Dynamics at the Surface of Spacetime at the End of Inflation

Sylwester Kornowski

Abstract: We really need to change the basics of physics because we are approaching a dead end. Here we answered following questions: What is the nature of dark energy (DE)? Why it is very difficult to create the dark matter (DM) and DE structures in collisions of baryons? Why was the abundance of created DM and DE very high at the end of inflation?

1. Introduction

There can be two states of a volume: nothingness or fully filled (a piece of space). Physics describes interactions between pieces of space. The fundamental interaction is due to viscosity of the pieces of space which follows from smoothness of their surfaces. Phase transitions of spacetime composed of such pieces of space cause that there appear the other interactions: quantum entanglement, confinement, gravitational interaction, electromagnetism, and the strong and weak interactions [1].

In the Scale-Symmetric Theory (SST), the initial inflation field was composed of the superluminal pieces of space (the SST tachyons) packed to maximum [1]. The initial inflation field, as a whole, had the left external helicity which, at the end of the inflation, has led to the matter-antimatter asymmetry in our Cosmos. Just a fermion differs from its anti-fermion by the sign of electric or weak charge (it is physical torus or loop) and by internal helicity which is neglected in modern physics. For example, neutron is internally left-handed, while antineutron is right-handed [1].

The inflation was due to a collision of the initial inflation field with a much, much bigger piece of space [1].

The SST inflation is described in [1], [2].

Due to the SST inflation, there appeared the two-component spacetime composed of the SST Higgs field (this is the remainder of the initial inflation field) and of the Einstein spacetime (it consists of the neutrino-antineutrino pairs – masses of neutrinos are invariant and the pairs are moving with the speed of light in "vacuum" c) [1], [3]. Neutrinos acquire their masses due to their interaction with the SST Higgs field – such interaction leads to the gravitational constant G [1].

When the radius of the expanding Einstein's spacetime exceeded the value $\sim 2.3 \cdot 10^{30}$ m, the gravitational pressure squeezing the outer layer of this spacetime became higher than the dynamic pressure responsible for the expansion of the spacetime [4]. This caused the outer layer of spacetime to collapse and create a stable boundary of the inner Cosmos, while at the same time, baryon matter (BM), dark matter (DM), and dark energy (DE) were produced in large quantities.

In [5], we calculated the mean critical densities of BM, DM, and DE in the inner Cosmos:

$$\rho_{Critical,BM} = 3.6313 \cdot 10^{-27}\ \mathrm{kg/m^3}\ , \qquad (1)$$

$$\rho_{Critical,DM} = 2.1330 \cdot 10^{-27}\ \mathrm{kg/m^3}\ , \qquad (2)$$

$$\rho_{Critical,DE} = 5.7643 \cdot 10^{-27}\ \mathrm{kg/m^3}\ . \qquad (3)$$

These results lead to following ratios

$$\mathrm{BM : DM : DE} \approx 1.70 : 1 : 2.70\ . \qquad (4)$$

Notice that BM + DM = DE.

The collapse of the outer spacetime layer caused a shockwave composed of BM, DM and DE moving towards the center of the inner Cosmos. The shockwave created the cosmological black holes (universes) with different BM critical densities, similar DM critical density (see (2)), and similar DE critical density (see (3)) [5].

The creation of our Universe was separated in time from the inflation. Our Universe is a part of the inner Cosmos.

2. The most important properties of BM, DM, and DE

BM: In baryons is the core (the left-handed torus/electric-charge and central condensate both composed of the Einstein's-spacetime (Es) components), while outside it is obligatory the Titius-Bode law for the nuclear strong interactions [1], [6]. The spins of the Es components the electric-charge is built of are perpendicular to their velocities so the spins can rotate in plane perpendicular to velocity i.e. they can interact electromagnetically [1].

DM: Dark matter consists of the DM tori (mass is 727.43 MeV) which behave as the magnetic monopoles with short-distance magnetic interactions or short-distance entanglement (range is ~0.7 fm up to ~4.4 fm) [7]. The DM tori are built of the DM loops composed of the Es components which spins are tangent to the DM loops – it means that the spins in the DM tori and in the DM loops cannot rotate in plane perpendicular to velocity so they cannot interact electromagnetically. The DM loops in the DM torus are entangled so the DM tori can decay to the DM loops. Radii of the DM loops can be from ~0.23 fm up to cosmological sizes. The DM structures interact only gravitationally, magnetically but it is the short-distance interaction, and weakly via the virtual electron-positron pairs – it is also only the short-distance interaction [8], so detection of the DM structures is very difficult.

DE: The components of DE (the DE strings) are the open DM loops so they also cannot interact electromagnetically. Moreover, contrary to the DM tori and loops, the DE strings are moving with the speed of light in "vacuum" c so they increase the dynamic pressure in the Einstein's spacetime – it means that they indeed behave as dark energy. Lengths of the DE strings can be from ~1.5 fm up to cosmological sizes.

3. Why it is very difficult to create the dark matter (DM) and DE structures in collisions of baryons?
Why was the abundance of created DM and DE very high at the end of inflation?

The answer is very simple. At very high energies, Nature tries to duplicate the colliding particles without changing the total electric charge and internal helicity. So, during the collision of baryons, baryon-antibaryon pairs are produced, while during the thickening of the Einstein's spacetime (the collapse of the outer layer of the Es), loops were created composed of the neutrino-antineutrino pairs. The mass density of such loops is higher when the spins of the pairs are tangent to the loops – we can see that they are the DM loops which in turn are the building blocks of the DM tori.

At the end of inflation, due to the forced balance between mass and energy (here it is the balance between baryon matter and dark matter on the one hand, and dark energy on the other – see formulae (1) – (3)), a strictly defined number of the DM loops have been torn apart, which means that the DM loops transformed into dark energy (into the DE strings).

From (1) – (3) follows that at the end of the SST inflation, due to mass, for each 4 neutrons created there were ~11 DM tori:

BM / (DM + DE) ≈ 1.70 / 3.70 ≈ 0.46 i.e. 4 neutrons (3758 MeV) per 11 DM tori (8002 MeV) so 3758 / 8002 ≈ 0.47

4. Summary

To produce dark matter and dark energy in the laboratory, we must find a way to thicken the Einstein's spacetime which consists of the neutrino-antineutrino pairs.

References

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