The analysis of the β-decay that occurs in the nucleus

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ABSTRACT

In the special relativity theory and the quantum mechanics, if the β-decay that occurs in the nucleus is analyzed by the Yukawa's pion theory, a virtual electron and a virtual anti-neutrino move in the velocity u_0 in neutrons during the uncertainty time. If the nucleus give the enough energy E a neutron, the virtual electron, the virtual anti-neutrino and a neutron do the free electron, the free anti-neutrino of the velocity $c-\Delta v$ and the proton. And a virtual positive electron and a virtual neutrino move in the velocity u_0 in protons during the uncertainty time. If the nucleus give the enough energy E a proton, the virtual positive electron, the virtual neutrino and a proton do the free positive electron, the free neutrino of the velocity $c-\Delta v$ and a neutron.

PACS Number:**03.30.+p,03.65,23.40,14.20.D,13.30**

Key words:The special relativity theory,

The quantum mechanics,

The β-decay

The uncertainty principle

The electron

The neutrino

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I. Introduction

The article treats that the β-decay is analyzed by the Yukawa's pion theory.

The Yukawa's pion theory treats the uncertainty principle. If the virtual pion moves in nucleons, you can say that a proton is equal to a neutron in the nucleus.

$$\Delta E \cdot \Delta t \geq \hbar \qquad (1)$$

$$\Delta t \sim \frac{v}{c} \sim \frac{r}{c}, \qquad \Delta E \sim m_{\pi}c^2$$

$$\Delta E \cdot \Delta t \sim \hbar$$

$$(m_{\pi}c^2)(\frac{r}{c}) \sim \hbar \qquad (2)$$

Therefore,

$$m_{\pi} \sim \frac{\hbar}{rc} = \frac{1.05\times10^{-34} J\cdot s}{(1.7\times10^{-15} m)(3\times10^{8} m/s)} \sim 2.1\times10^{-28} kg \ (3)$$

If use the Yukawa's pion theory, understand the strong force.

In this time, $r = 1.7\times10^{-15} m = 1.7 fm$ is the distant that the strong force work.

$$1fm = 10^{-15} m$$

In this time, if give the energy $E = m_{\pi}c^2$ a nucleon, to do the law of an energy conservation in the nucleus, the virtual pion does a free pion.

II. Additional chapter-I

If the β-decay that occurs in the nucleus is analyzed by the Yukawa's pion theory, the virtual electron and the virtual anti-neutrino move in the velocity u_0 in neutrons during the uncertainty time. And the virtual positive electron and the virtual neutrino move in the velocity u_0 in protons during the uncertainty time.

The virtual electron and the virtual anti-neutrino move in the velocity u_0 in neutrons during the uncertainty time. Because, the nucleons' a spin and a magnetic moment is conserved by that the virtual electron and the virtual anti-neutrino move in the same velocity u_0 in nucleons.

$$\Delta E \cdot \Delta t \sim \hbar \ (4),$$

$$\Delta E_e \cdot \Delta t_e + \Delta E_{\overline{\upsilon}} \cdot \Delta t_{\overline{\upsilon}} \sim 2\hbar$$

$$\Delta t_e = \Delta t_{\overline{\upsilon}} \sim \frac{r}{u_0}$$

$$\Delta E_e \sim m_e c^2, \Delta E_{\overline{\upsilon}} \sim m_{\overline{\upsilon}} c^2 \quad (5)$$

$$(m_e c^2)\frac{r}{u_0} + (m_{\overline{\upsilon}} c^2)\frac{r}{u_0} = \{(m_e c^2) + (m_{\overline{\upsilon}} c^2)\}\frac{r}{u_0} \sim 2\hbar \quad (6)$$

if $m_e c^2 / u_0 >> m_{\bar{\upsilon}} c^2 / u_0$,

$$r \sim \frac{2\hbar}{(m_e c^2)/u_0 + (m_{\bar{\upsilon}} c^2)/u_0} \sim \frac{2\hbar}{(m_e c^2)/u_0} = \frac{2\hbar u_0}{m_e c^2} \sim R_0 = 1.2 \times 10^{-15} m$$

$$\frac{2\hbar}{m_e c} = \frac{2 \times (1.05 \times 10^{-34} J \cdot s)}{(9.1 \times 10^{-31} kg) \times (3 \times 10^8 m/s)} = 7.7 \times 10^{-13} m = 770 fm$$

