

# How Can We Heal Physics?

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**Abstract:** This is a review article. There are tens unsolved basic problems in cosmology and particle physics. It suggests that the two main theories, i.e. General Theory of Relativity (GR) and Quantum-Physics/Standard-Model (QP/SM), are the incomplete theories. To solve the hierarchy problem, we need a theory of size scales, not the postulated supersymmetric particles. There are the three self-similar scales i.e. the Planck scale, nuclear scale and a cosmological scale. A few additional symmetries that follow from properties of the inflation field (i.e. of the initial state of the superluminal Higgs field) lead to the self-similar fractal-like size scales that look as the analogs of quasars i.e. there is torus with central condensate (bigger tori are built of smaller tori). Such structures of basic bare fermions in the three self-similar scales (they are not the mathematical points) eliminate from theories all infinities, singularities, approximations, mathematical tricks as the mathematical indeterminate forms, free parameters, and reduce number of initial parameters to 7 only. The local/global duality of time, the non-linearity--linearity duality of phenomena and the non-local phenomena in GR and QP/SM lead to the two-component spacetime with radically different properties of the components - it causes that unification of GR and QP/SM within the same methods is impossible. Within the Scale-Symmetric Theory (SST) we partially unified GR and QP/SM via the size scales - besides the three gravitating self-similar scales, there appear two non-gravitating superluminal scales that are associated one with gravitational fields and the second with quantum entanglement. The carriers of quantum entanglement, due to their internal helicities, produce only single jet composed of antiparallel half-jets. We need very big number of such carriers to create the volumetric gravitational field - it is realized via neutrinos. How long theoretical cosmology and particle physics will move in a blind alley? Two decades is not enough (the theory of size scales was formulated in 1997)? Who is responsible for this i.e. for the present mess in the two major areas of knowledge? No one can see that Nature cannot be such complicated as the present-day theories suggest (the tens of parameters, many wrong basic results as the spin of proton, infinities, singularities, approximations, tricks)? Is it arrogance?

## Introduction and motivation

There are tens unsolved basic problems in cosmology and particle physics. It suggests that some important part of Nature is unnoticed.

Our Cosmos has a non-trivial story because there is the alignment of spins of quasars or the characteristic perpendicular orientation of the main disc and the vast polar structures (VPOSs) (it contains many of the satellite galaxies and other cosmological objects) in massive spiral galaxies or the origin and abundance of the dark matter and dark energy or the different amount of matter and antimatter that cannot be explained easily within the Big-Bang Theory. There are as well the crises in particle physics as, for example, the crisis of mass of proton or crises of its spin and radius or crisis of the non-locality in the Quantum Physics. It suggests that a simple evolution of the Big Bang can not be a full description.

There had to be additional phase transitions during the inflation following from additional symmetries that significantly simplify cosmology and particle physics in such a way that there do not appear infinities and singularities and that there are not needed approximations, mathematical tricks and tens of free and initial parameters.

The solution is the self-similarity of scales. To solve the hierarchy problem, we need a theory of scales, not the postulated supersymmetric particles. There must be at least three self-similar/fractal-like scales i.e. the Planck scale, nuclear scale, and a cosmological scale. Due to the self-similar/fractal-like scales (there is a torus with central condensate as it is in quasars - it eliminates infinities and singularities), we can derive the tens of parameters that appear in General Theory of Relativity (GR) and Quantum-Physics/Standard-Model (QP/SM) from 7 only most fundamental parameters. What should we do? There are the tree self-similar scales in physics but there is not some unification formula. The Scale-Symmetric Theory (SST) [1], [2], provides such formulae for the three scales i.e. for the Planck scale ( $\sim 10^{-35}$  m), for nuclear scale ( $\sim 10^{-15}$  m), and a cosmological scale ( $\sim 10^{25}$  m) – there appear two additional scales in the superluminal region. Just some theory of scales, which should lead to internal structures of characteristic bare objects, added to GR and QP, should heal physics. And the SST is the theory of unified self-similar fractal-like size scales that is the missing part of Theory of Everything (ToE).

What we should focus to find the missing part of physics and next eliminate the infinities, singularities, approximations, mathematical tricks such as the mathematical indeterminate forms that cause that theories are incoherent, and significantly reduce number of free and initial parameters? The vast majority of the scientific community believes that we will unify GR and QP/SM i.e. the majority of scientists believes that unification of GR and QP within the same methods within some quantum gravity (QG) is possible. They believe that a solution to some QG equation will solve the tens unsolved basic problems in physics. But GR and QP show that their unification is impossible – just time in these theories is going in different way – in QP time is linear/global whereas in GR is non-linear/local. The answer to the question at first place is very simple: just we should not neglect the internal structure of bare fermions (bare fermions, which have gravitational mass, spin, weak or electric charge, and so on, cannot be a mathematical point without size and without rich internal structure – we cannot solve this problem via vibrating superstring because flexible superstring cannot lead to invariants) and we should not apply the mathematical indeterminate forms:  $\infty - \infty = \text{const.} \neq 0$  or  $\text{const.} \neq 0 / 0 = \infty$ .

Structures of bare particles/characteristic-objects lead as well to internal structure of spacetime.

SST shows that unification at very high energy of the different scales into one scale is impossible.

The non-locality of gravity and quantum physics and coherence of mathematical or physical objects with non-local sizes (the distant points of non-local objects must quickly communicate to preserve their stability) lead to non-gravitating tachyons and superluminal quantum entanglement.

