The Neutrino and the Light of the Neutron

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Abstract

In this paper, we seek the light emitted from the decay of the neutron. The β-radiation, the emission of the electron from the nucleus, the anti-neutrino is emitted. $n \to p + e^- + \bar{\nu}_e$ where $\bar{\nu}_e$ is the anti-neutrino. The value of the neutron energy is $E_n = m_n c^2/e = 939.56563$ MeV. The neutron decays into the proton and the electron. There is a study to find the energy of the mass of the neutrino. The neutrino has three or more features. The first is that it has no electric charge. The second is that it has the weak interaction with gravity. The third is that it has passed through normal matter. We assert $n \to p + e^- + \nu$. Furthermore, we have suggested that the neutron decay radiation is not the particle, but the light. The gamma line is ν, the high frequency $2.592249921 \times 10^{22}$ Hz or short wavelength $1.156495196 \times 10^{-14}$ m. It has the energy of 0.782326MeV.

1. Preliminaries

We consider the two-body problem of nuclear and electron to be within one hydrogen atom.[1]-[4]. It is assumed that the electron moves on the fixed surface. Therefore, we put $\theta = \frac{\pi}{2} - \mathrm{i}\Omega$. Ω is a parameter that relates to the angle of rotation of the orbit.

Then the metric is

$$\mathrm{d}s^2 (= -\mathrm{d}c\tau^2) = -\mathrm{d}ct^2 + \mathrm{d}r^2 + r^2(\cosh^2\Omega \mathrm{d}\varphi^2 - d\Omega^2) \ (< 0) \tag{1}$$

And the polar coordinate is (t, r, Ω, φ). We have the equation of the Kepler type.

$$\begin{cases} \mathrm{c}t = \mathrm{c}t \\ x = r\cosh\Omega\cos\varphi \\ y = r\cosh\Omega\sin\varphi \\ iz = \mathrm{i}r\sinh\Omega \end{cases}.$$

$$\begin{cases} (a)\ m_e \mathrm{c}\dfrac{\mathrm{d}ct}{\mathrm{d}\tau} = m_e \mathrm{c} C_0 e^{\frac{keQ}{m_e c^2 r}} \cdots \text{(the conservation of energy)} \\ (b)\ \dfrac{\mathrm{d}^2}{\mathrm{d}\tau^2}(r\sinh\Omega) = -(\dfrac{keQ}{m_e c^2 r^2}\dfrac{\mathrm{d}ct}{\mathrm{d}\tau})(\tanh\Omega - r\cosh\Omega\dfrac{\mathrm{d}\varphi}{\mathrm{d}ct})\cosh\Omega(\dfrac{\mathrm{d}ct}{\mathrm{d}\tau}) \\ \qquad\qquad \cdots \text{(the structure of space)} \\ (c)\ r^2\{(r\cosh\Omega\dfrac{\mathrm{d}\varphi}{\mathrm{d}\tau})^2 - (r\dfrac{\mathrm{d}\Omega}{\mathrm{d}\tau})^2\} = C^2 \cdots \text{(the law of equal areas)} \\ (d)\ r^2\cosh\Omega\dfrac{\mathrm{d}\varphi}{\mathrm{d}\tau} = C\cosh\Theta(\geqq 0), \quad r\dfrac{d\Omega}{d\tau} = -C\sinh\Theta \\ \quad \Theta = -\int(\dfrac{keQ}{m_e c^2 r^2}\dfrac{\mathrm{d}ct}{\mathrm{d}\tau} - \sinh\Omega\dfrac{\mathrm{d}\varphi}{\mathrm{d}\tau})\mathrm{d}\tau \cdots\cdots \text{(the internal rotation)} \end{cases} \tag{2}$$

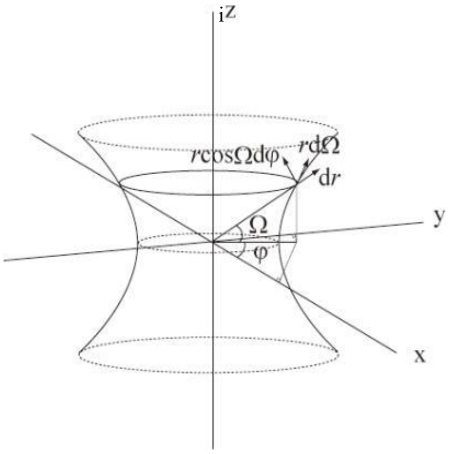

Fig. 1.The anti-de sitter space.

