

Relativistic Mass and Virtual Objects

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Abstract: Relativistic mass follows from constancy of the speed of light in “vacuum” and the law of conservation of spin. Relativistic mass appears in grainy spacetime. The Einstein-spacetime components have mass and luminal speed but they are the non-relativistic objects. In the Einstein spacetime can appear virtual objects. A virtual object consists of a particle-antiparticle pair or a condensate carrying positive mass and of a mass “hole” carrying negative mass. The gravitational fields are not directly associated with the luminal Einstein spacetime, they are directly associated with the superluminal Higgs field. Today production of virtual objects in the Higgs field is impossible - it is the reason that we cannot unify directly (within the same methods) gravity with electromagnetic, strong and weak interactions i.e. a direct unification of gravity and Standard Model is impossible.

It is not true that there can be in existence massless energy not carried by physical volumes i.e. inertial mass. A direct transformation of massless-energy/motions into mass/physical-volume is impossible. It is possible to transform indirectly in grainy fields a massless energy into mass. At first, the massless energy must decrease local pressure of the field (there besides the chaotic motions must appear ordered motions) so there can appear inflows of additional granules/particles the field consists of so there can increase local mass densities of the field. There appear regions with higher mass density. The mass of a region measured by a detector is

$$M_{\text{Region}} = V_{\text{Region}} (\rho_{\text{Region,mean}} - \rho_{\text{Field,mean}}), \quad (1)$$

where V is volume whereas ρ is mass density.

For the luminal Einstein spacetime is

$$E = M_{\text{Region}} c^2 = V_{\text{Region}} c^2 (\rho_{\text{Region,mean}} - \rho_{\text{Field,mean}}). \quad (2)$$

Such is the correct interpretation of the Einstein formula $E = mc^2$. For example, a vortex of rotational energies carried by the Principle-of-Equivalence Einstein-spacetime components (their mass is not equal to zero) decreases local dynamic pressure of the Einstein spacetime. Emphasize that each ordered motion in the Einstein spacetime decreases local dynamic pressure so each such motion creates additional flows in the spacetime.

The Einstein-spacetime components are luminal and have gravitational mass so they must be the non-relativistic objects. Such a conclusion follows from the fact that relativistic objects moving with the speed of light in “vacuum” c , should have infinite mass but it is physically impossible. We can see that the Einstein-spacetime components do not satisfy following Einstein formula

$$M_{\text{relativistic}} = M_{\text{rest}} / (1 - v^2/c^2)^{1/2}, \quad (3)$$

whereas particles composed of entangled Einstein-spacetime components satisfy this formula. Why? A moving particle/vortex composed of entangled Einstein-spacetime components produces ordered motions of the entangled components i.e. their mean linear speed is v . Since the resultant speed of the entangled Einstein-spacetime components must be equal to c so the spin speed of the particle/vortex must decrease. But due to the law of conservation of spin of the particle/vortex ($\text{spin} = M_{\text{relativistic}} v_{\text{spin}} r$), its mass must increase so there appear the inflows of the additional Einstein-spacetime components into the vortex. To ensure against instability of the relativistic particle/vortex, its angular momentum must overlap with linear velocity i.e.

$$v^2 = c^2 - v_{\text{spin}}^2. \quad (4)$$

We can rewrite this formula as follows

$$v_{\text{spin}}^2 / c^2 = 1 - v^2 / c^2. \quad (5)$$

From constancy of spin follows that $v_{\text{spin}} \sim 1 / M_{\text{relativistic}}$ whereas for resting particle is $v_{\text{spin}} = c \sim 1 / M_{\text{rest}}$ so formula (5) leads to the Einstein formula (3).

We derived the Einstein formula (3) in very simple way knowing internal structure of the Einstein spacetime and internal structure of bare particles. Moreover, we can see that electric charges are some vortices composed of entangled Einstein-spacetime components.

We can see that the relativistic formula for mass concerns only a grainy field composed of luminal components.

On the other hand, the Einstein-spacetime components consist of the superluminal binary systems of closed strings (of the entanglons) and there is not in existence a spacetime composed of free entanglons so we cannot accelerate the Einstein-spacetime components. Just such acceleration could violate the law of conservation of the unitary spin of the Einstein-spacetime components. We cannot change their mass because there cannot appear flows of free entanglons similar to the flows in the Einstein spacetime.

There can appear only exchanges of the entanglons which lead to the quantum entanglement.

We showed that the Einstein-spacetime components are the non-relativistic particles but they have mass and are moving with the speed c .

