

Facilitator Information

(All you need to know about rocks from space to survive the day)

Meteoroids, Meteors, Meteorites . . . What's the Difference?

Meteoroids are small particles — often no bigger than a grain of sand, but reaching up to between 10 and 50 meters (32 to 165 feet) across — that orbit our Sun. When meteoroids enter Earth's atmosphere, they produce brilliant streaks of light that can be seen in our sky. These brief streaks of light — and the particles that are moving through our atmosphere — are meteors. Meteorites are rocks from space that actually have *landed* on Earth's — or another planet's — surface.

What's the difference between asteroids and comets?

Asteroids are *rocky* bodies, bigger than meteoroids but less than 1000 kilometers across, that orbit our Sun. Asteroids occur in the asteroid belt between Mars and Jupiter. Comets are masses of *ice and dust*, less than 10 kilometers (6 miles) across, that usually stay in the cold outer reaches of our solar system.

Where Do Meteorites Come From?

Most meteorites appear to come from asteroids. This is based on a comparison of the composition of meteorites with our understanding of the composition of asteroids, based on remote sensing. It also is based on a comparison of the orbits of asteroids and the orbits of meteoroids, calculated from photographs of the meteoroids as they approached Earth. A few meteorites are from the Moon and Mars. These are pieces of the planets that were broken off and knocked into orbit when asteroids struck the planets. Meteorites from the Moon are similar to the samples collected by the Apollo astronauts. The Mars meteorites include sealed pockets of gas that scientists discovered contain the same gases as occur in the atmosphere of Mars.

What Happens to a Meteoroid On Its Way to Earth?

Not much when it is in space. When the meteoroid enters Earth's atmosphere, things begin to heat up! Actually, it is the air in front of the meteoroid that heats up. The particle is traveling at speeds between 20 and 30 kilometers (12 to 18 miles) per second. It compresses the air in front, causing the air to get hot. The air is so hot it begins to glow — creating a meteor - the streak of light observed from Earth. The intense heat also melts the outside of the meteoroid. The trip through Earth's atmosphere is fast enough that the inside of a meteoroid often is not heated at all. However, for most rocks from space, even the short trip is sufficient to melt away much of it; a meter-sized meteoroid can be reduced to the size of a baseball. Small meteoroids are vaporized completely. The atmosphere becomes thicker as the meteoroid gets closer to Earth's surface, causing the rock to slow and cool. The outer melted part of the meteoroid solidifies, leaving a fusion crust — a thin dark glassy rind. Some meteoroids break up just before they reach Earth's surface, creating a fireball accompanied by an explosion that can be heard kilometers away.

What Happens When a Meteoroid Hits the Earth?

For small meteoroids, not much! They make small holes in the ground. The impact from a large meteoroid striking the surface may leave a crater — a large, circular depression. Large meteoroids leave craters about 10 times their size, although the size depends on how fast the meteoroid is moving, its angle of approach, and other factors. Meteor Crater

was formed about 50,000 years ago when the 30-meter-wide (100-foot-wide) Canyon Diablo meteorite struck the ground, creating a kilometer-wide depression in Arizona.

Large impacts are rare now, but were much more common during the early history of our solar system when the space debris was being swept up. The surfaces of Mercury, the Moon, and Mars are covered with impact craters, most of which scientists believe formed during the first half billion years of solar system formation. Earth also has several impact craters on its surface, some quite large. One of the most famous — and destructive — impacts believed to have occurred took place about 65 million years ago. A meteoroid, 10–16 kilometers in diameter (6 to 7 miles), struck Earth near what is now the Yucatán Peninsula of Mexico. This impact is thought to have triggered global fires and tsunamis and created a cloud of dust and water vapor that enveloped the Earth in a matter of days, resulting in fluctuating global climate changes. The extreme environmental shifts are believed to have caused a mass extinction of 75% of Earth's species, including the dinosaurs.

For more information about Meteoroids, Meteors, and Meteorites, visit:
<http://www.lpi.usra.edu/education/skytellers/meteors/about.shtml>

Space Rocks! Images for the Day

Images of asteroids (and comets) can be found at:

Planetary Photojournal – Small Bodies

<http://photojournal.jpl.nasa.gov/target/Other>

Near Earth Object Program: Monitoring space for inbound asteroids!

<http://neo.jpl.nasa.gov/images/>

NEAR – Near Earth Asteroid Rendezvous: Images and touch-down on Asteroid Eros

<http://near.jhuapl.edu/>

DAWN: Mission to Ceres and Vesta

<http://dawn.jpl.nasa.gov/>