A New Methodology for Calculating the Universe

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Abstract In previous studies, from our originative method for the integration of four fundamental forces, dark energy ratio was calculated as 72.916%. In this study, dark energy ratio was calculated as 72.9138% and 68.5741% by adding our originative idea to physics formula. Additionally, from Planck length 1.616255E-35 m, cosmological constant was calculated as 1.106169E-52 /m2, age of universe as 13.784 BY, and Hubble parameter as 67.833 km/s/Mpc and 72.777 km/s/Mpc. Simultaneously with the above results, the radiation density of 9.117E-5 (= CMB 5.408E-5 + neutrino 3.708E-5) was calculated, and the value of 13.784E9Y x 5.408E-5 is 372,700 years. The following very important results were obtained from this study. Dark energy ratio is the constant regardless of time flow, and cosmological constant is parameter of time flow such as Hubble parameter.

1. Introduction

In Fig. 29 of Ref. [1] of previous study, dark energy ratio was a parameter according to time flow, cosmological constant was a constant regardless of time flow, and the results over time were calculated very strangely. Author also concluded that the results contained a major error. This study was calculated from physics formula, and it was proven that dark energy ratio is constant and cosmological constant is parameter according to time flow. If this were true, all the cosmology theories in physics would be overturned.

All results in this study were calculated with reference to only Planck length of 1.616255E-35 m, and the accuracy of results would be ±0.0001%.

2. Previous Study

2.1 Radius, Quantum matter : Event horizon = 1 : 2

In previous study [2], it was calculated that our universe is in a 4D quantum hole (hyper black hole). Fig. 1 is the shape of Quantum Hole, and our 3D universe is located between the 4D Event Horizon and 4D Quantum Matter. 4D quantum matter is a superconductor that floats the 3D universe in the empty space and expands it to the limit, and the 4D event horizon shrinks the 3D universe to the limit. This causes our 3D space to unfold in the between, and our 3D universe unfolds along the parallel lines of the two forces. It is necessary to calculate what will happen if two superconductors are pushed to their limits, which can help understand Fig. 1.

It is well known that the relationship between Planck length l_P and Schwarzschild radius r_s is 1 : 2. Since our 3D universe is in hyper black hole, l_{P3} : r_{s3} = 1 : 2 also is established. In Fig. 1, l_{P3} is the radius of 4D quantum matter, and r_{s3} is the radius of 4D event horizon.

2.2 Cosmological constant problem: 1E-121.53272

Planck length l_P is 1.616255E-35 m, and cosmological constant Λ is 1.1056E-52 /m2, so $l_P^2 \cdot \Lambda$ is 1E-121.5394, and the value is called cosmological constant problem. In section 3.18 of Ref. [1] or section 2.4 of Ref. [3], 1E-121.5327 was calculated. The more precise value is 1E-121.53272.

