**Constituents and Structure**

**Universe:**

The word *Universe* comes from the [Old French](https://simple.wikipedia.org/wiki/Old_French) word *Univers*, which comes from the [Latin](https://simple.wikipedia.org/wiki/Latin) word *universum*. The Latin word was used by [Cicero](https://simple.wikipedia.org/wiki/Cicero) and later Latin authors in many of the same senses as the modern [English](https://simple.wikipedia.org/wiki/English_language) word is used.

A different [interpretation](https://simple.wiktionary.org/wiki/interpretation) (way to interpret) of *unvorsum* is "everything rotated as one" or "everything rotated by one". This refers to an early Greek model of the Universe. In that model, all matter was in rotating spheres centered on the Earth; according to Aristotle, the rotation of the outermost sphere was [responsible](https://simple.wiktionary.org/wiki/responsible) for the motion and change of everything within. It was natural for the Greeks to assume that the Earth was stationary and that the heavens rotated about the [Earth](https://simple.wikipedia.org/wiki/Earth), because careful [astronomical](https://simple.wikipedia.org/wiki/Astronomy) and physical measurements (such as the [Foucault pendulum](https://simple.wikipedia.org/wiki/Foucault_pendulum)) are required to prove otherwise.

The most common term for "Universe" among the ancient Greek philosophers from [Pythagoras](https://simple.wikipedia.org/wiki/Pythagoras) onwards was *το παν* (The All), defined as all matter (*το ολον*) and all space (*το κενον*).

**Universe** is the name that we use to describe the collection of all the things that exist in space. It is made of many [millions](https://simple.wikipedia.org/wiki/Millions) of [millions](https://simple.wikipedia.org/wiki/Millions) of stars and [planets](https://simple.wikipedia.org/wiki/Planets) and enormous clouds of gas separated by a gigantic empty space.

[Astronomers](https://simple.wikipedia.org/wiki/Astronomers) can use [telescopes](https://simple.wikipedia.org/wiki/Telescopes) to look at very distant galaxies. This is how they see what the universe looked like a long time ago. This is because the light from distant parts of the universe takes a very long time to reach us. From these observations, it seems the [physical laws](https://simple.wikipedia.org/wiki/Physical_law) and [constants](https://simple.wikipedia.org/wiki/Constant) of the universe have not changed.

Physicists are currently unsure if anything existed before the [Big Bang](https://simple.wikipedia.org/wiki/Big_Bang). They are also unsure whether the size of the universe is [infinite](https://simple.wikipedia.org/wiki/Infinite).

**History**

Many people in history had ideas to explain the universe. Most early [models](https://simple.wiktionary.org/wiki/model) had the Earth at the center of the Universe. Some [ancient Greeks](https://simple.wikipedia.org/wiki/Ancient_Greece) thought that the Universe has infinite space and has existed forever. They thought it had a set of [spheres](https://simple.wikipedia.org/wiki/Sphere) which corresponded to the fixed stars, the [Sun](https://simple.wikipedia.org/wiki/Sun) and various [planets](https://simple.wikipedia.org/wiki/Planet). The spheres circled about a spherical but unmoving [Earth](https://simple.wikipedia.org/wiki/Earth).

Over the centuries, better observations and better ideas of gravity led to Copernicus's [Sun](https://simple.wikipedia.org/wiki/Sun)-centered model. **Nicolaus Copernicus** (19 February 1473 – 24 May 1543) was a [Prussian](https://simple.wikipedia.org/wiki/Prussia) [astronomer](https://simple.wikipedia.org/wiki/Astronomer).[[3]](https://simple.wikipedia.org/wiki/Nicolaus_Copernicus#cite_note-Davies20-4) People know Copernicus for his [ideas about the sun and the earth](https://simple.wikipedia.org/wiki/Heliocentrism). His main idea was that our world is *heliocentric* (*helios* = sun). His theory was that the sun is in the middle of the [solar system](https://simple.wikipedia.org/wiki/Solar_system), and the [planets](https://simple.wikipedia.org/wiki/Planet) go around it. This was published in his book, *De revolutionibus orbium coelestium* (On the Revolutions of the Heavenly Spheres) in the year that he died. This was hugely controversial at the time, and was fought long and hard by authorities of the [Christian church](https://simple.wikipedia.org/wiki/Roman_Catholic_Church) (see [Giordano Bruno](https://simple.wikipedia.org/wiki/Giordano_Bruno) and [Galileo](https://simple.wikipedia.org/wiki/Galileo)).

