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

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Abstract: Here, on the basis of the Scale-Symmetric Physics (S-SP), are the short remarks concerning 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 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 can appear different interpretations. The obtained here theoretical results for the today Universe: visible matter 4.91%, dark matter 26.46%, 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 is not the Standard Model particle associated with the Higgs mechanism. The Higgs boson is the condensate composed of confined Einstein-spacetime components (it is due to the Mexican-hat mechanism). The mechanism describing the transition from gravitationally massless pieces of space to the gravitational mass of neutrinos all Principle-of-Equivalence particles consist of is beyond the Standard Model and General Relativity. Such mechanism is described within S-SP.

1. Introduction

The Scale-Symmetric Physics (S-SP), [1], 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). The pairs interact gravitationally and weakly. But resultant weak charge of a pair is equal to zero whereas gravitational mass is very small (about $6.7 \cdot 10^{-67}$ kg) 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 interact weakly as well – due to the Mexican-hat mechanism, there appears the confinement. The shortest mean distances (about 2π or 2π/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 with shifted mass density. Mass of such regions can be measured.

The very high dynamic pressure (about 10^{45} Pa) causes that distribution of the Einstein-spacetime components is smooth in the whole Cosmos (size of the Cosmos is about 10,000 times greater than the today size of our Universe). The ground state of the Einstein spacetime is perfectly symmetrical i.e. number of all types of 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 gravitationally massless pieces of space (the Cosmos is the result of collision of two very big pieces of space).

The dark matter consists of the additional Einstein-spacetime components entangled with matter (it is the long-distance entanglement) and they as well interact first of all gravitationally. 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. 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 – it was the precursor of our Universe. 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. Due to some phase transition described within S-SP, some neutrons decayed to the neutrino-antineutrino pairs the dark matter consists of. 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 dark matter had caused that the remaining vortex started to expand – there appeared the smaller vortices which at the beginning of the expansion were the baryonic-plasma vortices.

Due to the ordered motions of baryonic plasma in vortices and between them, there as well appeared the ordered motions in the dark matter which is entangled with matter. In such ordered motions, the neutrino-antineutrino pairs were entangled i.e. between them were exchanged the superluminal binary systems of closed strings (the entanglons) the neutrino-antineutrino pairs consist of. Such ordered motions decrease local dynamic pressure so in the Einstein spacetime and the dark matter appear flows which create simultaneously the ‘islands’ (mass > 0) and mass ‘holes’ (mass < 0) or loops with positive mass and associated with them regions with negative mass. Such islands, mass holes, loops and regions consist as well of the non-entangled neutrino-antineutrino pairs interacting first of all gravitationally as it is in the Einstein spacetime and dark matter. The dark matter consists of such structures i.e. of the islands/gravitational-lenses and concentric loops in rotating galaxies which lead to the dark-matter motions of stars. We can say that dark matter consists of the islands and loops produced in the Einstein spacetime and dark matter due to the ordered motions of entangled neutrino-antineutrino pairs. But the ordered flows of the entangled Einstein-spacetime components produce as well the mass holes and loops with negative mass composed of non-entangled Einstein-spacetime components so the resultant contribution of the mass of dark matter to the mass of the Universe is equal to the mass of the dark matter at the beginning of expansion of the Universe.

The initial left-handed vortex at first transformed into the Protoworld – it was the cosmic left-handed torus, the central condensate and the mass outside it (proton is a miniature of the Protoworld). The very early Universe was the double cosmic loop which appeared inside the torus. All listed cosmic objects were built of nucleons and electrons. Near the Protoworld appeared the field composed of the virtual electron-positron pairs. Such pairs look as the real pairs but they are placed in regions of the Einstein spacetime with lowered mass density. When the core of the Protoworld transformed into the dark matter, the virtual pairs decayed to virtual photons. The pairs were polarized so after the transition, generally, the velocities of the virtual photons were tangent to concentric spheres with centre overlapping with the centre of the Protoworld. Such ordered 'spherical' motions decreased dynamic pressure in the Einstein spacetime inside and near to the Protoworld. It caused the inflow of the non-entangled Einstein-spacetime components from outside of the Protoworld – the additional non-entangled Einstein-spacetime components are the components of the dark energy. The field of the virtual pairs was smooth so it as well concerns the dark energy.