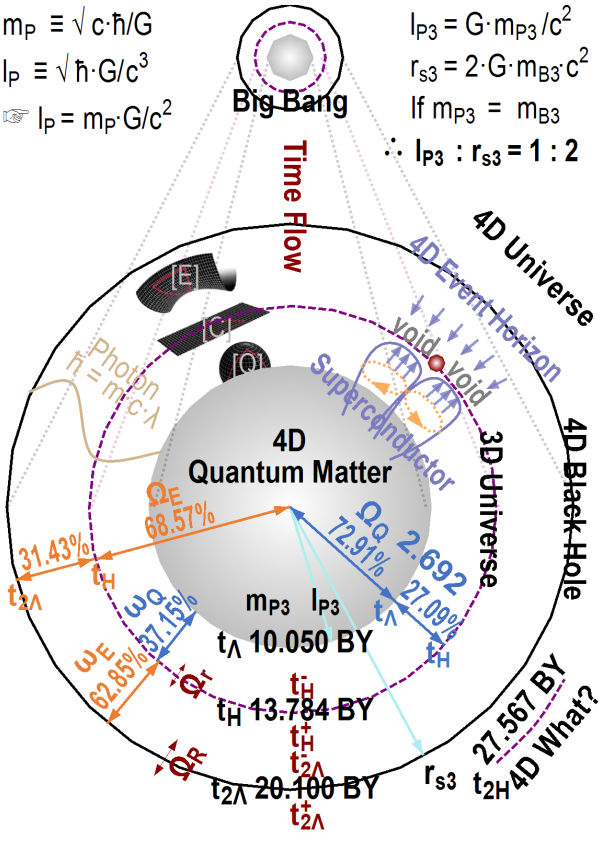

Fig. 1 Shape of Quantum Hole

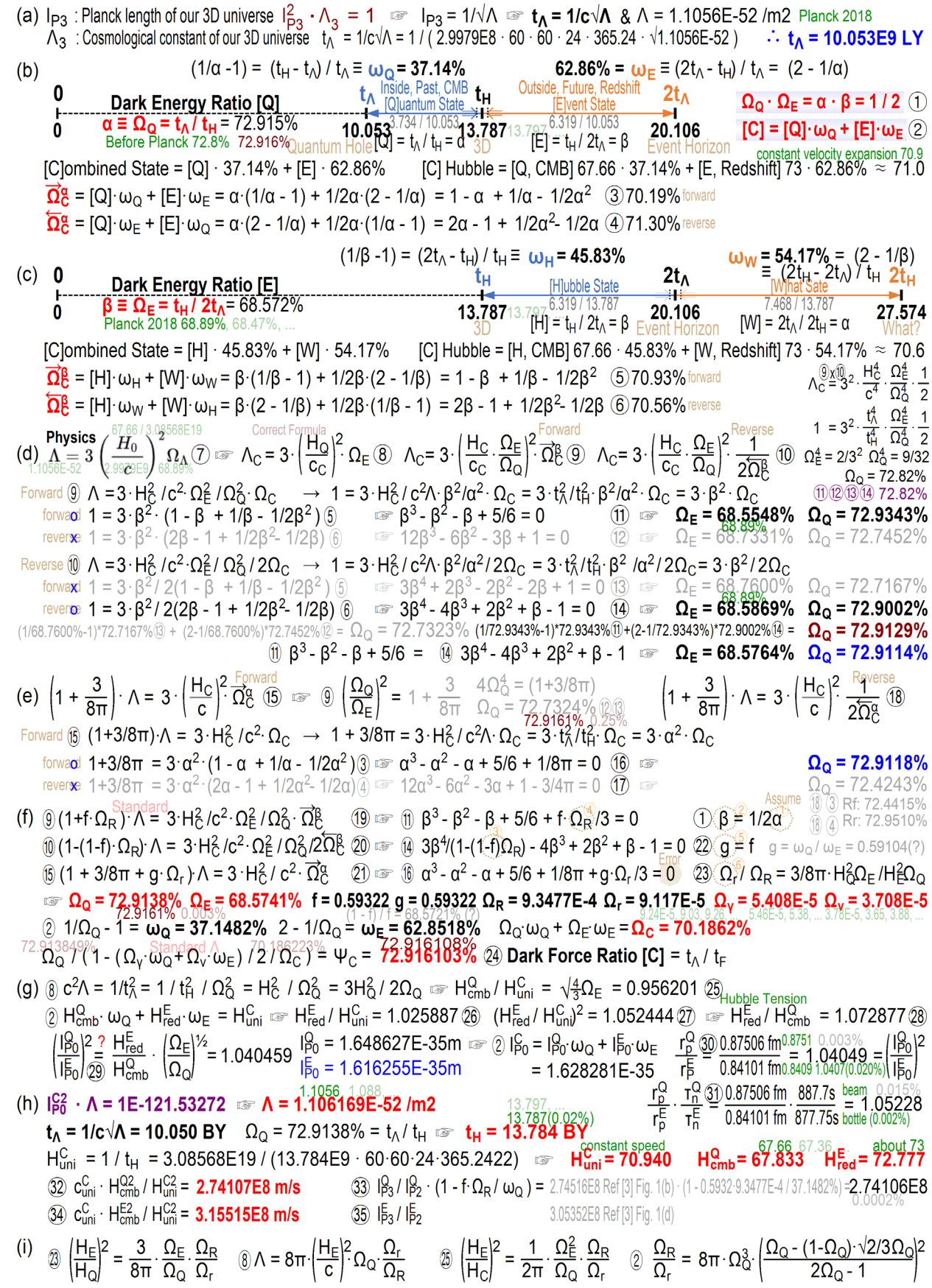

Fig. 2 Calculation of dark energy, cosmological constant, age of universe, and Hubble parameter

The cosmological constant problem is because l_P is the value of 0D and Λ is the value of 3D. That is, the formula is not $l_P^2 \cdot \Lambda$ but $l_{P0}^2 \cdot \Lambda_3$. As calculated in our previous study, we must remember that our universe consists of six dimensions. It is natural that the difference between 0D and 3D is almost infinite. As proven in Chapter 3.18 of Ref. [1], the value of 1E-121.532720 is the ratio ν_0/ν_3 of 0D and 3D neutrino masses. If the dimensions match, the ratio ν_3/ν_3 is 1. That is, the value of $l_{P3}^2 \cdot \Lambda_3$ is 1.