The invention of the [telescope](https://simple.wikipedia.org/wiki/Telescope) in the [Netherlands](https://simple.wikipedia.org/wiki/Netherlands), 1608, was a milestone in astronomy. By the mid-19th century, they were good enough for other galaxies to be distinguished. The modern optical (uses visible light) telescope is still more advanced. Meanwhile, the [Newtonian](https://simple.wikipedia.org/wiki/Isaac_Newton) dynamics (equations) showed how the [Solar System](https://simple.wikipedia.org/wiki/Solar_System) worked.

The improvement of telescopes led astronomers to realize that the Solar System is in a [galaxy](https://simple.wikipedia.org/wiki/Galaxy) made of billions of stars, the [Milky Way](https://simple.wikipedia.org/wiki/Milky_Way), and that other galaxies exist outside it, as far as we can see. Careful studies of the distribution of these galaxies and their [spectral lines](https://simple.wikipedia.org/wiki/Spectral_line) have led to much of [modern cosmology](https://simple.wikipedia.org/wiki/Physical_cosmology). Discovery of the systematic [redshift](https://simple.wikipedia.org/wiki/Redshift) of galaxies led to the conclusion that the Universe is expanding.

**Big Bang**:

The most used scientific model of the Universe is known as the [Big bang](https://simple.wikipedia.org/wiki/Big_bang) theory. The Universe [expanded](https://simple.wiktionary.org/wiki/expanded) from in which all the matter and energy of the Universe was concentrated. Several independent experimental measurements support the expansion of space and, more generally, the Big Bang idea. Recent observations support the idea that this expansion is happening because of. Most of the matter in the Universe may be in a form which cannot be detected by present methods. This has been named dark matter.

Just to be clear, dark matter and energy have not been detected directly (that is why they are called 'dark'). Their existence is from observations which would be difficult to explain otherwise. According to space can get bigger faster than the speed of light, but we can view only part of the universe because of the speed of light. We cannot see space beyond the limitations of light (or any [electromagnetic radiation](https://simple.wikipedia.org/wiki/Electromagnetic_radiation)) the diameter of the Universe is at least 93 billion.

It is estimated that the [age of the Universe](https://simple.wikipedia.org/wiki/Age_of_the_Universe) is 13.73 (± 0.12) billion years,[[1]](https://simple.wikipedia.org/wiki/Universe%22%20%5Cl%20%22cite_note-1) and that the diameter of the Universe is at least 93 billion [light years](https://simple.wikipedia.org/wiki/Light_year), or 8.80 ×1026 [meters](https://simple.wikipedia.org/wiki/Metre).

**Galaxy:**

Galaxy is a fundamental unit of the Universe. It consists of several hundred thousands of stars together with interstellar gas and dust. The word galaxy is derived from the Greek *galaxias* (γαλαξίας), literally "milky". Thousands of millions of galaxies stretch out to the limits of the observable Universe. They fall into four categories in shape; spiral, spherical, elliptical and irregular. Our galaxy is spiral, contains 100000000000 or One Hundred Billion stars with a diameter of 100000 or One Hundred Thousand light years and it is called the Milky Way. According to Greek legend, the pearly band of the Milky Way stretching across the sky is milk split from the breast of the goddess Juno. The nearest spiral galaxy to the Milky Way is Andromeda Galaxy; it is 2,200,000 light years away from us. This is our galactic neighbor along with Large Magellanic Cloud which is 170,000 light years away. The arms of the spiral galaxy are called the galactic arms. A collection of galaxies is called cluster.