Now, consider some phenomena possible in the Einstein spacetime. Its ground state has tremendous positive energy i.e. the kinetic energy of the superluminal entanglons the Einstein-spacetime components consist of and since the Einstein-spacetime components are moving with the speed c so there is the dynamic pressure of the spacetime. But due to the law of conservation of the internal structure of the Einstein-spacetime components and due to the constancy of the c , the ground-state energy is frozen i.e. we can assume that it is the zero on the energy scale. Within the Scale-Symmetric Everlasting Theory (S-SET), [1], we proved

that energy frozen inside the Einstein-spacetime components is about $0.6 \cdot 10^{119}$ times greater than the observed energy.

Now we can describe the virtual particles created in the Einstein spacetime.

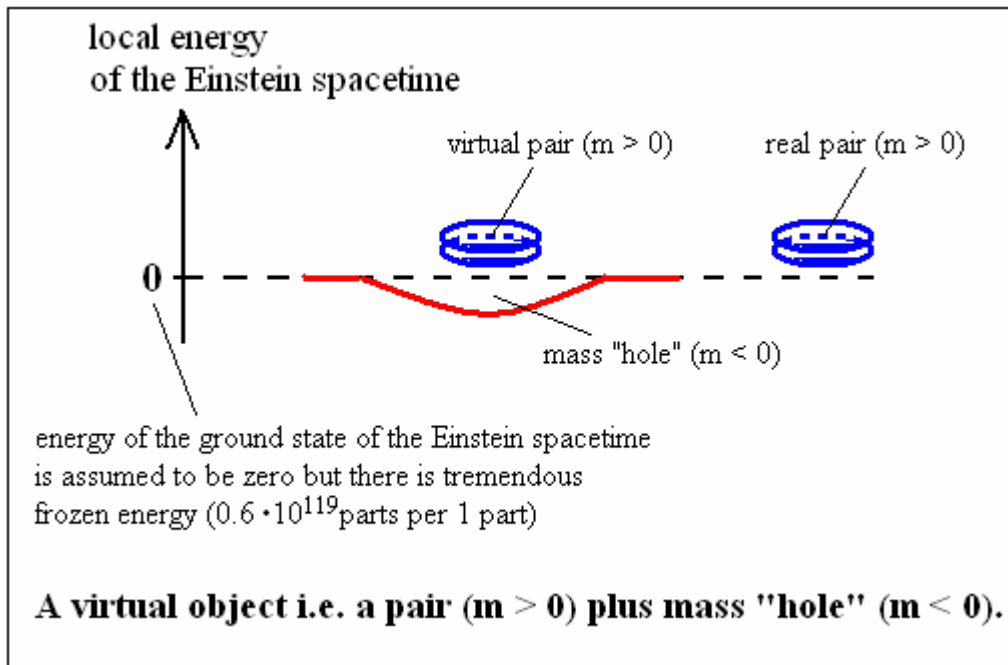
The S-SET shows that there are the two quantized distances between the Einstein-spacetime components which are very close to the mean distance of them in the spacetime. The mean distance between the free Einstein-spacetime components is $3510.237r_{\text{neutrino}}$ (the Einstein-spacetime components are the neutrino-antineutrino pairs).

The mean distance between the Einstein-spacetime components in a condensate is $3482.873r_{\text{neutrino}}$.

The mean distance between the Einstein-spacetime components in the electric charge of electron is $3482.902r_{\text{neutrino}}$.

Notice that the mean distance in condensates differs only insignificantly (about 0.8%) from the mean distance in the Einstein spacetime. The same concerns the electric charge of electron.

It causes that there are possible the creations of virtual electron-positron pairs. Spin of the Einstein-spacetime components is unitary so spins of the electron and positron in a pair are parallel. Since mean mass density of a pair is a little higher than the mean mass density of the Einstein spacetime so due to the production of the pair, there as well is produced a mass "hole" in the local Einstein spacetime. We assumed that the energy of the ground state of the Einstein spacetime is the zero on the energy scale so mass of the mass "hole" is negative whereas of the pair or condensate is positive. It is obvious that the sum of the masses of components of such virtual object, i.e. the sum of the positive mass of the pair or condensate and the negative mass of the mass "hole", is equal to zero. Moreover, since the Einstein spacetime tries to equalize its mass density, the virtual objects (virtual-object = pair or condensate + "hole") are the short-lived particles.



But virtual pairs can interact with, for example, real electron so there appear measurable quantities as for example the anomalous magnetic moments.

The gravitational fields are not directly associated with the luminal Einstein spacetime, they are directly associated with the superluminal Higgs field. Today production of virtual objects

in the Higgs field is impossible (it was possible during the inflation) – it is the reason that we cannot unify directly (within the same methods) gravity with electromagnetic, strong and weak interactions i.e. a direct unification of gravity and Standard Model is impossible.

References

- [1] Sylwester Kornowski (14 March 2014). “The Everlasting Theory and Special Number Theory”
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