2.3 Radius of quantum matter: 10.053E9 LY

Therefore, as shown in Fig. 2(a), the l_{P3} of our universe is $1/\sqrt{\Lambda}$, and the cosmological constant Λ represents the radius of quantum matter in Fig. 1. Since the cosmological constant Λ is known to be 1.1056E-52 /m2, the radius of 4D quantum matter t_Λ is calculated as 10.053E9 LY. Therefore, the radius of 4D event horizon $t_{2\Lambda}$ is twice 20.106E9 LY.

2.4 Shape of universe [C] = [Q] + [E]

On the 3D universe of Fig. 1, looking inside, there is a spherical quantum matter. Let's call it [Q]uantum state. Looking outside, there is a saddle-shaped event horizon. Let's call it [E]vent state. In previous study, [Q] was called Kinetic state and [E] was called Steady state. The universe consists of the mixture of [Q] and [E], which makes it appear flat universe. Let's call it the [C]ombined state.

2.5 Dark energy ratio Ω_Q: 72.915%

In the integration of four fundamental forces of Table 2 in Ref. [2], dark energy ratio was calculated as 72.916%. In Fig. 2(b), the left side of t_H is the force (⇒) pushed by superconductor, and the right side of t_H is the force (⇐) pushed by event horizon. Therefore, the characteristics of above two are different. The quantum state of left side is inside, past, and CMB, and the event state of right side is outside, future, and redshift. Let's define $\alpha \equiv \Omega_\mathrm{Q} = t_\Lambda/t_\mathrm{H}$. Since the age of universe t_H is known to be 13.787 BY, the dark energy ratio Ω_Q is 72.915% (= 10.053 / 13.787), the quantum state ratio $\omega_\mathrm{Q} = 1/\alpha - 1$ is 37.14% (= 3.734 / 10.053), and the event state ratio $\omega_\mathrm{E} = 2 - 1/\alpha$ is 62.86% (= 6.319 / 10.053).

2.6 Dark energy ratio Ω_E: 68.572%

In Fig. 2(c), twice t_Λ is $2t_\Lambda$, which is the event horizon. Double t_H is $2t_\mathrm{H}$ and let's call it 'What'. The left side of $2t_\Lambda$ is 4D black hole and the right side is 4D universe. Let's define $\beta \equiv \Omega_\mathrm{E} = t_H/2t_\Lambda$. From the same logic, the dark energy ratio Ω_E is 68.572% (= 13.787 / 20.106), the [H]ubble state ratio $\omega_\mathrm{H} = 1/\beta - 1$ is 45.83% (= 6.319 / 13.787), and the [W]hat state ratio $\omega_\mathrm{W} = 2 - 1/\beta$ is 54.17%% (= 7.468 / 13.787). It is very important that Ω_Q is based on the t_H of our universe, and Ω_E is based on the $2t_\Lambda$ of event horizon.

2.7 Constant velocity expansion: 71.0 km/s/Mpc

If universe is expanding at a constant velocity, Hubble constant is 70.92 km/s/Mpc. In Fig. 2(b), the sum of the 37.14% of CMB 67.66 km/s/Mpc and the 62.86% of Redshift ≈73 km/s/Mpc is 71.0 km/s/Mpc. Therefore, it is understood that universe is expanding at constant velocity. In Fig. 2(c), the value is calculated as 70.6 km/s/Mpc. Since Hubble value is measured in our universe on t_H, it can be understood that the calculation in (b) is correct.

