A calculation of neutron's mass based on virtual space-time

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Abstract: Based on the postulation of virtual space-time, I reconstruct a new neutron's model. Then I calculate the neutron's mass based on the new model. I obtain a theoretic neutron's mass that is close to the experimental results. My calculation shows that the neutron's theoretic mass is 939.579MeV.

Key words: Virtual space-time; neutron; quark

0 Introduction

It is a very interested subject to calculate the neutron's mass. People had been puzzled by the phenomenon of why neutron's mass is so closer to proton's mass since neutron was discover. Many people think that neutron is consisted with proton and electron. However we can find that the electromagnetic interaction between proton and electron will bring nearly several hundred MeV static electric energies through simple calculation. It is bigger than the actual mass difference between neutron and proton. Fermi theory of weak interaction can provide a way to solve this problem until 1933.[1] however it also brings new problems. [2] Robert Marshak and George Sudarshan's V-A theory can better solve the neutron's mass problem in the late thought the problems in Fermi theory are still exist. [3] There are many authors try to calculate the neutron's mass in the late, and obtain many results that can roughly meet the demand of experiments. [4~7] There are still some insurmountable problems existed in the neutron's mass calculations. For example, it will produce a problem that there will be 600MeV static energy existed in neutron in order to obtain more accuracy value of proton's radius. [8] Obviously, it is ridiculous.

We can obtain another way to interpret the neutron's mass from the postulation of virtual space-time. [9~11]

1 The neutron's model based on virtual space-time

Here we assume that the neutron is consisted with electron and proton. The electron and proton's charges can separate from the energy and space time structures.

The electron's charge will stay in the surface of proton after an electron enters into the proton. So the electron's charge will eliminate the proton's charge to keep neutron's electro-neutrality. Or if the electron's charge can enters into the inner side of proton, it will make the neutron behave like an electric dipole since electron will have motion inside proton. It is incompatible with the experiments.

Now that the negative charge have radius equal to proton's electromagnetic radius, it will also has static energy. This is the first part of energy that contributes to the neutron's mass.

On the other hand, the negative and positive charge located in the proton's electromagnetic radius will also produce a negative electric potential energy. This is the second part of energy that contributes to the neutron's mass.

After the main part mass and energy of the electron enter into the proton, it will find that there is a very open space inside the proton since electron's electromagnetic radius is far less than proton's.[10] So the electron's position will have a very large uncertainty. Therefore, the main part of the electron will carry additional virtual photons according to uncertainty principle and postulation of virtual photons. So the third part energy is consisted with those virtual photons.

The last fifth part energy is consisted of the static masses of proton and electron.

Figure 1 shows the schematic diagram of neutron's structure after an electron enters into a proton.

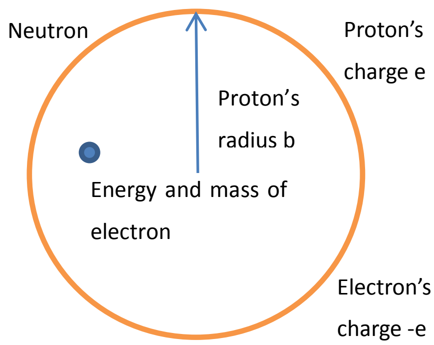

Figure 1 The schematic diagram of neutron's structure (not to scale)

2 The calculation of neutron's mass

2.1 The energy of negative charge on the surface of neutron

This is the first part of energy. Since the negative charge is uniformly distributed in the surface of a sphere with radius b, the first part of energy will be

$$E_1 = \frac{e^2}{8\pi\varepsilon b} = m_e c^2 \tag{1}$$

2.2 The negative potential energy

The second part of energy is

$$E_2 = -\frac{e^2}{4\pi\varepsilon b} = -2m_e c^2 \qquad (2)$$

2.3 The energy of virtual photons

According to uncertainty principle, we have

$$pX = \frac{\hbar}{2}$$

Where, the p is the electron's momentum that has no charge. The X is the range where the charge-less electron can move.

So X=2b, it equal to proton's diameter.

While momentum p reflects the virtual photon's energy

$$h\nu = pc$$

So we can calculate the virtual photon's energy origin from uncertainty principle.

$$h\nu = \frac{\hbar c}{4b} = \frac{m_e c^2}{2\alpha} \qquad (3)$$

We can also notice that the properties of virtual photons are same as photons except the velocity. [9] So virtual photon's spin is equal to the photon. However, the neutron's spin is 1/2, so the charge-less electron will carry two different spin virtual photons to satisfy the spin angular momentum conservation demanding.

So the total energy of the charge-less electron inside proton is

$$E = \sqrt{m_e{}^2 c^4 + \left(\frac{e^2}{8\pi\varepsilon a}\right)^2 + h^2\nu^2 + h^2\nu^2} \qquad (4)$$

Where, the first two parts are electron's mass and static energy on the right of formula (4). The specific analysis can refer to article [10]. The last two part of formula (4) are the energy of two virtual photons.

After calculation, we have

$$E \approx \frac{e^2}{8\pi\varepsilon a} + \left(m_e{}^2 c^4 + 2h^2\nu^2\right) / \left(\frac{2e^2}{8\pi\varepsilon a}\right) \approx m_p c^2 + \frac{2h^2\nu^2}{2m_p c^2}$$

$$E \approx\approx m_p c^2 + 1.037(MeV)$$

So the third part energy is

$$E_3 \approx 1.307(MeV) \qquad (5)$$

2.5 The mass of neutron

By adding four parts energy, we can obtain the neutron's mass as

$$m_n c^2 \approx m_p c^2 + m_e c^2 + E_1 + E_2 + E_3 = 939.579(MeV)$$

The experimental value is 939.565MeV

3 Discussions

Since there is an extra energy $\left(\frac{e^2}{8\pi\varepsilon a}\right)$ in neutron, which is the static electric energy of electron, there must be another negative energy $-\left(\frac{e^2}{8\pi\varepsilon a}\right)$ to eliminate this extra energy in order to keep neutrons total energy closely equaling to proton's total energy. It is interesting to assume that this negative energy is belonging to a negative neutrino. Perhaps we can understand some strange characteristics of neutrinos based on this assumption.

4 Conclusion

I established a new neutron's model. This model can obtain the neutron's mass that is consistent with the experimental value. However, there are errors between theoretic value and experimental value. However, I think it is a great step to understand the neutrinos behaviors.

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