There are many galaxies besides ours, though. There are so many, we can’t even count them all yet! The *Hubble Space Telescope* looked at a small patch of space for 12 days and found 10,000 galaxies, of all sizes, shapes, and colors. Some scientists think there could be as many as *one hundred billion* galaxies in the universe.

Some galaxies are spiral-shaped like ours. They have curved arms that make it look like a pinwheel. Other galaxies are smooth and oval shaped. They’re called elliptical galaxies. And there are also galaxies that aren’t spirals or ovals. They have irregular shapes and look like blobs. The light that we see from each of these galaxies comes from the stars inside it.

Sometimes galaxies get too close and smash into each other. Our Milky Way galaxy will someday bump into Andromeda, our closest galactic neighbor. But don’t worry. It won’t happen for about five billion years. But even if it happened tomorrow, you might not notice. Galaxies are so big and spread out at the ends that even though galaxies bump into each other, the planets and solar systems often don’t get close to colliding.

**The Solar System:**

The **Solar System** is the gravitationally bound system of the Sun and the objects that orbit it, either directly or indirectly. Of the objects that orbit the Sun directly, the largest are the eight planets, with the remainder being smaller objects, the dwarf planets and small Solar System bodies. Of the objects that orbit the Sun indirectly—the moons—two are larger than the smallest planet, Mercury.

The Solar System formed 4.6 billion years ago from the gravitational collapse of a giant interstellar molecular cloud. The vast majority of the system's mass is in the Sun, with the majority of the remaining mass contained in Jupiter. The four smaller inner planets, Mercury, Venus, Earth and Mars, are terrestrial planets, being primarily composed of rock and metal. The four outer planets are giant planets, being substantially more massive than the terrestrials. The two largest, Jupiter and Saturn, are gas giants, being composed mainly of hydrogen and helium; the two outermost planets, Uranus and Neptune, are ice giants, being composed mostly of substances with relatively high melting points compared with hydrogen and helium, called volatiles, such as water, ammonia and methane. All eight planets have almost circular orbits that lie within a nearly flat disc called the ecliptic.

The Solar System also contains smaller objects. The asteroid belt, which lies between the orbits of Mars and Jupiter, mostly contains objects composed, like the terrestrial planets, of rock and metal. Beyond Neptune's orbit lie the Kuiper belt and scattered disc, which are populations of trans-Neptunian objects composed mostly of ices, and beyond them a newly discovered population of sednoids. Within these populations, some objects are large enough to have rounded under their own gravity, though there is considerable debate as to how many there will prove to be. Such objects are categorized as dwarf planets. Identified or accepted dwarf planets include the asteroid Ceres and the trans-Neptunian objects Pluto and Eris. In addition to these two regions, various other small-body populations, including comets, centaurs and interplanetary dust clouds, freely travel between regions. Six of the planets, the six largest possible dwarf planets, and many of the smaller bodies are orbited by natural satellites, usually termed "moons" after the Moon. Each of the outer planets is encircled by planetary rings of dust and other small objects.

The solar wind, a stream of charged particles flowing outwards from the Sun, creates a bubble-like region in the interstellar medium known as the heliosphere. The heliopause is the point at which pressure from the solar wind is equal to the opposing pressure of the interstellar medium; it extends out to the edge of the scattered disc. The Oort cloud, which is thought to be the source for long-period comets, may also exist at a distance roughly a thousand times further than the heliosphere. The Solar System is located in the Orion Arm, 26,000 light-years from the center of the Milky Way galaxy.

**Earth:**

Earth is our home planet. Scientists believe Earth and its moon formed around the same time as the rest of the solar system. They think that was about 4.5 billion years ago. Earth is the fifth-largest planet in the solar system. Its diameter is about 8,000 miles. And Earth is the third-closest planet to the sun. Its average distance from the sun is about 93 million miles. Only Mercury and Venus are closer.

Earth has been called the "Goldilocks planet." In the story of "Goldilocks and the Three Bears," a little girl named Goldilocks liked everything just right. Her porridge couldn't be too hot or too cold. And her bed couldn't be too hard or too soft. On Earth, everything is just right for life to exist. It's warm, but not too warm. And it has water, but not too much water.

