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 parameter H is calculated to be 70.92 km/s/Mpc. The Hubble parameter measured from CMB is 67.66 km/m/Mpc, and the Hubble parameter 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 parameter 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 parameter 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 parameter of constant velocity expansion, the Redshift Hubble parameter 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_0 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 parameter is calculated as 70.92 km/s/Mpc from the equation in Fig. 1(b).

2.2 Hubble parameters from CMB and Redshift

The Hubble parameter presented on Wikipedia [1] are shown by measurement year in Fig. 1 (a). In Planck 2018 Results, the measured Hubble parameter from CMB is given as 67.66 km/s/Mpc. In Fig. 1(a), the simple average of the redshift 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_0 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 parameter

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 parameter is calculated as 70.93 km/s/Mpc.

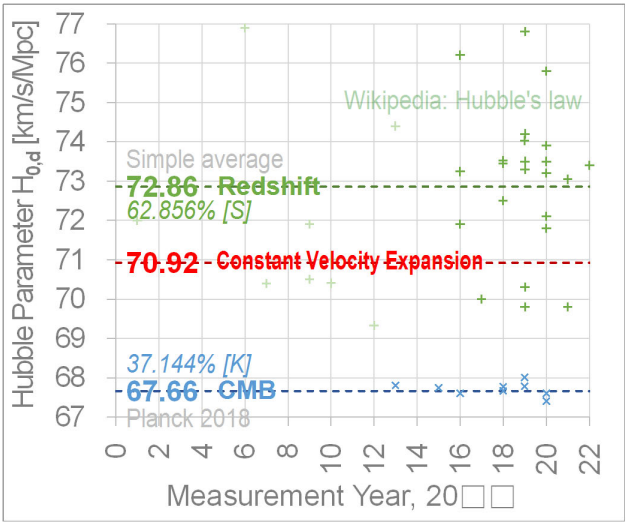
2.7 Constant velocity expansion

In previous study [3], the author has proven that the universe expands at constant velocity from dark matter. Calculated from the cosmological constant representing dark energy, 70.93 km/s/Mpc equals 70.92 km/s/Mpc of constant velocity expansion.

3. Accelerating Redshift

3.1 Shape of the universe

The shape of the universe is shown in Fig. 2(b). The past inside of 4D universe expanded at the speed of light to form a 4D sphere, and the future outside of 4D universe was stopped in the shape of horse's saddle. The current of 3D is defined as the combined ratio of 4D sphere surface and 4D



(a) Measured data [1]

[Planck 2018 Results]

t_0 = 13.787 BY Λ = 1.10560E-52 /m2

※ If constant velocity expansion

$H_{0,d} = V(0,d) / d = 1 / t_0$ [km/s/Mpc]

3.08568E19 km / 13.787E9 y / 60·60·24·365.24 s = **H_0 = 70.92**

1 Mpc year time 1 year km/s/Mpc

[Dark Time Ratio]

$1 / c\sqrt{\Lambda} = 1 / 2.9979E8 \cdot 60 \cdot 60 \cdot 24 \cdot 365.24 \cdot \sqrt{\Lambda}$ = 10.053 BY

Dark Time Ratio t_Λ / t_0 = 10.053 / 13.787 = **72.916%**

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

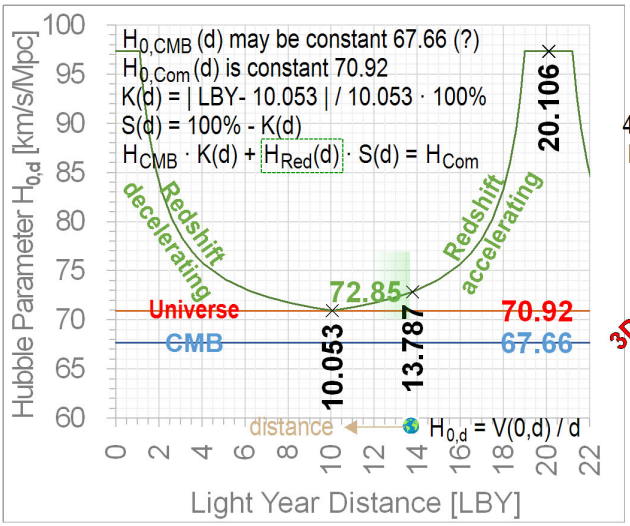
Steady State Ratio 100% - 37.143% = *62.856%*

