



EARTH, WORLD AND UNIVERSE: THREE MUSKETEERS OF COSMOS

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ABSTRACT

The ultimate single-word term that encompasses all of these nested scales—from our home planet to the totality of existence—is the cosmos. While "earth" names our specific rocky globe, "world" often includes human society and life upon it, and "universe" describes all physical matter and space, cosmos uniquely denotes the entire system as an orderly, harmonious, and unified whole. The Earth is an oblate spheroid (and more precisely a lumpy geoid), while the observable universe has a nearly flat geometry on a large scale. **Earth** refers specifically to our physical planet, while the **World** encompasses the planet along with human society, culture, and life. Earth is the **third planet** from the Sun and the only astronomical object known to harbour life. This is made possible by Earth being an ocean world, the only one in the Solar System sustaining liquid surface water. Almost all of Earth's water is contained in its ocean, which covers 70.8% of Earth's crust.

KEYWORDS: cosmos, galaxy, earth, planet, world, solar system.

INTRODUCTION

Earth is our home planet, serving as a specific world within the vast, boundless Universe, and our daily view of the sky is the direct result of this cosmic correlation.

The Scale from Earth to the Universe:

Earth: A rocky terrestrial planet covered in liquid water and wrapped in a protective atmosphere. It is one Unit 3: The Earth in relation to the universe of eight planets orbiting our host star, the Sun.

World: Represents Earth as a dynamic, inhabited environment with interconnected systems, life, and weather driven by solar heating.

Universe: The massive totality of space, time, matter, and energy, containing billions of galaxies, stars, and

planetary systems, of which our Milky Way galaxy is just a single component

- **Physical body:** The third planet from the Sun.
- **Land and water:** Made of rock, dirt, mountains, and oceans.
- **Literal meaning:** Can also mean soil or ground.

The Shape of the Earth

Oblate Spheroid: Earth spins on its axis. This spinning creates a centrifugal force. The force pushes the middle outward. Earth is wider at the equator than it is from pole to pole. A spheroid is a three-dimensional geometric shape that looks like a slightly flattened or stretched sphere.^[1]

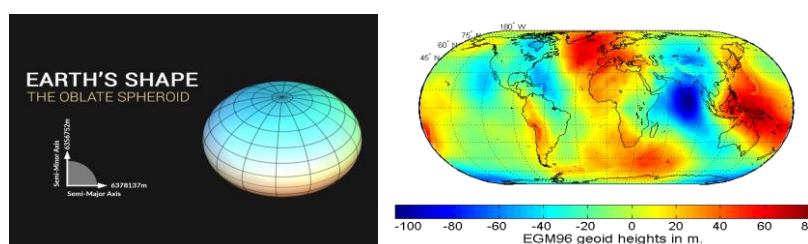


Figure-1: Shape of Earth.

The Geoid: Earth is not a smooth ball. Mountains, trenches, and underground mass change local gravity. Scientists map these gravity pulls. This true gravity-based shape is called a geoid, which looks a bit like a lumpy potato. A geoid is an imaginary, irregular surface that represents the global mean sea level based purely on Earth's gravity and rotation.

The Shape of the Universe

Flat Geometry: Cosmologists study the shape of the universe using cosmic background radiation. Data shows that space is nearly flat on a large scale. In a flat universe, light rays travel in straight lines, parallel lines never meet, and the angles of a giant cosmic triangle add up to 180 degrees.

Open or Closed Questions: While the observable universe appears flat, scientists still do not know if the

entire unobservable universe goes on forever or loops back on itself.

Earth is an oblate spheroid that bulges at the equator and flattens slightly at the poles.

Basic Geometry

Sphere view: From far away in space, Earth looks like a round ball.

Oblate spheroid: Earth spins on an axis. This spinning creates a force that pushes outward at the middle.

Universe is the total sum of all space, time, matter, and energy that exists.

Measurements: The distance across the equator is about 12,756 kilometers (7,926 miles). The distance from pole to pole is smaller, about 12,714 kilometers (7,900 miles).^[2]

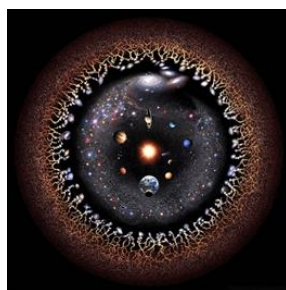


Figure-2: Universe.

The Geoid (True Shape)

Lumpy surface: Earth has mountains, deep ocean trenches, and different rock densities inside.

Gravity pull: These differences change local gravity.

