

The impact of relativity

The physicist Albert Einstein changed the notions of space, time and gravity that were considered well-established since Newton's and Galileo's times with his theory of relativity (special and general), in the first decades of the last century. This would dramatically alter our perception of the origin, evolution and structure of the universe.

Unimagined world

In 1905 Albert Einstein published his theory of relativity that space and time are not absolute. He stated that they "exist" in a single continuum of spacetime, which can be distorted by an object's mass. In 1915, Einstein published gravity as his theory (general relativity) and concluded that gravity is a consequence of the space-time bending. According to the physicist, the trajectory of light is modified when approaching heavenly bodies that warp space around them.

Space-time
In the context of relativity, the combination of space and time is a four-dimensional continuum, the fabric of spacetime. The fabric of spacetime is warped by mass, so that the trajectory of light is not linear but curved.

Big Bang
Einstein's ideas allowed him and other scientists to think about the "Big Bang" as the origin of the universe and the evolution of space-time (initially static universe).

Mass warps
When approaching an object like the Sun and the Earth, the curvature of the space-time fabric is so large that light is not traveling in a straight line but is bent during the day.

Expansion
In 1917, Einstein's theory predicted a static universe. However, when a series of observations showed that the light of the stars were receding at a fast angle (what representing the Big Bang).

Curved line
The trajectory of the straight line of an object approaching the Sun.

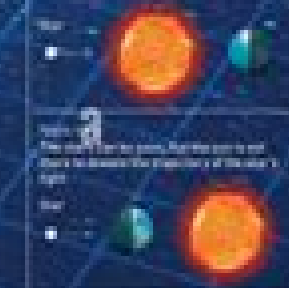


Perception
The trajectory of an object is not linear but curved. The apparent path is curved due to the Sun's gravity.

Light bent
The magnitude of the bending depends on the mass of the object. The Sun's gravity is strong enough to bend light rays. It is important to note that the bending of light is not a property of light itself, but a property of the space-time fabric that light travels through.

Perception
The gravitational field of the Sun warps space-time. The apparent path of light is curved.

A matter of position
Starting one day, star's light reaches the Earth directly because of their location. However, at night, the sun intervenes. The presence of solar gravity makes a deviation in the trajectory of light rays. The comparison could be made and proven right in the 1919 experiment.



Time runs slower
In 1905, Einstein's theory predicted that time runs slower for objects moving at high speeds. This was confirmed by experiments with atomic clocks. Time also runs slower in a strong gravitational field. This is why GPS satellites need to be corrected for time dilation.



General relativity
The theory of general relativity is a mathematical theory of gravitation. It describes gravity as a curvature of spacetime. The theory is based on the equivalence principle, which states that the effects of gravity are indistinguishable from the effects of acceleration.



Time dilation
Time dilation is the difference in the elapsed time measured by two observers whose relative motion is different from zero. It is a consequence of special relativity, which states that the laws of physics are the same for all observers in uniform motion relative to one another.

Relativity In Our Time

B Lingard



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