The New Cosmology

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Abstract: Here, applying the Scale-Symmetric Theory (SST), we present a recapitulation concerning evolution of our Cosmos and we point the pivotal differences between the new cosmology and the mainstream cosmology. We start from the superluminal non-gravitating inflation field (the Higgs field) and via the succeeding phase transitions of such field, we described evolution of the cosmic-object/Protoworld that appeared after the inflation/big-bang but before the expansion/"soft"-big-bang of the Universe. Evolution of the Protoworld leads to the origin of dark energy and dark matter. They both are associated with flows in the grainy luminal gravitating Einstein spacetime. The matter-antimatter asymmetry results from internal helicity of the vortex/Protoworld which, due to a fluctuation, appeared in the Einstein spacetime. The asymmetry has nothing with an asymmetry in behaviour of matter and antimatter. Due to the duality of relativity, the Universe is about 21.6 Gyr old (Ludwig *et al.* (2009) derived solar ages up to 22.3 Gyr) but we cannot see the initial period about 7.75 Gyr of evolution of the quasars. It is not true that the neutrons in neutron stars behave as a Fermi gas. There are at least three Chandrasekhar limits which leads to supernova explosions without neutron-star remnant. We described also evolution of quasars.

1. The Scale-Symmetric Theory [1]

The General Relativity leads to the non-gravitating Higgs field composed of tachyons [1A]. On the other hand, the Scale-Symmetric Theory (SST) shows that the succeeding phase transitions of such Higgs field lead to the different scales of sizes/energies [1A]. Due to the saturation of interactions via the Higgs field and due to the law of conservation of the half-integral spin that is obligatory for all scales, there consequently appear the superluminal binary systems of closed strings (entanglons) responsible for the quantum entanglement (it is the quantum-entanglement scale), stable neutrinos and luminal neutrino-antineutrino pairs which are the components of the luminal Einstein spacetime (it is the Planck scale), cores of baryons (it is the electric-charges scale), and the cosmic structures (protoworlds; it is the cosmological scale) that evolution leads to the dark matter, dark energy and expanding universes (the "soft" big bangs) [1A], [1B]. The non-gravitating tachyons have infinitesimal spin so all listed structures have internal helicity (helicities) which distinguishes particles from their antiparticles [1A]. SST shows that a fundamental theory should start from infinite nothingness and pieces of space [1A]. Sizes of pieces of space depend on their velocities [1A]. The inflation field started as the liquid-like field composed of non-gravitating pieces of space [1A]. Cosmoses composed of universes are created because of collisions of big pieces

of space [1A], [1B]. During the inflation, the liquid-like inflation field (the non-gravitating superluminal Higgs field) transformed partially into the luminal Einstein spacetime (the big bang) [1A], [1B]. In our Cosmos, the two-component spacetime is surrounded by timeless wall – it causes that the fundamental constants are invariant [1A], [1B].

SST shows that to obtain results consistent with experimental data, the big piece of space that transformed into the inflation field had before the collision a rotational energy very low in comparison with kinetic energy [1A]. It leads to conclusion that there was low anisotropy of the inflation field i.e. of the expanding superluminal non-gravitating Higgs field. It means that to such field we can apply the Kasner metric, [2], that is a solution to the vacuum Einstein equations so the Ricci tensor always vanishes. The Kasner metric is for an anisotropic cosmos without matter so it is a vacuum solution for the Higgs field. The one of the two semi-symmetrical Kasner solution, $(2/3, 2/3 -1/3)$, we interpret as virtual Higgs cyclones with toroidal and poloidal motions. Such tori appear in the succeeding phase transitions of the Higgs field [1A].

Due to the symmetrical decays of bosons on the equator of the core of baryons, there appears the atom-like structure of baryons described by the Titius-Bode orbits for the nuclear strong interactions [1A].

It is very difficult to detect the neutrino-antineutrino pairs because their resultant weak charge is equal to zero whereas the gravitational mass is very small, about $6.7 \cdot 10^{-67}$ kg [1A]. There are only two species of stable neutrinos (four different neutrinos) and the third unstable tau-"neutrinos" composed of three different stable neutrinos.

Applying 7 parameters only and a few new symmetries we calculated a thousand of basic physical (and mathematical) quantities (there are derived the physical and mathematical constants as well) consistent or very close to experimental data and observational facts (http://vixra.org/author/sylwester_kornowski). In SST there do not appear approximations, mathematical tricks, and free parameters which are characteristic for the mainstream particle physics and mainstream cosmology.

2. The boundary of our Cosmos [1B], [3]

In the expanding Einstein spacetime, there was an abstract sphere above which the gravitational pressure (it tried to collapse the Einstein spacetime) was higher than the dynamic pressure (it tried to expand the Einstein spacetime). It caused that the Einstein spacetime above the abstract sphere collapsed to stable boundary. There as well appeared a boundary for the inflation-field/Higgs-field. Calculated radius of our Cosmos is about $2.3 \cdot 10^{30}$ m. The two boundaries of the two-component spacetime cause that the basic physical constants are practically invariant.