2.8 Dark energy ratio: Ω_Q x Ω_E = 1 / 2

As shown in Eq. ① of Fig. 2(b), $\Omega_\mathrm{Q} \times \Omega_\mathrm{E} = 1/2$ is established. Let's remember this formula always. Before Planck value is 72.8%, Planck 2018 value is 68.89%, and the product of above two is 50.15% (=1 / 1.994). It is understood that both Before Planck and After Planck are correct. Proton radius in hydrogen is 0.8751 fm and muon is 0.8409 fm, neutron lifetime in beam is 887.7s and in bottle is 877.75s, and Hubble constant of 67.66 km/s/ Mpc of CMB and about 73 km/s/Mpc of redshift are all correct.

2.9 Combined dark energy ratio Ω_C: 70% ~ 71%

The combined state is defined as Eq. ②. To explain it easily, the present [C] is made up of a mixture of ω_Q% of past [Q] and ω_E% of future [E]. Therefore, the combined dark energy ratio is expressed as Eqs. ③ and ⑤, which are in the 'forward' direction calculated from left to right. Eqs. ④ and ⑥ are 'reverse' direction calculated from right to left. These values are calculated as 70.19%, 71.30%, 70.93%, and 70.56%. The calculation logic of previous studies was Eq. ③.

3. New Methodology

3.1 Relational expression of Λ, H_o, c, Ω_Λ

Eq. ⑦ in Fig. 2(d) is a relational expression in physics. Everything should be separated into [Q] [E] [C]. The cosmological constant Λ calculated from Fig. 1(f) of Ref [3] is in [C] state, and the speed of light c 2.99792E8 m/s from Table 1(4) of Ref [3] is calculated as in [C] state. Therefore, in Eq. ⑦, the Λ of 1.1056E-52 /m2 is [C], the c of 2.9979E9 m/s is [C], the H_0 of 67.66 km/s/Mpc is [Q], and the Ω_Λ of 68.89% is [E]. This is Eq. ⑧, and it is judged to be one of the correct formulas. Eq. ⑨ is proposed to calculate [C], and this is in the 'Forward' direction formula. From the idea of Eq. ①, Eq. ⑩ will be established, which is the 'Reverse' direction formula. When ⑨ and ⑩ are multiplied, Ω_Q is calculated as 72.82%. The value of Before Planck is 72.8%.

3.2 Dark energy ratio: 72.9343%

Since Eq. ⑨ is deduced from Eq. ⑧ of Ω_E, it is the relational expression of β. Therefore, after rearranging Eq. ⑨ of 'Forward', if Eq. ⑤ of 'forward' is substituted, Eq. ⑪ is arranged. From Fig. 3(a), the value of Ω_E is calculated as

