The Running Hubble Constant

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Abstract: The Scale-Symmetric Theory (SST) shows that the quantum entanglement fixes the speed of light in “vacuum” c in relation to its source or a last-interaction object (it can be a detector). It causes that the spatial distances to galaxies differ from the time distances (the light travel time) - it is the duality of relativity. The duality of relativity leads to the running time Hubble constant that creates an illusion of acceleration of expansion of the Universe. According to SST, for the nearest Universe, the time Hubble constant is 70.52. SST gives for mean time Hubble constant 64.01 - it should be the mean observed Hubble constant when we apply the General Relativity (GR) to the whole observed Universe. If we neglect some part of distant Universe then the GR/observed time Hubble constant should be defined by following interval <64.01, 70.52>. But emphasize that the real mean spatial Hubble constant calculated within SST is 45.24. It leads to the age of Universe 21.614 +- 0.096 Gyr but time distance to most distant observed Universe cannot be longer than 13.866 +- 0.096 Gyr. SST shows that evolution of galaxies accelerated about 13.1 Gyr ago - it leads to an illusion that cosmic objects are not older than 13.1 Gyr.

1. Introduction

The Scale-Symmetric Theory (SST) [1] is based on four stepwise phase transitions of the Higgs field and on the atom-like structure of baryons. It leads to conclusion that there are five levels of Nature. For example, to describe the highest cosmological level we need the all four lower levels i.e. the next smaller proton-charge level composed of hadrons, charged leptons and quarks, the third level composed of neutrinos, the second level composed of entanglons that are responsible for the quantum entanglement, and the first level i.e. the non-gravitating Higgs field which causes that the neutrinos acquire their gravitational mass [1A], [1B].

According to SST [1], the front of baryonic matter expands with recessional velocity $0.6415c$ [1B]. The redshift higher than $z_{front} = 0.6415$ was a result of protuberances of dark matter produced at the beginning of the expansion of the Universe but with time they were suppressed [1B] – the suppression causes that we can see galaxies with redshift higher than 1.

2. Calculations

SST shows that mean effective observed redshift for whole universe is $z_{eff,mean} = 0.6415/2 = 0.32075$. Applying the General-Relativity (GR) cosmic calculator [2] with the SST cosmological parameters derived ab initio (70.52: see formula (1), $\Omega_M = 0.3137$, flat

Universe [1B]) – only then we can compare the SST results with observational data based on GR, we obtain the mean effective light travel time $T_{eff,ltt}$ = 3.570 Gyr.

SST shows that the quantum entanglement fixes the speed of light in “vacuum” c in relation to its source or a last-interaction object (it can be a detector). It causes that the spatial distances to galaxies differ from the time distances (the light travel time) – it is the duality of relativity [1B]. The speed of light emitted by the nearest galaxies in relation to an observer on Earth is close to c so the time Hubble constant for the nearest Universe is

$$H_{o,T,nearest} = c / T_{Observed} \approx 70.52 \text{ km s}^{-1} \text{ Mpc}^{-1}, \quad (1)$$

where $T_{Observed}$ = 13.866 ± 0.096 Gyr [1B].

The real spatial Hubble constant $H_{o,S,real}$, which is equal to the time Hubble constant $H_{o,T,distant}$, for the observer placed in time distance $T_{Observed}$ is

$$H_{o,S,real} = H_{o,T,distant} = c\, z_{front} / T_{Observed} = c / T_{Universe} \approx 45.24 \text{ [km s}^{-1} \text{ Mpc}^{-1}], \quad (2)$$

where $T_{Universe}$ = 21.614 ± 0.096 Gyr [1B].

We can see that the running time Hubble constant decreases for the observed Universe from 70.52 for the nearest Universe down to 45.24.

Calculate the mean time Hubble constant for whole observed Universe

$$H_{o,T,mean} = H_{o,T,nearest} - T_{eff,ltt}\, (H_{o,T,nearest} - H_{o,T,distant}) / T_{Observed} \approx$$

$$\approx 64.01 \text{ [km s}^{-1} \text{ Mpc}^{-1}]. \quad (3)$$

If we neglect some part of distant Universe then the GR/observed time Hubble constant should be defined by following interval

$$H_{o,T} \equiv < 64.01, 70.52 >. \quad (4)$$

Assume that we measure the running time Hubble constant for following interval of redshift $0 < z < z_{end}$. Then according to SST, for $z_{end} \rightarrow \infty$ we should obtain $H_{o,T,mean}$ = 64.01, for z_{end} = 0 we should obtain $H_{o,T,nearest}$ = 70.52, whereas for increasing z_{end} we should obtain values closer and closer to 64.01. We can compare it with the last result $67.6^{+0.7}_{-0.6}$ [3] – there was $0.2 < z < 0.75$.

But emphasize that the real mean spatial Hubble constant calculated within SST is 45.24. It leads to the age of Universe 21.614 ± 0.096 Gyr but time distance to most distant observed Universe cannot be longer than 13.866 ± 0.096 Gyr.

SST shows that evolution of galaxies accelerated about 13.1 Gyr ago – it leads to an illusion that cosmic objects are not older than 13.1 Gyr [4].

The relation describing dependence of the running time Hubble constant on redshift is highly asymmetric. It follows from the fact that due to the duality of relativity [1B], the speed of light emitted by massive galaxies with redshift higher than 0.6415 towards Earth, is close to $(1 - 0.6415)c = 0.3585c$. It causes that effective redshift and relative effective recessional velocity is ~0.32 whereas effective speed of light towards Earth is about $(1 - 0.32)c = 0.68c$.

