

## Encyclopedic Entry

# orbit

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An [orbit](#) is a regular, repeating path that one object takes around another object or center of [gravity](#). Orbiting objects, which are called [satellites](#), include [planets](#), moons, [asteroids](#), and manmade devices.

Objects orbit each other because of gravity. Gravity is the force that exists between any two objects with [mass](#). Every object, from the smallest [subatomic particle](#) to the largest [star](#), has mass. The more massive the object, the larger its [gravitational pull](#). Gravitational pull is the amount of force one object [exerts](#) on another object.

The [sun](#) is the most massive object in our solar system. All of the other objects in the [solar system](#) are subject to the gravitational pull of the sun.

Many satellites orbit on [orbital planes](#). An orbital plane is a flat, disk-shaped space that connects the center of the object being orbited with the center of orbiting objects. Because all planets in our solar system share a similar orbital plane, planets don't run into each other.

All the planets in our solar system line up with each other on the same general orbital plane. However, sometimes orbital paths of other objects in the solar system [intersect](#), and the objects can collide. [Comet Tempel-Tuttle](#), for instance, passes through [Earth's orbit](#). The [debris](#) from the [tail](#) of this [comet](#) passes through Earth's [atmosphere](#) as [meteors](#), or falling stars, at a specific time every year. The debris from the comet's orbit is called the [Leonid meteor shower](#).

The time it takes for an object to orbit around another object is called its [orbital period](#). Earth completes its orbital period around the sun every 365 days. The further away a planet is from the sun, the longer its orbital period. The planet Neptune, for example, takes almost 165 years to orbit the sun.

Each orbit has its own [eccentricity](#). Eccentricity is the amount an orbit's path differs from a perfect circle. A perfect circle has an eccentricity of zero. Earth's eccentricity is .017. Mercury has the largest eccentricity of all the planets in the solar system, at .206.

## Types of Orbits

Moons orbit planets, while planets orbit the sun. Our entire solar system orbits around the [black hole](#) at the center of our [galaxy](#), the [Milky Way](#). There are three major types of orbits: galactocentric orbits, heliocentric orbits, and geocentric orbits. Objects with geocentric orbits have their own types.

A [galactocentric orbit](#) is an orbit that goes around the center of a galaxy. Our solar system follows this type of orbit around the Milky Way.

A [heliocentric orbit](#) is one that goes around the sun. All the planets in our solar system, along with all the asteroids in the [Asteroid Belt](#) and all comets, follow this kind of orbit. Each planet's orbit is regular: they follow certain paths and take a certain amount of time to make one complete orbit. The planet Mercury completes its short heliocentric orbit every 88 days. [Comet Kohoutek](#) may take 100,000 years to complete its long heliocentric orbit.

A geocentric orbit is one that goes around the Earth. Our moon follows a geocentric orbit, and so do most manmade satellites. The Moon is Earth's only natural satellite. It takes about 27 days for the moon to complete its orbital period around the Earth. There are three major types of geocentric orbits: low-Earth orbit (LEO), medium-Earth orbit (MEO), and geostationary orbit.

[Low-Earth orbit](#) exists between 160 kilometers (100 miles) and 2,000 kilometers (1,240 miles) above Earth's surface. Most artificial satellites with human crews are in low-Earth orbit. The orbital period for objects in LEO is about 90 minutes.

[Medium-Earth orbit](#) exists between 2,000 kilometers (1,243 miles) and 36,000 kilometers (23,000 miles) above the Earth's surface. Satellites in MEO are at greater risk for damage, because they are exposed to powerful [radiation](#) from the sun. Satellites in MEO include [global positioning system \(GPS\)](#) and [communication satellites](#). MEO satellites can orbit the Earth in about two hours.

Satellites in [geostationary orbit](#) circle the Earth directly above the [Equator](#). These satellites have [geosynchronous orbits](#), or move at the same [rotation](#) of the Earth. Therefore, the orbital period of geosynchronous satellites is 24 hours.

Geostationary satellites are useful because they appear as a fixed point in the sky. [Antennae](#) pointed toward the geostationary satellite will have a clear signal unless objects in the atmosphere (such as storm clouds) between Earth and the satellite interfere. Most [weather satellites](#) are geostationary and provide images of Earth's atmosphere.

## Satellite Orbits

Manmade satellites are sent to orbit the Earth to collect information we can only assemble from above the atmosphere. The first satellite, [Sputnik](#), was launched by the [Soviet Union](#) in 1957. Today, thousands of satellites orbit the Earth. Weather satellites provide images of weather patterns for [meteorologists](#) to study. Communication satellites connect cell phone users and [GPS receivers](#). [Military satellites](#) track movement of weapons and [troops](#) from different countries.