3. The Protoworld and very early Universe [1B], [3]

The initial inflation field had left-handed angular velocity in relation to velocity of the field as a whole. Due to the collapse of the outer shell of the Einstein spacetime, there appeared the convergent shock wave that created in centre of the Cosmos the left-handed vortex that transformed into the Protoworld. Protoworld consisted of cosmic torus, central condensate and a ring outside the torus [1B]. It was built of nucleons.

The very early Universe was the double cosmic loop composed of disc-shape protogalaxies built of the modified neutron black holes (MNBHs; inside them is not a central singularity but there is a circle with spin speed equal to the speed of light in "vacuum" c). We cannot treat the neutron stars as a Fermi gas so the factors that appear in the Chandrasekhar limit are incorrect. Due to the strong interactions, in the neutron stars, so as well in the MNBHs, there is the lattice with neutrons in its vertices but the nuclear binding energy is frozen inside the neutron stars. The theory of the neutron lattice leads to at least three Chandrasekhar limits i.e.

about 24.8, 11.2 and 1.394 solar masses. The first mass is the mass of neutron black holes, the second is the mass of the SN 1987A supernova and the last mass is the mass of the Type Ia supernovae. They should explode without a neutron-star remnant.

4. The matter-antimatter asymmetry [1B], [3]

Matter differs from antimatter by internal helicity of the tori in fermions. Neutrons, protons and positrons have the left-handed resultant internal helicity whereas antineutrons, antiprotons and electrons have right-handed one. But internal helicity of more massive fermions dominates.

Due to the initial left-handedness of the inflation field, there appeared the left-handed vortex in the Einstein spacetime. In such vortex, there were preferred the transformations of the electron-positron pairs into the proton-electron pairs (and next into neutrons), not into antiproton-positron pairs.

5. Dark matter, dark energy and the exit of the Universe from the black-hole state [1B], [3]

According to SST, the neutrinos are the lightest gravitational masses but the superluminal non-gravitating energy frozen inside a neutrino is equivalent to the gravitational mass of the core of the Protoworld. It causes that the entanglons exchanged between the Einstein-spacetime components the core of Protoworld consist of, can collapse to new neutrino – then the core decays to the neutrino-antineutrino pairs still entangled with the very early Universe. It is the dark matter. It consists of the additional Einstein-spacetime components entangled with expanding visible matter. Initially, there were the inflows of dark matter into the early Universe.

After the core-of-Protoworld→neutrino transition, the virtual pairs decayed to virtual photons moving divergently so the quantum/chaotic behaviour of the virtual pairs transformed into the ordered divergent motions of the virtual photons still entangled with the very early Universe. Such chaotic-behaviour→ordered-divergent-motions transition decreased the dynamic pressure so there appeared the inflows of the free additional neutrino-antineutrino pairs (they interact gravitationally only) into the early Universe.

Due to the inflows of the dark matter and the dark energy into the early Universe, there was the exit of the Universe from its black-hole state.

Due to the inflows of the dark matter and the dark energy into the protogalaxies, the core of each protogalaxy transformed into modified black hole composed of the neutron black holes and neutron stars, whereas the outer neutron black holes transformed into the Population III big stars (the first-generation stars) and next, due to their explosions, into gas composed of ions and electrons.

There were the mergers of protogalaxies. They transformed into the quasars. Typical quasars, due to the four-binary-system symmetry ($N = 2 \cdot 4^d$, where $d = 0, 1, 2, 4, 8, 16$ and 32), had mass equal or eight times greater than binary system of protogalaxies.

Calculated within SST the abundances of the visible matter, dark matter and dark energy are respectively 4.91%, 26.46% and 68.63%.

6. The duality of relativity and age of the Universe [1B], [3]

The speed of light c in 'vacuum' (i.e. in the Higgs field and Einstein spacetime) is the speed in relation to source or a last-interaction object. It is due to the quantum entanglement. Since detectors are the last-interaction objects so they always measure the speed c. But we can see that due to the quantum entanglement, detectors cannot see the duality of relativity i.e. that speed of light cannot be the c simultaneously in relation to all reference frames.

Due to the duality of relativity, the correct age of the Universe is about 21.6 Gyr (Ludwig *et al.* (2009) derived solar ages up to 22.3 Gyr) but we cannot see the initial period about 7.75 Gyr of evolution of the protogalaxies and of their common mergers.