Notice as well that according to SST, number density of massive galaxies should be highest for ~0.64 [5] – see Fig. 1 in this paper. It means that to obtain in experiments the results presented here we must select massive galaxies in such a way the number density of them for each small interval of redshift was the same.

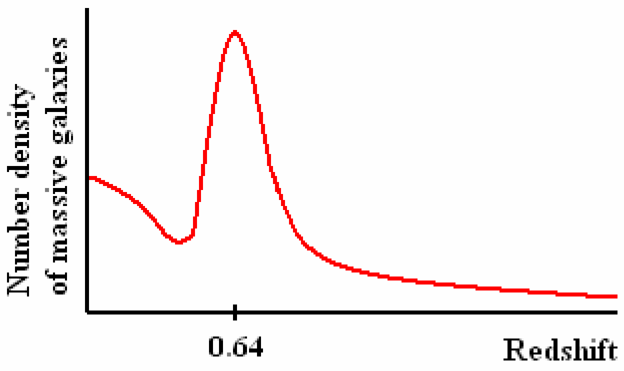

Fig. 1

Table 1. *The running time Hubble constant*

Redshift *z*	Light Time Travel T_{ltt}: [2] with SST parameters [Gyr]	Time Hubble Constant: formula (3) [km s^{-1} Mpc^{-1}]
0	**0**	**70.52 The upper limit in SST**
0.1	**1.290**	**68.17**
0.2	**2.409**	**66.13**
0.3208	**3.570**	**64.01 Mean value for whole Universe**
0.4	**4.235**	**62.80**
0.5	**4.981**	**61.44**
0.6415	**5.888**	**59.78**
0.7	**6.220**	**59.18**
0.8	**6.735**	**58.24**
0.9	**7.194**	**57.40**
1	**7.603**	**56.66**
2	**10.065**	**52.17**
3	**11.148**	**50.19**
4	**11.727**	**49.14**
5	**12.078**	**48.50**
6	**12.309**	**48.08**
8	**12.588**	**47.57**
10	**12.746**	**47.28**
25	**13.073**	**46.69**
∞	**13.197**	**46.46**
–	**13.866**	**45.24 The lower limit in SST**

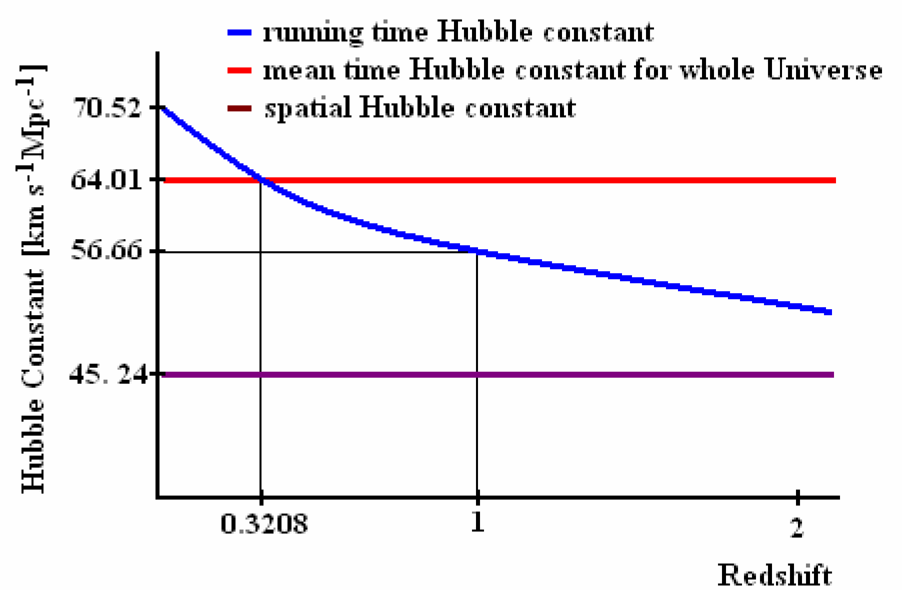

Fig. 2

3. Summary

The running time Hubble constant (it decreases with increasing redshift) leads to an illusion of acceleration of expansion of the Universe – it follows from the duality of relativity. Just the GR cosmology describes how an observer on Earth sees the Universe – it is not a cosmology of the Universe independent of the observer.

On the other hand, the spatial Hubble constant is an invariant that results from the fact that the spacetime does not expand [1B], [1A] – there expands the dark energy (DE) but the ratio of densities of DE and spacetime is today about $1 : 10^{55}$ [1B]. Just the SST cosmology is the cosmology of the Universe independent of the observer.

References

[1] Sylwester Kornowski (2015). *Scale-Symmetric Theory*
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[3] Jan Niklas Grieb, *et al.* (11 November 2016). “The clustering of galaxies in the completed SDSS-III Baryon Oscillation Spectroscopic Survey: Cosmological implications of the Fourier space wedges of the final sample” arXiv:1607:03143v2 [astro-ph.CO]

[4] Sylwester Kornowski (14 January 2017). “Cosmic Reionization of Hydrogen and Helium and the Supermassive Black Holes in Very Distant Universe” http://vixra.org/abs/1701.0465

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