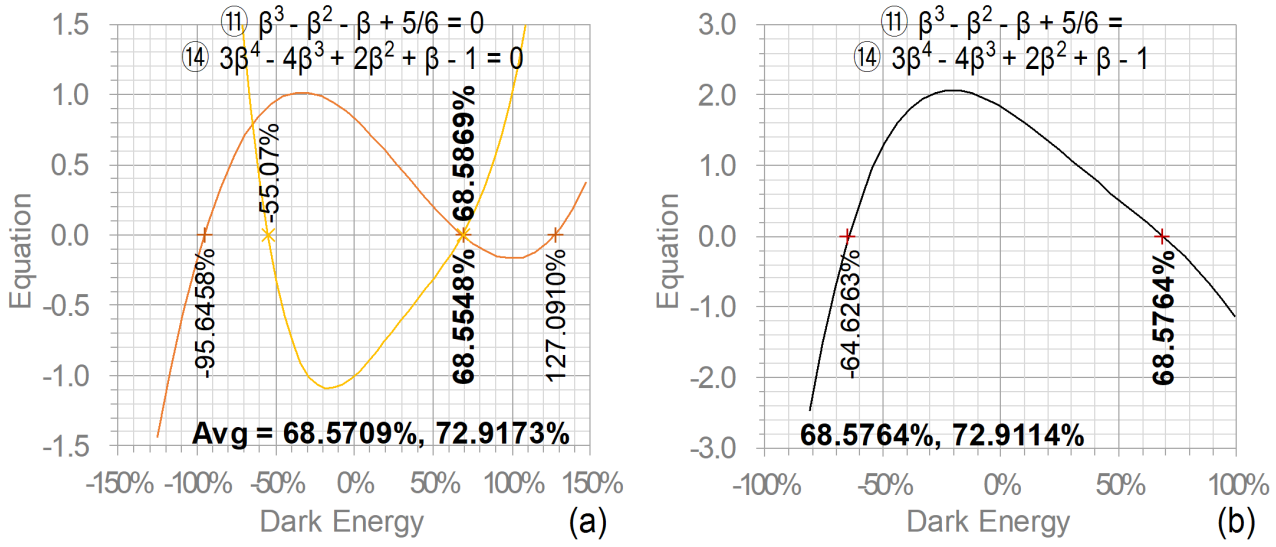

Fig. 3 Functions of Eqs. ⑪ & ⑭

68.5548%, and from Eq. ①, the value of Ω_Q is calculated as 72.9343%. Substituting Eq. ⑥ of 'reverse', it is arranged into Eq. ⑫, and Ω_E and Ω_Q are calculated as 68.7331% and 72.7452%.

3.3 Dark energy constant & Cosmological parameter

In Fig. 2(a), t_Λ is $1/c\sqrt{\Lambda}$. If Λ is a constant, t_Λ is also a constant. In (b), Ω_Q is t_Λ/t_H. Since t_H is time flow and t_Λ is a constant, Ω_Q becomes parameter. The formula developed above is a general-purpose formula according to time flow, but Ω was calculated as a constant. This means that dark energy ratio Ω is a constant regardless of time flow and cosmological constant Λ is parameter such as Hubble constant.

3.4 Change of universe according to time flow

In Fig. 29 of Ref. [1], dark energy ratio was parameter, cosmological constant was constant, and the results over time were calculated very strangely. From the results of this study, as shown in Fig. 1, from Big Bang to present, everything grows, but the ratio of growth over time is constant. As one example, meter can be changed, second can be changed, but the meter / second such as 2.9979E8 m/s is absolutely constant. If this result is applied to previous study, it will be calculated whether the masses of various particles according to time flow are constants or parameters.

3.5 Dark energy ratio: 72.9002%

After rearranging Eq. ⑩ of 'Reverse' and substituting Eq. ⑤ of 'forward', Eq. ⑬ is derived, and 68.7600% and 72.7167% are calculated. Substituting Eq. ⑥ of 'reverse', Eq. ⑭ is arranged, and from Fig. 3(a), 68.5869% and 72.9002%

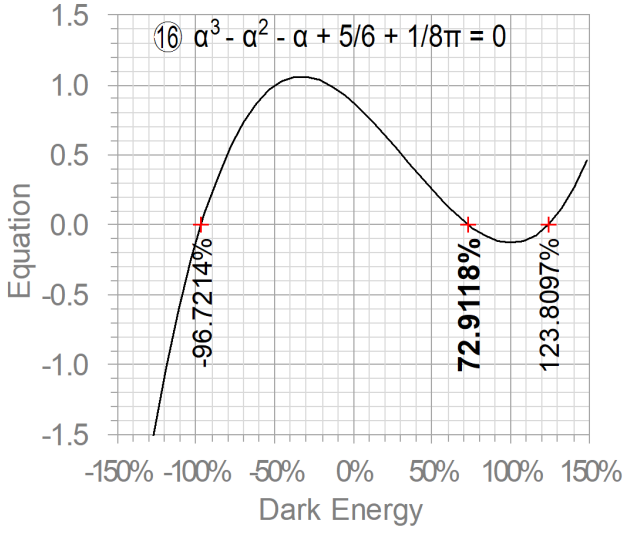

Fig. 4 Function of Eq. ⑯

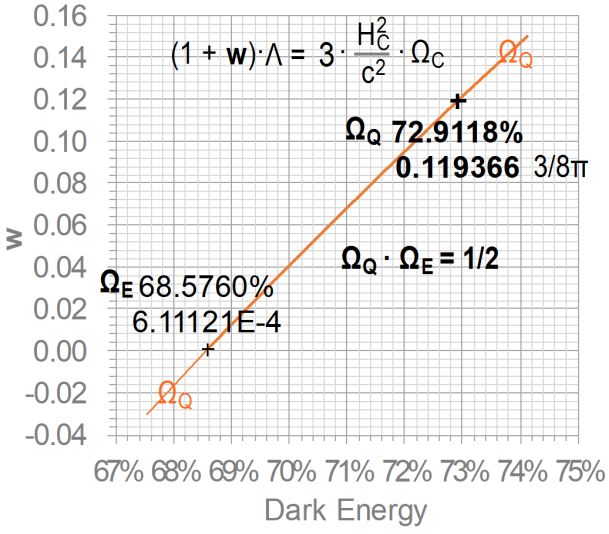

Fig. 5 Calculation according to change of [w]