Sometimes, manmade satellites have people on them. The most famous manmade satellite is the [International Space Station \(ISS\)](#). [Astronauts](#) from all over the world stay on the ISS for months at a time as it orbits the Earth. [Astronomers](#) and stargazers can see the ISS and other satellites as they orbit through [telescopes](#) and even powerful binoculars.

Not all artificial satellites orbit the Earth. Some orbit other planets. The [Cassini-Huygens](#) mission, for instance, is studying the planet [Saturn](#). The project has a spacecraft, Cassini, in orbit around Saturn.

Putting satellites into orbit is [complex](#) and costly. Few [governments](#) can afford large space programs. Manmade satellites from the United States are sent into orbit by the National Aeronautics and Space Administration, or [NASA](#). The European Space Agency (ESA) sends up satellites from countries in the [European Union](#). The Russian Federal Space Agency (Roscosmos), the Japanese Space Agency (JSA), and the Iranian Space Agency (ISA) have all successfully put satellites into orbit.

Satellites are put into orbit from [spaceports](#), which are carefully [constructed](#) for that purpose. The Baikonur

Cosmodrome in Kazakhstan and the Kennedy Space Center in the U.S. state of Florida are both well-known spaceports.

## VOCABULARY

Term	Part of Speech	Definition
<b>antenna</b>	<i>noun</i>	structure through which electromagnetic signals are received.
<b>Arthur C. Clarke</b>	<i>noun</i>	(1917-2008) British scientist and author.
<b>asteroid</b>	<i>noun</i>	irregularly shaped planetary body, ranging from 6 meters (20 feet) to 933 kilometers (580 miles) in diameter, orbiting the sun between Mars and Jupiter.
<b>asteroid belt</b>	<i>noun</i>	area of the solar system between the orbits of Mars and Jupiter filled with asteroids.
<b>astronaut</b>	<i>noun</i>	person who takes part in space flights.
<b>astronomer</b>	<i>noun</i>	person who studies space and the universe beyond Earth's atmosphere.
<b>atmosphere</b>	<i>noun</i>	layers of gases surrounding a planet or other celestial body.
<b>black hole</b>	<i>noun</i>	region of space where the gravitational field is so strong even light cannot escape.
<b>Cassini-Huygens</b>	<i>noun</i>	mission to study the planet Saturn and its moons.
<b>comet</b>	<i>noun</i>	celestial object of matter surrounded by ice and dust that orbits the sun and leaves a tail of debris.
<b>Comet Kohoutek</b>	<i>noun</i>	comet that orbits the sun about every 100,000 years; discovered in 1973.
<b>Comet Tempel-Tuttle</b>	<i>noun</i>	comet that orbits the sun every 33 years.
<b>communication satellite</b>	<i>noun</i>	instrument that orbits the Earth to connect devices such as cell phones, GPS units, and television broadcasts.
<b>complex</b>	<i>adjective</i>	complicated.
<b>construct</b>	<i>verb</i>	to build or erect.
<b>debris</b>	<i>noun</i>	remains of something broken or destroyed; waste, or garbage.
<b>Earth</b>	<i>noun</i>	our planet, the third from the Sun. The Earth is the only place in the known universe that supports life.
<b>eccentricity</b>	<i>noun</i>	amount an orbit's path differs from a perfect circle.
<b>Equator</b>	<i>noun</i>	imaginary line around the Earth, another planet, or star running east-west, 0 degrees latitude.
<b>European Union</b>	<i>noun</i>	association of European nations promoting free trade, ease of transportation, and cultural and political links.
<b>exert</b>	<i>verb</i>	to force or pressure.
<b>galactocentric orbit</b>	<i>noun</i>	regular path around the center of a galaxy.
<b>galaxy</b>	<i>noun</i>	collection of stars, planets, gases, and other celestial bodies bound together by gravity.
<b>geostationary orbit</b>	<i>noun</i>	orbit around the Earth directly above the Equator.

