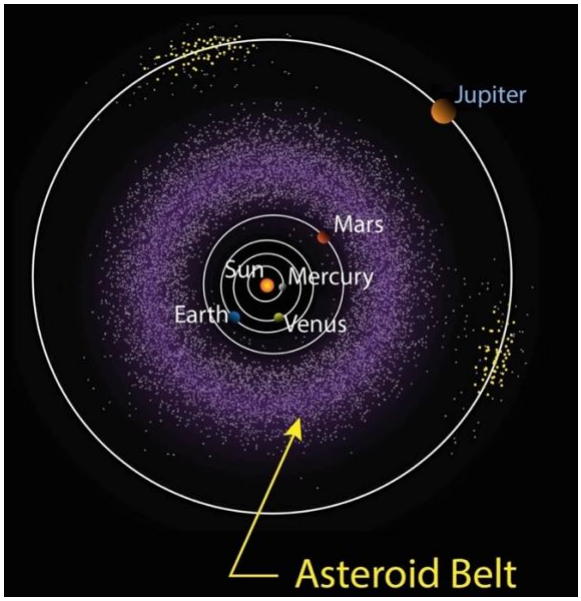
## Asteroids

Asteroids are smaller than planets or dwarf planets. Most asteroids in the Solar System are found in the main **asteroid belt** between Mars and Jupiter. There are over a million asteroids there with diameters of over a half a mile – and millions more smaller ones.

Asteroids can also be found in other locations in the Solar System.

Some orbit the Sun in a path that takes them near Earth. These are called **near-Earth asteroids.** They will be discussed in a later section of this handout.

Other asteroids can be found in the orbits around planets. These are called **Trojans**. In the diagram below, the yellow dots are those orbiting in front and behind Jupiter.




The composite image below shows the comparative sizes of nine asteroids. Vesta, which is also considered a protoplanet because it's a large body that almost became a planet, dwarfs all other small bodies in this image, with its diameter of approximately 330 miles.