[Combined Hubble Constant]

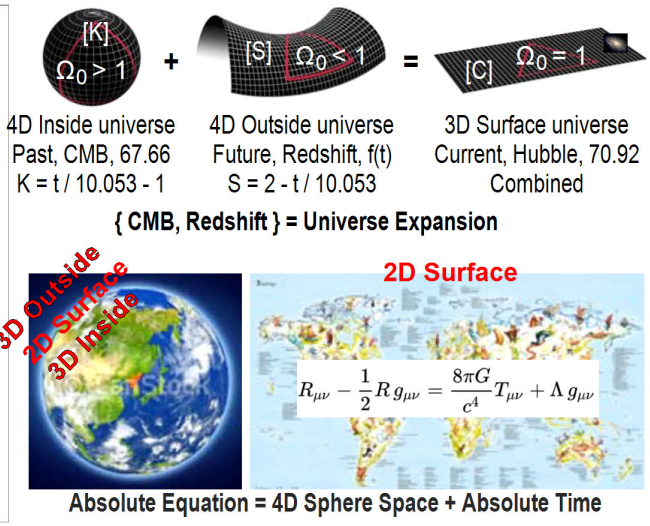
67.66 · 37.144%[K] + 72.86 · 62.856%[S] = **H_0 = 70.93**

(b) Calculation

Fig. 1 Cause of Hubble Tension



(a) Accelerating Redshift



(b) Shape of universe

Fig. 2 Accelerating Redshift and shape of universe

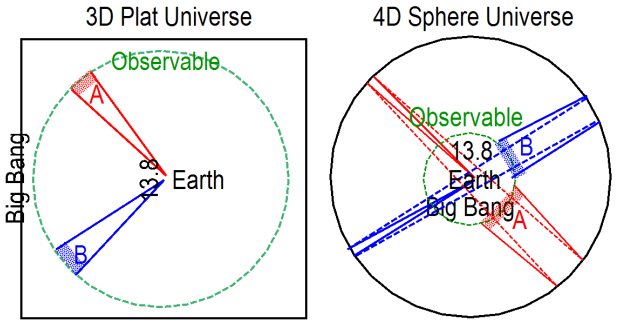
saddle surface.

3.2 Measured values according to distance

The horizontal axis in Fig. 2(a) is the value obtained by converting the distance to the left observed from the current earth (13.787) into light time. CMB in the past will be observed as a constant of 67.66 km/s/Mpc regardless of distance. This needs to be checked. Since the universe is expanding at constant velocity, the 70.93 km/s/Mpc is also constant regardless of distance. Distance equals time. Therefore, 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

Therefore, Redshift(d) is calculated from the equation, and the result is shown in Fig. 2(a). It is understood that the current redshift is accelerating. Redshift appears as one result of the universe expansion, redshift and universe expansion are not the same thing. In the figure, the light green area is the result of observation in current physics. It can be seen that the observation distance is very narrow, and the error is also very large. When observation techniques with 10 times more precision are developed, this result will be verified.



