An Illusion of Acceleration and Deceleration of Expansion of the Observed Universe

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Abstract: Here, applying the lacking part of ultimate theory, i.e. the Scale-Symmetric Theory (S-ST), I described phenomena that lead to an illusion of acceleration of expansion of the Universe for z > 0.45 and of deceleration for z > 0.60. We cannot neglect both the gravitational redshift for z > = 0.53 and the duality of relativity. The derived formulae for time distance between source and observer, give the time distances greater than calculated within the mainstream cosmology (for z = 0.45 is about 30%). On the other hand, the distances of the Type Ia supernovae were, on average, 10% to 15% farther than expected. This means that the Type Ia supernovae are fainter than they should be not due to an acceleration of expansion but due to inaccurate formula for time distance applied in the mainstream cosmology. Correctness of the new formula follows from the fact that calculated maximum redshift is z = 11.9. This value is consistent with the present-day observational facts (the maximum is z = 11.8 +- 0.3 for the candidate protogalaxy UDFj-39546284). Due to the dominant decay of entangled photons about 6.5 Gyr ago, due to the duality of relativity, and due to the gravitational redshift for compact cosmological objects, it is very difficult to calculate within the mainstream cosmology the exact time distances on the base of the explosions of the Type Ia supernovae. The uncertainty is much higher than the assumed about 5%.

1. Introduction

The Scale-Symmetric Theory (S-ST) shows that due to the quantum entanglement, the interpretation of the Michelson-Morley experiment is incorrect [1]. Due to the quantum entanglement, the speed of light in 'vacuum' c is the speed in relation to source-emitter of the light or in relation to a last-interaction object. The detectors are the last-interaction objects so they cannot 'detect' the duality of relativity i.e. detectors cannot see that a photon cannot have simultaneously the speed c in relation to all reference frames. For quantum entanglement are responsible the superluminal binary systems of the closed strings, i.e. entanglons (they are the non-Principle-of-Equivalence objects), the Einstein-spacetime components consist of [2].

Here I will prove that some phenomena which follow from the S-ST (they do not appear in the mainstream cosmology) lead to an illusion of acceleration of expansion of the Universe for redshift z > 0.45 and to an illusion of deceleration for redshift z > 0.60.

2. An illusion of acceleration and deceleration of expansion of the Universe

The Scale-Symmetric Theory shows that the most distant galaxies are already 7.75 Gyr old and the time distance to them is 13.866 Gyr [3]. When we neglect the unseen initial 7.75-Gyr period of evolution of galaxies, when we neglect the duality of relativity [1] and gravitational redshift [3] then observed age t of galaxies we can calculate from following formula

$$t = T (1 - z / 0.6415), \tag{1}$$

where T = 13.866 Gyr whereas z is the kinematical redshift and its upper limit (i.e. for most distant galaxies) is z = 0.6415 [2].

The duality of relativity [1] causes that the relative speed of light observed on Earth, emitted by galaxies (due to the quantum entanglement, the speed of emitted light in relation to a galaxy-emitter is always equal to the speed of light in "vacuum" c), changes from v = 0.3585c for most distant galaxies to c for the nearby galaxies. It causes that the galaxies look older than they are. The age of galaxies reduced by 7.75 Gyr, we can calculate from following formula (it follows from the duality of relativity)

$$t_{duality} = T - z T_1 / (1 - z), \tag{2}$$

where $T_1 = 0.3585T/0.6415 = 7.75$ Gyr.

The difference in the age $\Delta t = t_{duality} - t$ is

$$\Delta t = z (T - T_2 z) / (1 - z), \tag{3}$$

where $T_2 = T + T_1 = 21.614$ Gyr.

The derivative of the function (3) leads to the extremum for z = 0.40 and the maximum difference in age is 3.48 Gyr.

The Scale-Symmetric Theory shows that there was the dominant decay of entangled photons about 6.5 Gyr ago (i.e. age which follows from duality is 13.866 – 6.5 ≈ 7.4 Gyr; redshift calculated from formula (2) is z ≈ 0.45) [2]. The entangled photons decayed to smaller photons so probability of emission of radiation energy increased. It causes that for z > 0.45, the Type Ia supernovae are fainter than they should be.

