

# Origin of Koide Formula

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**Abstract** The core of Koide formula is to figure out what the root mass means. The key points are as follows. (1) Origin particles are 3 neutrinos and 3 gravitons (graviton, photon, gluon). (2) The 6 origin particles exist all in electron, muon, and tau. (3) The compressed quantum space is reversible and optimized. As the result, the  $\sqrt{m}$  is established. (4) The 9 combination mass regions are composed of 3 mass regions of electron, muon, tau and 6 empty regions. (5) Electron, muon, and tau fight each other to occupy the six empty regions. The fighting process is  $1/3 < \text{Koide} < 1$ . (6) The fairest and most stable result of the fighting is  $2/3$ . Due to this, quantum space becomes reversible and optimized.

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## 1. Introduction

The core of Koide formula is to understand  $\sqrt{m_e}$ ,  $\sqrt{m_\mu}$ , and  $\sqrt{m_\tau}$ . To do this, first, the origin of electron, muon, and tau must be answered.

## 2. Electron, Muon, Tau

### 2.1 Origin particles, Normal

The author suggested that the origin particles are electron neutrino (1<sup>st</sup>), muon neutrino (2<sup>nd</sup>), tau neutrino (3<sup>rd</sup>), graviton (1<sup>st</sup>), photon (2<sup>nd</sup>), and gluon (3<sup>rd</sup>) [Fig. 2 in Ref. 1], and calculated their masses [Fig. 4, 5 in Ref. 1]. The shapes and masses of the six origin particles are shown in Fig. 1(a).

### 2.2 Origin particles, Oscillation

The six origin particles have the oscillating masses, and the masses calculated in previous study [Fig. 4, 5 in Ref. 1] are shown in Fig. 1(b).

### 2.3 Square root mass of oscillation

In Fig. 1(b), the mass of electron neutrino oscillates at 13.53 MeV, 186.5 keV, and 0.1524 eV. The simple average is 4.572 MeV, and the 3 square root is 7.272 keV. The latter is the correct answer. What does the square root mass ① mean?

### 2.4 Combined particle mass

In Fig. 1(c), electron is the combination of 1st, 2nd, and 3rd particles, muon is the combination of 2nd and 3rd particles, and tau is the 3rd particle. This is also square root mass ②.

Expressing this as a line, the green line is the 3rd, the orange line is the 2nd, and the red line is the 1st. Each multiplication means line, plane, and volume, and each

square root mass means the regular length of one line.

### 2.5 Electron, Muon, Tau

In Fig. 1(c), electron, muon, and tau are composed of neutrino (three generations) and gravino (graviton, photon, and gluon). They are drawn as rectangles in (d). Therefore, the electron mass of  $m_e$  510.999 keV is the product of neutrino 557.80 keV and gravino 0.91609 eV, the muon mass of  $m_\mu$  105.658 MeV is the product of neutrino 4.8852 MeV and gravino 21.628 eV, and the tau mass of  $m_\tau$  1776.8 MeV is the product of neutrino 15.408 MeV and gravino 115.32 eV.

