The Einstein-Spacetime, Dark-Energy and Dark-Matter Particle and the Higgs Boson

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Abstract: Here, applying the Scale-Symmetric Theory (SST), we showed the origin of the Einstein-spacetime, dark-energy and dark-matter particle. Such particle carries unitary spin and very small gravitational mass. It is the neutrino-antineutrino pair which we will refer to as the Planck boson. The superluminal non-gravitating energy frozen in the Planck boson is about 119 powers of ten higher than its gravitational mass. Detection of the neutrino-antineutrino pairs is much difficult than neutrinos because their resultant weak charge is equal to zero. The different properties of dark energy and dark matter follow from the quantum entanglement. Emphasize that the particle associated with the Einstein spacetime, dark matter and dark energy is the same particle so there should be some phenomena that distinguish the dark matter from dark energy. The obtained here theoretical results for abundances in the today Universe (i.e. for visible matter we obtained 4.91%, for dark matter 26.46%, for dark energy 68.63%) and the ratio of dark and visible matter 5.389, are consistent with the Planck results (CMB + lensing) at the 68% levels. The Higgs boson with a mass of 125 GeV is not the Standard Model particle associated with the Higgs mechanism. Such Higgs boson is the condensate composed of confined Einstein-spacetime components (it is due to the Mexican-hat mechanism) so it is the composite Higgs boson. The real Higgs mechanism describing the transition from the non-gravitating tachyons/pieces-of-space the Higgs field consists of to the lightest gravitating objects, i.e. to the stable neutrinos all Principle-of-Equivalence particles consist of, is beyond the Standard Model and General Relativity. Such mechanism is described within SST.

1. Introduction

Within the Standard Model we still cannot calculate exact masses and spin of nucleons from the initial conditions (since 1964). On the other hand, within the Cosmological Standard Model we cannot define properties of the dark matter and dark energy and calculate their abundances from some initial conditions. We as well do not understand the origin of physical constants and applied in physics mathematical constants. It suggests that the two leading mainstream theories, i.e. the Quantum Physics and General Theory of Relativity, are the incomplete theories and that there should be a theory superior to these two theories. Such theory should lead to initial conditions applied in these two theories and should describe the lacking part of the Theory of Everything. We showed that the Scale-Symmetric Theory described in tens of papers (http://vixra.org/author/sylwester_kornowski) is the lacking part.

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]. There are only two species of stable neutrinos, i.e. the electron-neutrino and muon-neutrino, whereas the third unstable tau-"neutrino" consists of three different stable neutrinos [1A].

Applying 7 parameters only and a few new symmetries, [1A], 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. In SST there do not appear approximations, mathematical tricks, and free parameters which are characteristic for the mainstream particle physics and mainstream cosmology.

The Scale-Symmetric Theory shows that the components of the Einstein spacetime, dark energy and dark matter are the same – they are the neutrino-antineutrino pairs. The neutrinos in a pair carry opposite weak charges. Spins of neutrinos in a pair are parallel so the spin of pairs is unitary. The pairs are as well the carriers of the rotational energies i.e. they are the carriers of photons and gluons (photons behave as gluons in strong fields i.e. in fields with internal helicity) [1A]. The free neutrino-antineutrino pairs interact gravitationally only but they can be entangled and/or confined. But resultant weak charge of a pair is equal to zero whereas gravitational mass is very small (about $6.7 \cdot 10^{-67}$ kg [1A]) so a detection of the neutrino-antineutrino pairs is much difficult than the neutrinos. It is the reason that we still cannot detect them.

The mean distance between the Einstein-spacetime components causes that the neutrino-antineutrino pairs interact first of all gravitationally but small changes in the mean distance causes that the components can be confined due to the Mexican-hat mechanism [1A]. The two shortest mean distances (about 2π or $2\pi/3$ times the radius of neutrino) lead to the very stable shortest-distance entanglement. Both the confinement and shortest-distance entanglement cause that in the Einstein spacetime appear condensates and other structures with shifted mass density. Mass of such regions can be measured.

The very high dynamic pressure (about 10^{45} Pa [1A]) causes that distribution of the Einstein-spacetime components is practically smooth in the whole Cosmos (size of the Cosmos is about 10,000 times greater than the today size of our Universe [1B]). The ground state of the Einstein spacetime is perfectly symmetrical i.e. number of all types of stable neutrinos is the same i.e. there is perfect matter-antimatter symmetry. Such symmetric Einstein spacetime appeared during the inflation due to the succeeding phase transitions of the superluminal non-gravitating Higgs field.