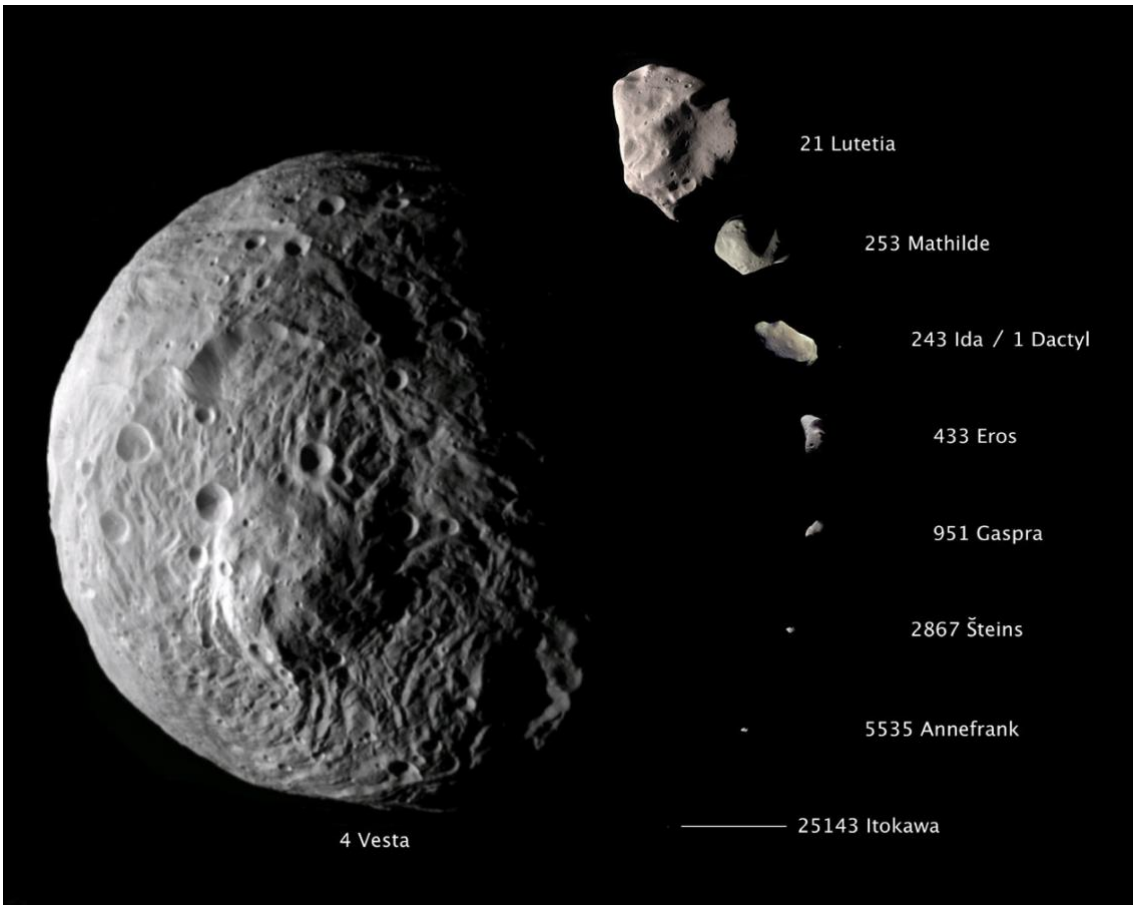
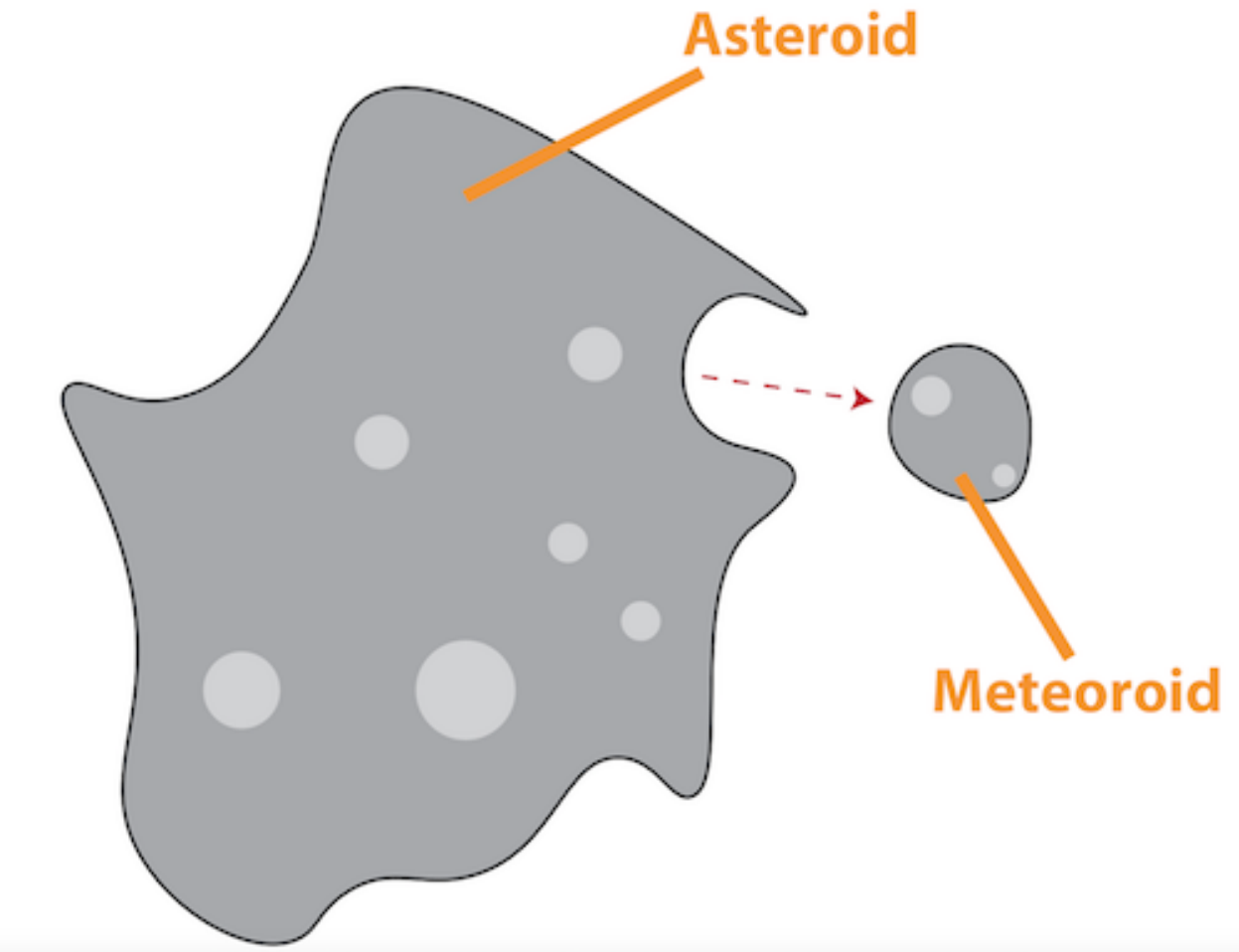



