Do We See the Equivalence Principle in Its True Aspect?

Sylwester Kornowski

Abstract: The interaction of the non-gravitating Higgs field with an inertial mass, due to the fifth force, resulting from the dynamic viscosity of the inertial mass and Higgs field, causes the inertial mass to be surrounded by non-gravitating/inertial gravitational field which is the gradient in the Higgs field. Such gravitational clothing does not result in the appearance of a new mass type commonly referred to as gravitational mass. Since there is only one kind of mass, that is inertial mass, so the challenge is not to answer the question of why the inertial and gravitational masses are the same. The challenge is to answer why the gravitational constant G does not depend on the internal structure of bodies - this is the fundamental problem of the Equivalence Principle. Here we justify that the invariance of the gravitational constant is due to the fact that the second component of spacetime, i.e. the Einstein spacetime, and all bodies consist of inertial masses-charges having invariant inertial mass. Interactions such as gravity, electromagnetism, weak interactions, and nuclear strong interactions can not change the mass of the inertial masses-charges - they can only change their number in the system under consideration. The same concerns the quantum entanglement which is a result of simultaneous exchanges of the same parts of the inertial masses-charges. In formula ma = GMm/(rr), M and m are the inertial masses, not some gravitational masses, whereas G depends on properties of Higgs field and dynamic viscosity of it and indirectly of the invariant masses-charges. The inertial masses-charges produce only the invariant negative gradients in the Higgs field so gravitational force is always attractive.

1. The Equivalence Principle (EP) problem

An electromagnetically separated observer in test laboratory (then $\mathbf{g} = G\,M\,\mathbf{r}\,/\,r^3 =$ const.) cannot distinguish between being on a sphere with radius r with centre overlapping with a massive point mass M and being in a laboratory accelerating at $\mathbf{a} = -\mathbf{g}$ when we neglect the mechanism generating $\mathbf{a}$. Then the "gravitational mass" of an object, $m_{gr} = \mathbf{F}\,/\,\mathbf{g}$, should be equal to the inertial mass of the same object, $m_{in} = \mathbf{F}\,/\,(-\mathbf{a})$. It is the equivalence principle (EP).

The EP problem defined in such a way is narrowed down because it neglects the relativistic processes and the other interactions.

We can define the EP problem in many different ways, but the most general formulation is related to the invariance of the gravitational constant G, assuming that there is only one kind of mass, i.e. inertial.

How does the Higgs field (HF) interact with inertial mass?

2. The only one type of mass and the fifth force

The interaction of the Higgs field with an inertial mass, due to the fifth force, resulting from the dynamic viscosity of the inertial mass and Higgs field, causes the inertial mass to be surrounded by non-gravitating/inertial gravitational field which is the gradient in the Higgs field. Such gravitational clothing does not result in the appearance of a new mass type commonly referred to as "gravitational mass".

Since there is only one kind of mass, that is inertial mass, so the challenge is not to answer the question of why the inertial and gravitational masses are the same. The challenge is to answer why the gravitational constant G does not depend on internal structures of bodies – this is the fundamental problem of the EP.

In the Scale-Symmetric Theory [1], all particles and spacetime consist of pieces of space (tachyons) with the same invariant dynamic viscosity ($\eta = 1.87516465 \cdot 10^{138}$ kg/(m s)) [1]. The dynamic viscosity of pieces of space is directly associated with the fundamental force commonly called the fifth force. The fifth force cannot change the inertial masses of bodies.

3. Invariance of gravitational constant in all interactions so in quantum entanglement, which is directly associated with the sixth force, also

In SST, the gravitational constant, G, is defined as follows

$$G = \rho_{HF} \, v_{st}^{\,4} / \eta^2 = 6.6740007 \cdot 10^{-11} \text{ m}^3/(\text{kg s}^2), \qquad (1)$$

where $\rho_{HF} = 2.645834 \cdot 10^{-15}$ kg/m^3 is the mean inertial mass density of the Higgs field, $v_{st} = 1.725741 \cdot 10^{70}$ m/s is the mean speed on equator of the non-gravitating inertial pieces of space (tachyons).

These three (ρ_{HF}, v_{st} and η) and four more parameters applied in SST, have been calculated to yield hundreds of basic experimental results.

Notice that in formula (1), there are only quantities defining properties of the Higgs field.

SST shows that the objects producing gradients in HF (stable neutrinos) are built of the binary closed strings with internal helicity (entanglons) [1]. The internal helicity of the closed strings transforms, due to the dynamic viscosity, the chaotic motions of tachyons in HF into divergently moving tachyons [1]. The collisions of the divergently moving tachyons with the tachyons moving chaotically produce gradients in HF around the stable neutrinos [1]. Emphasize that G concerns the gradients around the stable neutrinos.

So why in formula (1) does not appear directly an expression defining the invariant gradients around the stable neutrinos?

