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Is Gravity the Only Way to Bend Space-Time?

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Abstract

The purpose of this article is to raise the question, "Is gravity the only way to bend the space-time, or can there be other ways to bend space-time?" The answer to this question can be either, A) a description of the mechanism of non-gravitational curvature of space-time, or B) proof that gravity is the only method to bend space-time and there is no other way. Since modern science can prove neither A nor B, the question raised in this article remains open.

This article also discusses and rejects the objection that non-gravitational curvature of space-time would be observed as a kind of "additional" gravity, what is not taking place. The scale and strength of non-gravitational curvature is important. Also, the non-gravitational curvature of space-time does not necessarily have the U-shaped form, which we observe as a gravity.

The explanation of gravity by the curvature of space-time generated by the presence of mass-energy was put forward by Einstein in his works *Die Feldgleichungen der Gravitation* [1] and *Die Grundlage der allgemeinen Relativitätstheorie* [2], published in 1915 and 1916 respectively. The Theory of General Relativity has been brilliantly confirmed in many fields of physics and is used in astronomy, engineering, astronautics, atomic physics, etc.

Thus, General Relativity and subsequent experiments:

A. created a precedent that space-time can be bent;
B. proposed the presence of mass-energy as the mechanism of this curvature;
C. confirmed this model in many experiments in various fields of science and technology.

Thus, a precedent has been created. It is possible to bend space-time and there is at least one mechanism that can do this. However (as far as the author knows) no one has ever proved that gravity is the *only* way to bend space-time.

Therefore, may there be some other mechanism of space-time curvature?

This question is unusual, but in the absence of evidence that gravity is the only way to bend space-time, it is a legitimate one.

The author's goal, of course, is not to propose another way to bend space time. Perhaps it simply does not exist. This article is merely a statement of the problem, which in all probability has only two solutions:

A. a description of the mechanism of non-gravitational curvature of space-time, or
B. proof that gravity is the only method to bend space-time and there is no other way.

Since modern science can prove neither A nor B, the question raised in this article remains open.

Discussion

The question posed in the article may cause a natural objection. Since the curvature of space-time is perceived by us as gravity, then any non-gravitational curvature of space-time will also be perceived by us as some kind of "additional" gravity. And since we do not observe anything like this in nature, only the gravitational curvature of space-time is possible.

This objection, however, is untenable for three reasons.

First, the scale at which the non-gravitational curvature of space-time occurs is important. If it takes place on a scale of, say, several meters, then we probably will not notice any effect on the Earth's motion. If it occurs in space on a planetary scale, then when observing the stars, we also will not notice it, etc.

Secondly, intensity is also important. Gravitational curvature of space-time depends on the mass of the object. The larger the mass, the stronger (and more noticeable) the curvature of space (the stronger is the gravity of the object). For a small mass, the gravitational curvature of space is negligible. The same thing with non-gravitational curvature of space-time. It can be so weak that it is not detected as a deviation of gravity.

Thirdly, most important. We perceive gravity as the U-shaped curvature of space-time. (Figuratively speaking, for a black hole it is more like a Y-shaped curvature of space-time.) However, we do not know how the curvature of space-time of a *different* form is perceived. Therefore, speaking of the non-gravitational curvature of space-time, we cannot postulate that it will also be U-shaped, and that it will be perceived by us as some kind of additional gravity.

Once again, the purpose of the article is not to prove that a non-gravitational curvature of space-time is possible, but only to pose the question about it.

References

1. Albert Einstein. Die Feldgleichungen der Gravitation // Sitzungsberichte der Preussischen Akademie der Wissenschaften zu Berlin. — 1915. — 25 November. — P. 844—847.

2. Albert Einstein. Die Grundlage der allgemeinen Relativitätstheorie // Annalen der Physik. — 1916. — V. 354, # 7. — P. 769—822.