Earth is the only planet known to have large amounts of liquid water. Liquid water is essential for life. Earth is the only planet where life is known to exist.

From space, Earth looks like a blue marble with white swirls and areas of brown, yellow, green and white. The blue is water, which covers about 71 percent of Earth's surface. The white swirls are clouds. The areas of brown, yellow and green are land. And the areas of white are ice and snow.

The equator is an imaginary circle that divides Earth into two halves. The northern half is called the Northern Hemisphere. The southern half is called the Southern Hemisphere. The northernmost point on Earth is called the North Pole. The southernmost point on Earth is called the South Pole.

Humans have known that Earth is round for more than 2,000 years! The ancient Greeks measured shadows during summer solstice and also calculated Earth's circumference. They used positions of stars and constellations to estimate distances on Earth. They could even see the planet's round shadow on the moon during a lunar eclipse. (We still can see this during lunar eclipses.)

Today, scientists use geodesy, which is the science of measuring Earth's shape, gravity and rotation. Geodesy provides accurate measurements that show Earth is round. With GPS and other satellites, scientists can measure Earth's size and shape to within a centimeter. Pictures from space also show Earth is round like the moon.

Even though our planet is a sphere, it is not a perfect sphere. Because of the force caused when Earth rotates, the North and South Poles are slightly flat. Earth's rotation, wobbly motion and other forces are making the planet change shape very slowly, but it is still round.

Earth orbits the sun once every 365 days, or one year. The shape of its orbit is not quite a perfect circle. It's more like an oval, which causes Earth's distance from the sun to vary during the year. Earth is nearest the sun, or at "perihelion," in January when it's about 91 million miles away. Earth is farthest from the sun, or at "aphelion," in July when it's about 95 million miles away.

At the equator, Earth spins at just over 1,000 miles per hour. Earth makes a full spin around its axis once every 24 hours, or one day. The axis is an imaginary line through the center of the planet from the North Pole to the South Pole. Rather than straight up and down, Earth's axis is tilted at an angle of 23.5 degrees.

At all times, half of Earth is lighted by the sun and half is in darkness. Areas facing toward the sun experience daytime. Areas facing away from the sun experience nighttime. As the planet spins, most places on Earth cycle through day and night once every 24 hours. The North Pole and South Pole have continuous daylight or darkness depending on the time of year.

Earth has seasons because its axis is tilted. Thus, the sun's rays hit different parts of the planet more directly depending on the time of year.

From June to August, the sun's rays hit the Northern Hemisphere more directly than the Southern Hemisphere. The result is warm (summer) weather in the Northern Hemisphere and cold (winter) weather in the Southern Hemisphere.

From December to February, the sun's rays hit the Northern Hemisphere *less* directly than the Southern Hemisphere. The result is cold (winter) weather in the Northern Hemisphere and warm (summer) weather in the Southern Hemisphere.

From September to November, the sun shines equally on both hemispheres. The result is fall in the Northern Hemisphere and spring in the Southern Hemisphere.

The sun also shines equally on both hemispheres from March to May. The result is spring in the Northern Hemisphere and fall in the Southern Hemisphere.

Earth consists of land, air, water and life. The land contains mountains, valleys and flat areas. The air is made up of different gases, mainly nitrogen and oxygen. The water includes oceans, lakes, rivers, streams, rain, snow and ice. Life consists of people, animals and plants. There are millions of species, or kinds of life, on Earth. Their sizes range from very tiny to very large.

Below Earth's surface are layers of rock and metal. Temperatures increase with depth, all the way to about 12,000 degrees Fahrenheit at Earth's inner core.

Earth's parts once were seen as largely separate from each other. But now they are viewed together as the "Earth system." Each part connects to and affects each of the other parts. For example:

* Clouds in the air drop rain and snow on land.
* Water gives life to plants and animals.
* Volcanoes on land send gas and dust into the air.
* People breathe air and drink water.

Earth system science is the study of interactions between and among Earth's different parts.