What conditions must be satisfied the G was invariant?

A) The ρ_{HF} can be invariant only when the Higgs field has stable boundary composed of packed to maximum pieces of space. Then there can be created only gradients in HF (i.e. the gravitational fields) but the mean inertial density of the Higgs field as a whole is invariant.

B) We can see that relative changes in ρ_{HF}, i.e. $\Delta\rho_{HF} / \rho_{HF}$, must be infinitesimal – then in formula (1) we can neglect an expression defining the invariant gradients (the "holes" in HF)

around the stable neutrinos. SST shows that inertial density of the pieces of space is $\rho_t = 8.32192436 \cdot 10^{85}$ kg/m^3 i.e. is very high. Relative changes in ρ_{HF} are infinitesimal when the reduced volume of a stable neutrino (it is volume of the bound tachyons a stable neutrino consists of packed to maximum) is infinitesimal in relation to their real volume. SST shows that the ratio of reduced and real volume of stable neutrinos is about $0.7 \cdot 10^{-48}$ i.e. is infinitesimal [1]. It means that only not numerous chaotically moving tachyons are transformed by the stable neutrinos into the divergently moving tachyons i.e. the "deepness" of the "holes" in HF is infinitesimal in relation to the "deepness" of HF.

C) Without the invariant stable neutrinos (according to SST, they are the non-relativistic objects), which we will call the inertial masses-charges with invariant mass density, there could be objects carrying the same inertial mass but "producing" different gravitational constants – then the EP does not act correctly. Notice as well that according to SST, the interactions of the SST Higgs field with the inertial masses-charges cause that they are the indestructible objects (the fifth force stabilizes them) i.e. they cannot be destroyed by no one of the six different forces acting in Nature [1].

D) Interactions such as gravity, electromagnetism, weak interactions, and nuclear strong interactions can not change the inertial mass of the inertial masses-charges – they can only change their number in the system under consideration.

E) The quantum entanglement, which leads to the sixth force, can not change the inertial mass of the inertial masses-charges also – according to SST, quantum entanglement is a result of simultaneous exchanges of the same parts of the inertial masses-charges [1].

We showed why in formula (1) does not appear an expression, besides the dynamic viscosity, describing structure and interactions of the inertial masses-charges (stable neutrinos) with the SST Higgs field. It causes that gravity can be perceived as entirely geometrical by nature – it means that metric alone determines the effect of gravity but it is not true that gravity is not associated with some field (here it is the non-gravitating SST Higgs field).

4. Definition of inertial mass

Mass of a body is the product of number of the inertial masses-charges the body consists of (it includes also the inertial masses of particles exchanged between components of the body) and their invariant inertial mass reduced by the negative masses of the created "holes" in the Einstein spacetime by the body (ES is the second component of the spacetime). On the other hand, the invariant mass of an inertial mass-charge is the product of the reduced volume of the mass-charge and density of the pieces of space (tachyons).

5. The General Theory of Relativity (GR)

There are the two sides of the Einstein field equations. The left side, i.e. the Ricci tensor plus the product of the Ricci scalar, which is the tensor contraction of the Ricci tensor, and metric tensor (the invariant dynamic viscosity of the free and bound tachyons, i.e. the fifth force, is the source of the left side), concerns the SST non-gravitating Higgs field whereas the right side, i.e. the stress-energy tensor, concerns the SST gravitating Einstein spacetime and all objects composed of the ES components. The Higgs field can be curved. The components of the stress-energy tensor describe such phenomena as density of relativistic mass or flows in the ES that decrease pressure in them so force the next flows that increase mass density of ES near them (they are the metastable dark-energy structures). Flows in ES are forced by masses and are more intensive near bodies with higher mass density. Stable neutrinos and the carriers of photons and gluons (i.e. the ES components) are the non-relativistic objects i.e. their speed and mass are practically invariant. Rotating neutrinos increase near them density in ES so there are created the metastable disc-like dark-energy structures that are not a part of the

rotating neutrinos but they increase their effective radii. The dynamic viscosity of both components of the SST spacetime (the SST Higgs field and the SST Einstein spacetime) causes that near rotating neutrino or rotating ES component there can appear a shear stress i.e. the force vector component parallel to the cross section. All such phenomena are described within SST [2]. Notice that speeds characteristic for the two sides of the Einstein field equations are not the same – the left side is superluminal but emphasize that the gravitational gradients in ES are carried by stable neutrinos so speed of the gradients (produced by the inertial mass-charges) as a whole are moving with the speed of light c!

References
[1] Sylwester Kornowski (6 June 2016). "Foundations of the Scale-Symmetric Physics (Main Article No 1: Particle Physics)"
http://vixra.org/abs/1511.0188
[2] Sylwester Kornowski
http://vixra.org/author/sylwester_kornowski