Image of Vesta taken by NASA's Dawn spacecraft

## Meteoroids

Sometimes one asteroid can smash into another. This can cause small pieces of the asteroid to break off. Those pieces are called **meteoroids**. Meteoroids can also come from comets.



## Meteors

If a meteoroid comes close enough to Earth and enters Earth's atmosphere, it vaporizes and turns into a **meteor**: a streak of light in the sky.

Because of their appearance, these streaks of light are sometimes called "shooting stars." But meteors are not actually stars.

*At certain times of the year, you might be lucky enough to see more meteors in the sky than usual. This is called a **meteor shower**. This photo was taken during the Perseid meteor shower, which happens each year in August. Image credit: NASA/JPL*

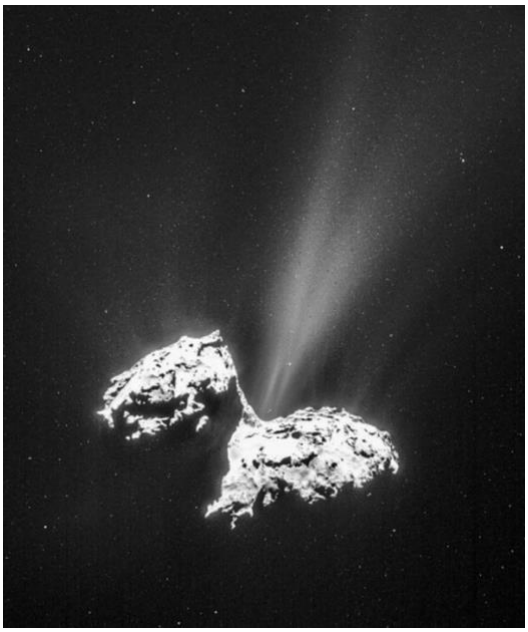
Because meteors leave streaks of light in the sky, they are sometimes confused with comets. However, these two things are very different.

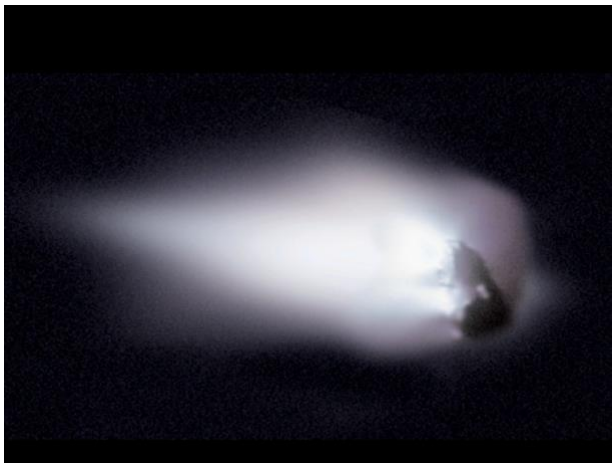
## Comets

Comets orbit the Sun, like asteroids. But comets are made of ice and dust—not rock.

