A simple formula for neutrino masses

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Abstract

This is a simple formula related to neutrino masses, according to which we get the absolute masses of three neutrinos.

Introduction

The three types of charged leptons are: electron, muon and tau. Their masses are: M_e, M_μ, M_τ, and the neutrino masses corresponding to them are: m_1, m_2, m_3. This paper assumes that neutrinos come from within charged particles, and they are related to the spin of charged particles, and then we get a simple formula for calculating the neutrino masses, as follows:

$$m_n = \frac{M_e \alpha^3}{16 g_l^2} \sqrt{\frac{M_a \alpha}{M_b}} \tag{1}$$

Thereinto:

m_n is the mass of the neutrino; $n = 1.2.3.$

M_e is the mass of the electron;

α is the fine structure constant;

M_a is the mass of the charged lepton before decay;

M_b is the mass of the charged lepton after decay;

g_l is the orbital g-factor of electron, muon and tau.

Now let's start calculating the masses of the three neutrinos.

Since both muon and pottery can decay into electrons, we have $M_b = M_e$. Since the electron is a stable particle and has no decay, for the value of its M_a, here we use the mass of the electron in the excited state to replace it, then we have the relationship:

$$M_a = M_e + \alpha M_e \tag{2}$$

αM_e is the equivalent mass corresponding to the electrostatic potential energy of the electron in excited state.

Now, substitute the equation (2) into the equation (1), and we get that

The mass of the electron neutrino is:

$$m_1 = \frac{M_e \alpha^3}{16 g_{el}^2} \sqrt{\frac{\sqrt{\pi/3}\,(1+\alpha) M_e}{M_e}} \tag{3}$$

The calculation result of the formula (3) is: $m_1 = 0.01257116 \text{ eV}/c^2$.

$\sqrt{\alpha}$ is a factor related to decay, and since the electron is a stable particle, so formula (3) does not need it. $\sqrt{\pi/3}$ is a factor related to the excited state.

The mass of the muon neutrino is:

$$m_2 = \frac{M_e \alpha^3}{16 g_{\mu l}^2} \sqrt{\frac{M_\mu \alpha}{M_e}} \tag{4}$$

The calculation result of the formula (4) is: $m_2 = 0.01520928 \text{ eV}/c^2$.

The mass of the tau neutrino is:

$$m_3 = \frac{M_e \alpha^3}{16 g_{\tau l}^2} \sqrt{\frac{25}{36} \frac{M_\tau \alpha}{M_e}} \tag{5}$$

The calculation result of the formula (5) is: $m_3 = 0.05197472 \text{ eV}/c^2$.

For $g_{\tau l}$, we take the theoretical value of its. Since the tau has many decay modes, $25/36$ is a decay rate of the tau. $P(A \cup B)/\sqrt{\pi/3} = 25/36$. $P(A) = 64.79\%$, which is the branching ratio of the hadronic type decay of the tau; $P(B) = 17.82\%$, which is the branching ratio of the electronic type decay of the tau [1].

The sum of three neutrino masses is:

$$m_1 + m_2 + m_3 = 0.07975516 \text{ eV}/c^2 \tag{6}$$

The mass ordering of the three neutrinos is:

$$m_3 > m_2 > m_1 \tag{7}$$

Reference

[1] https://en.m.wikipedia.org/wiki/Tau_(particle)