The geoid model: Scientists use a gravity-based model called the geoid to show the true, irregular shape of global sea levels. It looks a bit like a lumpy potato. Current data strongly suggests that the observable universe is spatially flat on a cosmic scale, meaning it has a zero overall curvature where parallel lines stay parallel forever and triangles have angles adding up to 180 degrees. The Three **Main Geometric Possibilities:** Cosmologists look at the Shape of the Universe by measuring its local geometry (curvature), which depends on the total density of matter and energy versus its expansion rate.

Flat (Zero Curvature): Space extends infinitely in a Euclidean geometry. Data from the Planck data and Cosmic Microwave Background measurements heavily support this model.

Closed (Positive Curvature): Space curves back on itself like the surface of a sphere. This would mean the universe is finite, and traveling in a straight line long enough would eventually bring you back to where you started.

Open (Negative Curvature): Space curves like a saddle, expanding infinitely with lines diverging away from each other.

Key Characteristics

Age: Approximately 13.8 billion years old, born from a massive expansion event known as the Big Bang.

Size: The observable portion stretches about 93 billion light-years across, though the total size remains unknown and may be infinite.

Composition: Ordinary matter (like stars, planets, and gas) makes up only about 5% of the cosmos, while 27% is invisible dark matter and 68% is dark energy.

World refers to the planet Earth together with all of its living inhabitants, societies, and natural features.

Definitions and Meanings

The Planet: The physical globe and third planet from the Sun.

Humankind: The total population of human beings on Earth.

The Universe: Everything that exists in the physical space, or the cosmos as a whole.

A Domain or Sphere: A specific field of activity, section of society, or individual experience (e.g., "the plant world" or "living in your own world")

Human experience: The home of human civilization, history, and relationships.

Broader domains: Can describe a specific field or environment, such as the "world of music".

Living systems: Focuses on the community of living things rather than just the rocks and dirt.^[3]

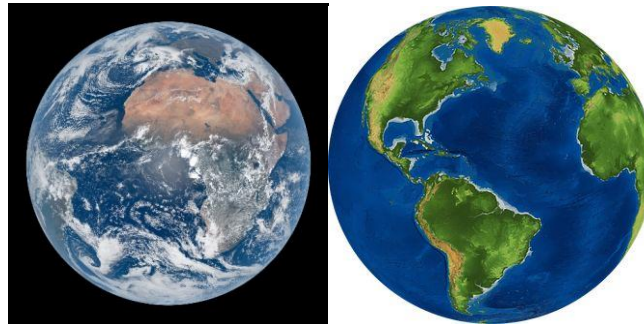


Figure-3: Earth & World.

Earth (The Physical Planet)

- Position: It is the third planet from the Sun in our solar system.
- Type: It is a rocky planet, also called a terrestrial planet.
- Water: About 70% of its surface is covered in water.
- Life: It is the only place we know of that has living things
- Named as the third planet from the sun.
- Means the actual globe, dirt, rocks, oceans, and landmasses.
- Used in scientific, geological, and astronomical contexts (e.g., "orbiting the Earth").
- Can literally mean ground or soil (e.g., "digging into the earth").

World (Society and Experience)

- The world is the totality of entities, the whole of reality, or everything that exists. The nature of the world has been conceptualized differently in different fields. Some conceptions see the world as unique, while others talk of a "plurality of worlds". Some treat the world as one simple object, while others analyze the world as a complex made up of parts.
- Refers to Earth together with its human population, countries, and systems.

- Focuses on human experience, history, and culture (e.g., "traveling the world").
- Used more broadly to describe a specific sphere or domain (e.g., "the world of art").

The main difference is that Earth is a single, small rocky planet, while the universe is the vast, all-encompassing totality of everything that exists.

Earth

Definition: Earth is the third planet from the Sun in our solar system.

Composition: It is made of rock, metal, water, and an atmosphere that supports life.

Scale: It is a tiny, localized body with a radius of about 6,371 kilometres.

Universe

Definition: The universe includes all space, time, matter, and energy.

Composition: It contains billions of galaxies, stars, planets, black holes, dark matter, and dark energy.