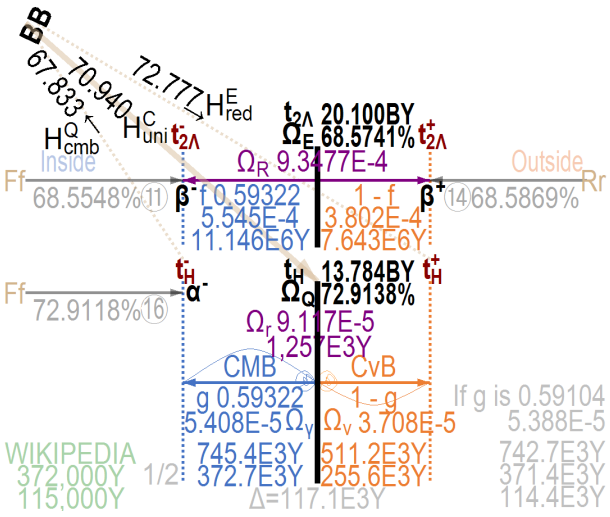

Fig. 6 Results of Calculation

are calculated.

3.6 Which is correct answer?

The average of ⑪⑫⑬⑭ is calculated as 72.82%, and Before Planck value is 72.8%. As shown in Fig. 3(a), the simple average of ⑪⑭ is 72.9173%. From various calculation methods, various values such as 72.7323% and 72.9129% are calculated. If Eq. ⑪ and Eq. ⑭ are the same, from Fig. 3(b), 68.5764% and 72.9114% are calculated.

After Planck is 68.3%, Panck 2018 Result is 68.34(84)%, 68.47(73)%, or 68.89(56)%, PDG 2022 is 68.5(7)%. Which is correct answer?

3.7 Dark energy ratio: 72.9118%

As shown in Fig. 2(e), Eq. ⑮ is proposed. When solving by substituting Eq. ⑨, Ω_{Q} is calculated as 72.7324%, which is exactly the same with 72.7323% of ⑫⑬. This formula is very clean and the results are exactly the same, so 72.7323% appears to be the correct answer. However, Eq. ⑫ is 'Forward & reverse', and Eq. ⑬ is 'Reverse& forward', which have different logic and direction. Also, in a previous study, 72.916% was calculated, and the error from 72.7323% is 0.25%, which is wrong answer.

By expanding Eq. ⑮ of 'Forward' and substituting Eq. ③ of 'forward', Eq. ⑯ is arranged, and 72.9118% is calculated from Fig. 4. Substituting Eq. ④ of 'reverse', Eq. ⑰ is arranged, and 72.4243% is calculated. Eq. ⑱ is 'Reverse' formula, and by substituting Eq. ③ and Eq. ④, 72.4415% and 72.9510% are calculated. As shown in Fig. 5, the result according to the change of [w] is shown. At 6.11121E-4 and 3/8π, $\Omega_{\mathrm{Q}} \cdot \Omega_{\mathrm{E}}$ becomes 1/2. Therefore, it can be understood that 1 + 3/8π is a conversion factor that changes Ω_{E} to Ω_{Q}.

3.8 Inside and outside time ratio: Ω_r, Ω_R

The value of 6.11121E-4 is judged to mean the difference between Eqs. ⑨, ⑩, and ⑮. In Fig. 1, the time of universe flows from Big Bang to t_{H} 13.784 BY. In that 4D space direction, there is Ω_{r} of inside t_H^- and outside t_H^+. Also, there is Ω_{R} of inside $t_{2\Lambda}^-$ and outside $t_{2\Lambda}^+$. Fig. 6 shows this in detail. The time of event horizon is $t_{2\Lambda}$ 20.100E9Y. The β^- 68.5548% of Eq. ⑪ means the inside time $t_{2\Lambda}^-$, and the β^+ 68.5869% of Eq. ⑭ means the outside time $t_{2\Lambda}^+$. Also, the time of our universe is t_H 13.784E9Y, and the α^- 72.9118% of Eq. ⑯ means the inside time t_H^-.