There should be some physical differences that distinguish non-linearity from linearity i.e. gravity from quantum physics or, for example, friction from superposition.

The gravitational local time that depends on position in spacetime and the QP/SM global time that does not depend on position lead to two theories that cannot be unified within the same methods i.e. to GR and QP/SM.

Summarize our thoughts.

**1.**

To solve the hierarchy problem, we need a theory of scales, not the postulated supersymmetric particles. There should be at least three scales i.e. the Planck scale, nuclear scale and a cosmological scale. Cores of fundamental objects in these scales should be self-similar – the structure of quasars suggests that there should be a torus with central condensate that should eliminate the infinities, singularities and mathematical indeterminate forms from the two leading theories.

It is obvious that bare fermions cannot be a mathematical point or flexible superstring that does not preserve their stability. To describe the self-similar structures, we need new methods. We cannot describe such structures via a wave equation or Lagrangian. Applied methods and mathematics must be much simpler.

**2.**

The size scales need additional symmetries beyond GR and Standard Model (SM). The additional symmetries are as follows.

- The half-integral spin of the tori in the cores of the three self-similar structures and the fundamental closed string (the superluminal entanglon responsible for the quantum entanglement is the spin-1 binary system of such closed strings). The half-integral spin of the closed string follows from classical dynamics of the initial inflation field i.e. from the initial state of the superluminal Higgs field composed of non-gravitating tachyons.
- The fractal masses of the three self-similar structures are proportional to  $K^{2(d-1)}$ , where  $K^2$  is the number of tachyons the fundamental closed string consists of,
  - $d = 2$  for the Planck scale,
  - $d = 4$  for the nuclear scale, and
  - $d = 8$  for the cosmological scale.
- The same surface densities of the self-similar tori – due to the fractal structure (bigger tori consist of smaller tori), such symmetry causes that damages to the tori are quickly repaired.
- The succeeding symmetrical decays of some bosons at high densities that lead to the Titius-Bode law for the nuclear GUT interactions (i.e. the weak, electromagnetic and strong). The succeeding symmetrical decays concern as well some atomic nuclei especially containing  $2^n$  nucleons, where  $n = 1, 2, 3, 4, 5, 6, 7, 8$ .

**3.**

QP is non-local (there is needed superluminal communication between entangled non-local particles to explain, for example, the spin polarization) and GR is non-local as well (there is the information problem concerning the quantized-mass black holes without singularity [1B] – information must freely flow via such black holes). It means that Nature needs superluminal entanglons and non-gravitating tachyons. Such superluminal objects cause that distant points of, for example, wave function can quickly communicate (practically, immediately) – it causes that wave function is physically a coherent object. Just the non-locality of gravity and non-locality of quantum physics and the needed coherence of non-local mathematical or

physical objects lead to superluminal objects. Photons in gravitational field can exchange energy with the non-gravitating tachyons the gravitational fields consist of.

**4.**

There should be some physical differences that distinguish non-linearity from linearity i.e. gravity from quantum physics. There is a high probability that production of virtual and/or real particle-antiparticle pairs effectively suppresses turbulences in fields (it is possible in quantum fields) so production of pairs in gravitational fields is impossible because they are non-linear. It distinguishes gravity from quantum physics and causes that unification of them within the same methods is impossible. The non-linearity—linearity duality leads to two-component spacetime. To the two-component spacetime leads as well the local-global duality of time that distinguishes GR and QP. The gravitational local time depends on position in spacetime whereas the quantum-physics global time does not depend on position.

**5.**

It is impossible to apply the same methods to fields with extremely different properties. Gravitational fields consist of the non-gravitating tachyons whereas the GUT fields consist of objects composed of the gravitating luminal neutrino-antineutrino pairs. It causes that unification of GR and SM within the same methods is impossible.

$$\text{ToE} = \text{SST} + \text{GR} + \text{QP/SM}$$

### Summary

- A) Hierarchy problem leads to size scales.
- B) There are additional symmetries beyond GR and Standard Model (SM) that lead to the self-similar fractal-like size scales – they are described within SST.
- C) Due to the additional symmetries, fundamental bare fermions in different scales are self-similar/fractal-like objects that contain torus with central condensate as the quasars i.e. as the high-density cosmological objects. It eliminates infinities, singularities and mathematical indeterminate forms.
- D) Non-local phenomena in GR and QP/SM lead to non-gravitating tachyons and superluminal quantum entanglement.
- E) Non-linear gravitational phenomena such as, for example, friction, and linear quantum phenomena such as, for example, superposition, lead to the two-component spacetime.
- F) Local time (there are the relative units of time) or global time (there is an invariant unit of time) lead to two theories that cannot be unified within the same methods. We can unify them, i.e. GR and SM, via the self-similar fractal-like size scales.

**It heals physics.**

### References

- [1] Sylwester Kornowski (2015). *Scale-Symmetric Theory*  
 [1A]: <http://vixra.org/abs/1511.0188> (Particle Physics)  
 [1B]: <http://vixra.org/abs/1511.0223v2> (Cosmology)
- [2] Sylwester Kornowski (2012-2016; but foundations of SST were published already in 1997: see [1A])  
[http://vixra.org/author/sylwester\\_kornowski](http://vixra.org/author/sylwester_kornowski)