Due to the dominant decay of entangled photons, about 6.5 Gyr ago (they are the mean values), and due to the gravitational redshift for compact cosmological objects, it is very difficult to calculate exact distance to galaxies with redshift higher than 0.45 on the base of the explosions of the Type Ia supernovae. The uncertainty is much higher than the assumed about 5%.

Explosions of the Type Ia supernovae near to Schwarzschild surfaces of the black holes in centres of galaxies as well cause that the supernovae are fainter than they should be. It is important for the distant compact cosmological objects and centres of massive galaxies because for them probability of such explosions is much higher.

But most important is the fact that the relation between the time distance from observer to source and the observed redshift applied in the mainstream cosmology gives too short distances. In reality, the spacetime does not expand, there expands only matter, the dark energy, dark matter and CMB [4]. Moreover, generally, the local radial speeds of the dark matter and cosmic structures are practically the same i.e. in very good approximation the cosmic objects are in the rest in relation to the expanding dark matter. It leads to conclusion that we do not need relativistic formulae – relativistic formulae should lead to wrong conclusions.

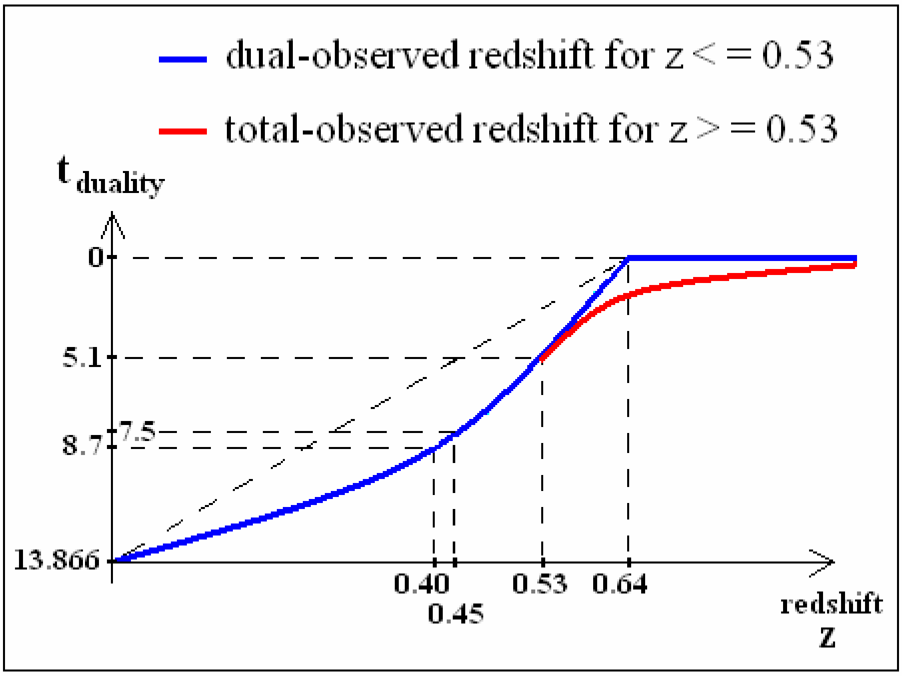
How should look the correct time-distance–observed-redshift relation?

Total-observed redshift, z_T, should be the sum of the dual-kinematical redshift, $z_{K,dual}$, and gravitational redshift, z_G

$$z = z_T = z_{K,dual} + z_G. \tag{4}$$

The time distance from observer to source $L_{K,dual}$ associated with the duality of relativity we can calculate from formula (2)

$$L_{K,dual,z\le 0.53} = T - t_{duality} = z\, T_1 / (1 - z). \tag{5}$$



It is obvious that the gravitational redshift was more important in the earlier Universe. Can we calculate lower limit for gravitational redshift i.e. value below which the gravitational redshift can be neglected? The S-ST shows that the cosmological black holes consist of the neutron black holes [2]. It leads to conclusion that plasma appears above the Schwarzschild surface for the strong interactions in neutrons [2]. Gravitational redshift is zero when on surface of the plasma appear the relativistic neutral pions with mass the same as in the d = 1 state i.e. M = 208.643 MeV ([2]: Table 1). It follows from the fact that due to the d = 1 state, the plasma confines the relativistic pions with a mass M.

Since range of a boson with a mass 187.57 MeV is A + 4B = 2.7048 fm ([2]: see the explanation below formula (32); A = 0.6974425 fm is the external radius of the core of neutron whereas A/B = 1.3898) so range of the mass M is R = 2.4316 fm.

