Origin of Hubble Tension

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Abstract The Hubble constant presented from JWST (2024) is 72.6 km/s/Mpc. When the data are reinterpreted, it is calculated as 72.78 km/s/Mpc, and the H0 calculated in our previous study was 72.777 km/s/Mpc. Also, JAGB, TRGB, and Cepheids are presented as 67.96, 69.85, and 72.05 km/s/Mpc from JWST (2024). Reinterpreting this, it is calculated as 70.942 km/s/Mpc, and the H0 calculated in our previous study was 70.940 km/s. The Hubble constant presented in Planck results is 67.3 km/s/Mpc in 2013, 67.8 km/s/Mpc in 2015, and 67.4 km/s/Mpc in 2018, and the H0 calculated from our previous study was 67.833 km/s/Mpc. Depending on the state of star or the methodology of calculation, Hubble constant is judged to be measured or calculated differently. That is, all measured values from 68 to 77 km/s/Mpc for red shift could be correct.

1. Introduction

In previous study [1], dark energy ratio was calculated as Ω_{Q} 72.914% (such as 72.8% of Before Planck) and Ω_{E} 68.574% (such as 0.6834, 0.6847, and 0.6889 in Planck 2018 results). From these values, the quantum state ratio of ω_{Q} 37.148% (=$1/\Omega_{\mathrm{Q}} - 1$) and the event state ratio of ω_{E} 62.852% (=$2 - 1/\Omega_{\mathrm{Q}}$) are calculated, which are new concepts that do not exist in the knowledge of physics. From these values and Planck length, as shown in Fig. 1, the Hubble constant of quantum state H^{Q}_{cmb} is calculated as 67.833 km/s/Mpc, and the Hubble constant of event state H^{E}_{red} is calculated as 72.777 km/s/Mpc. Form these, the Hubble constant of combined state H^{C}_{uni} is calculated as 70.940 km/s/Mpc (= 67.833·37.148% + 72.777·62.852%), and the age of the universe at constant expansion is calculated as 13.784 BY.

Recently, from the observation results of JWST (James Webb Space Telescope), Hubble constant was suggested as 72.6 km/s/Mpc [2], JAGB 67.96, TRGB 69.85, and Cepheids 72.05 km/s/Mpc [3]. The purpose of this study is to compare and review the values calculated in previous study [1] with those of JWST [2, 3].

2. Origin of Hubble Tension

2.1 HST 72.8, JWST 72.6 km/s/Mpc

The Hubble constant values from HST (Hubble Space Telescope) and JWST (James Webb Space Telescope) are presented in Table 4 of Ref. [1] and plotted in Fig. 2. In that study, three representative values were selected such as Eq. ①, and 72.8 km/s/Mpc was presented at HST and 72.6 km/s/Mpc at JWST. These values can be said to be the same as H^{E}_{red} 72.777 km/s/Mpc calculated in previous study [1].

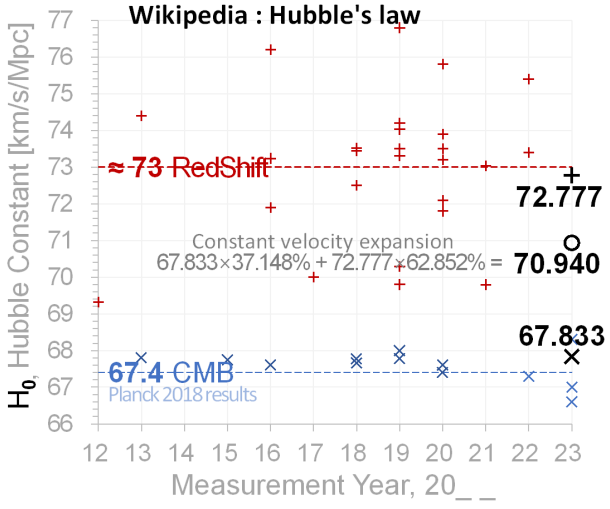

Fig. 1 Previous results on Hubble constant

2.2 H = (Avg H_{UP} + Avg H_{DOWN}) / 2 = 72.78 km/s/Mpc

The average of 72.2, 73.4, and 72.1 km/s/Mpc is slightly biased toward 72 km/s/Mpc. In Fig. 2, based on 72.777 km/s/Mpc, the average of up numbers and the average of down numbers are calculated, and the average of those two averages will be more reasonable. Therefore, Eq. ② is calculated as 72.78 km/s/Mpc, and Eq. ③ is also calculated as 72.78 km/s/Mpc. The value calculated in previous study [1] is 72.777 km/s/Mpc.

The average for all values in Fig. 2 is HST 72.62 and JWST 72.59, as in Eq. ④. However, at 11 SN Ia of Fig. 2, HST is 71.2 and 71.2, but JWST is 72.0 and 70.1. The 70.1 of JWST is judged to be an incorrect value. If this value is the same 72.0, then the overall average of JWST is calculated as 72.78 km/s/Mpc of Eq. ⑤.

