Principle of constancy and finiteness of the speed of gravitational interaction and dark matter.

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Abstract: It can be shown that the anomalously high rates of rotation of the outer regions of galaxies follow from the constancy and finiteness of the rate of gravitational interaction, which is equal to the speed of light in accordance with general relativity of A. Einstein. Since the speed of propagation of the gravitational interaction is constant and equal to the speed of light, then for compensation of lag of the gravitational field, an increase in the mass velocity will always be used, since the metric tensor according to general relativity of A. Einstein is depends on to both geometry and kinematics of masses.

Keywords: principle of constancy and finiteness of the speed of gravitational interaction, dark matter, field lag effect, general relativity of A. Einstein, metric tensor, speed of light.

INTRODUCTION.

The classical definition dark matter sounds like this: dark matter is a hypothetical form of matter that does not emit electromagnetic radiation and does not directly interact with ordinary matter (which makes its direct observation impossible and practically translates into the rank of "virtual matter"). In science, when such "virtual constructions" occur, they usually turn out to be incorrect and later replaced by other concepts. For example, let us recall the theory of phlogiston with the help of which the theory of combustion was tried to explain in chemistry [1]. Phlogiston, also a "virtual substance," which as we now know for sure does not exist in reality, but which has dominated science for almost 100 years. And only the oxygen theory of combustion created by the brilliant Antoine Lavoisier [2] replaced the phlogiston theory and actually gave rise to modern chemistry.

Dark matter is actually a "hidden mass", which is needed to explain the abnormally high speeds of rotation of outer regions of galaxies. But this effect can be explained using only the principle of constancy and finiteness of the speed of gravitational interaction (which is equal to the speed of light).

RESULTS AND DISCUSSION.

In the Newtonian gravity theory, the speed of gravity is considered infinitely large (this is actually taken as an axiom). But if we assume that the speed of gravity is not infinitely large, then in the theory of Newton's gravitation problems begin, and for galaxies these problems actually become critical. If the gravitational action is transmitted with finite velocity and does not depend on the velocities of the bodies, then all points of the body 1 should be attracted to the point where the body 2 was somewhat earlier, and not to its simultaneous location (this means that in the system of moving bodies there will be no momentum - part of the momentum will be transferred to the gravitational field, this is analogous to how it happens in the electromagnetic interaction of charges in electrodynamics).

Laplace showed [3] that our solar system will be stable provided that the propagation velocity of the gravitational Newtonian interaction can not be less than 50 million light velocities. In other cases, the solar system will be unstable. It should be noted that it was Laplace who showed that the solar system is a stable system, before this much was doubted.

If we accept the condition that the speed of light is equal to the speed of gravity, then the dimensions of the solar system will grow at enormous speeds, for example, the distance from the Earth to the Sun would double every 1200 years. Proceeding from this, Laplace showed that the propagation velocity of the gravitational Newtonian interaction can not be less than 50 million light velocities. From this it follows logically that if the speed of gravity is equal to the speed of light (no one doubts this, since the speed of light is the limiting speed of energy transfer in our Universe), then there can not be stable galaxies by definition. But they exist !!! Where is the error?

This moment is especially well explained in the book "Einstein's field equations and their application in astronomy" on page 90 (Bogorodsky A.F., Kiev, Kiev University Press, 1962) [4]:

"... Attempts to abandon the principle of long-range action were repeatedly made in the classical theory long before the rise of the theory of relativity. However, they had no success. For the first time, apparently, even Laplace [60] showed that the addition of Newton's theory by the principle of a finite speed of the transfer of gravity leads to considerable difficulties.

So, for example, in the two-body problem, this principle requires the introduction of an additional component of the force directed along the tangent to the orbit and equal to

$$(\gamma * m1 * m2)/r^2 - v/c$$

where v - is the relative velocity, c - is the propagation velocity of gravity. Accounting for this force complicates the two-body problem, causing, in particular, a century-long increase in the average distance.

One can raise the question of the lower boundary of the velocity c, at which the influence of the additional component of the force will not clearly contradict the data of astronomical observations. Laplace found that to reconcile the theory with the observed motion of the moon.

It is necessary to postulate an extremely high speed of gravity propagation, assuming that it exceeds the speed of light by at least a hundred million times. Later researchers, such as Oppelzer [61], Lehmann [62], etc., who studied the effect of the additional component of force on the motion of the moon, planets, and comets, came to somewhat different estimates of the lower boundary of c. However, in all cases, this boundary turned out to be an enormous number of times the speed of light.

This conclusion, which we will call the Laplace paradox, is the result of a one-sided generalization of Newton's law of gravitation. From the point of view of the theory of relativity, the addition of the law of gravitation of Newton by the mere principle of a finite velocity of gravitation is unacceptable, since the field of the metric tensor is due not only to geometry, but also to the kinematics of masses. The solution (II, 4.2) already shows that the effects caused by the kinematics of masses and the finite velocity of gravity have the same orders, so that the refinement of Newton's theory by taking into account only one of these effects is erroneous."

Further, the author of the book (Bogorodsky A.F.) on pages 91-92 specifies: "In this approximation, the delayed potential effect is compensated by the dependence of the gravitational field on the mass motion, which eliminates the Laplace order."