In a good approximation, the neutron black holes are some analogs to spherically symmetric, non-rotating (the Einstein spacetime inside such black hole has the same angular velocity as the black hole so the black hole is in the rest in relation to the spacetime [2]), uncharged black hole. For such black hole, the relation between the gravitational redshift and the radial coordinate of the point of emission, r, looks as follows

$$z_G = \{1 / \mathrm{sqrt}[1 - 2\, G\, M_{BH} / (rc^2)]\} - 1. \tag{6}$$

For the strong black hole of neutron is $GM_{BH}/c^2 = A$ [2] so we can rewrite formula (6) as follows

$$z_G = [1 / \mathrm{sqrt}(1 - 2\,A / r)] - 1. \tag{7}$$

For r = R, we obtain $z_G = 0.53$. It leads to conclusion that for $z_G \le 0.53$, the gravitational redshift is equal to zero, i.e. for the interval $0 \le z_G \le 0.53$ the time distance can be calculated using the formula (5). For $z_G = 0.53$, we obtain time distance $L_{K,dual} = 8.7$ Gyr.

On the other hand, from the cosmological facts follows that for bigger and bigger distances, the same changes in time distance cause greater and greater increases in total redshift. It leads to conclusion that total redshift should depend exponentially on total time distance, L_T, i.e. the relation between the time distance and total redshift should look as follows

$$L_{T,z\ge 0.53} = a \ln(z + 1) + b. \tag{8}$$

Assume that the a is the kinematical age t calculated from formula (1) for $z = 0.53$

$$a = t = T\,(1 - z / 0.6415) = 2.41 \text{ Gyr}. \tag{9}$$

The constant b we can calculate from the condition that for $z = 0.53$ the formulae (5) and (8) must give the same time distance – it leads to $b = 7.71$ Gyr.

Now, we can test whether the formula (8) is correct. Calculate maximum z for the maximum distance $L_T = 13.866$ Gyr – we obtain $z_{max} = 11.9$. Distance can be determined via spectroscopy or using a photometric redshift technique. Spectroscopy is more precise. We know that the maximum photometric redshift is $z = 11.8 \pm 0.3$ – it is for the candidate protogalaxy UDFj-39546284 [5]. It leads to conclusion that obtained here theoretical result, $z_{max} = 11.9$, is so far consistent with observational facts so probability that formula (8) is correct is very high.

Now we can compare the results obtained using the formulae (5) and (8) with results obtained within the mainstream cosmology. Generally, presented here model leads to greater time distances of cosmological objects in comparison with the mainstream cosmology and it concerns the Type Ia supernovae as well. For example, for z = 0.45, formula (5) gives time distance about 1.4 Gyr greater i.e. about 30% bigger. On the other hand, the distances of the Type Ia supernovae calculated within the mainstream cosmology were, on average,10% to 15% farther than expected [6]. This means that the Type Ia supernovae are fainter than they should be not due to an acceleration of expansion but due to inaccurate formula for time distance applied in the mainstream cosmology.

Moreover, the duality of relativity causes that the calculated within the mainstream cosmology the value of the Hubble constant is incorrect. We can see (Fig.) that for redshift from z = 0 to z = 0.45 the function (2) is in an approximation linear. The change in the age 6.4 Gyr (13.866 – 7.5 ≈ 6.4) is for the change in the kinematical redshift equal to 0.45. It leads to conclusion that for this period (i.e. for the nearby Universe) the Hubble constant is about H ≈ 69 – it is close to the value applied in the cosmological standard model (about 70). But it is an illusion that follows from the duality of relativity. The space distances, not time distances, lead to H = 45.24 [2].

The Fig. shows that we should observe an acceleration of expansion of the Universe for the interval $0.45 < z < 0.6$ and a deceleration for redshift higher than about 0.60 (i.e. for distant Universe). But it as well is an illusion.

Due to the frozen entanglons, there was very rapid acceleration of expansion of the Universe at the beginning of the expansion [2]. But we cannot see it because the most distant galaxies, in reality, are already 7.75 Gyr old.

Let us compare the distance-redshift relations obtained within Special Relativity (SR) and S-ST.