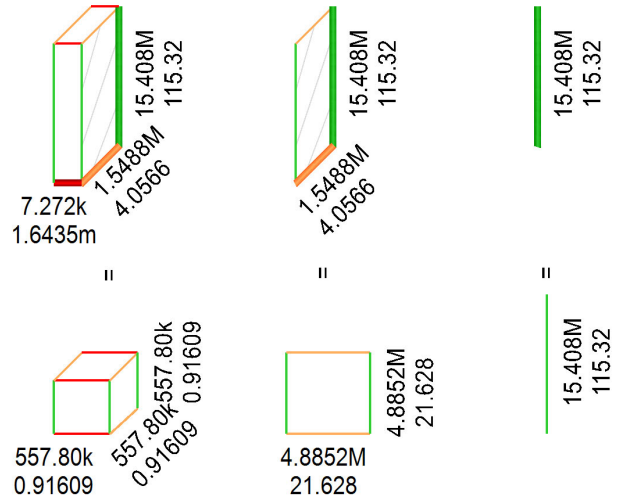
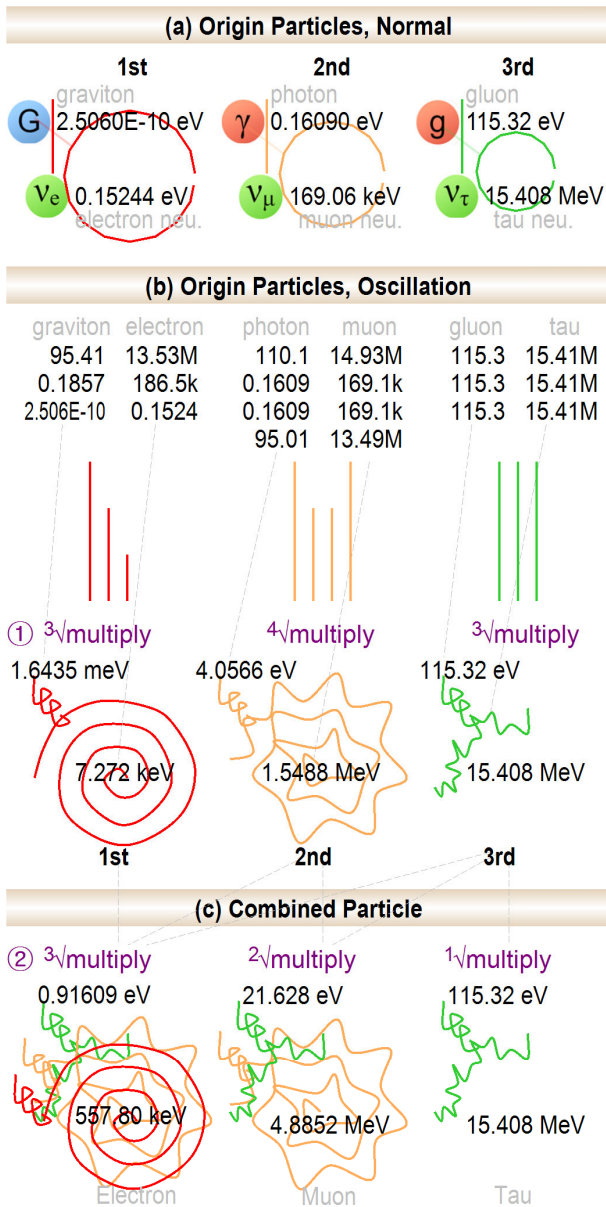
The  $\sqrt{m_e}$ ,  $\sqrt{m_\mu}$ , and  $\sqrt{m_\tau}$  is the change of shape from the rectangle mass to square mass. Why does rectangle change into square? ① in (b) and ② in (c) are also the same phenomenon.

### 2.6 Reversible and optimized quantum space

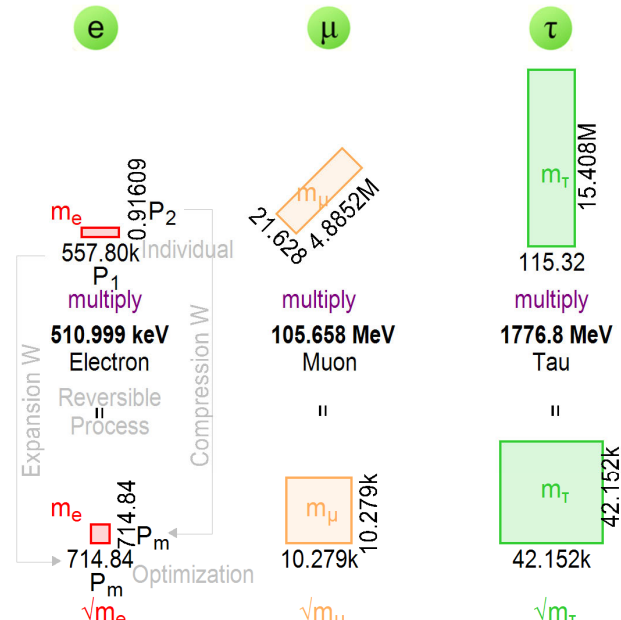
The compressed quantum space gives particles mass [Fig. 5 in Ref. 2]. That is, quantum space has the same characteristics as a compressor of thermodynamics. In a reversible two-stage compressor, the intermediate pressure  $P_m$  of minimum work for compressing inlet state  $P_1 T_1$  to outlet state  $P_2 T_{2s}$  is calculated as  $\sqrt{P_1 \cdot P_2}$  of  $W_I = W_{II}$  from the complex equations of thermodynamics. The above prerequisites are reversibility and optimization.