7. The evolution of quasars into spiral and elliptic massive galaxies

The quasars transformed, generally, into the typical massive spiral (a merger of two protogalaxies) and elliptical (a merger of eight binary systems of protogalaxies) galaxies. But due to the duality of relativity, we can see only the late period about 2.5 Gyr of the era of quasars (about 10 Gyr).

Evolution of a quasar is as follows.

Due to the inflows of dark matter and dark energy into the merged protogalaxies, they swell. It causes that the outer shell transforms into torus whereas the central region into the modified black hole composed of modified neutron black holes. The MNBHs in the torus transform into the Population III big stars. The explosions of the Population III supernovae transform them into gas of ions and electrons. The density of dark matter and dark energy was lower in centre of quasar so there still are the neutron stars.

Internal helicity of quasars is defined by both toroidal and poloidal motions in the torus.

Due to the gravitational attraction of the central black hole composed of the neutron stars, there are flows of the gas from the torus towards the very hot accretion disc and next to the Schwarzschild surface of the central black hole.

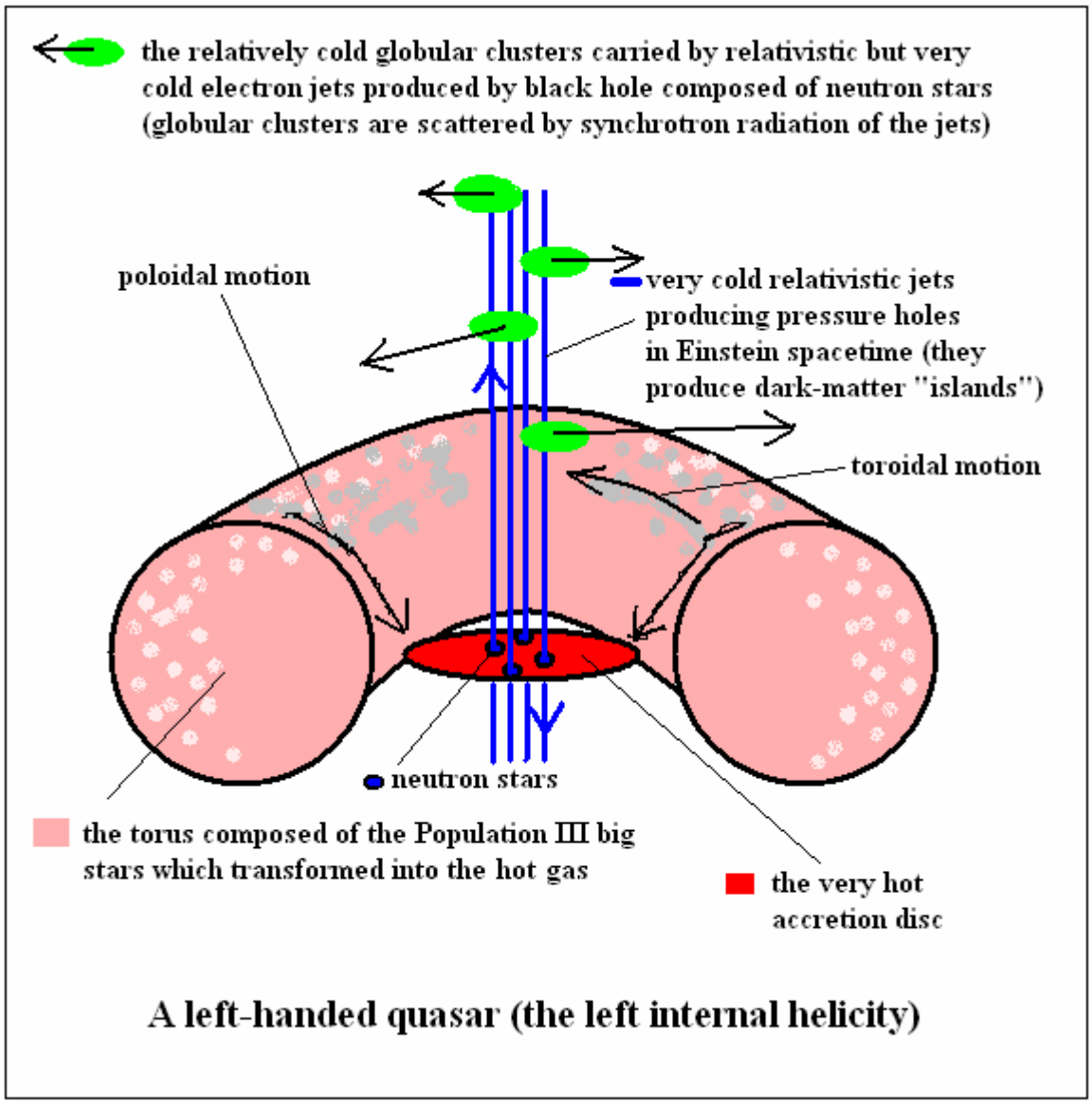
On equators of the neutron stars are produced the energetic loops. They travel towards the poles of the neutron stars and their radius is reduced to the reduced Compton radius of bare electron ($\lambda\!\!\!^{-}_{C,bare\text{-}electron} = 3.8661 \cdot 10^{-13}$ m). Energy of such loop is equal to the rest mass of the electron. But due to the four-binary-systems symmetry, there appear electrons which initial energy is $2 \cdot 4^{32}$ times greater than the rest mass. Due to the lattice inside neutron stars, there is strong spin polarization of neutrons so neutron stars produce very strong collimated magnetic jets. The very energetic electrons are moving helically along the magnetic jets so they produce the synchrotron radiation in directions almost perpendicular to the magnetic jets.