The kinematical redshift of Special Relativity, z_{SR}, we obtain from following formula

$$z_{SR} = (z^2 + 2z) / (z^2 + 2z + 2). \tag{10}$$

Distance between observer and source, L_{SR}, we can calculate within SR applying following formula

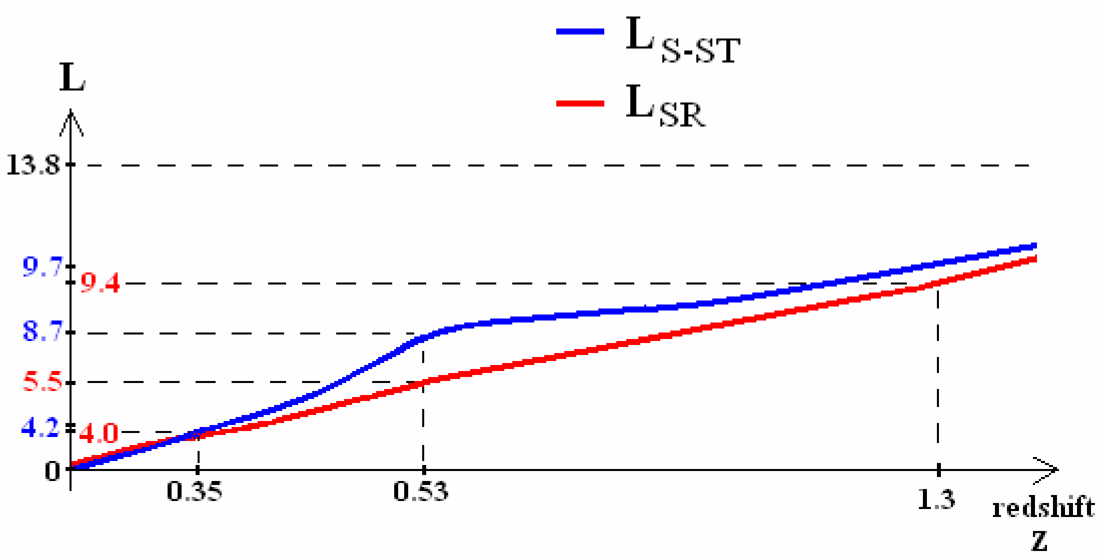
$$L_{SR} = z_{SR} L_o, \tag{11}$$

where L_o = 13.8 Gyr ≈ 4230 Mpc.

Calculate the Hubble constant within the SR cosmology

$$H_{SR} = z_{SR}\, c / L_{SR} = c\ [\text{km/s}] / L_o\ [\text{Mpc}] = 70.9. \tag{12}$$

In the Fig. below, we present the differences in distance L of source from observer obtained within SR (formula (11)) and S-ST (formulae (5) and (8)).



Differences in distances L from observer obtained within SR and S-ST.

We can see that, in reality, for z > 0.35, the Type Ia supernovae are more distant than it follows from SR applied in mainstream cosmology (so they are fainter than they should be).

3. Summary

Here, applying the lacking part of ultimate theory, i.e. the Scale-Symmetric Theory (S-ST), I described phenomena that lead to an illusion of acceleration of expansion of the Universe for z > 0.45 and of deceleration for z > 0.60.

We cannot neglect both the gravitational redshift for $z \geq 0.53$ and the duality of relativity. The derived formulae for time distance between source and observer, give the time distances greater than calculated within the mainstream cosmology (for $z = 0.45$ is about 30%). On the other hand, the distances of the Type Ia supernovae were, on average, 10% to 15% farther than expected. This means that the Type Ia supernovae are fainter than they should be not due to an acceleration of expansion but due to inaccurate formula for time distance applied in the mainstream cosmology. We proved that, in reality, for distances from observer greater than about 4 Gyr the Type Ia supernovae are more distant than it follows from SR applied in mainstream cosmology (so they are fainter than they should be).

Correctness of the new formula follows from the fact that calculated maximum redshift is $z = 11.9$. This value is consistent with the present-day observational facts (the maximum $z = 11.8 \pm 0.3$ for the candidate protogalaxy UDFj-39546284).

Due to the dominant decay of entangled photons about 6.5 Gyr ago, due to the duality of relativity, and due to the gravitational redshift for compact cosmological objects, it is very difficult to calculate within the mainstream cosmology the exact time distances on the base of the explosions of the Type Ia supernovae. The uncertainty is much higher than the assumed about 5%.

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