Scale: It is unimaginably huge and constantly expanding. If you'd like, I can share more details about:

The scale of our solar system compared to the rest of the galaxy. How Earth formed within the early universe.^[4]

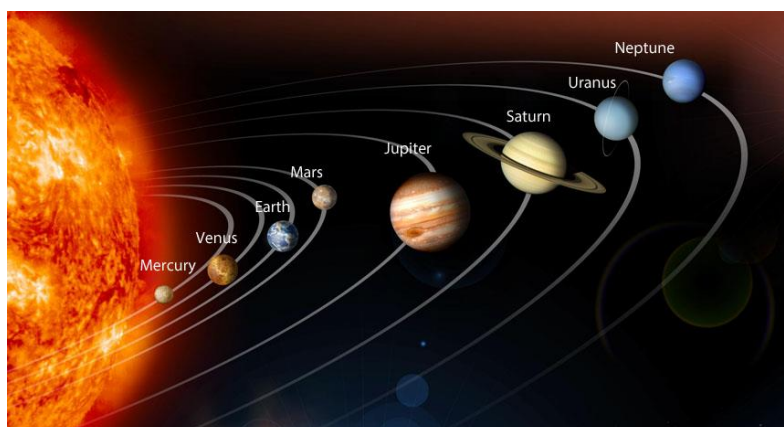


Figure-4: Earth the third planet.

The fundamental difference is that the world typically refers specifically to planet Earth and human life, while the universe is the all-encompassing totality of everything that exists physically across space and time.

The World: Planet

Earth: Most often means our specific home planet, including its land, oceans, and living creatures.

Human Experience: Refers to human society, affairs, and specific domains of activity (e.g., "the corporate world").

Singular Setting: Can describe any individual planet or a distinct fictional or physical realm.

The Universe

Everything Physical: Contains all matter, energy, planets, stars, galaxies, and the void of space.

Whole Earth Composition

Iron (Fe): Makes up about 32.1% of the Earth by mass.

Oxygen (O): Makes up about 30.1% by mass.

Silicon (Si): Makes up about 15.1% by mass.

Magnesium (Mg): Makes up about 13.9% by mass.

Other elements: Sulphur, nickel, calcium, and aluminium make up the remaining mass.

Layers of the Earth

Crust: The solid outer layer rich in oxygen, silicon, and aluminium.

Mantle: The thick, slowly flowing middle layer made of silicate rocks rich in iron and magnesium.

Core: The inner metallic region made mostly of a liquid outer core and a solid inner core of iron and nickel.

Chemistry is the central science that studies the composition, structure, properties, and change of matter.

The Role of Chemistry

Life and Matter: Everything in the universe is made of atoms and molecules.

Global Solutions: Chemistry helps purify water, create cleaner fuels, and design targeted medicines.

States of Matter: Matter exists as solids, liquids, and gases, changing states based on temperature and pressure.

The chemistry of the universe studies how chemical elements form, distribute, and evolve across space and time from the Big Bang to the **present day**.

Elemental Composition

Ordinary Matter: Normal visible matter makes up only about 5% of the total mass-energy of the universe, while dark matter and dark energy make up the rest.

Hydrogen and Helium: Hydrogen accounts for roughly 74% to 75% of ordinary matter, and helium accounts for about 23% to 24%.

Heavy Elements: All other elements (like oxygen, carbon, and iron) make up a tiny fraction of the universe's overall mass, often referred to by astronomers as "metals".

Galaxy of cosmos chemical ingredients: The chemical ingredients of the cosmos and galaxies are dominated by simple primordial gases like hydrogen and helium, which are later enriched by stardust and complex organic molecules. The primary chemical ingredients that build our universe and galaxies.

Hydrogen [${}^1\text{H}^1$]: Makes up roughly 74% of the ordinary matter in the universe, serving as the basic fuel for stars.

Helium [${}^2\text{He}^4$]: Accounts for about 24% of cosmic matter, having mostly formed during the Big Bang.

Oxygen [${}^8\text{O}^{16}$], Carbon [${}^6\text{C}^6$], and Nitrogen [${}^7\text{N}^{14}$]: Essential heavier elements forged inside the core of stars, making up a small percentage of overall cosmic mass.^[5]

Complex Organic Molecules: Interstellar ingredients discovered in galactic clouds—such as methanol, ethanol, and ethyl formate—which prove that life-ready chemistry is abundant across space.

CONCLUSION

Earth, world, and universe form a nested hierarchy of physical reality, moving from our specific terrestrial home outward to the entire cosmos.

Definitions and Distinctions

- **Earth:** The specific physical planet, composed of rock, metal, and water, orbiting the Sun as the third planet in our solar system.
- **World:** Often synonymous with Earth, but frequently used in a human or ecological sense to mean the habitable sphere, society, or the environment experienced by living beings.
- **Universe:** The totality of space, time, matter, and energy, encompassing billions of galaxies, including our Milky Way and planet Earth.

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