Solution of Hubble Tension

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Abstract In Planck 2018 Results, the current time is given as 13.787 BY, and the cosmological constant Λ is given as 1.1056E-52 /m2. From above, if the universe is expanding at constant velocity, the Hubble constant H is calculated to be 70.92 km/s/Mpc. The Hubble constant measured from CMB is 67.66 km/m/Mpc, and the Hubble constant measured from Redshift is about 72.86 km/m/Mpc. The universe operates in the combination of above two, and the core factor is the cosmological constant Λ. In this paper, the combined Hubble constant was calculated to be 70.93 km/s/Mpc, and this value means that the universe is expanding at constant velocity. In addition, the result was calculated that the Hubble constant measured by Redshift is accelerating expansion. It is judged that the universe expands at the speed of light toward 4D direction. In this case, the radius of the universe is calculated as 9.749 BY.

1. Introduction

In this study, the Combined Hubble Constant of constant velocity expansion, the Redshift Hubble Constant of accelerating expansion, and the 4-dimensional radius of the universe were calculated.

2. Hubble Tension

2.1 Planck 2018 Results

In Planck 2018 Results, the current time t_H is given as 13.787 BY and the cosmological constant Λ as 1.1056E-52 /m2. If the universe is expanding at constant velocity, the Hubble constant is calculated as 70.92 km/s/Mpc from the equation in Fig. 1(b).

2.2 Hubble constants from CMB and Redshift

The Hubble constant values presented on “Hubble's law” website of Wikipedia [1] are shown by measurement year in Fig. 1 (a). In Planck 2018 Results, the measured Hubble constant from CMB is given as 67.66 km/s/Mpc. In Fig. 1(a), the simple average of the data up to 2016 is 72.86 km/s/Mpc.

2.3 Cosmological constant time

In Fig. 18 of previous study [2], the meaning of the cosmological constant Λ was described in detail. In Fig. 1(b), the value of $1/c\sqrt{\Lambda}$ is calculated as 10.053 BY. This is the cosmological constant time t_Λ, and it means the quantization time unit of the universe. The ratio of t_Λ and t_H is calculated as 72.916%, which is the dark time ratio.

2.4 Kinetic state ratio

Based on present, the past is the kinetic state in which the universe expanded almost at the speed of light. Therefore, based on present, the ratio of past is calculated as 37.144%.

2.5 Steady state ratio

Based on present, the future is the steady state in which the expansion of the universe does not exist. Therefore, based on present, the ratio of future is calculated as 62.856%.

2.6 Combined Hubble constant

Observation of light in the past on the present Earth is CMB of kinetic state. The light that past supernova explosions have reached the future Earth is the Redshift. Present is operated by the combination of past 37.144% and future 62.856%. Therefore, the Combined Hubble Constant is calculated as 70.93 km/s/Mpc. This value is equal to 70.92 km/s/Mpc of constant velocity expansion.

3. Accelerating Expansion of Redshift

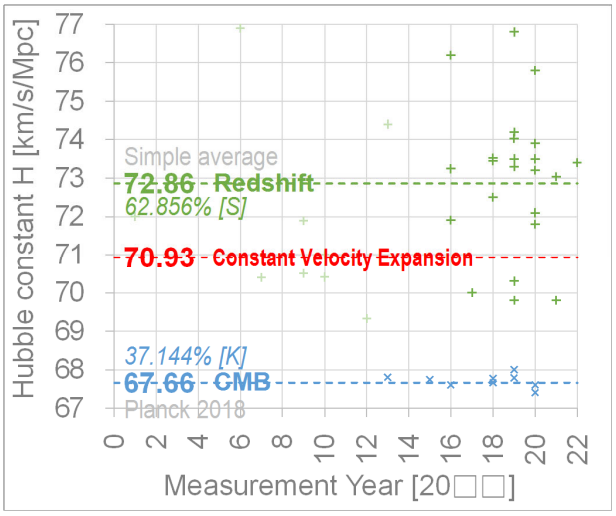
3.1 Shape of the universe

The shape of the universe is shown in Fig. 2(b). If the universe is in steady state, the shape of the universe is 4D sphere. Since the universe expands almost at the speed of light, redshift is observed such as a horse saddle. The combination of the two makes the universe flat.

