Why Gravity is Not a Force?

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In high school physics classes, we were taught that gravity is a force. Nobody has ever explained why gravity is a force or what its nature is. In this article, I will try my best to explain how gravity actually works.

Gravity is often thought of as a force between objects with mass. When you stand on a scale, for example, the number you see there shows the pull of the planet Earth's gravity on your mass or weight. It is easy to imagine the gravitational force of the Sun holding the planets in their orbits or the strong gravitational pull near a black hole. Gravity appears to be a simple concept after all, since forces are easy to understand as pushes and pulls.

Things are different in the current age. Thanks to Einstein and his general theory of relativity, we now know that gravity, as a force, is only a small part of a much more complex phenomenon. At first, let's start with Newton's gravity.

Gravity by Isaac Newton

Newton is a well - known scientist, and we are all familiar with the tale of the apple falling on his head (which is not true). Newton saw an apple fall from a tree, and he wondered why the apple fell straight towards the ground and not in another direction. Newton believed an apple falls because a gravitational force accelerates it towards the ground. Newton felt that his theory was incomplete and was not entirely happy with it. He first thought of gravity as a pull rather than a push. His theory of gravity, which held that the magical pull was an essential quality of mass, was accepted as gospel. For the following 400 years, the theory concealed the reality. All of that changed when Albert Einstein came in 1905 and presented his general theory of relativity.

Einstein's General Theory of Relativity and Galilei's Experiment

Everything in a gravitational field falls at the same rate, according to the General Theory of Relativity, yet Galileo Galilei discovered this, not Albert Einstein. We all think that heavier objects are pulled more strongly by gravity than lighter ones. But that is actually not the case. Galilei conducted an experiment with two objects of totally different masses. He threw these two objects off the famous Pisa Tower, and the results were shocking: these two objects fell to the ground at thesame time. What can be inferred from that experiment is that all objects fall at the same rate, regardless of their mass. But why?

Elliptical Motion of Planets around the Sun

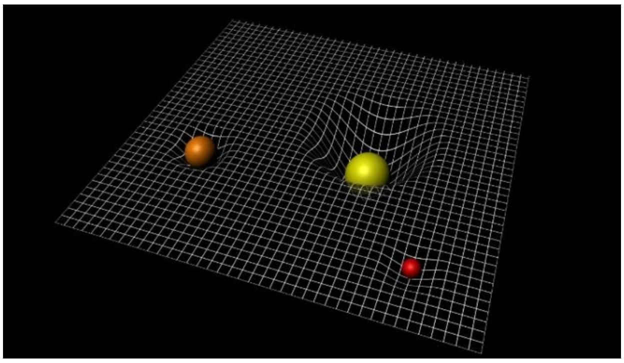

Figure 1

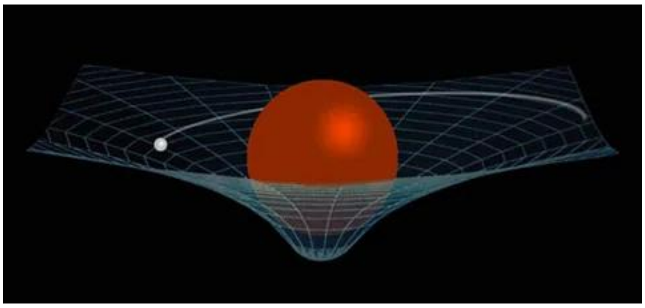

Figure 2

Heavy objects in space, like planets, stars, and black holes, warp the space. The heavier the object, the more it warps the space (Figure 1). The sun, for example, is a massive object that warps space (see Figure 2). The planets of the solar system actually go along a straight line, but because the space itself is curved, they end up orbiting the sun. And that is the property of space; it does not depend on the mass of an object. Everything follows the same trajectory. That is why it looks like everything is going in an elliptical motion around the sun, and the "being pulled" is an illusion. This is the idea of Einstein.

Back to the General Theory of Relativity

According to Einstein's theory of relativity, gravity is a warping of space and time rather than a force acting between two objects with mass. Einstein believed that smaller objects are not pulled on by more massive objects but, instead, the objects are being pushed down by the space above them, and there is no gravitational field.

According to Einstein's theory, matter warps both time and the fabric of space. The term for this is space - time. And every object in space bends the fabric of space and time. Space - time is the three dimensions of space: length, width, and height, combined with the fourth dimension - time.

It might seem like Einstein has this gravity thing all locked down, and there is lots of evidence to support his theory. There is a significant issue, though: it is incompatible with quantum mechanics. Quantum gravity is a theoretical physics that uses quantum mechanics to describe gravity. There is no such theory that is universally accepted and confirmed by experience. Einstein's theory is known to break down at some point within a black hole. Currently, researchers are searching for a space - time curvature that is so severe that the general theory of relativity fails. They believe that the theory of general relativity will be tested to its breaking point within the next 10 years, and another brilliant scientist will come along and show us where Einstein was wrong.

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