On the relationship between proton-Mass and electron-Mass

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Abstract: In this paper, I analysis the relationship between proton-mass and electron-mass. I point out that the mass difference is origin from the energy-mass relationship among difference spaces. I give the comprehensive formula to show this. The relationship between proton-mass and electron-mass can be expressed as

$$m_p = \sqrt[3]{\frac{1}{8\alpha^5}}m_e$$
.

Key words: virtual space; Electron; Proton; Mass

This paper is based on my previous work.[1~3] In this paper, I continue to analysis the characteristic of electric-magnetic space after I finished analyzing the gravitational space in previous work. [1]

1 Why proton-mass is different from electron-mass

I point in paper [1] that a particle's energy can be divided into two parts. One is the static energy, and the other is motion energy. The particle's mass (static energy) reflects the virtual photon's energy (motion energy) in other space-time. For a particle with electric charge "e" and mass m_a, its static energy is $m_a c^2$, and its motion energy is the static electric field's energy $\frac{e^2}{8\pi\varepsilon a}$ that produced by "e".

Here we assume that the charge "e" uniformly distributed in a sphere of radius "a".

So the total energy of particle m_a is

$$E_a^{\ 2} = m_a^{\ 2}c^4 + \left(\frac{e^2}{8\pi\varepsilon a}\right)^2 \qquad (1)$$

By using the method provided in paper [1], the mass can be represented by the virtual photon's wavelength in virtual space. And then by converting the virtual photon's wave length to the length unit in real space, we have

$$E_a{}^2 = \left(\frac{\hbar ca}{r_c{}^2}\right)^2 + \left(\frac{e^2}{8\pi\varepsilon a}\right)^2 \qquad (2)$$

Here, the r_c is similar to the Plank length. However, it will not equal to Plank length since it only take effects in electric-magnetic space.

Formula (2) also provides another meaning that a particle with mass m_a can produce a hole of radius “a” in real space. So the hole can produce the spherically symmetric static electric field of radius “a”.

The same as for particle “b”

$$E_b{}^2 = \left(\frac{\hbar cb}{r_c{}^2}\right)^2 + \left(\frac{e^2}{8\pi\varepsilon b}\right)^2 \qquad (3)$$

If particle “a” and “b” are totally symmetric particles, for example, like the proton and electron, then we have the relationship below for the symmetric demanding.

$$E_a{}^2 = E_b{}^2 \qquad (4)$$

If a≠b, then we have

$$ab = \frac{\alpha r_c{}^2}{2} \qquad (5)$$

Considering

$$\begin{cases} m_a c^2 = \dfrac{\hbar ca}{r_c{}^2} \\ m_b c^2 = \dfrac{\hbar cb}{r_c{}^2} \end{cases} \qquad (6)$$

Insert them into formula（5）, we have

$$m_a m_b = \frac{\hbar^2 c^2}{r_c{}^4}\frac{\alpha r_c{}^2}{2c^4} = \frac{\alpha\hbar^2}{2r_c{}^2 c^2} \qquad (7)$$

Here α is the fine structure constant.

So we can see that the two particle’s mass are not equal. It can be used to explain why proton-mass is not equal to electron-mass. We use m_b represent proton-mass, and m_a represent electron-mass for convenient.

We can solve r_c by using formula (7)

$$r_c = \frac{\hbar^2 c^2}{r_c{}^4}\frac{\alpha r_c{}^2}{2c^4} = \frac{\hbar}{\sqrt{m_a m_b}\,c}\sqrt{\frac{\alpha}{2}} \qquad (8)$$

Here r_c is similar to Plank length. It reflects the length ratio of electric-magnetic space. If we use any length divided by r_c, we can get the dimensionless length quantity.

2 The calculation of proton-mass

Here I use the magnetic monopole hypothesis to calculate proton's mass.[4] However the string here that producing monopole is different from Dirac's string[4]. Its bottom surface radius and string length is limited. We can assume that the string is the cylindrical shape solenoid. The solenoid's bottom area is πb^2 and its length or height is r_c. Then the string will produce a magnetic monopole correspondence to proton. The reason while use these parameters are due to the symmetric consideration. The volume of the string is

$$V = \pi b^2 r_c \tag{9}$$

For a monopole of magnetic charge "m", it can produce the magnetic field in radius "b".

$$B = \frac{\mu m}{4\pi b^2} \tag{10}$$

So if the magnetic field is uniformly distributed in the string, we can calculate the total energy of magnetic field in string.

$$E = \frac{B^2}{2\mu} V = \frac{\mu m^2}{32\pi^2 b^4} \pi b^2 r_c = \frac{\mu m^2 r_c}{32\pi b^2} \tag{11}$$

Considering the relationship of monopole charge and electric charge in paper [2], we have

$$\alpha^2 \mu m^2 = \frac{e^2}{\varepsilon}$$

By using the mass-energy relation, we can have

$$m_b = \frac{e^2 r_c}{32\pi\varepsilon\alpha^2 b^2 c^2} = \frac{\hbar r_c}{8\alpha b^2 c} \tag{12}$$

Insert formula（6）（8）into formula（12）, we have

$$m_b = \sqrt[3]{\frac{1}{8\alpha^5}} m_a \tag{13}$$

Insert fine structure constant into formula（13）, we have

$$m_b = 1821.22 m_a \tag{14}$$

So if m_b is the proton-mass, and m_a is the electron-mass, we can calculate the proton-mass by using real electron-mass.

$$m_b = 1.659042 \times 10^{-27} kg$$

It seems that the results are consistent with the experimental value. However, there are errors between theoretic prediction and experimental value. The cause of errors may be due to not take into account of the energy of particle's spin energy. The other reason may be due to the complex structure of proton. There are many things can affect the proton-mass. More accurate calculation will be published after deeply research.

Reference

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