### 2.7 Meaning of square root

To explain (d) thermodynamically,  $P_1$  557.80 keV produces the expansion work of  $W$  and changes to  $P_m$  714.84 eV, and  $P_2$  0.91609 eV receives the compression work of  $W$  and changes to  $P_m$  714.84 eV. Therefore, the above rectangle is the product mass of neutrinos and individual gravinos, and the below square is the optimized combined mass of neutrinos and gravinos. The optimized combined each mass of neutrinos and gravinos is  $\sqrt{m_e}$ ,



(d) Electron, Muon, Tau = 3 Neutrinos  $\perp$  3 Gravitos



※ Intermediate pressure  $P_m$  to minimize 2-stage reversible compression work  $W_{1,rev} + W_{II,rev}$

$$P_1 T_1 \xrightarrow{W_I} P_m T_{m,s} \xrightarrow{Q_{out}} P_m T_1 \xrightarrow{W_{II}} P_2 T_{2s} \Leftrightarrow \text{Thermodynamic calculations} \Leftrightarrow \begin{matrix} W_I = W_{II} \\ P_m = \sqrt{P_1 \cdot P_2} \end{matrix}$$

Quantum Space  
1) Reversible  
2) Optimized

Fig. 1 Origin of electron, muon, tau

$\sqrt{m_\mu}$ , and  $\sqrt{m_\tau}$ . Therefore, the masses of ① and ② are also calculated as square root.

### 3. Koide Formula

#### 3.1 Combination of gravinos + neutrinos

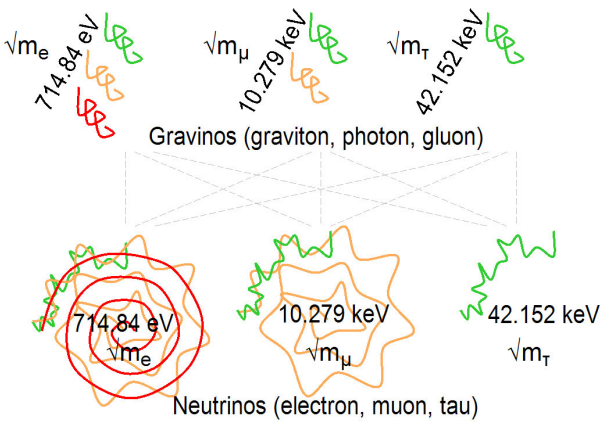
In Fig. 2(a), gravinos and neutrinos constituting electron, muon, and tau are individually shown. The number of cases

where these are combined is nine, and they are shown in (b). Since they are combinations, their masses are reversible and optimized  $\sqrt{m_e}$ ,  $\sqrt{m_\mu}$ , and  $\sqrt{m_\tau}$ . Here, it can be understood that "strange" in (b) cannot be established pictorially. Therefore, those six particles do not exist.

#### 3.2 Empty quantum space

In Fig. 2(d), the right figure is the same as the left figure. As understood from Fig. 1(d), the optimization should be

