

# The Differences between the Bright Matter, Dark Matter, a Virtual Energy, Energy and Dark Energy

Sylwester Kornowski

**Abstract:** According to the Scale-Symmetric Theory (SST), there is the two-component spacetime composed of the superluminal non-gravitating Higgs field and the gravitating Einstein spacetime (ES) composed of the very stable non-rotating-spin-1 neutrino-antineutrino pairs (NAPs) moving with the invariant speed of light in “vacuum” c. NAPs in ES do not rotate. The main feature of the bright matter (BM) is that it contains parts with mean distances between the NAPs smaller than the mean distance between the ES components because of the short-distance quantum entanglement or confinement - BM is not a part of ES. The main feature of the dark matter (DM) is that mean distances between the NAPs are equal or greater than the mean distance between the ES components because of the long-distance entanglement - DM is not a part of ES and NAPs do not rotate. Virtual energy (VE) appears due to creation of the virtual pairs (it has positive mass) from the local ES components so there appears as well a local virtual hole in ES (it has negative mass). Mean mass of such virtual structure is equal to zero. But due to the annihilations of the virtual pairs to real photons (they are the rotational energies of the ES components) that escape from surrounding of a real particle (BM), virtual processes decrease density of the ES. Virtual pairs, virtual holes and real photons (real photons carry real energy (E)), are not parts of ES. Interactions of virtual particles create BM that is the anomalous mass of a real bare particle. A decay of real object (BM) to DM (it happened about 100 million years before the beginning of the expansion of the Universe) causes that virtual processes disappear. Since mass density of the ES around the object was negative so there is an inflow of ES into the region with lowered density of ES. The inflowing ES is the dark energy (DE). DE is needed to accelerate expansion of the Universe at the beginning and next to maintain a constant expansion rate. DE is a part of ES.

## 1. Introduction

The Scale-Symmetric Theory (SST) shows that the successive topological phase transitions of the superluminal non-gravitating Higgs field during its inflation (the initial big bang) lead to the different scales of sizes/energies [1A]. Due to a few new symmetries, there consequently appear the superluminal binary systems of closed strings (the spin-1 entanglons) responsible for the quantum entanglement (it is the quantum-entanglement scale), neutrinos

and the spin-1 neutrino-antineutrino pairs moving with the speed of light in “vacuum”,  $c$ , which are the components of the gravitating Einstein spacetime (it is the Planck scale), cores of baryons (it is the electric-charge scale), and the cosmic-structure/Protoworld (it is the cosmological scale) that evolution leads to the dark-matter structures (they are built of entangled non-rotating-spin neutrino-antineutrino pairs), dark energy (it consists of the additional non-rotating-spin neutrino-antineutrino pairs interacting gravitationally only i.e. they are not entangled) and the expanding Universe (the “soft” big bang due to the inflows of the dark energy into the Protoworld which created the early Universe) [1A], [1B]. The electric-charge scale leads to the atom-like structure of baryons [1A].

We can see that there is the two-component spacetime composed of the superluminal non-gravitating Higgs field and the gravitating Einstein spacetime (ES) composed of the very stable non-rotating-spin-1 neutrino-antineutrino pairs (NAPs) moving with the invariant speed of light in “vacuum”  $c$ . NAPs in ES do not rotate. To show the differences between the bright matter (BM), dark matter (DM), a virtual energy (VE), energy (E) and dark energy (DE), most important are the processes in ES.

## 2. Properties of neutrinos

We know that there is the classical and quantum mass of electron. By an analogy to electron, SST shows that there are two masses of neutrinos i.e. the lower limit for particle mass of non-rotating neutrinos that is very low  $m_{neutrino} = 3.3349306 \cdot 10^{-67}$  kg and the wave mass associated with size of a rotating bare neutrino, which is close to the Planck mass [3]. Calculated within SST sum of mean masses of the three species of neutrinos is 0.287 eV [3] – it is consistent with experimental data. Moreover, SST shows that due to the tremendous non-gravitating energy frozen inside neutrinos and the very strong short-distance quantum entanglement, the neutrino-antineutrino pairs cannot annihilate. Detection of the non-rotating neutrino-antineutrino pairs in ES is very difficult because the particle mass of them, which concerns the non-rotating pairs, is beyond range of present-day detectors – the ES components in ES interact gravitationally only.

## 3. Main features of the bright matter, dark matter, a virtual energy, energy and dark energy

The main feature of the bright matter (BM) is that it contains parts with mean distances between the NAPs smaller than the mean distance between the ES components because of the short-distance quantum entanglement or confinement [1A] - BM is not a part of ES.

The main feature of the dark matter (DM) is that mean distances between the NAPs are equal or greater than the mean distance between the ES components because of the long-distance entanglement [4] - DM is not a part of ES and NAPs do not rotate.

Virtual energy (VE) appears due to creation of the virtual pairs (it has positive mass) from the local ES components so there appears as well a local virtual hole in ES (it has negative mass) [5]. Mean mass of such virtual structure is equal to zero. But due to the annihilations of the virtual pairs to real photons (they are the rotational energies of the ES components) that escape from surrounding of a real particle (BM), virtual processes decrease density of the ES. Virtual pairs, virtual holes and real photons (real photons carry real energy (E)), are not parts of ES. Interactions of virtual particles create BM that is the anomalous mass of a real bare particle [1A].

A decay of real object (BM) to DM (it happened about 100 million years before the beginning of the expansion of the Universe [1B]) causes that virtual processes disappear. Since mass density of the ES around the object was negative so there is an inflow of ES into the region with lowered density of ES. The inflowing ES is the dark energy (DE) [1B]. DE is

needed to accelerate expansion of the Universe at the beginning and next to maintain a constant expansion rate. DE is a part of ES.

The very early Universe was the binary system of loops composed of protogalaxies built of the neutron black holes [1B]. The inflow of dark energy (pressure in ES increased) caused that there was the exit of majority of the neutron black holes from their black-hole state. It caused that the protogalaxies or their groups transformed into quasars.

## References

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