Calculation of Down Strange Bottom Quark Masses by Q-theory

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May 03, 2021

Keywords: Bottom quark, Charm quark, Down quark, Strange quark, Top quark, Up quark

Abstract
Down, strange, and bottom quarks are the combination particles composed of the shell fermion of neutrinos and the inside boson of a pair of neutrino and gravino. When down quark collides, the most external electron neutrino is peeled off and it is turned into strange quark. When the strange quark collides, the most external muon neutrino is peeled off and it is turned into bottom quark. When the bottom quark collides, the most external tau neutrino is peeled off, and a pair of neutrino and gravino boson pops out. All masses can be calculated from the measured masses of top quark, bottom quark, proton, Z boson and H boson. As the result of applying Q-theory, the mass of up, charm, down, strange quark was calculated as 2.254 MeV, 1277.1 MeV, 4.767 MeV, and 95.17 MeV. From these values, the cosmological constant was calculated as 98.4% of 1.1056E-52/m².

1. Introduction
In previous studies, the mass of H boson was calculated easily from logarithmic parabolic equation relationship of W boson and Z boson(1), the characteristics of logarithmic elliptic equation and the principle of universal change were described(2), the dimension of our space was calculated as 6.00108 from the masses of electron, muon, and tau(3), the standard masses and oscillating masses of three generation neutrinos and gravinos were calculated(4), the mass of up quark was calculated(5), four fundamental forces were unified by logarithmic parabolic equation(6), and the masses of proton and neutron were calculated(7).

The purpose of this study is to calculate the masses of up, charm, down, and strange quarks by Q-theory.

2. Shape of quarks
2.1 Quark and Anti-quark
In the previous study(5), the shapes of up, charm, and top quarks in Fig. 1 were described. These are anti-particles composed of standard anti-neutrinos, and down, strange, and bottom quarks are particles composed of oscillating neutrinos. Due to the difference of standard and oscillation, the masses of quarks vary greatly.

Fig. 1 Shape of quarks

2.2 Shape of quarks
In Fig. 1, α, β, and γ mean each 1st, 2nd, and 3rd generation fundamental particles, subscript n and s mean neutrino and anti-neutrino, small letter and capital letter mean standard and oscillation, and superscript f and b mean fermion and boson. Therefore, $\alpha_n^f$, $\beta_n^f$, and $\gamma_n^f$ are the oscillating fermion neutrinos of electron on 4D, muon on 5D, and tau on 6D. $\alpha_{n\text{gts}}^b$, $\beta_{n\text{gts}}^b$, and $\gamma_{n\text{gts}}^b$ are a pair of standard boson brane(7) on 10D, on 11D, and on 12D.

2.3 Collapse of quark
When down quark $a\beta_{n\text{gts}}$ radiates, the $\alpha_n^f$ is peeled off and it is turned into strange quark $\beta_{n\text{gts}}$. When the strange quark collides, the $\beta_n^f$ is peeled off and it is turned into bottom quark $\gamma_n^f$. There is w boson $\alpha_{n\text{gts}}^b$ of 10D in down quark, z boson $\beta_{n\text{gts}}^b$ of 11D in strange quark, and h boson $\gamma_{n\text{gts}}^b$ of 12D in bottom quark. These are all the same particles. Quantum space imparts the mass to particle(1), and because the quantum dimension of the most external shell is changed to 4D,
Table 1 Calculation of down, strange, and bottom quark masses.

<table>
<thead>
<tr>
<th>Term</th>
<th>Reference</th>
<th>Kinetic State</th>
<th>Steady State</th>
<th>Unit</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>FERMION</td>
<td>Fig. 1,3(a)[4]</td>
<td>0.1531 170.0k 15.50M 0.1384 166.0k 15.52M eV</td>
<td>$a_n^4$ $\beta_n^5$ $\gamma_n^6$</td>
<td>4D</td>
<td>5D</td>
</tr>
<tr>
<td>ns</td>
<td>Eq. 3</td>
<td>28.74k 35.77k 67.05k 28.45k 35.44k 66.67k eV</td>
<td>$m_{n4}$ $m_{n6}$ $m_{n8}$</td>
<td>4D</td>
<td>5D</td>
</tr>
<tr>
<td>DARK</td>
<td>Fig. 8[6]</td>
<td>0.3842 0.0394 0.00065 0.3842 0.0394 0.0065 eV</td>
<td>$\xi_4$ $\xi_5$ $\xi_6$</td>
<td>4D</td>
<td>5D</td>
</tr>
<tr>
<td>QUARK</td>
<td>Sum</td>
<td>6.684 7.973 9.624 6.685 7.978 9.630 eV</td>
<td>$m_d$ $m_s$ $m_b$</td>
<td>4D</td>
<td>5D</td>
</tr>
</tbody>
</table>

