Cosmology in Crisis

Sylwester Kornowski

Abstract: The value of the Hubble constant depends strongly on the models we use and ranges from 40 to 100. Most often we get a value of about 70, but recent measurements (November 2019) suggest a value of 50-58, suggesting a possible crisis for cosmology. On the other hand, the Scale-Symmetric Theory leads to a result of 44-45 and shows that the erroneous assumption about invariance of speed of light in "vacuum" leads to a result of about 69-71. Here we also calculated the critical density from the properties of the initial inflation field and we described the origin of the baryon-antibaryon asymmetry.

1. Introduction

Within the Scale-Symmetric Theory (SST) we showed that the Universe is flat because density of the Einstein spacetime, $\rho_{ES} = 1.10220055\ kg/m^3$ [1], is much higher than the critical density, $\rho_{Critical,SST}$, calculated here.

From the Friedmann equation for the flat Universe we have

$$H_{o,SST}{}^2 = \{100\ h_{SST}\ [(km/s)/Mpc]\}^2 = 8\ \pi\ G\ \rho_{Critical,SST} / 3\ , \qquad (1)$$

where $H_{o,SST}$ is the Hubble constant and h_{SST} is the Hubble parameter calculated within SST.

Knowing that (km/s)/Mpc = $3.2408 \cdot 10^{-20}$ [1/s], we have

$$(H_{o,SST} / 100)^2 = h_{SST}{}^2 = 0.53236 \cdot 10^{26}\ \rho_{Critical,SST}\ . \qquad (2)$$

The value of H_o depends strongly on the models we use and ranges from 40 to 100. Most often we get a value of about 70, but recent measurements suggest a value of [2]

$$H_o = 54.4^{+3.3}{}_{-4.0}\ . \qquad (3)$$

Such value was obtained in a ΛCDM + Ω_K model – PL 18 power spectra provide such constraint at 68 % C.L. Is it evidence for a possible crisis for cosmology?

On the other hand, the SST leads here to a result of 44.0 while our earlier result is 45.2 [3]. We showed that the erroneous assumption about invariance of speed of light in "vacuum" leads to a result of about [3]

$$H_{o,SST}{}^* = H_{o,SST} / 0.6415 \qquad (4)$$

so we obtain about 68.6-70.5.

Here we also calculated the critical density from the properties of the initial inflation field and we described the origin of the baryon-antibaryon asymmetry.

2. Calculations

In SST, the baryon-antibaryon asymmetry follows from the left-handedness of the initial inflation field (it was composed of the non-gravitating tachyons). The excess of the baryon matter is directly proportional to the squared mean spin speed of the tachyons [1]. Such mean spin speed, we can calculate as the spin speed on equator of an abstract tachyon with a mass two times lower than the mean mass of the real tachyons. We have

$$4 \pi R_{Real\text{-}tachyons,mean}^3 / 3 = 2 \cdot 4 \pi R_{Abstract\text{-}tachyon,M/2}^3 / 3 \qquad (5)$$

i.e.

$$R_{Abstract\text{-}tachyon,M/2} = R_{Real\text{-}tachyons,mean} / 2^{1/3} \approx 0.7937\, R_{Real\text{-}tachyons,mean} . \qquad (6)$$

Tachyons are the rigid objects so the spin speed on equator of the abstract tachyon is

$$v_{Tachyon\text{-}spin,abstract} = v_{Tachyon\text{-}spin,real} / 2^{1/3} , \qquad (7)$$

where $v_{Tachyon\text{-}spin,real} = 1.725741 \cdot 10^{70}$ m/s is the mean spin speed on equators of the real tachyons [1].

We know that kinetic or rotational energy is directly proportional to squared speed. On the other hand, there is the energy-mass equivalence so density of a field is directly proportional to squared speed.

We assume that the Einstein spacetime does not violate the matter-antimatter asymmetry and its density is directly proportional to the squared mean linear speed of the real tachyons

$$\rho_{ES} \sim v_{Tachyon\text{-}linear,real}^2 , \qquad (8)$$

where $v_{Tachyon\text{-}linear,real} = 2.386344 \cdot 10^{97}$ m/s [1].

On the other hand, we assume that the critical density of matter (i.e. the mean density of the excess baryon matter evenly distributed in the inner Cosmos [4]) is directly proportional to the squared abstract spin speed

$$\rho_{Critical,SST} \sim v_{Tachyon\text{-}spin,abstract}^2 . \qquad (9)$$

From (8) and (9) we have

$$\rho_{Critical,SST} \sim \rho_{ES} (v_{Tachyon\text{-}spin,abstract} / v_{Tachyon\text{-}linear,real})^2 = 3.631275 \cdot 10^{-27} \text{ kg/m}^3 . \qquad (10)$$

From (2) and (10) we have

$$H_{o,SST} = 44.0 \text{ (km/s)/Mpc} . \qquad (11)$$

Formulae (4) and (11) lead to

$$H_{o,SST}{}^* = 68.5 \text{ (km/s)/Mpc} . \qquad (12)$$

3. Summary

The different values of the Hubble constant in SST and General Theory of Relativity (~45 and ~70 respectively) follow from the fact that the speed of light in "vacuum" c is in SST not an invariant. In reality, the c is the speed of photons in relation to objects with which the photons are entangled. The recent measurements [2] lead to $H_o = 54.4^{+3.3}_{-4.0}$ which suggests a crisis in cosmology and is closer to the SST result.

Critical density is the value at which the Universe is at balance, and expansion is stopped. In SST, such definition means that all matter of the Universe is evenly distributed in the inner Cosmos with a radius of $\sim 2 \cdot 10^{30}$ m [4].

References

[1] Sylwester Kornowski (23 February 2018). "Foundations of the Scale-Symmetric Physics (Main Article No 1: Particle Physics)"
http://vixra.org/abs/1511.0188v4

[2] Eleonora Di Valentino, Alessandro Melchiorri, Joseph Silk (5 November 2019). "Planck evidence for a closed Universe and a possible crisis for cosmology"
Nature Astronomy (2019): 484
See:
https://wiki.cosmos.esa.int/planck-legacy-archive/index.php/Cosmological_Parameters
http://en.wikipedia.org/wiki/Hubble%27s_law (see Figure in the Paragraph "Measured values of the Hubble constant")

[3] Sylwester Kornowski (2 January 2016). "The Hubble Constant in the Scale-Symmetric Theory"
http://vixra.org/abs/1412.0261

[4] Sylwester Kornowski (14 February 2019). "Foundations of the Scale-Symmetric Physics (Main Article No 2: Cosmology)"
http://vixra.org/abs/1511.0223v3