

# How to Eliminate the Messy Mathematical Methods from Physics and Cosmology?

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**Abstract:** The gauge invariance of equations follows from constancy of charges. There appear arbitrary functions so to obtain quantized values we must apply approximations, mathematical tricks and free parameters. The second messy mathematical method applied in physics follows from the wrong assumption that the bare particles are sizeless and that there are in existence interactions with infinite range (it follows from the massless carriers of interactions). In such method, to obtain theoretical results consistent with experimental data, there must appear the mathematical indeterminate forms so they are incoherent as well. Such messy method cannot be eliminated via vibrating flexible strings, as it is in the M/string theory, because such assumption cannot lead to constancy of physical constants. What we should do to eliminate the arbitrary functions, sizeless bare particles, infinite ranges of forces and flexible strings? And some extension to the General Relativity is the answer.

## 1. Introduction and motivation

The gauge invariance of equations follows from constancy of charges. We can say that the gauge invariance is associated with the laws of conservation of charges. Instead of some vector potential  $A$  and scalar potential  $\varphi$  we can apply the modified quantities

$$A' = A + \text{grad } f, \quad (1)$$

$$\varphi' = \varphi - (1/c) \partial f / \partial t, \quad (2)$$

where  $f$  is an arbitrary function.

Due to the arbitrary function,  $f$ , there is a big number of solutions (big number of different gauge fields) which conserve charges. It causes that to obtain theoretical results consistent with experimental data, i.e. consistent with quantized values, there sooner or later in the gauge theories containing the arbitrary function  $f$ , must appear approximations, mathematical tricks and free parameters. Of course, the gauge theories are partially useful because they lead to symmetries (sometimes to broken symmetries) and next to the laws of conservation. But it looks as a lucky hit, not as a coherent theory. Moreover, such mathematical methods never will lead to the complete internal structures of the charges so as well to the complete internal

structure of spacetime and other fields. It causes that we cannot properly/unmistakably describe the interactions of charges with spacetime and other fields. There appear many wrong assumptions and interpretations.

The second messy mathematical method applied in physics follows from the wrong assumption that the bare particles are sizeless and that there are in existence interactions with infinite range (it follows from the massless carriers of interactions). In such method, to obtain theoretical results consistent with experimental data there must appear the mathematical indeterminate forms as, for example,  $\infty - \infty = \text{arbitrary-constant}$ . It causes that theories with such assumptions are mathematically incoherent so there appears the mathematical trick i.e. the renormalization. Such messy method cannot be eliminated via vibrating flexible strings, as it is in the M/string theory, because such assumption cannot lead to constancy of physical constants.

Ultimate theory should simultaneously lead to the origin of physical constants, to internal structure of space and to internal structure of bare charges and it is in the fruitful Scale-Symmetric Everlasting Theory (S-SET), [1], [2].

What we should do to eliminate the arbitrary functions, sizeless bare particles, infinite ranges of forces and flexible strings?

The General Relativity (GR) with the upper limit for speed  $c$  concerns the Principle-of-Equivalence objects i.e. objects which inertial mass is equal to gravitational mass. So the fundamental question is: Can there be in existence non-gravitational inertial-mass-only pieces of space moving with superluminal speeds? And some extension of the GR “says” YES [3]. Just such extension leads to physical/nontransparent volumes without fields – they are the bare objects/tachyons. In S-SET, the gas composed of the tachyons is the modified Higgs field and it was the inflation gas. The kinetic and rotational energies are carried by the pieces of space so in such theory cannot appear singularities and infinite ranges – just renormalization is eliminated.

Next, we can apply the simplest dynamics of fluids. There appear the superluminal closed strings with half-integral inertial-only spin. The half-integral spin is copied in greater and greater structures composed of more and more tachyons. Due to the half-integral spin, masses, radii and speeds of such structures are quantized. They lead to the internal structures of bare charges. It is the S-SET. This theory simultaneously leads to the origin of physical constant, internal structures of charges, spacetime and possible fields and finite ranges of gravity and electromagnetism. Just in this theory the all messy mathematical methods are eliminated.

Why range of gravitational interactions is finite? The gravitational fields are the gradients in the modified Higgs field produced by the Einstein-spacetime components. The range is finite due to the collisions of the tachyons – it is about  $2 \cdot 10^{36}$  m. Photons are the rotational energies of the Einstein-spacetime components.

### **Why closed strings, not balls/condensates-of-tachyons?**

In fluids can appear vortices/closed-strings. The tachyons rotate so the closed strings have internal helicity. Balls/condensates-of-tachyons cannot have internal helicities. Just tori are the simplest mathematical objects which can have internal helicity. To conserve the zero-internal helicity of the Higgs field, the closed strings appear as the pairs with opposite internal helicity of components of a pair. We can see that the succeeding phase transitions break local symmetries whereas global symmetry is conserved. Broken symmetries are needed to our existence.

### **Why not the Riemannian supermetrics?**

Due to the succeeding phase transitions, the succeeding scalar/radion fields have very different properties so unification of gravity and Standard Model within the same mathematical methods is impossible.

### **Why unification of gravity and Standard Model within quantum physics is impossible?**

Gravity is associated with the classical non-gravitating modified Higgs field whereas Standard Model with the Einstein spacetime which gravitates. Properties of these two fields are very different so unification is impossible.

### **Why complete ground unification is impossible?**

It is due to the succeeding phase transitions. The partial theories are connected via a channel and the Scale-Symmetric Everlasting Theory is the channel. Within the S-SET we solved all basic problems not solved within the mainstream theories. Moreover, the S-SET shows the all limitations for the partial theories. We can say that S-SET is the Holy Grail of physics and cosmology.

### **Why ten dimensions of the closed strings?**

In reality, the 'ten dimensions' are the degrees of freedom to describe position, shape and possible motions of a closed string composed of tachyons. We need x, y, and z to describe initial position of the centre of a closed string, its two radii, linear speed (time), toroidal speed, poloidal speed and two angular velocities to describe rotation of spin of the closed string in relation to the linear velocity and spin i.e. we need 9 spatial degrees of freedom and 1 time degree of freedom.

### **References**

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