Fig. 1 shows the anti-de sitter space.

$$C_0 = \frac{c}{\sqrt{1-(\frac{v}{c})^2}} e^{-\frac{R_0}{r}}, C = r\frac{v}{\sqrt{1-(\frac{v}{c})^2}} \tag{3}$$

where $R_0 = \frac{keQ}{m_e c^2}$ is electronic classical radius, C_0 is the speed constant for the energy function, C is the area speed constant, k is the coulomb constant.

The main equation is

$$(\frac{dr}{dc\tau})^2 = (\frac{dct}{dc\tau})^2 - r^2((\cosh\Omega\frac{d\varphi}{dc\tau})^2 - (\frac{d\Omega}{dc\tau})^2) - 1$$

$$= (\frac{C_0}{c} e^{\frac{R_0}{r}})^2 - (\frac{C}{cr})^2 - 1, \quad R_0 = \frac{keQ}{m_e c^2} \doteq 2.81795\times10^{-15}\text{m}. \tag{4}$$

2. The flower orbit of the electron around the proton

The orbit equation for $\frac{1}{r}$ is

$$(\frac{d\frac{1}{r}}{e^{-\frac{R_0}{r}} d\Phi})^2 = (\frac{dr}{r^2 e^{-\frac{R_0}{r}} d\Phi})^2 = (\frac{C_0{}^2}{C^2} e^{\frac{2R_0}{r}} - \frac{1}{r^2} - \frac{c^2}{C^2}) e^{\frac{2R_0}{r}}, d\theta = e^{-\frac{R_0}{r}} d\Phi. \tag{5}$$

And the orbit equation for r is

$$\frac{dr}{e^{-\frac{R_0}{r}} d\Phi} = -r\sqrt{-1 + r^2\frac{C_0{}^2}{C^2} e^{\frac{2R_0}{r}} - r^2\frac{c^2}{C^2} e^{\frac{R_0}{r}}}, d\theta = e^{-\frac{R_0}{r}} d\Phi\cdot \tag{6}$$

We get the solution of the equation (6) from the inside of the Bohr radius. In the case, $n_f{}^2 = \frac{x}{x-1}$ =1.2(x=6) is apsidal precession[3].

$$C = rc\frac{\sqrt{\frac{R_0}{r}}}{\sqrt{1-\frac{R_0}{r}}} = 1.01954\times10^{-14}\times299792458\times\frac{\sqrt{\frac{2.817940287410717\times10^{-15}}{1.01954\times10^{-14}}}}{\sqrt{1-\frac{2.817940287410717\times10^{-15}}{1.01954\times10^{-14}}}}$$

$$=1.88902\times10^{-6}[\mathrm{m}^2/\mathrm{s}].$$

$$C_0 = \frac{\mathrm{c}}{\sqrt{1-\frac{R_0}{r}}}\mathrm{e}^{\frac{-R_0}{r}} = \frac{\mathrm{c}}{\sqrt{1-\frac{2.817940287410717\times10^{-15}}{1.01954\times10^{-14}}}}\mathrm{e}^{-\frac{2.817940287410717\times10^{-15}}{1.01954\times10^{-14}}} = 2.67321\times10^{8}[\mathrm{m}/\mathrm{s}]\cdot$$

When the circle obit in the radius $r = 1.01954\times10^{-14}$ m which is the minimum radius of the electric charge. The speed constant for the energy function and the area speed constant are $C = 1.88902\times10^{-6}\mathrm{m}^2/\mathrm{s}, C_0 = 2.67321\times10^{8}\mathrm{m/s}$.