3.9 Dark energy ratio: 72.9138%

As shown in Fig. 2(f), Eq. ⑲ is Eq. ⑨ plus $f \cdot \Omega_{\mathrm{R}}$, which moves the value of ⑪ in Fig. 6 to the right. Eq. ⑳ is Eq. ⑩ minus $(1-f) \cdot \Omega_{\mathrm{R}}$, which moves the value of ⑭ in Fig. 6 to the left. Eq. ㉑ is Eq. ⑮ plus $g \cdot \Omega_{\mathrm{r}}$, which moves the value of ⑯ in Fig. 6 to the right. The rearranged equations are similar to eqs. ⑪, ⑭, and ⑯. β is $1/2\alpha$ from Eq. ①. Let's assume g is equal to f in Eq. ㉒, and Ω_{r} is calculated from Ω_{R} in Eq. ㉓. Here, $\mathrm{H_Q/H_E}$ is calculated from Fig. 2(g). Calculating the above formulas, the values of Ω_{Q}, Ω_{E}, and Ω_{C} are calculated as 72.9138%, 68.5741%, and 70.1862%.

3.10 Radiation ratio: 9.117E-5 = 5.408E-5 + 3.708E-5

In Fig. 1, Big Bang's CMB is located on t_H^-, and Big Bang's CνB is located on t_H^+. The value of Ω_{r} was calculated as 9.117E-5. Therefore, 5.408E-5 is the Ω_{γ} of CMB, and 3.708E-5 is the Ω_{ν} of CνB. Multiplying this value by 13.784E9Y, 745.4E3Y and 511.2E3Y are calculated. Half of them is 372.7E3Y and 255.6E3Y, and Δ is 117.1E3Y. If g in Eq. ㉒ is $\omega_{\mathrm{Q}}/\omega_{\mathrm{E}}$, 371.4E3Y and 256.9E3Y are calculated, and Δ is 114.4E3Y. Here, the calculation of formula and the explanation of picture must match each other. However, the formula $\omega_{\mathrm{Q}}/\omega_{\mathrm{E}}$ cannot be drawn on Fig. 6. By the same logic, on 4D event horizon in Fig. 1, there are something of 11.146E6Y to the left and 7.643E6Y to the right.

In the formula of Fig. 2(f), the standard for Ω_{R} and Ω_{r} is Λ. However, in Fig. 6, Ω_{R} is plotted on $t_{2\Lambda}$ and Ω_{r} is plotted on t_{H}. The picture may be slightly inaccurate. There seems to be something wrong in the Fig. 6.

3.11 Hubble parameter ratio: 1.072877

As shown in Fig. 2(g), expanding Eq. ⑧, H_{cmb}^Q/H_{uni}^C is derived into ㉕ $\sqrt{4/3 \cdot \Omega_{\mathrm{E}}}$, and the value is calculated as 0.956201. From Eq. ②, H_{red}^E/H_{uni}^C is calculated as ㉖ 1.025887, and the square is ㉗ 1.052444. Therefore, the value of H_{red}^E/H_{cmb}^Q is ㉘ 1.072877.

3.12 Combined Planck length: 1.628281E-35 m

The Planck length 1.616255E-35m in physics is the value of l_{P0}^E. Eq. ㉙ is proposed, and its value is 1.040459. From this, l_{P0}^Q is calculated as 1.648627E-35m, and l_{P0}^C is calculated as 1.628281E-35m from Eq. ②. In Fig. 22 of Ref. [1],

the proton radius in hydrogen was calculated as r_p^Q 0.87506 fm (physics 0.8751), the proton radius in muon was calculated as r_p^E 0.84101 fm (physics 0.8709), and the ratio is ㉚ 1.04049 (physics 1.0407). The value of Eq. ㉙ is 1.040459, and the difference is 0.003% (physics 0.020%). Coupled with the lifetime time of neutrons in beam and bottle, the value is ㉛ 1.05228. Here, the $(H_{red}^E/H_{uni}^C)^2$ is ㉗ 1.052444, and the difference is 0.015%.

3.13 Cosmological parameter: 1.106169E-52 /m2

In section 3.18 of Ref. [1], the value of $l_{P0}^{C2} \cdot \Lambda_3$ was calculated as 1E-121.5327. The more precise value is 1E-121.53272. Therefore, as shown in Fig. 2(h), cosmological constant Λ is calculated as 1.106169E-52 /m2.