$R_0 \sim 1.2 \times 10^{-15} m = 1.2 fm$, R_0 is a nucleon's radius

Therefore,

$$\frac{u_0}{c} = \frac{1.2 \times 10^{-15} m}{7.7 \times 10^{-13} m} = 1.56 \times 10^{-3}, u_0 \sim c \times 1.56 \times 10^{-3} \quad (7)$$

The real event occurs about the uncertainty principle.

$$\Delta p \cdot \Delta d \geq \hbar \quad (8)$$

But, the event that the virtual electron and the virtual anti-neutrino move in the velocity u_0 isn't a real event.

$$\Delta p_e = m_e u_0, \Delta p_{\bar{\upsilon}} = m_{\bar{\upsilon}} u_0, \ \Delta d_e = \Delta d_{\bar{\upsilon}} = \Delta d = r \sim \frac{2\hbar u_0}{m_e c^2}$$

$$\Delta p_e \cdot \Delta d_e + \Delta p_{\bar{\upsilon}} \cdot \Delta d_{\bar{\upsilon}} = (m_e + m_{\bar{\upsilon}}) u_0 \cdot \frac{2\hbar u_0}{m_e c^2} \ , \ \Delta p_{\bar{\upsilon}} = m_{\bar{\upsilon}} u_0 \sim 0$$

$$= m_e u_0 \cdot \frac{2\hbar u_0}{m_e c^2} = 2\hbar \frac{u_0^2}{c^2} < 2\hbar \quad (9)$$

In this time, if the nucleus give the energy $E = (m_e + m_{\bar{\upsilon}})c^2 + \frac{1}{2}(m_e + m_{\bar{\upsilon}}) u_0^2 \approx m_e c^2$ a neutron, to do the law of an energy conservation in the nucleus, the virtual electron, the virtual anti-neutrino and a neutron do the free electron, the free anti-neutrino of the velocity $c - \Delta v$ and the proton and therefore the β-decay that occurs in the nucleus is

$$n \to p + e^- + \bar{\upsilon} \quad (10) \ ,$$

$$KE = \gamma_e m_e c^2 - m_e c^2 + \gamma_{\bar{\upsilon}} m_{\bar{\upsilon}} c^2, m_{\bar{\upsilon}} c^2 \sim 0 \ , \gamma_e = 1/\sqrt{1 - V_e^2 / c^2} \quad (11)$$

The virtual positive electron and the virtual neutrino move in the velocity u_0 in the protons during the uncertainty time. Because, the nucleons' a spin and a magnetic moment is conserved by that the virtual positive electron and the virtual neutrino move in the same velocity u_0 in nucleons.

Instead Eq(6),if use the virtual positive electron and the virtual neutrino

$$\Delta E \cdot \Delta t \sim \hbar$$

$$\Delta E_{e^+} \cdot \Delta t_{e^+} + \Delta E_{\upsilon} \cdot \Delta t_{\upsilon} \sim 2\hbar$$

$$\Delta t_{e^+} = \Delta t_{\upsilon} \sim \frac{r}{u_0}$$

$$\Delta E_{e^+} \sim m_{e^+}c^2, \Delta E_{\upsilon} \sim m_{\upsilon}c^2$$

$$(m_{e^+}c^2)\frac{r}{u_0} + (m_{\upsilon}c^2)\frac{r}{u_0} = \{(m_{e^+}c^2) + (m_{\upsilon}c^2)\}\frac{r}{u_0} \sim 2\hbar \qquad (12)$$

if $m_{e^+}c^2 / u_0 >> m_{\upsilon}c^2 / u_0$,

$$r \sim \frac{2\hbar}{(m_{e^+}c^2)/u_0 + (m_{\upsilon}c^2)/u_0} \sim \frac{2\hbar}{(m_{e^+}c^2)/u_0} = \frac{2\hbar u_0}{m_{e^+}c^2} \sim R_0 = 1.2 \times 10^{-15} m$$

$$\frac{2\hbar}{m_{e^+}c} = \frac{2 \times (1.05 \times 10^{-34} J \cdot s)}{(9.1 \times 10^{-31} kg) \times (3 \times 10^8 m/s)} = 7.7 \times 10^{-13} m = 770 fm$$

$R_0 \sim 1.2 \times 10^{-15} m = 1.2 fm$, R_0 is a nucleon's radius

Therefore,

$$\frac{u_0}{c} = \frac{1.2 \times 10^{-15} m}{7.7 \times 10^{-13} m} = 1.56 \times 10^{-3}, u_0 \sim c \times 1.56 \times 10^{-3}$$