3.2 Flow of time

In Fig. 2(a), since CMB is in steady state, The 67.66 km/s/Mpc does not change according to time flow. Since the universe is expanding at constant velocity, the 70.93 km/s/Mpc is also constant. According to time flow, the kinetic state ratio K(t) is (time - 10.053) / 10.053, and the steady state ratio S(t) is 1 - K.

3.3 Accelerating redshift



(a) Measured data [1]

[Planck 2018 Results]

t_H = 13.787 BY Λ = 1.10560E-52 /m2

※ If constant velocity expansion

3.08568E19 km / 13.787E9 y / 60·60·24·365.24 s = **H 70.92**

1 Mpc year time 1 year

[Dark Time Ratio]

1 / c√Λ = 1 / 2.9979E8·60·60·24·365.24·√Λ = 10.053 BY

Dark Time Ratio t_Λ / t_H = 10.053 / 13.787 = **72.916%**

Kinetic State Ratio (13.787 - 10.053) / 10.053 = *37.144%*

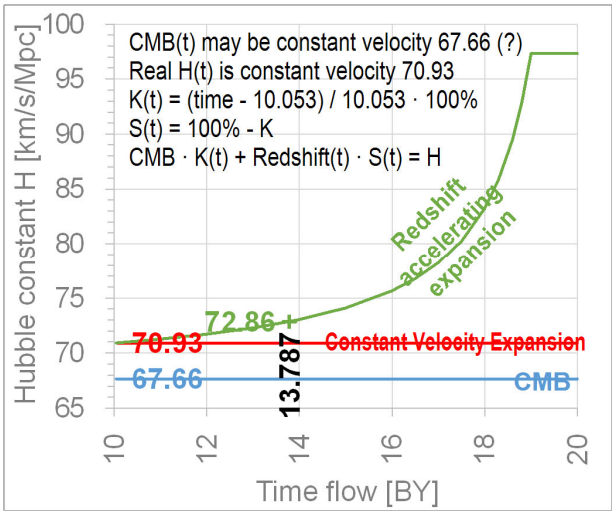
Steady State Ratio 100% - 37.143% = *62.856%*

[Combined Hubble Constant]

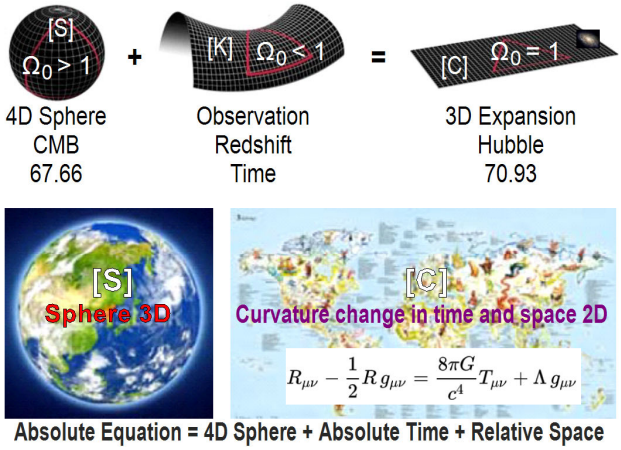
67.66 · 37.144%[K] + 72.86 · 62.856%[S] = **H 70.93**

(b) Calculation

Fig. 1 Cause of Hubble Tension



(a) Accelerating expansion of Redshift



(b) Shape of universe

Fig. 2 Accelerating expansion of Redshift and shape of universe

Therefore, Redshift(t) is calculated, and the result is shown in Fig. 2(a). It is understood that Redshift is accelerating.

3.4 Question

At 20 BY, Redshift has infinite speed. This is a difficult result to understand. When synthesizing the previous study results [Fig. 22 in Ref. 3], it is judged that the value will have a constant around 19 BY.