5D, and 6D, that of the boson brane also is naturally changed to 10D, 11D, and 12D.

2.4 Collapse of boson

In the previous study[7], the mass of H boson was calculated as 125.02 eV from logarithmic parabolic equation.

When the bottom quark collides some under 125.02 eV, the $\gamma^f_N$ is peeled off, the boson brane $\gamma^b_{ngt}$ on 12D pops out, it jumps into our quantum space 6D, and it changes to H boson. Then, it jumps to 5D by oscillation phenomenon(3-4), and it changes to Z boson. Then it jumps to 4D by oscillation phenomenon, and it changes to W boson.

When the bottom quark collides over 125.02 eV, the boson brane $\gamma^b_{ngt}$ separates into a pair of neutrinos $\nu_b^3$ and a pair of gravinos $\nu_b^4$ on 12D. They jump into our quantum space 6D and jump into 5D and 4D by oscillation phenomenon. When it is placed in 5D space, it can be measured as a pair of photon and anti-photon $\rho^b_{ngt}$.

2.5 Light and Anti-light

In Fig. 1, there are no $\gamma^b_{ngt}$, $\rho^b_{ngt}$, and $\gamma^b_{ngt}$ in up, charm, and top quarks. These particles are all the same, and these may be the light and anti-light in our universe and simulation universe(2). The shell fermion particles of quark and the inside boson particles of quark are in super-gauge symmetry(2). Therefore, the shell fermion is always in steady state, and the inside boson may be always in kinetic state moving at the speed of light. This may be why light has the speed of light.

3. Calculation of quark mass

3.1 Kinetic state and Steady state

Everything is divided into kinetic state and steady state. The kinetic state is the analysis that our universe is absolutely expanding, and the steady state is the analysis that particles are relatively stationary.

It is judged that three generation boson dark forces are acting on the boson particles. Due to this, the masses of quarks cannot be calculated. However, it is necessary to look at the flow of calculation.
Table 2 Calculation of strange quark mass in kinetic state.

<table>
<thead>
<tr>
<th>Term</th>
<th>Reference</th>
<th>Logarithmic ellipse equation</th>
<th>Logarithmic parabolic equation</th>
<th>Unit</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quark</td>
<td></td>
<td>Down Strange Bottom</td>
<td>Down Strange Bottom</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.756M 102.6M 4.180G</td>
<td>4.756M 95.16M 4.180G</td>
<td>eV</td>
<td>m_d, m_s, m_b</td>
</tr>
<tr>
<td>Shell + Inside</td>
<td></td>
<td>6.677 8.011 9.621</td>
<td>6.677 7.978 9.621</td>
<td>log</td>
<td>q_d, q_s, q_b</td>
</tr>
<tr>
<td>Dimension</td>
<td></td>
<td>4D 5D 6.001D</td>
<td>4D 5D 6.001D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shell</td>
<td>Table 1</td>
<td>5.742 6.689 7.191</td>
<td>5.742 6.689 7.191</td>
<td>log</td>
<td>αβγ_N^456, βγ_N^56, γ_N^6</td>
</tr>
<tr>
<td>Dimension</td>
<td></td>
<td>10.001D 11.001D 12.002D</td>
<td>10.001D 11.001D 12.002D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inside</td>
<td>Quark – Shell</td>
<td>0.936 1.322 2.430</td>
<td>0.936 1.289 2.430</td>
<td>log</td>
<td>α^10_n_{gfts}, β^11_n_{gfts}, γ^12_n_{gfts}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.625 20.98 269.3</td>
<td>8.625 19.47 269.3</td>
<td>eV</td>
<td>w, z, h</td>
</tr>
</tbody>
</table>

3.2 Mass of muon and tau neutrinos

The neutrino masses of muon β^5_n, and tau γ^6_n must be given of calculation. In Table 1, the muon mass of 170 keV and tau mass of 15.50 MeV in kinetic state are given by measurement. The muon mass of 166.0 keV and tau mass of 15.52 MeV in steady state are now assumed. These values are calculated by applying a trial & error method to the charm and top quark masses.