On pages 90-92 of this book Bogorodsky A.F. considers the issue in more detail, here is its consideration:

"Let's consider the issue in more detail. Let the particle move in the field of the system of point masses ms, the coordinates as, bs, cs of which are given functions of time. This motion is determined by the equation of the geodesic line, which in this case must be approximated to within 3/2 terms of order y inclusive. According to the solution (II, 8.10) in this approximation we have

$$h_{44} = -2\sum \frac{m_s}{r_s(\vartheta)} + 2\sum \frac{m_s}{r_s}\frac{\partial r_s}{\partial t}, \qquad \text{(II, 9,1)}$$

where

$$r_s^2 = (x - a_s)^2 + (y - b_s)^2 + (z - c_s)^2,$$
$$r_s^2(\vartheta) = [x - a_s(\vartheta)]^2 + [y - b_s(\vartheta)]^2 + [z - c_s(\vartheta)]^2, \ \vartheta = t - r_s(\vartheta).$$

The first term on the right-hand side of formula (II, 9.1) is a retarded potential, which differs from the Newtonian potential by the correction for the finite rate of gravity transfer. The second term determines the dependence of the component g44 on the motion of gravitational masses.

Making use of the obvious rations

$$a_s(\vartheta) = a_s(t) - r_s\dot{a}_s(t)$$

and so on, with the accepted degree of accuracy we obtain

$$\frac{m_s}{r_s(\vartheta)} = \frac{m_s}{r_s} + \frac{m_s}{r_s}\left(\frac{\partial r_s}{\partial a_s}\dot{a}_s + \frac{\partial r_s}{\partial b_s}\dot{b}_s + \frac{\partial r_s}{\partial c_s}\dot{c}_s\right)$$

and

$$\frac{m_s}{r_s}\frac{\partial r_s}{\partial t} = \frac{m_s}{r_s}\left(\frac{\partial r_s}{\partial a_s}\dot{a}_s + \frac{\partial r_s}{\partial b_s}\dot{b}_s + \frac{\partial r_s}{\partial c_s}\dot{c}_s\right).$$

Thus, up to terms of order 3/2 inclusive we have

$$-\frac{1}{2}h_{44} = \sum \frac{m_s}{r_s}.$$

On the other hand, the equations of the geodesic line, written in the form (I, 3, 16), are given in the same approximation to the form

$$\frac{d^2x^i}{dt^2} = \frac{\partial}{\partial x^i}\left(-\frac{1}{2}h_{44}\right).$$

Consequently, the motion of a particle in the field of the point masses under consideration occurs according to Newton's law

$$\frac{d^2x^i}{dt^2} = \frac{\partial}{\partial x^i}\sum \frac{m_s}{r_s}.$$

In this approximation, the retarded potential effect is compensated by the dependence of the gravitational field on the mass motion, which eliminates the Laplace order. The deviation of the motion of a particle from Newton's law is revealed in the theory of relativity only if the investigation is carried out to within terms not lower than the second order."

The above quotations logically explain the anomalously high speed of rotation of the outer regions of galaxies (it is in fact the same): since the velocity of propagation of the gravitational interaction is equal to the speed of light, an increase in the velocity of the masses will always be used to compensate for the retarded potential (the field lag). The increase in the velocity of the masses will always be used (the greater the velocity of the masses, the stronger the gravitation), since this is the only way to maintain the constancy of the rate of gravitational interaction, and otherwise can not be (according to GRT).

In other words, if we have a system of masses (for example, a galaxy), then this system in a certain way curvature the space-time continuum, which expresses the metric tensor corresponding to this curvature in accordance with general relativity. But, the gravitational interaction is constant and equal to the speed of light. Therefore, in order for the corresponding, curved space-time continuum to satisfy this condition (the constancy of the velocity of gravity equal to the speed of light between different masses in this continuum), the gravitational field of the mass system must have a certain intensity (energy) that is regulated by the speed of the masses themselves. That is, if the mass system is large (for example, a galaxy), then in order to compensate for the retarded potential effect (in other words, the field lag), the masses will need to increase the speed, which is observed with the rotation speeds of the outer regions of galaxies. Naturally, the larger the distance at which the interaction takes place (if other components are equal), then the field delay will be stronger and the masses will be more accelerated, and therefore an anomalous increase in the rotation rates of the outer regions of the galaxies is noticed. If there were no increase in the velocities of mass motion, then the speed of gravitational interaction (between masses in the given system) would be greater than the speed of light, a according to the general theory of Einstein this is impossible, hence exist the effect of mass acceleration. This effect of accelerating the masses to maintain a constant rate of gravity will be manifested with a significant curvature of space-time, and at considerable distances (that is, at astronomical objects).

CONCLUSION.

Thus, it is shown that the anomalously high rotation rates of the outer regions of galaxies result from the constancy and finiteness of the velocity of gravitational interaction, which is equal to the speed of light in accordance with Einstein's general theory of relativity. An increase in the mass velocity is used to compensate for the retardation of the gravitational field, since the metric tensor depends both on the geometry and on the kinematics of the masses. Moreover, if we mentally increase grandiose objects like galaxies and move to the next level, that is, we will consider the universe, then it is easy to understand that in such a transition the mass velocities will be so large that in this case the masses will break from their circular (elliptic) orbits, and begin to move away from each other with constantly increasing velocities (this follows from the condition of maintaining a constant speed of gravitational interaction, because the distances will constantly increase). And now, if we accept that our masses are galaxies, then we will get an expanding model of the universe, with a constant increase in the velocities of galaxies. And we note that this does not require a Big Bang and a dark energy, all this is a consequence of the constancy and finiteness of the speed of gravitational interaction in accordance with the theory of general relativity A. Einstein.

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