$$\boldsymbol{e} = \sqrt{x((\frac{C_0}{\mathrm{c}})^2-1)+1} = \mathrm{i}0.4789167960708896.$$

$$r = -R_0 + \mathrm{Re}[\frac{xR_0}{1+\mathrm{i}\boldsymbol{e}_1\sin(n_f\theta)}] = -R_0 + \frac{xR_0}{1+\boldsymbol{e}_1{}^2\sin^2(n_f\theta)}$$

$$= -2.817940287410717\times10^{-15} + \mathrm{Re}[\frac{1.6907641709345915\times10^{-14}}{1+\mathrm{i}0.4789167960708896\sin(1.0954451151082842\theta)}]$$

$$= -2.817940287410717\times10^{-15} + \frac{1.6907641709345915\times10^{-14}}{1+0.22936129755880608\sin^2(1.0954451151082842\theta)}.$$

Fig. 2 shows the graph of orbit and R_0.

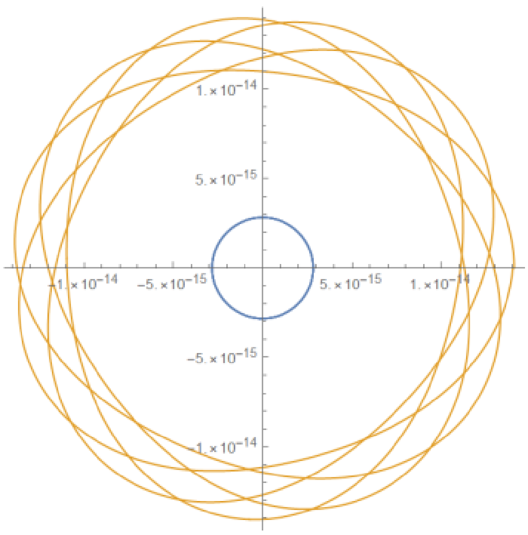

Fig. 2. $n_f{}^2 = 1.2(6/5)$ for $0 \leqq \theta \leqq 2\pi\times5$.

3. The neutron's orbit and the gamma line

The index of orbit which is a solution of Kepler's type is as follows:

(i) $x=(\frac{C}{\mathrm{c}R_0})^2+1$ (ii) $n_f=\sqrt{\frac{x}{x-1}}$ (iii) $\boldsymbol{e}=\sqrt{x((\frac{C_0}{\mathrm{c}})^2-1)+1}$

where C_0 is the speed constant for the energy function and C is the area speed constant.

The angular moment is (i) $C=\underline{\mathrm{c}\sqrt{x-1}R_0}=\mathrm{c}(x-1)R_0\sqrt{\frac{1}{x}\frac{x}{x-1}}=\underline{\underline{(xR_0-R_0)}}\frac{\mathrm{c}\sqrt{\frac{1}{x}}}{\underline{\underline{\sqrt{1-\frac{1}{x}}}}}$.

This is an area speed constant from electronic classical radius R_0. Therefore, we coincide with xR_0 and the position r.

Then C represents a new definition and $C=\underline{\underline{(r-R_0)}}\frac{\mathrm{c}\sqrt{\frac{R_0}{r}}}{\underline{\underline{\sqrt{1-\frac{R_0}{r}}}}}\fallingdotseq r\ v$ at r is not small.

Therefore, the Planck constant in the position r is guessed as:

$$h(x)=2\pi m_e C\cdot n_f=2\pi m_e C\cdot n_f=2\pi m_e \mathrm{c}\sqrt{x}R_0=2\pi m_e xR_0\frac{\mathrm{c}}{\sqrt{x}}. \tag{7}$$

Because when position r is the Bohr radius $\boldsymbol{r_1},\ \boldsymbol{x_B}=\frac{\boldsymbol{r_1}}{\boldsymbol{R_0}}$.

$$h(x_B)=2\pi m_e r_1\cdot\mathrm{c}\sqrt{\frac{R_0}{r_1}}=2\pi m_e r_1\cdot v_1=6.626068974366999\times10^{-34}[\mathrm{J\cdot s}]\fallingdotseq h \tag{8}$$

where h is Planck constant.

We show the (ii), $n_f=\sqrt{\frac{x}{x-1}}$. This is a value of perihelion movement.