From logarithmic elliptic equation, the electron neutrino mass α^4_n is calculated as 0.1531 eV and 0.1384 eV^41.

3.3 Oscillating mass of neutrino

All masses are calculated logarithmically. At quarks in Fig. 1, the electron neutrino α^4_n oscillates with α^4_n, α^3_n, and α^2_n, the muon neutrino β^4_n oscillates with α^4_n, α^6_n, β^6_n, and β^5_n, and the tau neutrino γ^4_n oscillates with γ^6_n. Therefore, the oscillating neutrino masses of electron, muon, and tau are calculated as α^456_n, β^456_n, and γ^46_n by equation 1) in Table 1.

3.4 Shell fermion mass

The shell masses of down, strange, and bottom quarks are calculated as αβγ_N^456, βγ_N^56, and γ_N^6 by equation 2) in Table 1. These values are the masses of the shell in Fig. 1.

3.5 Dimension of boson

The shells of quarks are the fermion quantum dimensions of 4D, 5D, and 6.001D, and the inside of quarks are the boson quantum dimensions of 10.001D, 11.001D, and 12.002D. Fermion and boson are super-gauge symmetry^20.

3.6 Mass of n and g of boson

Boson neutrino n has the value at 4D oscillating dimension, and boson gravino g has the value of 6D oscillating dimension. Here, the mass of m_{n_{g4}}, m_{g6}, and m_{g5} were calculated in the previous study^50.

3.7 Inside boson mass

In the previous study^50, the mass sum of boson’s particle and anti-particles was very well established by Equation 3) in Table 1. So, applying that formula, m_{n_{g5}} and m_{g5} are calculated. The logarithmic values of the mass are calculated, and the averages are α^10_n_{gfts}, β^11_n_{gfts}, and γ^12_n_{gfts}.

3.8 Dark force of super-gauge symmetry

In previous study^60, three generation dark forces of ξ_4, ξ_5, and ξ_6, acting toward our space from the outside of our universe was calculated. The dark forces act toward fermion’s 4D, 5D, and 6D spaces, and they change into boson’s 10D, 11D, and 12D spaces with super-gauge symmetry. However, since the conversion formula has not yet been identified, equation 4) in Table 1 was arbitrarily applied.

3.9 Quark mass

The logarithmic mass of quark is the sum of the shell fermion, inside boson, and dark force. Therefore, the down quark mass m_d, the up quark mass m_s, and the bottom quark mass m_b are calculated as 4.835 MeV, 93.94 MeV, and 4.204 GeV in kinetic state, and 4.840 MeV, 95.04 MeV, and 4.264 GeV in steady state. This value is similar to the value recognized in physics. However, there is no basis for Equation 4) in Table 1, and the above values cause errors in other calculations.

3.10 Error analysis

The exact value of quark mass is not yet known. Due to this, it is not possible to check whether the calculated values in Table 1 are correct. There are the following problems in this calculation. 1) Dark force may not work on boson particles. 2) It may have to be calculated as an imaginary number. 3) Equation 3 in Table 1 may be wrong. 4) Boson neutrino may not exist. 5) Some choice is wrong in Table 1. 6) The values of α^10_g, β^11_g, and γ^12_g should be calculated directly from the measured down, strange, and bottom quark masses. 7) The shell is in steady state, and the inside is in kinetic state. Various combinations for above calculation have been performed in this study, but the above dark force problem has not been solved yet.
4. Calculation of strange quark mass

4.1 Three additional conditions

Since the expected three dark energy values were not found, three other additional conditions are required.

4.2 Calculation of down quark mass form proton

In previous study\(^\text{(7)}\), down quark mass was calculated as 4.756 MeV from the measured proton mass. This is the first additional condition. Here, 4.756 MeV changes slightly as input values change.