3.14 Age of the universe: 13.784 BY

The size of quantum matter in Fig. 1 is calculated as t_Λ 10.050BY, and the age of the universe is calculated as t_H 13.784 BY. The value suggested by physics is 13.787BY, and the difference is 0.02%.

3.15 Hubble parameter: 67.832, 70.938, 72.774

As shown in Fig. 2(h), H_{uni}^C is 70.940 km/s/Mpc, H_{cmb}^Q is 67.833 km/s/Mpc, and H_{red}^E is 72.777 km/s/Mpc. Hubble tension problem has been solved, and the universe is expanding at the constant velocity. Eq. ㉜ is calculated as 2.74107E8 m/s. In Fig. 1(b) of Ref. [3], the value of l_{P3}^Q/l_{P2}^Q was 2.74516E8. From this value, the value of Eq. ㉝ is 2.74106E8, and the difference is 0.0002%. The unit of Eq. ㉜ is m/s, but Eq. ㉝ is unitless. This means that 1m at 3D is equal to 1s at 2D. Eq. ㉞ is calculated as 3.15515E8 m/s. From the same logic, Eq. ㉟ should be calculated, but we haven't found the formula yet.

As can be understood from Fig. 6, there is the speed of light c_{uni}^C on the middle, the speed of CMB c_{cmb}^Q on the left, and the speed of redshift c_{red}^E on the right. Here, each speed is calculated in various cases, but which one is the correct answer has not yet been determined.

3.16 Wave–particle duality

As shown in Fig. 6, there is a 4D space of 745.4E3Y on the left and 511.2E3Y on the right of our 3D space. We can never recognize 4D direction. This may be the cause of wave-particle duality.

3.17 Various formulas

As shown in Fig. 2(i), various formulas are established. If these results are true, many new formulas will be discovered.

3.18 Dark force ratio Ψ_C : 72.916103%

The results of previous studies were derived from six variables: Electron 510.998 950 keV, Muon 105.658 375 MeV, Proton 938.272 089 MeV, Fine-structure constant 1/137.035 999, Gravitational coupling constant 5.90 595E-39(0.002%), Z boson 91.1876(0.002%) GeV. In the integration of four fundamental forces of Table 2 in Ref. [2], dark energy ratio was calculated as 72.916% (in more detail 72.916108%). The results of previous studies were all calculated using this value, and the difference from 72.9138% is 0.003%. The error of Eq. ㉚ in previous study and Eq. ㉙ in this study is also 0.003%. In Table 1(4) of Ref. [3], the speed of light was calculated with 0.001% error. As a result of recalculation by substituting 72.9138%, the error was 0.003%. The error of Eq. ㉜ and Eq. ㉛㉝ is 0.0002%.

In Fig. 6, Ω_γ and Ω_ν have a vertex at 1/2 point, and [C] is calculated from Eq. ②. Since the standard for this value is t_Λ, by dividing Ω_C, Eq. ㉔ in Fig 2(f) is arranged. That is, t_F is t_H shifted slightly to the left. The value is calculated as 72.916103%, and the dark force ratio calculated in previous study was 72.916108%.

4. Conclusions

Everything is divided into [Q]uantum state on the left of our universe, [E]vent state on the right, and [C]ombined state in the middle. In this study, the dark energy ratio was calculated as [Q] 72.9138%, [E] 68.5741%, and [C] 70.1862%, and if the proposed formulas in this study are true, the error of calculation will be exactly zero. The value based on our 3D universe is 72.9138%, and the value based on the 4D event horizon is 68.5741%. Both are correct answer, but the value that affects our universe is 72.9138%.

All ratios including dark energy ratio are constant regardless of time flow. The cosmological constant of 1.106169E-52 /m2, the age of the universe of 13.784 BY, and the Hubble constant of 67.833 and 72.777 km/s/Mpc are parameters linearly proportional to time flow. It has not yet been determined whether the masses of various particles in the Standard Model are constant or parameters according to time flow.

Planck units represent the characteristics of dimensional quantum holes and are parameters that change linearly over time. Quantum hole is much stronger than black hole. Our 3D universe unfolds within the supermassive black hole at the center of a galaxy in 4D universe, and a 2D universe unfolds within the supermassive black hole at the center of a galaxy in 3D universe.

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