3.5 Absolute cosmological equation

As shown in Fig. 2(b), the shape of the earth in steady state is a 3D sphere. If the Earth were to expand at the speed of light, it would be observed such as a 2D flat map. It is judged that such a phenomenon appears in cosmological space. The cosmological equation should include 4D space and expansion toward 4D direction.

4. Radius of the Universe

4.1 Observable universe

In Fig. 3, the perspective of observing space from the Earth is shown. The left side is looking outward from the Earth, and the right side is looking inward from the Earth. The difference is whether Big Bang was at the outer boundary of the universe or at the center of the universe. The right side

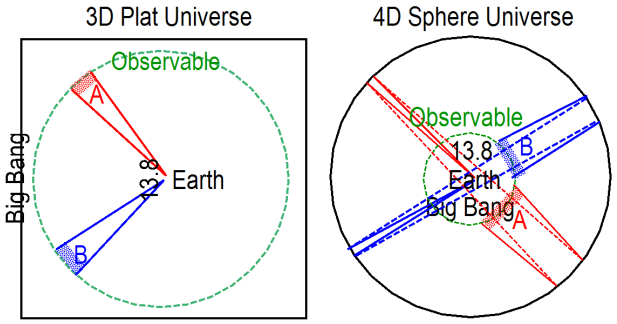


Fig. 3 Observable universe

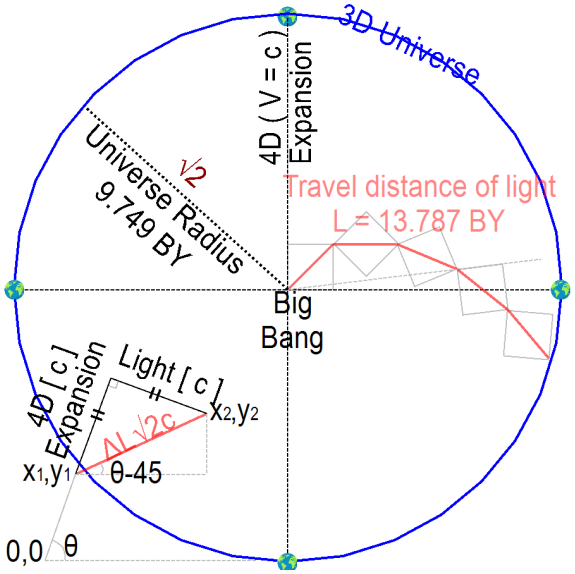
would be the correct answer.

4.2 Equation

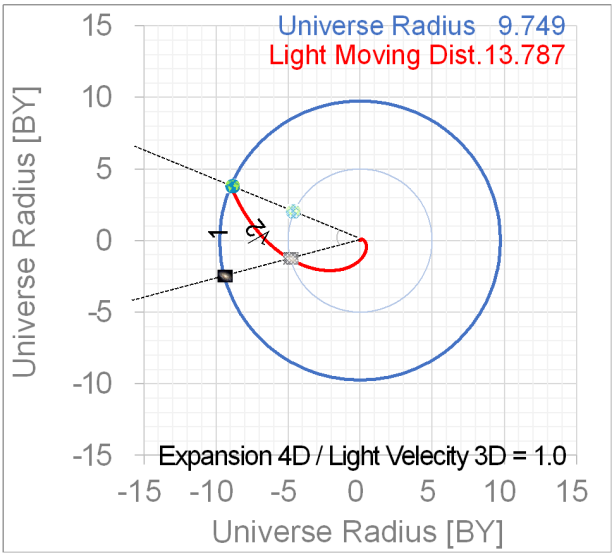
In Fig. 4(a), the blue circle is the current 3D universe, and the vertical 4D inside is the past universe. Therefore, the center of the circle is the Big Bang. It is assumed that the speed of space expansion toward 4D direction and the speed of light in 3D direction are the same. Therefore, the light of red color travels such as gray rectangles, and the ratio of the travel distance becomes $\sqrt{2}$.

