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Relativistic Gravidynamics Conquers General Relativity

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Abstract: Two existing relativistic theories of gravity are compared from the viewpoint of the fulfillment of 4 of Einstein's postulates. An additional 5th postulate of the agreement of theory with experiment is considered with the same aim.

The principle of equivalence (proportionality) of mass and energy as expressed by the known formula

$$E=mc^2 \qquad (1)$$

is the foundation of the general theory of relativity (GR).

In fact, on its basis, a "heavy" mass E/c^2 is ascribed to each energy E.[1] Thus, energy becomes a gravitational charge in GR. As early as 1919, the French astronomer Deslanders summarized the subject of Einstein's theory by his remark that energy attracts energy.[2]

Note also that the known Einstein remark[3]: "…it was clear from the general opinions of the special theory of relativity that the inert mass of a physical system must increase with the growing of the total energy." It is in fact the consequency of eq.(1). Otherwise, here mass is not a Lorentzian invariant (4-scalar).

The relativistic gravidynamics (RGD) or the Lorentz-covariant theory of gravity[4] alternative to GR leans upon Minkowski's equation[5]

$$E=p^0c=mu^0c^2=m\gamma c^2 \qquad (2)$$

presenting in fact the covariant notation of eq.(1). Here p^0 is the time component of energy-momentum 4-vector; $u^0=dt/d\tau$, the time component of 4-velocity (kinetic potential) or Lorentz-factor $\gamma=(1-v^2/c^2)^{-1/2}$; τ, the proper time. From eq.(2) it is directly seen that the energy increase in motion is just conditioned by growing u^0 whereas mass remains an invariant quantity, i.e. a 4-scalar. It is a gravitational charge in RGD (as well as in Newton's theory).

Let us consider now both discussed theories from the viewpoint of four main postulates, which in Einstein's opinion[6] any reasonable theory of gravity must agree with. Let me briefly enumerate them.

1. Fulfillment of the conservation laws of momentum and energy.

According to RGD, we have the balance of energies (neglect a small recoil)

$$M^*c^2 + M^*\Phi = Mc^2 + M\Phi + h\nu_g \qquad (3)$$

on photon emission by an exited atom of mass M* in a gravitational field (GF) with potential Φ. Whence for the frequency of the photon emitted in GF, we obtain[7]

$$\nu_g=\nu(1+\Phi/c^2), \qquad (4)$$

where ν is the photon frequency in the absence of GF ($\Phi=0$). This equation presents evidently a gravitational red shift.

From the GR viewpoint, the right side of eq.(3) is not equal to the left one (i.e. the energy is not conserved) since the potential energy of the photon is not taken into account. After its addition, we have

$$M^*c^2(1+\Phi/c^2) = Mc^2(1+\Phi/c^2) +h\nu_G+h\nu_G\Phi/c^2 \qquad (5)$$

As a result, after contraction by the quantity $(1+\Phi/c^2)$, we obtain the expression

$$M^*c^2 = Mc^2 + h\nu_G \quad (6)$$

answering the energy balance on photon emission in the absence of GF. Whence it follows that the photon frequency does not change on its radiation in GF according to the GR:

$$\nu_G = \nu \quad (7)$$

This contradicts directly the experimental results on "gravitational time slowing down".[8] Recall that the change of an atomic clock rate in this experiment is conditioned by the indicated frequency change eq.(4) of the corresponding quantum transition.

That is what the factual violation of the energy conservation law (conditioned by ascribing gravitational potential energy to the photon) leads to.

2. Equality of inert and heavy masses.

For the photon having light velocity, the Lorentz-factor $\gamma=\infty$. In order to insure the finiteness of its energy E, it is necessary to assume in eq.(2) that the inert photon has a mass equal to zero. Therefore, the ascription of heavy mass to a photon in GR, based on eq.(1), means a direct violation of postulate 2.

In RGD, *the photon is gravitationally neutral*, i.e. the equality of inert and heavy masses is automatically fulfilled.

3. Justice of the special theory of relativity.

One can say that there is no complete agreement here between physicists and it is not conditioned by this Einstein postulate. At the same time, an attentive analysis of his following (albeit little-known) statements shows us directly the change of his position on this question.

So, Einstein's remarks in his Gibson lecture on the GR origin[9]: "Then I declined an attempt to consider… the problem of gravitation in the frames of special theory of relativity." Later, he writes in "Autobiographical Notes"[3] about his conviction "that there is no place for a satisfactory theory of gravity in the special theory of relativity."

However, much earlier Einstein already arrives at the conclusion "that the light velocity constancy in vacuum presenting one of the two main premises of the special theory of relativity cannot claim a limitless applicability according to the general theory of relativity";[10] "… this result excludes a universal applicability of Lorentz transformations".[11]

4. Nature's laws must not depend on absolute values of the gravitational potential.

The author has already analyzed this problem previously.[12] He showed that GR does not satisfy postulate 4 whereas RGD agrees with it. Therefore, we confine ourselves to the aforementioned.

Instead of this, we consider an additional 5th postulate whose fulfillment is undoubtedly implied by the construction of any scientific theory.

5. **Agreement with experiment**.

Point 1 has already pointed to the violation of this demand at a "relativistic level" when describing the light radiation in GR. But recently it has been found[13] that postulate 5 is not fulfilled in a Newton approximation of GR either. The expression for energy calculated on the basis of eq.(2) takes the form (cf. with the left side of eq.(3))

$$E=mc^2-m\Phi. \quad (8)$$

This means *gravitational repulsion*! Here, we take into account that the interval

$$ds=cd\tau=g_{00}^{1/2}\,cdt=(1+\Phi/c^2)cdt \quad (9)$$

in particular for a resting body and Schwarzschild's solution.

Thus, the gravitational repulsion (contravariant component of energy) also takes place in GR (unlike the Newton theory and RGD) along with attraction (covariant component). An impression is being made that the GR advocates hush up this fact.

Conclusion: GR (unlike RGD) does not satisfy all four of Einstein's postulates. It also contradicts experiment evidence and does not transit to the Newton theory within the limit. Now, RGD is the only non-contradictory theory of gravity.

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