The dark matter and dark-matter structures consist of the additional Einstein-spacetime components entangled with visible matter (it is the long-distance entanglement). We cannot distinguish the Einstein-spacetime components from the dark-matter components but the dark-matter field which fills our Universe is asymmetrical i.e. there is more the electron-antineutrinos [1B]. The asymmetrical dark matter appeared before the expansion of the Universe. Due to the fluctuations of the Einstein spacetime, there at first appeared a vortex with left-handed internal helicity that transformed into the Protoworld (it consisted of the cosmic torus and central condensate (it was the core of the Protoworld) and a ring outside the torus all composed of nucleons and electrons) – it was the precursor of our Universe that appeared inside the cosmic torus as the double cosmic loop composed of protogalaxies built of the neutron black holes [1B]. Contrary to the antineutrons, the neutrons have left-handed internal helicity so the collapsing vortex produced more neutrons than antineutrons – it created the matter-antimatter asymmetry [1B]. SST shows that the non-gravitating energy frozen inside stable neutrino is tremendous and is equivalent to the gravitational mass of the core of Protoworld. Due to the core-of-Protoworld→new-neutrino transition, the core transformed into the dark matter i.e. into the neutrino-antineutrino pairs still entangled with the early Universe. But in the beta decays appear the electron-antineutrinos so their number in the dark matter is greater than the other types of neutrinos. It is the matter-antimatter asymmetry in the dark matter. This asymmetry causes that in the Universe lifetimes of particles and antiparticles are not the same (the same concerns the neutron-antineutron asymmetry).

The virtual particles produced by the Protoworld decayed to the virtual photons moving divergently. Such ordered motions in the Einstein spacetime decreased its dynamic pressure so there were the inflows of additional free Einstein-spacetime components – it is the dark energy.

The inflows of the dark matter and dark energy into the cosmic double loop, i.e. into the very early Universe, caused the exit of the Universe from its black-hole state.

The rotating baryonic plasma in protogalaxies produced concentric circles composed of the entangled neutrino-antineutrino pairs – they are the dark-matter structures. Such ordered motions decreased local dynamic pressure in the Einstein spacetime so there were the inflows of the Einstein-spacetime components that increased local mass density. It concerns as well the linear motions of baryonic plasma between the early quasars. Due to the expansion of the Universe, the sizes of the dark-matter structures increased. We can see that the ordered motions create the “islands” (mass > 0) and mass “holes” (mass < 0) or loops and filaments with positive mass and associated with them regions with negative mass. The mean ratio of the masses of the dark matter and of the visible matter is equal to the ratio of the masses of the core of the Protoworld and of the very early Universe – it is about 5.4 [1B].

Here we calculated the abundance of the visible matter, dark matter and dark energy at the beginning of the expansion of the Universe and the today abundances.

The Higgs boson is not the Standard Model particle associated with the Higgs mechanism – it is the condensate of the confined Einstein-spacetime components. The mass of the Principle-of-Equivalence particles (they consist of the entangled and/or confined neutrino-antineutrino pairs and neutrinos) follows from the gravitational mass of neutrinos.

The real Higgs mechanism describing the transition from the non-gravitating tachyons/pieces-of-space the Higgs field consists of to the lightest gravitating objects, i.e. to the stable neutrinos all Principle-of-Equivalence particles consist of, is beyond the Standard Model and General Relativity. Such mechanism is described within SST.

2. Calculations

According to the SST, the Protoworld was self-similar/dual to proton (the core of proton consists of torus and the condensate in its centre; outside the core is the relativistic pion in the $d = 1$ state) whereas the core of the Protoworld (i.e. the cosmic torus plus the condensate in its centre) was dual to stable neutrinos.

The cosmic-double-loop/very-early-Universe was an analog to the double large loop (it is the neutral pion) produced in the core of baryons that is responsible for the nuclear strong interactions [1A].

Mass of the core of proton is $H^+ = 727.44$ MeV, [1A], whereas mass of the core of the Protoworld was $M_{Dark\text{-}Matter} = 1.961 \cdot 10^{52}$ kg [1B]. Mass of the neutral pion is $m_{pion(o)} = 134.9766$ MeV so the mass of the double-cosmic-loop/very-early-Universe, $M_{Visible\text{-}Matter}$, is

$$M_{Visible\text{-}Matter} = M_{Dark\text{-}Matter}\, m_{pion(o)} / H^+ = 3.6386 \cdot 10^{51} \text{ kg}. \quad (1)$$

Mass of the relativistic charged pion in the $d = 1$ state in proton is $W_{Rel,pion(-)} = 215.760$ MeV [1A]. An cosmic analog to it, W_{CA}, has mass

$$W_{CA} = M_{Dark\text{-}Matter}\, W_{Rel,pion(-)} / H^+ = 5.8164 \cdot 10^{51} \text{ kg}. \quad (2)$$

Due to the very strong gravitational interactions, the mass W_{CA} was destroyed to photons and neutrinos. We can separate the rest mass, $W_{CA,Rest(o),Photons}$ (it is the energy of the photons), from the W_{CA}

$$W_{CA,Rest(o),Photons} = M_{Dark\text{-}Matter}\, m_{pion(o)} / H^+ = M_{Visible\text{-}Matter}. \quad (3)$$

The remnant is the energy of neutrinos $W_{CA,Remnant,Neutrinos}$

$$W_{CA,Remnant,Neutrinos} = M_{Dark\text{-}Matter}\, (W_{Rel,pion(-)} - m_{pion(o)}) / H^+ = 2.1777 \cdot 10^{51} \text{ kg}. \quad (4)$$