Within SST we described dynamics of the modified black holes [4]. They produce specific flows in the Einstein spacetime. The advection that follows from the weak interactions of the flowing Einstein spacetime and visible matter causes that the magnetic jets carry the clouds of plasma composed of the highly ionized gas. Such clouds, due to the synchrotron radiation, are dispersed in directions perpendicular to the magnetic jets. Next, they transform into the globular clusters composed of the Population II stars only. We can see that today the old globular clusters should orbit centres of the massive galaxies and their orbits should lie in the halos of the massive galaxies. We should distinguish such old globular clusters from other globular clusters which contain as well the Population I stars so they are younger. In reality, such younger globular clusters are the satellite dwarf galaxies consumed by massive galaxies. The dwarf galaxies and satellite dwarf galaxies appeared due to the initial explosions of the protogalaxies [3]. The upper limit for mass of the old globular clusters depends on mass of quasar and is greater for more massive quasar. The calculated upper limit for mass of the old globular clusters in the Milky-Way Galaxy is 155,200 solar masses.

The electron magnetic jets are relativistic but in them the thermal motions are reduced almost to zero so they are the cold regions in the Universe. They as well cool down the carried old globular clusters. We can see that in the old globular clusters, due to the cooling, there appeared the stars that are the oldest observed stars.

Notice that the motions of nuclear plasma from the torus, via accretion disc, via magnetic jets to the old globular clusters, cool down quasars.

The initially coherent synchrotron radiation is scattered by the old globular clusters so we should observe incoherent radiation.



8. The dark matter and filaments in the large-structure of the Universe

The dark matter consists of the additional Einstein-spacetime components entangled with visible matter. Ordered motions of baryonic plasma (there were the orbital motions in the protogalaxies and the filamental motions between quasars along the jets in very early Universe) produced ordered motions of the dark matter so there appeared loops and filaments composed of the dark matter which are entangled with matter. Due to the expansion of the Universe, sizes of the loops and filaments of the dark matter increased. The dark-matter loops in rotating galaxies cause that there appear the dark-matter orbital speeds of stars.

9. Summary

There are the big differences between the new cosmology and the mainstream cosmology. New cosmology shows as follows.

A. Due to the shock wave that appeared at the end of the inflation and the left-handedness of the Higgs field, there appeared the protogalaxies already before the expansion of the Universe (before the “soft” big bang). Due to the four-object symmetry and quantum

entanglement, the protogalaxies were grouped in larger structures already before the expansion of the Universe.

B. The inflation (the big bang) was separated in time from the beginning of expansion of the Universe (the "soft" big bang).

C. Due to the duality of relativity, we cannot see the initial period about 7.75 Gyr of evolution of quasars but it is true that the most distant galaxies are in time distance about 13.866 ± 0.096 Gyr.

D. It is not true that the neutrons in neutron stars behave as a Fermi gas – neutron stars behave as ferromagnetic crystals. There are at least three Chandrasekhar limits which leads to supernova explosions without neutron-star remnant.

E. There are not in existence black holes with a central singularity but there are in existence the MBHs composed of MNBHs – in such black holes there is a circle with spin speed equal to c.

F. Dark energy and dark matter do not consist of some exotic particles. Dark matter consists of additional Einstein-spacetime components entangled with visible matter whereas dark energy as well consists of additional Einstein-spacetime components but they are not entangled with matter.

G. It is not true that the matter-antimatter asymmetry follows from asymmetry in behaviour of matter and antimatter. The asymmetry follows from different behaviour of matter and antimatter in fields having internal helicity.

H. We cannot unify within the same methods gravity with the Standard-Model interactions because there are the two very different spacetimes i.e. the superluminal non-gravitating Higgs field associated with gravitational fields and the luminal gravitating Einstein spacetime associated with the Standard-Model interactions.

I. It is not true that the two-component spacetime is still expanding. There must be the two stable boundaries of our Cosmos because only then the fundamental physical constants can be practically invariant. There expand the visible matter, dark matter, dark energy (maximum mean radial speed is $0.6415c$) and CMB (maximum radial speed is c).

References

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