4.3 Radius of the universe

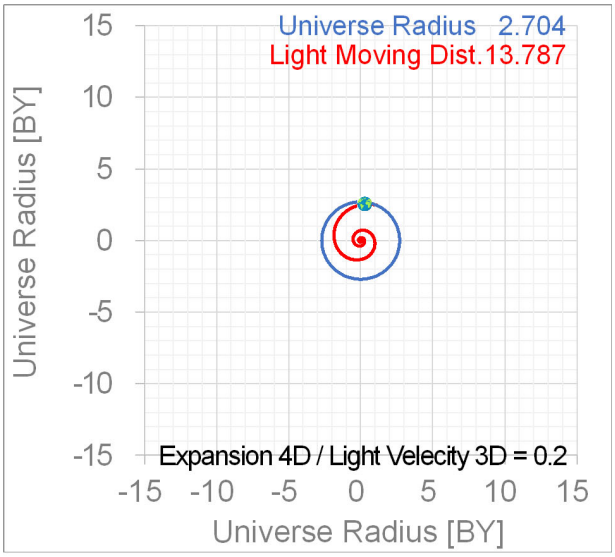
(b) is the result of calculating the rectangle in (a) as very



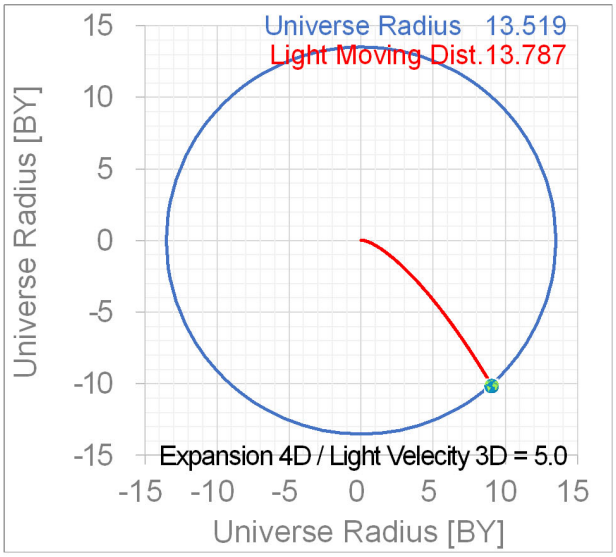
(a) Equation



(b) Expansion 4D / Light Velocity 3D = 1.0



(c) Expansion 4D / Light Velocity 3D = 0.2



(d) Expansion 4D / Light Velocity 3D = 5.0

Fig. 4 Radius of the universe

small, and the radius of the universe is calculated as 9.749 BY. (c) is the result when the universe expands at 0.2 of the speed of light. If this is correct, one galaxy should be observed overlapping in the distant past and recent. (d) is the result when the universe expands at 5.0 the speed of light. If this is correct, only a part of the universe is observed from Earth. (b) is judged to be the correct answer.

5. Conclusions

Redshift is right for accelerated expansion. Here, it should be noted that Redshift and the Universe are not the same thing, but that Redshift is a phenomenon that occurs within the Universe. All things are measured in two kinds of kinetic state and steady state. This is the cause of proton radius puzzle, neutron life puzzle, and Hubble tension. Particles are in one state of above two, and the universe is the combined state of above two. The steady state shape of the universe is a 4D sphere, and due to the kinetic state expansion of the speed of light toward 4D direction, the cosmological space changes to a 3D flat shape. The speed of expansion toward 4D direction of the universe is judged to be the speed of light.

References

[1] Wikipedia, Hubble's law, https://en.wikipedia.org/wiki/Hubble%27s_law

[2] D. Kim, 2022, New Standard Model, Version 5, https://vixra.org/pdf/2207.0003v5.pdf

[3] D. Kim, 2022, New Standard Model, Version 2, https://vixra.org/pdf/2207.0003v2.pdf