Calculate abundances of matter and energy in the Universe when the CMB was released. The total energy was

$$E_{T,beginning} = M_{Dark\text{-}Matter} + M_{Visible\text{-}Matter} + W_{CA} = 2.9065 \cdot 10^{52} \text{ kg}. \quad (5)$$

The percentage of the dark matter was

$$Dark\ matter = 100\%\ M_{Dark\text{-}Matter} / E_{T,beginning} \approx 67.5\ \%. \qquad (6)$$

The percentage of the visible matter (atoms) was

$$Visible\ matter\ (atoms) = 100\%\ M_{Visible\text{-}Matter} / E_{T,beginning} \approx 12.5\ \%. \qquad (7)$$

The percentage of the photons was

$$Photons = 100\%\ W_{CA,Rest(o),Photons} / E_{T,beginning} \approx 12.5\ \%. \qquad (8)$$

The percentage of the neutrinos was

$$Neutrinos = 100\%\ W_{CA,Remnant,Neutrinos} / E_{T,beginning} \approx 7.5\ \%. \qquad (9)$$

Calculate abundances of matter and energy in the today Universe. We assume the same ratio of expansion of all components (virtual photons are still entangled with visible matter whereas dark energy appears because the ordered motions produce lowered pressure in the field composed of virtual photons). According to the SST, the sum of absolute energies of virtual particles is two times greater than mass of bare particle [1A], [3]. The Protoworld had mass

$$M_{Bare\text{-}Protoworld} = M_{Dark\text{-}Matter} + W_{CA}. \qquad (10)$$

This leads to conclusion that the dark energy outside the bare Protoworld, so as well outside the CMB, was

$$E_{Dark\text{-}Energy} = 2\ M_{Bare\text{-}Protoworld} = 5.0853 \cdot 10^{52}\ \text{kg}. \qquad (11)$$

The photons (formula (8)) and neutrinos (formula (9)) are today on the front of the expanding Universe so we can neglect them in the calculations concerning the today distribution. It leads to conclusion that today the total energy is

$$E_{T,today} = M_{Visible\text{-}Matter} + M_{Dark\text{-}Matter} + E_{Dark\text{-}Energy} = 7.4101 \cdot 10^{52}\ \text{kg}. \qquad (12)$$

The today percentage of the visible matter is

$$Visible\ matter\ (today) = 100\%\ M_{Visible\text{-}Matter} / E_{T,today} \approx 4.91\ \%. \qquad (13)$$

The today percentage of the dark matter is

$$Dark\ matter\ (today) = 100\%\ M_{Dark\text{-}Matter} / E_{T,today} \approx 26.46\ \%. \qquad (14)$$

The today percentage of the dark energy is

$$Dark\ energy\ (today) = 100\%\ E_{Dark\text{-}Energy} / E_{T,today} \approx 68.63\ \%. \qquad (15)$$

Today the ratio R of the dark and visible matter is

$$R = 26.46 / 4.91 \approx 5.389. \quad (16)$$

We can see that the theoretical results are consistent with the Planck results (CMB + lensing) at the $68\ \%$ limits [4].

3. Summary

Here, applying the Scale-Symmetric Theory (SST), we showed the origin of the Einstein-spacetime, dark-energy and dark-matter particle. Such particle carries unitary spin and very small gravitational mass. It is the neutrino-antineutrino pair which we will refer to as the Planck boson. The superluminal non-gravitating energy frozen in the Planck boson is about $0.6 \cdot 10^{119}$ higher than its gravitational mass. Detection of the neutrino-antineutrino pairs is much difficult than neutrinos because their resultant weak charge is equal to zero.

The different properties of dark energy and dark matter follow from the quantum entanglement. Emphasize that the particle associated with the Einstein spacetime, dark matter and dark energy is the same particle so there should be some phenomena that distinguish the dark matter from dark energy. SST shows that the dark matter is entangled with visible matter (there appear also the dark-matter structures) whereas dark energy interacts gravitationally only. Dark matter is the remnant of the core of Protoworld that appeared after the inflation – the Protoworld created the very early Universe. The divergent motions of virtual photons (i.e. the ordered motions) decreased dynamic pressure in the Einstein spacetime so there were inflows of additional Einstein-spacetime components that interact gravitationally only.

The obtained here theoretical results for abundances in the today Universe (i.e. for visible matter we obtained 4.91%, for dark matter 26.46%, for dark energy 68.63%) and the ratio of dark and visible matter 5.389, are consistent with the Planck results (CMB + lensing) at the 68% levels.

The Higgs boson with a mass of $125\ \mathrm{GeV}$ is not the Standard Model particle associated with the Higgs mechanism. Such Higgs boson is the condensate composed of confined Einstein-spacetime components (it is due to the Mexican-hat mechanism) so it is the composite Higgs boson. The real Higgs mechanism describing the transition from the non-gravitating tachyons/pieces-of-space the Higgs field consists of to the lightest gravitating objects, i.e. to the stable neutrinos all Principle-of-Equivalence particles consist of, is beyond the Standard Model and General Relativity. Such mechanism is described within SST.

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