4.3 Logarithmic elliptic equation at boson

In Fig. 1, if dark energy does not affect the w, z, and h bosons, logarithmic elliptic equation must be established for the w, z, and h bosons as shown in Fig. 2.

In Table 1, the down quark mass \(m_d\) is the calculated value from proton, and the bottom quark mass \(m_b\) is the measured value. Its logarithmic values are \(q_d\) and \(q_b\). The logarithmic masses of quark shells \(\alpha \beta \gamma N\) and \(\beta \gamma N\) are given in Table 1. Thus, the inside bosons \(\alpha_{ngts}\) and \(\gamma_{ngts}\) are calculated, and its masses w and h are calculated as 8.625 eV and 269.3 eV.

Since these values must satisfy logarithmic elliptic equation in Fig. 2 from the assumption that dark forces do not exist, the value of z boson is calculated as 20.98 eV. Since the sum of the shell \(\beta \gamma N\) and the inside \(\beta_{ngts}\) is \(q_\beta\), the mass of the strange quark is calculated as 102.6 MeV.

The mass range of the recognized strange quark is about 95 ~ 96 MeV. Therefore, it is understood that the results in Fig. 2 are wrong. This means that dark forces are acting toward the bosons from the outside of our universe.

4.4 Logarithmic parabolic equation at boson

In Table 2, When the down \(m_d\), strange \(m_s\), and bottom \(m_b\) quark masses are given, the w, z, and h boson masses are calculated as 8.625 eV, 19.47 eV, and 269.3 eV. Applying these values to the logarithmic parabolic equation in Fig. 3, The value of 5D is calculated as 91.1876 GeV, and this is the mass of Z boson.

When down and strange masses are 4.8 MeV and 95 MeV, the value of 5D is calculated as 117.5 GeV, and at 4.7 MeV and 96 MeV, the value of 5D is calculated as 52.4 GeV. This value is very similar to the mass 91.1876 GeV of Z boson. It may be a coincidence, but this is judged to be the correct answer. If the shape of quantum space is shown mathematically, all questions of quantum mechanics will be solved.

In previous study\(^\text{(6)}\), the four fundamental forces applied by dark force were calculated by logarithmic parabolic equation. The boson in quark is also a series of particle force and dark force, and the logarithmic parabolic equation in Fig. 3 is established. Therefore, the strange mass is calculated as 95.16 MeV.

In Fig. 4, the mass in up, charm, top quark is shown.
50.58 eV, 126.7 eV, and 1772 eV in Fig. 4. If the mass all calculations must be performed. However, since the change follows the logarithmic parabolic equation, the masses will be measured around 200 keV. Since this is a 4.5 Boson in up, charm, top quarks

In the previous study(5), the masses of boson neutrino pairs in up, charm, and top quarks in Fig. 1 were calculated as 50.58 eV, 126.7 eV, and 1772 eV in Fig. 4. If the mass change follows the logarithmic parabolic equation, the masses will be measured around 78.24 GeV in 5D. If the mass change follows the logarithmic elliptic equation, the masses will be measured around 200 keV. Since this is a pair of neutrinos, the elliptic equation will be correct.

4.6 Sensitivity analysis

In principle, given the masses of top and bottom quarks, all calculations must be performed. However, since the equation for three generation dark forces acting on boson has not yet been found, down quark mass can be calculated from proton mass, and strange quark mass can be calculated from Z boson mass. Here, the charm quark mass remains unknown value.

In Table 3, when the mass of bottom quark is 4.180 GeV, up quark, down quark, strange quark, cosmological constant, and birth time of life are calculated according to the change of top quark and charm quark mass. Here, Λ is the measured cosmological constant 1.1056E-52, and Λ’ is the calculated value from the quark masses. The calculation process will be described in a future study. All of the up quark mass satisfies 2.2 ~ 2.3 MeV. Looking at the down quark mass range of 4.7 ~ 4.8 MeV and the strange quark mass range of 95 ~ 96 MeV, the cosmological constant ratio Λ’/Λ is about 98%. This means that the calculated values are about 2% different from the cosmological constant Λ.

Table 3 Sensitivity analysis according to the change of top and charm. Where, bottom quark is 4.180 GeV.