(a) Outside Big Bang (b) Inside Big Bang

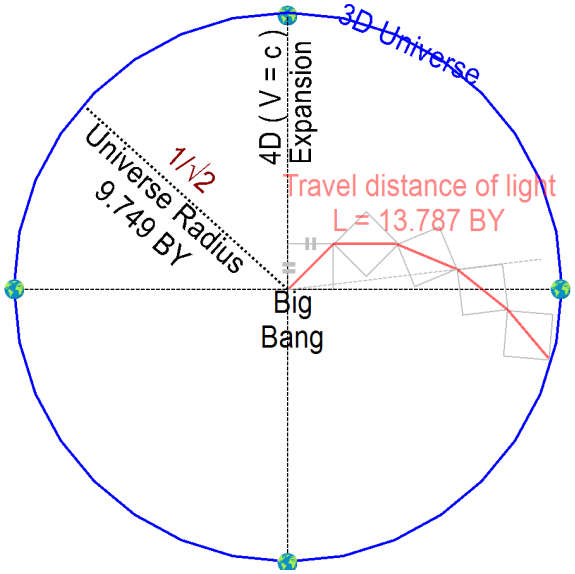
Fig. 3 Observable universe

3.4 Question

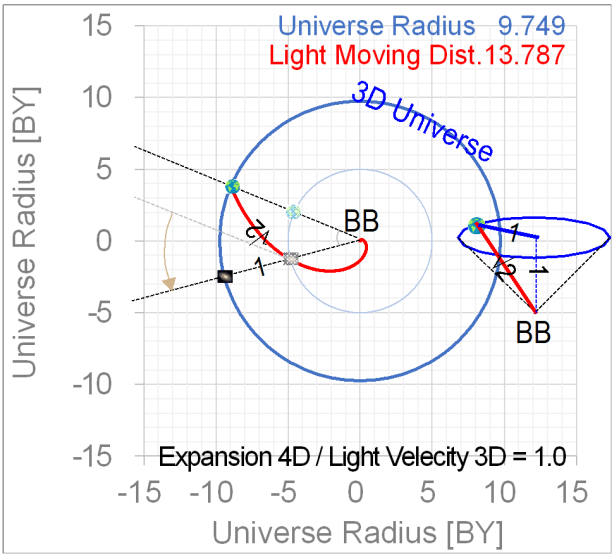
At 0 BY and 20.106 BY, Redshift has infinite speed. This is a difficult result to understand. When synthesizing the previous study results [Fig. 22 in Ref. 4], it is judged that the value will have a constant around 1 BY and 19 BY. This is due to the quantization of the overall universe, just like the shell of atom.

3.5 Absolute cosmological equation

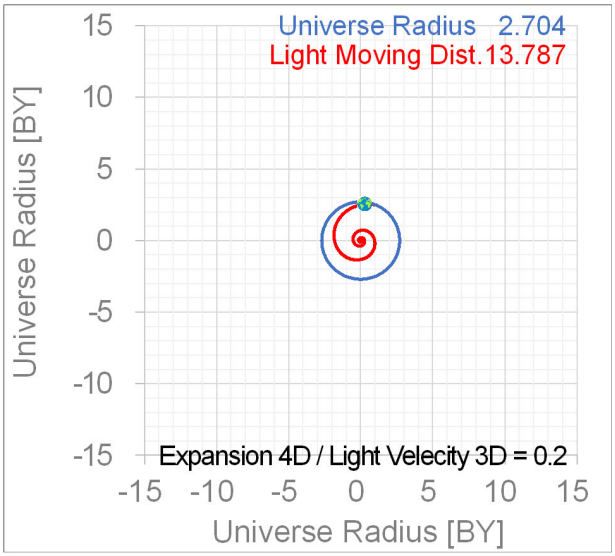
In Fig. 2(b), the inner shape of the earth is a 3D sphere, the outer shape of the earth is a 3D saddle, and we live on the 2D surface. It is judged that such a phenomenon appears



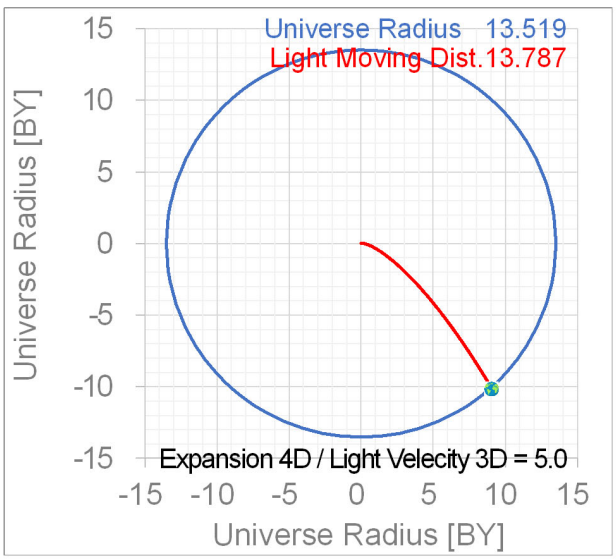
(a) Equation



(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

in cosmological space. The cosmological equation should include 4D space and expansion toward 4D direction, and this is absolute time.

4. Radius of the Universe

4.1 Observable universe

In Fig. 3, the perspective of observing space from the Earth is shown. (a) is looking outward from the Earth, and (b) 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. (b) 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 as very small rectangle in (a), 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 distant past and near past. (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 speed of expansion toward 4D direction of the universe is judged to be the speed of light, and this is the absolute time.

References

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