Lorentz-Invariant Gravitation Theory

Chapter 3. The axiomatics of LIGT and its consequences

1.0. Lemma of electromagnetism

In the previous chapter of LITG, we presented evidence of the electromagnetic origin of inertial mass. Feynman noted (Feynman et al, 1964), that this statement does not contradict the experimental data.

On this basis, we state here the following lemma, which will serve as a foundation for building LIGT (let us call it "*Lemma of electromagnetism*").

Lemma of electromagnetism: ***The electromagnetic field is the basis for the origin of matter in the Universe***

From here follow a number of conclusions that are important for the theory of gravitation.

1) The equivalence of gravitational and inertial masses leads to the conclusion that gravity has an electromagnetic origin.

This conclusion is of fundamental importance for the construction of the Lorentz-invariant theory of gravitation.

2) The Lorentz-invariance of the laws of electromagnetism, determines Lorentz-invariance of the laws of gravity.

3) Elementary particles are the primary carriers of matter and its characteristics. Hence, the equation of gravitation should follow from the equations of elementary particles.

4) Matter is involved in the creation of the gravitational field as its source, without quantization of this source. Thus, the gravitational field can be regarded as a classical field, which does not require quantization. The assumed origin of this equation from quantum equations of elementary particles, is not a limitation here, because a transition exists from quantum to classical equations.

5) In the elementary particles' theory, inertial mass is associated with energy and momentum of particle by the equation:

$$\varepsilon^2 - c^2 p^2 = m_0^2 c^4,$$

where m_0 is the rest mass (invariant quantity). From this follows, what in general is the equivalence of mass and energy-momentum

$$m_0 = \frac{1}{c^2}\sqrt{\varepsilon^2 - c^2 p^2},$$

According to the above mentioned cause we can consider mass, energy and momentum as the gravitation sources.

6) Since in general case, the original equations of microcosm are nonlinear, we should assume that the gravitational equations are non-linear (it is easy to show that the same should follow from the principle of the equivalence of mass and energy-momentum).

Based on formulated above Lemma of electromagnetism, we can choose the following axioms for LIGT, which do not contradict to the experimental data.

2.0. Axiomatics of LIGT

As the first and second postulates we will take the experimental facts:

1. Postulate of source: ***the source of the gravitational field is matter in the form of an island matter or a field mass.***

2. Postulate of the masses' equivalence: ***the gravitational charge (mass) is proportional to the inertial mass.***

The electromagnetic origin of the mass of all elementary particles, as well as the weakness of the gravitational field compared to the electromagnetic field, allow us to take the following postulate.

3. Postulate of Mossotti -Lorentz: ***the gravitational field is a residual electromagnetic field.***

(*Note: we do not associate this axiom with the Mossotti model which explains how this residue is formed, but have in mind the general idea that the gravitational field is a small part of the electromagnetic field, which acts attractively*).

4. **The locality postulate:** ***gravitational field is locally Lorentz-invariant, that is Lorentz-invariant on any infinitely small time interval and on any infinitely small distance.***

(*Note: since the EM field is itself Lorentz- invariant, this axiom can be seen as a consequence of the axiom of Mossotti-Lorentz. But classical mechanics is globally Lorentz- invariant. With the introduction of postulate 4 we actually emphasize that gravitation, in the general case, is not globally Lorentz-invariant*).

From these axioms the next consequences follow, proof of which may serve as a confirmation of the axioms.

Corollary 1: since the gravitational field is residual, it is much weaker than the electromagnetic field, but in the case of a neutral matter (in the electromagnetic sense), the gravitational field is decisive.

Corollary 2: the gravitational constant is determined as a portion of full electromagnetic interaction.

Corollary 3: as in the theory of electromagnetism the interaction is described by the Lorentz force, the same (or its modification) describes the theory of gravitation.

Corollary 4: the equations of massive elementary particles can be regarded as the source equations of the gravitational field.

Corollary 5: all the features of motion of matter in the gravitational field come from the electromagnetic theory, in particular, from the effects associated with the Lorentz transformations.

Corollary 6: all the characteristics of gravitational field (its energy, momentum, angular momentum, etc) have an electromagnetic origin and obey the laws of electromagnetism.

The foregoing allows us to give a new interpretation of the equivalence of inertial and gravitational masses, different from that of Einstein.

Using our interpretation of the masses' equivalence and the abovementioned axiomatics we shall try to build a Lorentz-invariant theory of gravitation.