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The Hubble Constant in the Scale-Symmetric Theory

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Abstract: The Scale-Symmetric Theory (SST) shows that the quantum entanglement fixes the speed of light in "vacuum" 'c' as the relative radial speed of photons in relation to their sources or a last-interaction object (it can be a detector) - such is the correct interpretation of the Michelson-Morley experiment. It causes that in cosmology, generally, the spatial distances to galaxies differ from time distances concerning the speed c - it is the duality of relativity. The duality of relativity causes that there appear the two different Hubble constants, i.e. the real Hubble constant that is 45.24 and the Special-Relativity Hubble constant that is 70.52. Moreover, at the beginning of expansion of the Universe there appeared the cascades of protuberances of the dark matter and dark energy carrying the protogalaxies. The dampened protuberances led to the redshift higher and much higher than the mean redshift z = 0.6415 characteristic for the front of the expanding baryonic matter. SST shows that the protuberant redshift behaves similar to the gravitational redshift. Notice as well that the protuberances led to the observed untypical radial motions of groups of protogalaxies that we can observe - they do not follow from a gravitational attraction by some mass external to the expanding Universe. SST shows that spacetime does not expand - there expand the dark matter and dark energy. The acceleration of expansion of the Universe is an illusion that follows from the duality of relativity.

Introduction and motivation

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 [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, stable neutrinos and luminal neutrino-antineutrino pairs which are the components of the luminal Einstein spacetime (it is the Planck scale), cores of baryons, and the cosmic structures (protoworlds) that evolution leads to the dark matter, dark energy and expanding universes [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 [1A]. In our Cosmos, the two-component spacetime is surrounded by timeless wall – it causes that the fundamental constants are invariant [1A], [1B].

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].

The Scale-Symmetric Theory (SST) shows that the quantum entanglement fixes the speed of light in "vacuum" c as the relative radial speed of photons in relation to their sources or a last-interaction object (it can be a detector) - such is the correct interpretation of the Michelson-Morley experiment [1B], [3]. It causes that in cosmology, generally, the spatial distances to galaxies differ from time distances concerning the speed c – it is the duality of relativity [2], [3]. The duality of relativity causes that there appear the two different Hubble constants, i.e. the real Hubble constant that is $H_{Real} = H_{SST,mean} = 45.24$ and the Special-Relativity Hubble constant that is $H_{SR} = H_{SST,duality} = 70.52$ [2].

Moreover, at the beginning of expansion of the Universe there appeared the cascades of protuberances of the dark matter and dark energy carrying the protogalaxies [1B], [3] (in paper [3] is described the origin of the kinematical redshift higher than 1). The dampened protuberances led to the redshift higher and much higher than the mean redshift $z = 0.6415$ characteristic for the front of the expanding baryonic matter [1B]. SST shows that the protuberant redshift behaves similar to the gravitational redshift [2].

Notice as well that the protuberances led to the observed untypical radial motions of groups of protogalaxies that we can observe - they do not follow from a gravitational attraction by some mass external to the expanding Universe.

SST shows that spacetime does not expand - there expand the dark matter and dark energy [1B].

The acceleration of expansion of the Universe is an illusion that follows from the duality of relativity [4].

The Hubble constant is defined as the ratio of a change in radial speed Δv of two cosmological structures (expressed in km/s) to radial distance ΔL between them (expressed in Mpc)

$$H = \Delta v / \Delta L. \tag{1}$$

The correct age of the Universe is $T_{Universe} = 21.614 \pm 0.096$ Gyr = 6626.8 Mpc [5], [1B], (calculated within SST the time distance to most distant galaxies is close to 13.866 ± 0.096 Gyr = 4251.3 Mpc [1B]) and the front of CMB has radial speed $c = 2.9979 \cdot 10^5$ km/s [1B] ($z = 1$) so the real Hubble constant H_{Real} we can calculate from following formula

$$H_{Real} = \Delta v / \Delta L = c\, z / T_{Universe} = 45.24 \text{ [km s}^{-1}\text{ Mpc}^{-1}\text{]}. \tag{2}$$

Value of the Hubble constant depends on method we use and on phenomena that we take into account. Generally, when we neglect expansion of spacetime (SST shows that today spacetime does not expand but it does not concern the dark matter, dark energy, and visible matter [1B]) and when we use the formula for the Special-Relativity redshift then, due to the initial protuberances of the dark matter and dark energy [2B], the maximum Special-Relativity redshift is very close to 1. On the other hand, SST shows that the time distance (not the spatial distance) to the galaxies with highest observed redshift is close to 13.866 ± 0.096 Gyr – this time distance is consistent with the spatial radius of the Universe calculated within the mainstream cosmology ($R_{spatial,mainstream} \approx 13.8$ Gyr = 4230 Mpc). Emphasize once more that when we use the invalid in cosmology formula for Special-Relativity redshift ($z_{SR} = (z^2 + 2z) / (z^2 + 2z + 2)$) and the incorrect spatial distance to the most distant observed galaxies (SST shows that due to the duality of relativity, such spatial distance is in reality the time distance) then calculated redshift is

$$H_{mainstream} = c / R_{spatial,mainstream} \approx 70.9 \text{ km s}^{-1} \text{ Mpc}^{-1}. \quad (3)$$

On the other hand, the SST shows that the spatial distance to the front of the CMB is $L_{SST,CMB\text{-}spatial} = 21.614 \pm 0.096$ Gyr and that radial speed is equal to the c, i.e. $v_{R\text{-}CMB} = c$, whereas the time distance to the observed front of the expanding baryonic matter is $L_{SST,baryonic\text{-}time} = 13.866 \pm 0.096$ Gyr and that the mean radial speed of it is $v_{R\text{-}baryonic} = 0.6415c$, [1B], so the mean SST Hubble constant is

$$H_{Real} = H_{SST,mean} = c / L_{SST,CMB\text{-}spatial} = v_{R\text{-}baryonic} / L_{SST,baryonic\text{-}time} \approx \approx 45.24 \text{ km s}^{-1} \text{ Mpc}^{-1}. \quad (4)$$

Notice as well that when we use the SST spatial distance to the front of the baryonic matter $L_{SST,baryonic\text{-}spatial} \approx 4.971$ Gyr (see formula (10) in following paper [2]) and the mean relative radial speed of light emitted by most distant observed galaxies in relation to Earth: $v_{R\text{-}photons,SST} = (c - v_{R\text{-}baryonic}) = 0.3585c$ [2], then we obtain

$$H_{SST,duality} = v_{R\text{-}photons,SST} / L_{SST,baryonic\text{-}spatial} \approx 70.52 \text{ km s}^{-1} \text{ Mpc}^{-1}. \quad (5)$$

This value is close to the mainstream Hubble constant i.e. $H_{SST,duality} \approx H_{mainstream}$.

We must emphasize that the dynamics of the Universe by using the kinematical redshift and the protuberant/"gravitational" redshift is only an approximate/averaging/rough description of the real dynamics. Protuberant redshift is important for regions close to the front of the expanding baryonic matter (according to SST it is for observed redshift higher than about 0.53 [4]). For such redshift we should observe some departure from the mean Hubble constant defined by formula (4) or (5).

References

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