<b>geosynchronous orbit</b>	<i>noun</i>	orbit that moves at the same speed as the Earth's rotation.
<b>Global Positioning System (GPS)</b>	<i>noun</i>	system of satellites and receiving devices used to determine the location of something on Earth.
<b>government</b>	<i>noun</i>	system or order of a nation, state, or other political unit.
<b>GPS receiver</b>	<i>noun</i>	device that gets radio signals from satellites in orbit above Earth in order to calculate a precise location.
<b>gravitational pull</b>	<i>noun</i>	the physical attraction between two objects.
<b>gravity</b>	<i>noun</i>	physical force by which objects attract, or pull toward, each other.
<b>heliocentric orbit</b>	<i>noun</i>	regular path around the sun.
<b>heliosheath</b>	<i>noun</i>	outer edge of the solar system where the sun loses its gravitational pull.
<b>intercontinental ballistic missile (ICBM)</b>	<i>noun</i>	projectile launched into sub-orbit above the Earth and carrying nuclear weapons.
<b>International Space Station (ISS)</b>	<i>noun</i>	satellite in low-Earth orbit that houses several astronauts for months at a time.
<b>intersect</b>	<i>verb</i>	to cross paths with.
<b>Leonid meteor shower</b>	<i>noun</i>	annual event, usually in November, when debris from the tail of Comet Tempel-Tuttle fall as meteors. Also called the Leonids.
<b>low-Earth orbit</b>	<i>noun</i>	between 160 kilometers (100 miles) and 2,000 kilometers (1,240 miles) above Earth's surface.
<b>mass</b>	<i>noun</i>	unit of measurement (abbreviated m) determined by an object's resistance to change in the speed or direction of motion.
<b>medium-Earth orbit</b>	<i>noun</i>	between 2,000 kilometers (1,243 miles) and 36,000 kilometers (22,370 miles) above the Earth's surface.
<b>meteor</b>	<i>noun</i>	rocky debris from space that enters Earth's atmosphere. Also called a shooting star or falling star.
<b>meteorologist</b>	<i>noun</i>	person who studies patterns and changes in Earth's atmosphere.
<b>military satellite</b>	<i>noun</i>	instrument that orbits the Earth to track the movement of troops, weapons, and information.
<b>Milky Way</b>	<i>noun</i>	galaxy in which the Earth and sun are located.
<b>moon</b>	<i>noun</i>	natural satellite of a planet.
<b>Moon</b>	<i>noun</i>	Earth's only natural satellite.
<b>NASA</b>	<i>noun</i>	(acronym for National Aeronautics and Space Administration) U.S. agency responsible for space research and systems.
<b>Neptune</b>	<i>noun</i>	eighth planet from the sun in our solar system.
<b>nuclear weapon</b>	<i>noun</i>	explosive device that draws power from the splitting and combining of atomic nuclei.
<b>orbit</b>	<i>noun</i>	path of one object around a more massive object.
<b>orbital period</b>	<i>noun</i>	time it takes for an object to complete an orbit.

<b>orbital plane</b>	<i>noun</i>	flat space in which a body orbits.
<b>planet</b>	<i>noun</i>	large, spherical celestial body that regularly rotates around a star.
<b>Pluto</b>	<i>noun</i>	dwarf planet in our solar system.
<b>radiation</b>	<i>noun</i>	energy, emitted as waves or particles, radiating outward from a source.
<b>rocket</b>	<i>noun</i>	device that moves through the atmosphere by release of expanding gas.
<b>rotation</b>	<i>noun</i>	object's complete turn around its own axis.
<b>satellite</b>	<i>noun</i>	object that orbits around something else. Satellites can be natural, like moons, or made by people.
<b>Saturn</b>	<i>noun</i>	sixth planet from the sun.
<b>solar system</b>	<i>noun</i>	the sun and the planets, asteroids, comets, and other bodies that orbit around it.
<b>Soviet Union</b>	<i>noun</i>	(1922-1991) large northern Eurasian nation that had a communist government. Also called the Union of Soviet Socialist Republics, or the USSR.
<b>spacecraft</b>	<i>noun</i>	vehicle designed for travel outside Earth's atmosphere.
<b>space junk</b>	<i>noun</i>	material orbiting Earth that is no longer working or useful.
<b>spaceport</b>	<i>noun</i>	facility for launching vehicles or capsules into space.
<b>Sputnik</b>	<i>noun</i>	(1957) first artificial satellite, launched by the Soviet Union, from Earth.
<b>star</b>	<i>noun</i>	large ball of gas and plasma that radiates energy through nuclear fusion, such as the sun.
<b>subatomic particle</b>	<i>noun</i>	unit that is part of an atom, such as protons or electrons, or even smaller particles such as quarks and bosons.
<b>sun</b>	<i>noun</i>	star at the center of our solar system.
<b>tail</b>	<i>noun</i>	stream of gas or dust debris behind a comet.
<b>telescope</b>	<i>noun</i>	scientific instrument that uses mirrors to view distant objects.
<b>troop</b>	<i>noun</i>	a soldier.
<b>universe</b>	<i>noun</i>	all known matter, energy, and space.
<b>Voyager II</b>	<i>noun</i>	(1977) satellite launched to study the outer solar system.
<b>weather satellite</b>	<i>noun</i>	instrument that orbits the Earth to track weather and patterns in the atmosphere.

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- NASA: Space School Musical—Orbital Mechanics

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- National Geographic Science: Orbital Objects

### Websites

- NASA: Mars Reconnaissance Orbiter
- National Geographic Science: Moons—Orbital Partners
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