As a comet's orbit takes it toward the Sun, the ice and dust begin to vaporize. That vaporized ice and dust become the comet's tail. You can see a comet even when it is very far from Earth. (However, when you see a meteor, it's in our atmosphere.)

The photos below show real comets vaporizing as they got closer and closer to the Sun.





## Meteorites

Sometimes meteoroids don’t vaporize completely in the atmosphere. In fact, sometimes they survive their trip through Earth’s atmosphere and land on the Earth’s surface. When they land on Earth, they are called **meteorites**.

*A scientist investigates a meteorite that landed in Sudan's Nubian Desert in 2008. Image credit: NASA*

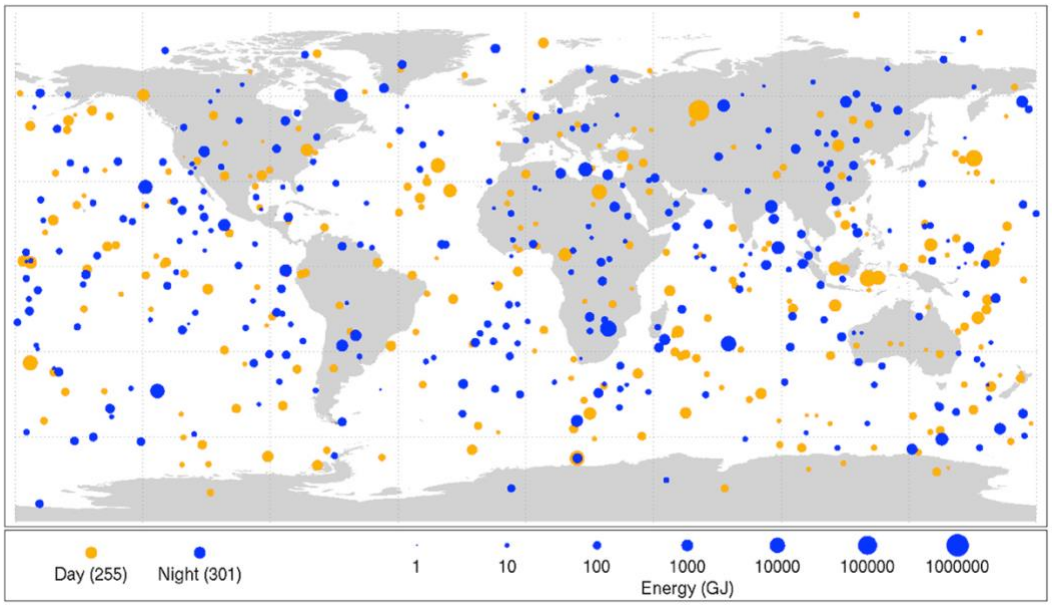
Because asteroids formed in the early days of our solar system nearly 4.6 billion years ago, meteorites can give scientists information about what the solar system was like way back then.

## Bolides and Fireballs

A fireball is an exceptionally bright meteor. A bolide is a fireball that explodes.

The photo above is of a bolide exploding over Chelyabinsk, Russia on February 15, 2013. Its shockwave damaged over 7,000 structures and injured 1,200 people.

The diagram below maps data gathered from 1994-2013 on small asteroids that impacted Earth's atmosphere creating bolides. The yellow dots (daytime impacts) and blue dots (nighttime impacts) show the location of impacts from objects about 3 feet to almost 60 feet in size.



## Near-Earth Objects (NEO's)

NEO's are asteroids (NEA's) or comets (NEC's) that approach our planet within less than 1.3 times the distance of the Earth to the Sun.

A small number of near-Earth asteroids are called Potentially Hazardous Asteroids (PHA's) because they approach the Earth within less than half the Earth-Sun distance.

NASA – the United States' National Aeronautics and Space Administration – endeavors to identify and track these objects as they may pose a threat to the Earth. NASA is also currently working on possible ways to protect the Earth from them.

Below is a diagram of the orbits of nineteen NEA's that were identified by the Pan-STARRS PS1 telescope in Hawaii during one night in January of 2011.