<table>
<thead>
<tr>
<th>Top</th>
<th>172.76 GeV</th>
<th>172.57 GeV</th>
<th>172.38 GeV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charm</td>
<td>Up</td>
<td>Down</td>
<td>Strange</td>
</tr>
<tr>
<td>1270</td>
<td>2.223</td>
<td>4.888</td>
<td>96.83</td>
</tr>
<tr>
<td>1271</td>
<td>2.227</td>
<td>4.870</td>
<td>96.61</td>
</tr>
<tr>
<td>1272</td>
<td>2.231</td>
<td>4.853</td>
<td>96.39</td>
</tr>
<tr>
<td>1273</td>
<td>2.235</td>
<td>4.836</td>
<td>96.17</td>
</tr>
<tr>
<td>1274</td>
<td>2.239</td>
<td>4.819</td>
<td>95.96</td>
</tr>
<tr>
<td>1275</td>
<td>2.243</td>
<td>4.802</td>
<td>95.74</td>
</tr>
<tr>
<td>1276</td>
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<td>4.785</td>
<td>95.53</td>
</tr>
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<td>2.251</td>
<td>4.768</td>
<td>95.31</td>
</tr>
<tr>
<td>1278</td>
<td>2.255</td>
<td>4.751</td>
<td>95.10</td>
</tr>
<tr>
<td>1279</td>
<td>2.259</td>
<td>4.734</td>
<td>94.89</td>
</tr>
<tr>
<td>1280</td>
<td>2.263</td>
<td>4.717</td>
<td>94.67</td>
</tr>
</tbody>
</table>

MeV. Here, if a condition changes, the 95.16 MeV also changes slightly.

Fig. 5 Dimension shift of w, z, and h

Fig. 6 Logarithmic ellipse equation of charm quark
5. Calculation of charm quark mass

5.1 One additional condition

One additional condition is required to calculate the mass of charm quark. By substituting the cosmological constant $\Lambda$ condition, the charm quark mass can be calculated. However, the $\Lambda$ is the condition for checking how accurate the overall calculations are. Therefore, we should find another condition.

5.2 A certain idea

In Fig. 3, the logarithmic masses of bosons $w$, $z$, and $h$ are 0.936, 1.289, and 2.430. The logarithmic value of boson $Z$ is 10.960. Calculating with the formula in Fig. 3, the D value of Fig. 4 is 84.06 GeV and the B value is 118.59 GeV. As shown in Fig. 5, the logarithmic ellipse of the center on 3D, 84.06 on 4D, 91.1876 on 5D, and 118.59 on 6D are shown.

5.3 Charm quark mass

Change the initial charm quark mass using trial and error method. The right vertex value in Fig. 5 becomes 125.02 GeV, and the charm quark value is calculated as 1278 MeV. It cannot be explained why Fig. 5 and Fig. 6 should be established. Above is one idea. When the shape of quantum space is completely calculated by mathematical formula, all questions of quantum mechanics will be solved.

5.4 Sensitivity analysis

The masses of up, charm, down, and strange quarks according to the changes of top and bottom quark masses are shown in Table 4. The calculated up quark mass satisfies all 4.7 ~ 4.8 MeV. The strange quark mass is recognized as 95 ~ 96 MeV. Therefore, when the top quark mass is 172.76 GeV, the ratio of the calculated cosmological constant $\Lambda$ and the measured value $\Lambda'$ is calculated as about 93.4% ~ 100.2%, and at 172.38 GeV, it is calculated about 96.1% ~ 103.1%.

6. Conclusions

To calculate the masses of steady-state quarks, the muon and tau neutrino masses and the three generation dark forces must be given. However, the dark forces have not yet been identified. Substituting inversely top quark 172.76 GeV, bottom quark 4.180 GeV, proton 938.3 MeV, Z boson 91.1876 GeV, and H boson 125.02 GeV, all of masses can be calculated.

As the results, the masses were calculated as up quark 2.254 MeV, charm quark 1277.7 MeV, down quark 4.756 MeV, and strange quark 95.16 MeV. From the above results, the cosmological constant was calculated as 98.4% of the measured value. It can be understood that the results of these calculations are quite accurate.

References