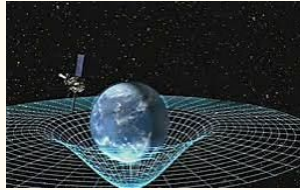


SPACE

TIME

THEORY



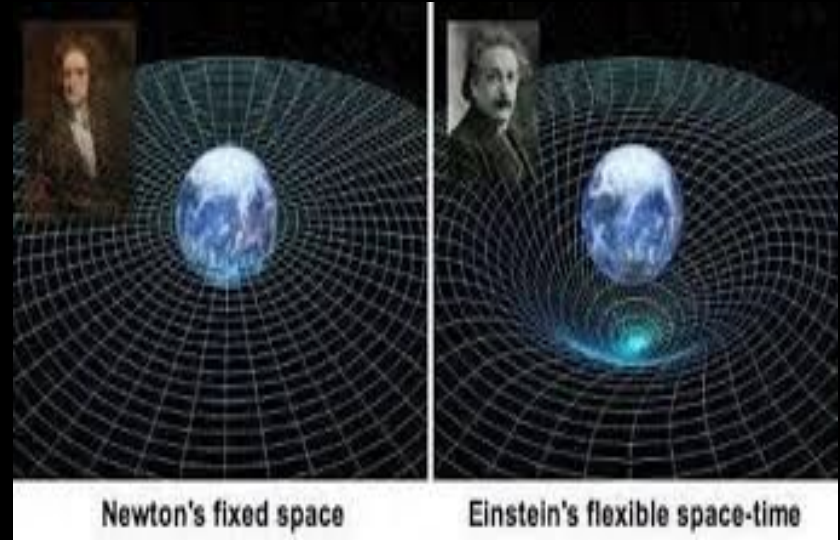
Space-time, in physical science, single concept that recognizes the union of space and time, first proposed by the mathematician Hermann Minkowski in 1908 as a way to reformulate Albert Einstein's special theory of relativity .

Space-Time

In physics, *spacetime*, also called the *space-time continuum*, is a mathematical model that fuses the three dimensions of space and the one dimension of time into a single four-dimensional continuum. Spacetime diagrams are useful in visualizing and understanding relativistic effects, such as how different observers perceive where and when events occur.

Until the turn of the 20th century, the assumption had been that the three-dimensional geometry of the universe (its description in terms of locations, shapes, distances, and directions) was distinct from time (the measurement of when events occur within the universe). However, space and time took on new meanings with the Lorentz transformation and special theory of relativity.

In 1908, Hermann Minkowski presented a geometric interpretation of special relativity that fused time and the three spatial dimensions of space into a single four-dimensional continuum now known as Minkowski space. This interpretation proved vital to the general theory of relativity, wherein spacetime is curved by mass and energy.



FUNDAMENTALS

Non-relativistic classical mechanics treats time as a universal quantity of measurement that is uniform throughout, is separate from space, and is agreed on by all observers. Classical mechanics assumes that time has a constant rate of passage, independent of the observer's state of motion, or anything external.^[7] It assumes that space is Euclidean: it assumes that space follows the geometry of common sense.

In the context of special relativity, time cannot be separated from the three dimensions of space, because the observed rate at which time passes for an object depends on the object's velocity relative to the observer. General relativity provides an explanation of how gravitational fields can slow the passage of time for an object as seen by an observer outside the field.

In ordinary space, a position is specified by three numbers, known as dimensions. In the Cartesian coordinate system, these are often called x , y and z . A point in spacetime is called an event, and requires four numbers to be specified: the three-dimensional location in space, plus the position in time (Fig. 1). An event is represented by a set of coordinates x , y , z and t . Spacetime is thus four-dimensional.

Unlike the analogies used in popular writings to explain events, such as firecrackers or sparks, mathematical events have zero duration and represent a single point in spacetime.^[5] Although it is possible to be in motion relative to the popping of a firecracker or a spark, it is not possible for an observer to be in motion relative to an event.

The path of a particle through spacetime can be considered to be a sequence of events. The series of events can be linked together to form a curve that represents the particle's progress through spacetime. That path is called the particle's world line.^[1]

THE SCIENCE OF SPACE-TIME

Scientists have discovered that space and time are not separate entities, but are intertwined in a fabric called space-time. This fabric can be warped by the presence of mass and energy, and this warping is what we experience as gravity.

Mass warps space-time, and this warping is what we experience as gravity. The more mass there is, the more space-time is warped, and the stronger the gravity. This is why objects fall towards the Earth, and why the Earth orbits the Sun.

Space-time is a four-dimensional fabric, with three dimensions of space and one dimension of time. It is this fabric that we live in, and it is this fabric that we are trying to understand.

General relativity is the theory that describes how space-time is warped by mass and energy. It is a theory that has been tested many times, and it has always been found to be correct.

One of the most interesting predictions of general relativity is that space and time can be warped so much that they can form loops. This is what happens in a black hole, where the gravity is so strong that nothing can escape, not even light.

Another interesting prediction is that space and time can be warped so much that they can form bridges between different parts of the universe. These are called wormholes, and they are one of the most mysterious and fascinating concepts in modern physics.

So, the science of space-time is a science that is still in its infancy, but it is a science that is full of promise and potential. It is a science that is helping us to understand the universe in a way that we never could before.

Crossing space-time

It shows a diagram of space-time, which is a four-dimensional fabric, with three dimensions of space and one dimension of time. It is this fabric that we live in, and it is this fabric that we are trying to understand.

The diagram shows a curved surface, which represents the warping of space-time by mass and energy. The surface is curved downwards, and the more mass there is, the more the surface is curved. This is what we experience as gravity.

The diagram also shows a path that an object can take through space-time. The path is a straight line, but it is curved because of the warping of space-time. This is what we experience as the path of an object in a gravitational field.

So, the diagram shows that space and time are not separate entities, but are intertwined in a fabric called space-time. This fabric can be warped by the presence of mass and energy, and this warping is what we experience as gravity.

General relativity

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