(13)

The real event occurs about the uncertainty principle.

$$\Delta p \cdot \Delta d \geq \hbar \qquad (14)$$

But, the event that the virtual positive electron and the virtual neutrino move in the velocity u_0 isn't a real event.

$$\Delta p_{e^+} = m_{e^+}u_0, \Delta p_{\upsilon} = m_{\upsilon}u_0, \ \Delta d_{e^+} = \Delta d_{\upsilon} = \Delta d = r \sim \frac{2\hbar u_0}{m_{e^+}c^2}$$

$$\Delta p_{e^+} \cdot \Delta d_{e^+} + \Delta p_{\upsilon} \cdot \Delta d_{\upsilon} = (m_{e^+} + m_{\upsilon})u_0 \cdot \frac{2\hbar u_0}{m_{e^+}c^2} \ , \ \Delta p_{\upsilon} = m_{\upsilon}u_0 \sim 0$$

$$= m_{e^+}u_0 \cdot \frac{2\hbar u_0}{m_{e^+}c^2} = 2\hbar \frac{u_0^2}{c^2} < 2\hbar \qquad (15)$$

In this time, if the nucleus give the energy $E = (m_{e^+} + m_{\upsilon})c^2 + \frac{1}{2}(m_{e^+} + m_{\upsilon})u_0^2 \approx m_{e^+}c^2$ a proton, to do the law of an energy conservation in the nucleus, the virtual positive electron, the virtual neutrino and a proton do the free positive electron, the free neutrino of the velocity $c-\Delta v$ and a neutron and therefore the β-decay that occur in the nucleus is

$$p \to n + e^{+} + \upsilon \quad (16),$$

$$KE = \gamma_{e^{+}} m_{e^{+}} c^{2} - m_{e^{+}} c^{2} + \gamma_{\upsilon} m_{\upsilon} c^{2}, m_{\upsilon} c^{2} \sim 0, \gamma_{e^{+}} = 1/\sqrt{1 - V_{e^{+}}{}^{2}/c^{2}} \quad (17)$$

III. Conclusion

Therefore, the β-decay that occurs in the nucleus is concerned about the uncertainty principle. In specially, the β-decay of a nucleon (ex, a proton, a neutron) out of the nucleus doesn't understand by this theory and the β-decay understands by this theory only in the nucleus.

$$p + e^{-} \to n + \upsilon \quad (18)$$

In the time that Eq(18)'s phenomenon occur, if Eq(16)'s phenomenon occur

$$p + e^{-} \to n + e^{-} + e^{+} + \upsilon \to n + \upsilon + \gamma \quad (19)$$

Therefore, Eq(18)'s phenomenon is understood by this theory.

The inverse β- decay,

$$p + \overline{\upsilon} \to n + e^{+} \quad (20)$$

$$n + \upsilon \to p + e^{-} \quad (21)$$

In the time that Eq(20)'s and Eq(21)'s phenomenon occur, if Eq(16)'s and Eq(10)'s phenomenon occur,

$$p + \overline{\upsilon} \to n + e^{+} + \upsilon + \overline{\upsilon} \to n + e^{+} + \gamma \quad (22)$$

$$n + \upsilon \to p + e^{-} + \overline{\upsilon} + \upsilon \to p + e^{-} + \gamma \quad (23)$$

Therefore, Eq(20)'s and Eq(21)'s phenomenon, the inverse β-decay is understood by this theory.

Hence, the β-decay that occurs in the nucleus is understood by this theory.

Finally, the Yukawa's pion theory expands to be the Gell-Mann theory, this theory expands to be the Weinberg –Salam theory.

Reference

[1]A.Miller,Albert Einstein's Special Theory of Relativity(Addison-Wesley Publishing Co., Inc., 1981)

[2]W. Rindler, Special Relativity(2nd ed., Oliver and Boyd, Edinburg, 1966)

[3]P.Bergman,Introduction to the Theory of Relativity(Dover Pub. Co.,Inc., New York,1976),Chapter V

[4]D.Halliday &R.Resnick, Fundamentals of PHYSICS(John Wiley & Sons,Inc.,1986)

[5]R.L.Liboff, Quantum Mechanics(Addison-Wesley Publishing Co., Inc.,1990)

[6]A.Beiser, Concept of Modern Physics(McGraw-Hill,Inc.,1991)