Here we calculated the abundance of the baryonic 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 mechanism describing the transformation of the gravitationally massless pieces of space into the gravitational mass of neutrinos is beyond the Standard Model and General Relativity – such mechanism is described within the S-SP.

2. Calculations

According to the S-SP, due to the succeeding phase transitions of the modified Higgs field (I refer it to as the Newtonian spacetime also), the cosmic structure before the expansion of the Universe (i.e. the Protoworld) was 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 neutrinos.

The very early Universe was the double cosmic loop which was created inside the cosmic torus which was the part of the core of the Protoworld. Such cosmic-loop/very-early-Universe was an analog to the large loop produced in the core of baryons which is responsible for the strong interactions. Neutral pion consists of two such large loops. In my previous papers I assumed that there was produced one cosmic loop whereas in this paper we assume that the very early Universe was an analog to the neutral pion i.e. that there was produced a binary system of cosmic loops (double cosmic loop).

Mass of the core of proton is $H^+ = 727.44$ MeV whereas mass of the core of the Protoworld was $M_{Dark\text{-}Matter} = 1.961 \cdot 10^{52}$ kg ([2]: formula (164)). Mass of the neutral pion is $m_{pion(o)} = 134.9766$ MeV so the mass of the binary system of cosmic loops (the 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 ([2]: Table 1). 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}

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

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

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

Estimate distribution of matter and energy in the Universe when the CMB was released. The total energy was

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

The percentage of the dark matter was

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

The percentage of the visible matter (atoms) was

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

The percentage of the photons was

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

The percentage of the neutrinos was

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

Estimate distribution of matter and energy in the today Universe. We assume the same ratio of expansion of all components. According to the S-SP the virtual pairs (we neglect the negative mass of the mass holes [3]) have energy two times greater than mass of bare particle. The Protoworld had mass

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

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

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

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

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

The today percentage of the visible matter is

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

The today percentage of the dark matter is

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

The today percentage of the dark energy is

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

Today the ratio R of the dark and visible matter is

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

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

3. Summary

The Einstein-spacetime components, dark-matter components and dark-energy components are the same. They are the neutrino-antineutrino pairs which we refer to as the Planck bosons. The superluminal energy frozen in the Planck boson is about $0.6 \cdot 10^{119}$ times higher than its gravitational mass.

The Einstein-spacetime components are the gravitationally interacting neutrino-antineutrino pairs (smaller mean distances lead to confinement and shortest-distance entanglement) – their distribution is very smooth but there can appear the cosmic fluctuations. The pairs can be entangled (range of entanglement can change) or confined (due to the Mexican-hat mechanism).

The dark energy consists of additional non-entangled Einstein-spacetime components – its distribution is smooth.

Dark matter consists of the islands and loops composed of the additional Einstein-spacetime components entangled with baryonic matter. The dark-matter islands and loops appear due to the flows forced by the negative dynamic pressure produced by ordered motions of additional entangled Einstein-spacetime components i.e. motions of the dark matter. Such entanglement was and is produced by ordered motions of baryonic plasma. Due to the expansion of the Universe, the sizes of the dark-matter loops increased. Notice that the regions with lowered dynamic pressure attracted the baryonic plasma as well.

Emphasize that the particle associated with the Einstein spacetime, dark matter and dark energy is the same particle so there can appear different interpretations.

The obtained theoretical results for the today Universe: visible matter 4.91%, dark matter 26.46%, 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 is not the Standard Model particle associated with the Higgs mechanism.

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