**(a) Reversible & Optimized : Gravinos + Neutrinos**



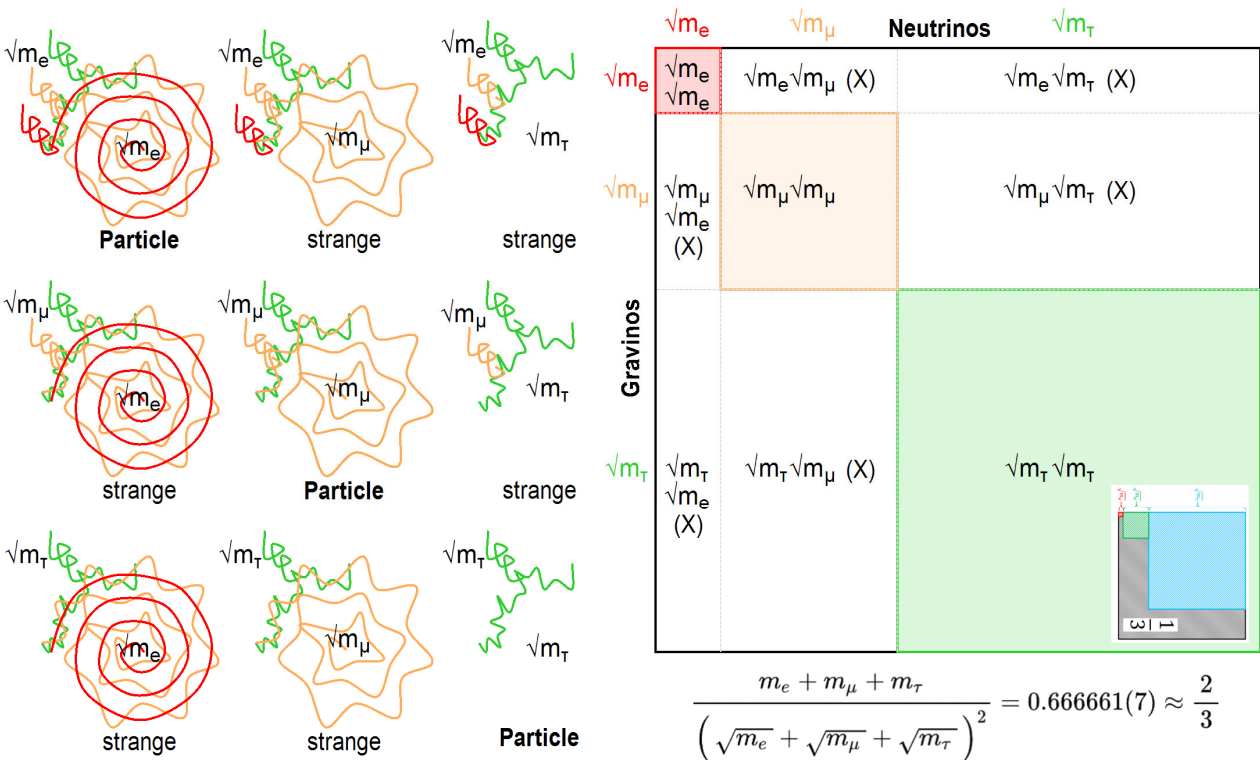
**(c) Cause of Koide formula**

1. Origin particles = 3 Neutrinos  $\perp$  3 Gravinos
2. The 6 origin particles exist all in electron, muon, and tau
3. Compressed Q.S. = Reversible & Optimized =  $\sqrt{\quad}$
4. 9 combination region = 3 region of  $e \mu \tau$  + 6 empty region
5. The fighting process of  $e \mu \tau = 1/3 < \text{Koide} < 1$

**< Reversible & Optimized = Stable & Fair >**

- ① Dimensions  $\rightleftharpoons$  Six, Hexagon
- ② Mathematical Formula  $\rightleftharpoons$  Elliptic equation
- ③ Mass Distribution  $\rightleftharpoons$  Koide formula, 2/3
- ④ ?
- ⑤ ?
- ⑥ Change  $\rightleftharpoons$  Absolute Time

**(b) Total number of 9 combinations = electron + muon + tau + 6 empty**



**Fig. 2 Cause of Koide formula**

square. Therefore, the rectangles are not optimized, so particle cannot be located. These are empty quantum space.

**3.3 1/3 < Koide formula < 1**

Therefore, Koide formula is derived. Even if the dotted line in (d) is moved arbitrarily, the Koide value is greater than 1/3 and less than 1.

**3.4 Reversible & Optimized = Stable & Fair = 2/3**

In (d), the movement of the dotted lines is a reversible process without loss. If  $\sqrt{m_e}$ ,  $\sqrt{m_\mu}$ , and  $\sqrt{m_\tau}$  are the same, the Koide area becomes 1/3, and the empty area becomes 2/3. This is a non-optimized mass distribution. If one is very large and two are very small, the Koide value is 1. This is unfair mass distribution. The reversible, optimized, stable, and fair mass distribution is 1/3.

**3.5 Other particles**

As shown in Fig. 1, electron, muon, and tau contain all six

origin particles. Therefore, Koide formula is established only for electron, muon, and tau. That is, the other particles cannot be established.

### 3.6 Before Big Bang

In Fig. 2(c), the reversible, optimized, stable, and fair dimension is six. That mathematical equation is elliptic equation. That mass distribution is Koide  $2/3$ . That change is absolute time. If the above conditions were completed after Big Bang, the probability of our universe being born is  $1 / 10^{120}$ , and if the above conditions were completed before Big Bang, the probability of our universe being born is  $1 / 1$ .

### 3.7 Why? Koide = 0.666 661

From the measurements of electron, muon, and tau masses, the Koide value is calculated as 0.666 661. The difference with  $2/3$  is 0.000 005. If Koide formula is true, there must be a very fine effect. (1) In muon  $g-2$  experiment, the value of anomalous magnetic moment is 0.000 004 [Table 1 in Ref 3]. (2) In PDG 2022, proton radius is given as  $0.8409 \pm 0.0004$  fm. The value may be 0.84094 fm [Fig. 10 in

Ref. 4]. In this way, Koide formula is judged to be the correct answer, and there must be a very fine cause that has not yet been found.

## 5. Conclusions

The value  $1/3$  of Koide formula is judged to be true. This means that quantum space is reversible and optimized. A very fine effect, as yet unknown, are thought to exist as much as 0.000 005 from 0.666 661.

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