When the First Baryons Were Created?

Sylwester Kornowski

Abstract: According to the Scale-Symmetric Theory (SST), the big bang (the superluminal inflation) was separated in time from the "soft" big bang of the Universe. During the inflation (it lasted about 67 powers of ten times shorter than a second) there was no time for the three Standard-Model interactions i.e. electromagnetism, weak interactions, and the nuclear strong interactions - such interactions need much longer time. During the inflation baryons were not created. There were created only the neutrino-antineutrino pairs that are the components of the Einstein spacetime (ES). It was because the interactions of the entanglons the neutrinos consist of were due to the inflation field i.e. due to the non-gravitating tachyons moving with speed about 97 powers of ten m/s. It means that the time of interactions of the ES components in distance equal to the Planck length is about 132 powers of ten times shorter than a second. SST shows that first baryons were created at the end of the inflation because of the collapse of the external layer of the ES - there was created more baryons than antibaryons because initially the inflation field had the left-handed helicity. Due to the return shock wave, there were created additional baryons in the centre of the Cosmos.

Introduction and motivation

The Scale-Symmetric Theory (SST) [1] shows that the succeeding phase transitions of the superluminal non-gravitating Higgs field (HF) during its inflation (the initial big bang) had led to the different mass/energy scales and size scales (bigger structures consist of smaller structures) [1A]. Due to a few new symmetries and 7 parameters only, there appear the superluminal binary systems of closed strings (the spin-1 entanglons) which are responsible for the quantum entanglement (it is the quantum-entanglement scale), neutrinos and the very stable spin-1 neutrino-antineutrino pairs (NAPs) moving with the speed of light in "vacuum", c, which are the components of the gravitating Einstein spacetime (ES) (it is the Planck scale; mass of lightest neutrino is the smallest gravitational mass; neutrinos acquire their gravitational masses due to their interactions with the Higgs field [1A]; as for electrons, we can define two different masses of a neutrino i.e. particle mass and wave mass (or their geometric mean) [2]), cores of baryons (it is the proton/electric-charge scale), and the cosmic-structure/Protoworld (it is the cosmological scale; Protoworld created the early Universe [1B]) that evolution leads to the dark-matter (DM) structures (they are built of entangled non-rotating-spin NAPs), dark energy (it consists of the additional non-rotating-spin NAPs interacting gravitationally only i.e. they are not entangled i.e. the dark energy is an infinitesimal part of the ground state of ES) and the expanding Universe (the "soft" big bang due to the inflows of the dark energy into the Protoworld) [1A], [1B]. The proton scale leads to the atom-like structure of baryons [1A].

During the inflation almost whole the non-gravitating Higgs field composed of tachyons transformed into the gravitating Einstein spacetime. The residual Higgs field causes that the ES components acquire their gravitational mass. All hadronic matter and the charged leptons are built of the ES components [1A]. The collapse of the external layer of the expanding ES created the return shock wave that created in the centre of the Cosmos both the Protoworld and the very early Universe inside it [1B], [1A]. Due to the evolution of the Protoworld, there appeared the expanding Universe [1B].

According to SST, the big bang (the superluminal inflation) was separated in time from the "soft" big bang of the Universe [1B]. The components of the inflation-field/Higgs-field are moving with mean speed equal to $\sim 2.4 \cdot 10^{97}$ m/s i.e. with speed about $8 \cdot 10^{88}$ times higher than the speed of light in "vacuum" [1A].

Calculated radius of the present-day Cosmos (it is much bigger than the Universe) is $\sim 2.3 \cdot 10^{30}$ m [3]. On the other hand, initially the inflation field as a whole had the left-handed helicity and the tachyons were packed closely [1B]. It means that inflation lasted about $\sim 10^{-67}$ s. We can see that there was no time for the three Standard-Model interactions i.e. electromagnetism, weak interactions, and the nuclear strong interactions – such interactions need much longer time. Just during the inflation baryons were not created. There were created only the neutrino-antineutrino pairs that are the components of the ES. It was because the interactions of the entanglons the neutrinos consist of were due to the inflation field i.e. due to the non-gravitating tachyons moving with speed about $8 \cdot 10^{88}$ times higher than the speed of light in "vacuum". It means that the time of interactions of the ES components in distance equal to the Planck length is about $\sim 10^{-132}$ s – it means that during the inflation there was time for such interactions. Entanglons are moving with speed $\sim 0.7 \cdot 10^{68}$ m/s so an exchange of them on distance equal to the Planck length lasts about $\sim 10^{-103}$ s – it means that there was time during the inflation for the quantum entanglement of neutrinos the ES components consist of.

SST shows that internal helicity distinguish fermions from antifermions. Baryons and positrons have left-handed internal helicity whereas antibaryons and electrons have right-handed internal helicity [1A]. SST shows that to create baryons, distance of some neutrino-antineutrino pairs in the ES must decrease about 554.3 times [1A]. It means that we need a shock wave in the ES to create baryons. Such return shock wave was created at the end of the inflation because of the collapse of the external layer of the ES (there gravitational attractive pressure was higher than the dynamic repulsive pressure). In the return shock wave there was created more baryons than antibaryons because initially the inflation field had the left-handed helicity.

The return shock wave created additional baryons in the centre of the Cosmos.

References

[1] Sylwester Kornowski (2015). *Scale-Symmetric Theory*
[1A]: http://vixra.org/abs/1511.0188 (Particle Physics)
[1B]: http://vixra.org/abs/1511.0223 (Cosmology)

[2] Sylwester Kornowski (27 August 2016). "The PMNS Neutrino-Mixing Matrix in the Scale-Symmetric Theory"
http://vixra.org/abs/1608.0145

[3] Sylwester Kornowski (11 January 2016). "The Matter-Antimatter Asymmetry: Is Our Universe the One and Only in Our Cosmos?"
http://vixra.org/abs/1411.0534