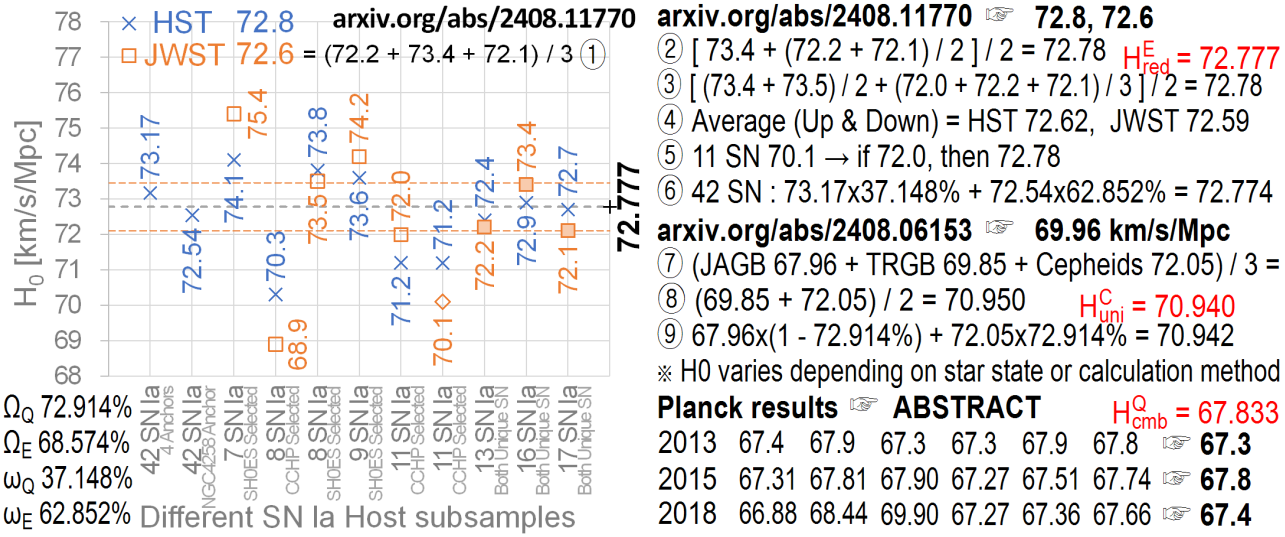

Fig. 2 Hubble constant values reinterpreted from JWST results

2.3 Quantum state 37.148%, Event state 62.852%

In Fig. 2, the values of 42 SN Ia are given as 73.17 and 72.54 of 4 significant digits. This probably means that it is accurate. Eqs. ①~⑤ were the calculation of average value. However, Eq. ⑥ is also calculated as 72.774 km/s/Mpc. What is the reason? If there is only one correct answer for Hubble constant, the calculation of Eq. ⑥ will be a coincidence value. However, if there are multiple correct answers for Hubble constant depending on the state of star or the methodology of calculation, the calculation of Eq. ⑥ will be correct. If the latter is true, most of the measured Hubble constant values may be correct.

2.4 JAGB 67.96, TRGB 69.85, Cepheids 72.05

Table 4 of Ref. [3] presents various H values measured from JWST, and the representative values for JAGB, TRBG, and Cepheids are presented as 67.96, 69.85, and 72.05 km/s/Mpc. In Ref. [3], 69.96 km/s/Mpc is presented as the combined value, as in Eq. ⑦. In previous study [1], H^C_{uni} 70.940 km/s/Mpc was calculated. As in Eq. ⑧, the average of 69.85 and 72.05 is calculated as 70.950 km/s/Mpc. Also, Eq. ⑨ is calculated as 70.942 km/s/Mpc.

2.5 Various combinations

In Fig.2, the 75.4 of 7 SN Ia is too large, and the 68.9 of 8 SN Ia is too small, which seems to be an error. However, the value of $68.9 \cdot \Omega_E$68.574% + $75.4 \cdot$(1 - 68.574%) is 70.94 km/s/Mpc. Also, the value of $74.2 \cdot \Omega_Q$72.914% + $68.9 \cdot$(1 - 72.914%) is 72.76 km/s/Mpc. Is this calculation correct or just a coincidence?

2.6 Huble constant of Planck results

Planck results present a variety of values. The abstract of the document shows 67.3 km/s/Mpc in 2013, 67.8 km/s/Mpc in 2015, and 67.4 km/s/Mpc in 2018. The H^Q_{cmb} value calculated in previous study [1] was 67.833 km/s/Mpc.

3. Conclusions

In previous study, 72.777 km/s/Mpc, 70.940 km/s/Mpc, and 67.833 km/s/Mpc were calculated, which are in close agreement with JWST (2024) and Planck results. The probability that they coincide is close to zero.

The order of our calculation is as follows: First, 70.940 km/s/Mpc is calculated, then based on this, 67.833 km/s/Mpc is calculated, and finally 72.777 km/s/Mpc is calculated. In the future, sufficiently large amounts of JWST data will be collected. If the result matches 72.777 km/s/Mpc exactly, this means that 70.940 and 67.833 km/s/Mpc are also exactly correct answers.

If Hubble constant has been accurately measured or calculated, all the values from 68 to 77 km/s/Mpc for red shift are judged to be correct answer. There will be relationship formula depending on the state of star.

References

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