By the (iii), we adopt the form of C_0 as:

$$C_0=\frac{\mathrm{c}}{\sqrt{1-(\frac{v}{\mathrm{c}})^2}}\mathrm{e}^{-\frac{R_0}{xR_0}}=\frac{\mathrm{c}}{\sqrt{1-\frac{R_0}{xR_0}}}\mathrm{e}^{-\frac{R_0}{xR_0}}=\frac{\mathrm{c}}{\sqrt{1-\frac{1}{x}}}\mathrm{e}^{-\frac{1}{x}}.$$

Because $\boldsymbol{e}=\boldsymbol{e}_0+\mathrm{i}\boldsymbol{e}_1=0+\mathrm{i}\boldsymbol{e}_1$, $\boldsymbol{e}_0$ is close to the zero, $\boldsymbol{e}_1$ is arbitrary.

When, $\boldsymbol{e}=\sqrt{x((\frac{C_0}{\mathrm{c}})^2-1)+1}=\mathrm{i}\boldsymbol{e}_1$.

Then, $(\frac{C_0}{\mathrm{c}})^2=1-(\frac{1+\boldsymbol{e}_1{}^2}{x})$.

$$C_0=\mathrm{c}\sqrt{1-\frac{1+\boldsymbol{e}_1{}^2}{x}}=\mathrm{c}\sqrt{\frac{x-1-\boldsymbol{e}_1{}^2}{x}}=\mathrm{c}\sqrt{\frac{x-1}{x}-\frac{\boldsymbol{e}_1{}^2}{x}}=\mathrm{c}\sqrt{\frac{1}{n_f{}^2}-\frac{\boldsymbol{e}_1{}^2}{x}}\ .$$

Another form of C_0 is

$$C_0=\frac{\mathrm{c}}{\sqrt{1-(\frac{v}{\mathrm{c}})^2}}\mathrm{e}^{-\frac{R_0}{(x-1)R_0}}=\frac{\mathrm{c}}{\sqrt{1-\frac{R_0}{xR_0}}}\mathrm{e}^{-\frac{R_0}{(x-1)R_0}}=\frac{\mathrm{c}}{\sqrt{1-\frac{1}{x}}}\mathrm{e}^{-\frac{1}{x-1}}=\frac{\mathrm{c}\sqrt{x}}{\sqrt{x-1}}\mathrm{e}^{-\frac{1}{x-1}}=\mathrm{c}n_f\mathrm{e}^{-\frac{1}{x-1}}$$

$$=\mathrm{c}n_f(\frac{1}{\mathrm{e}^{\frac{1}{x-1}}})<\mathrm{c}n_f(\frac{1}{1+\frac{1}{x-1}})=\mathrm{c}n_f(\frac{x-1}{x})=\mathrm{c}\frac{1}{n_f}\ .$$

Then,

$$\boldsymbol{e}^2=x((\frac{C_0}{\mathrm{c}})^2-1)+1=x((\frac{\frac{\mathrm{c}}{\sqrt{1-\frac{1}{x}}}\mathrm{e}^{-\frac{1}{x-1}}}{\mathrm{c}})^2-1)+1=x((\frac{1}{\sqrt{1-\frac{1}{x}}}\frac{1}{\mathrm{e}^{\frac{1}{x-1}}})^2-1)+1$$

$$<x((\frac{1}{\sqrt{1-\frac{1}{x}}}\frac{1}{(1+\frac{1}{x-1})})^2-1)+1=x((\frac{x}{x-1}\frac{(x-1)^2}{x^2})-1)+1=x((\frac{x-1}{x})-1)+1=0\ .$$

Therefore, the orbit formula is $r+R_0=\frac{xR_0}{1+\mathrm{i}e_1\ \sin n_f\theta}=\frac{xR_0(1-\mathrm{i}e_\alpha\ \sin n_f\theta)}{1+e_1{}^2\ \sin^2 n_f\theta}$

$$\doteqdot\frac{xR_0}{1+e_1{}^2\ \sin^2 n_f\theta}. \tag{9}$$

And the point $x=\frac{R_0}{R_0}=1$ is named as the white barrier, in the electromagnetic gravitational theory, as the black hole in the gravity.

Fig. 3 shows the white barrier. Fig. 4 shows the energy of the electron near the Bohr radius. The gray line is the Bohr radius. And, the blue line is the 511keV positron annihilation line. The yellow line is the energy of the electron.

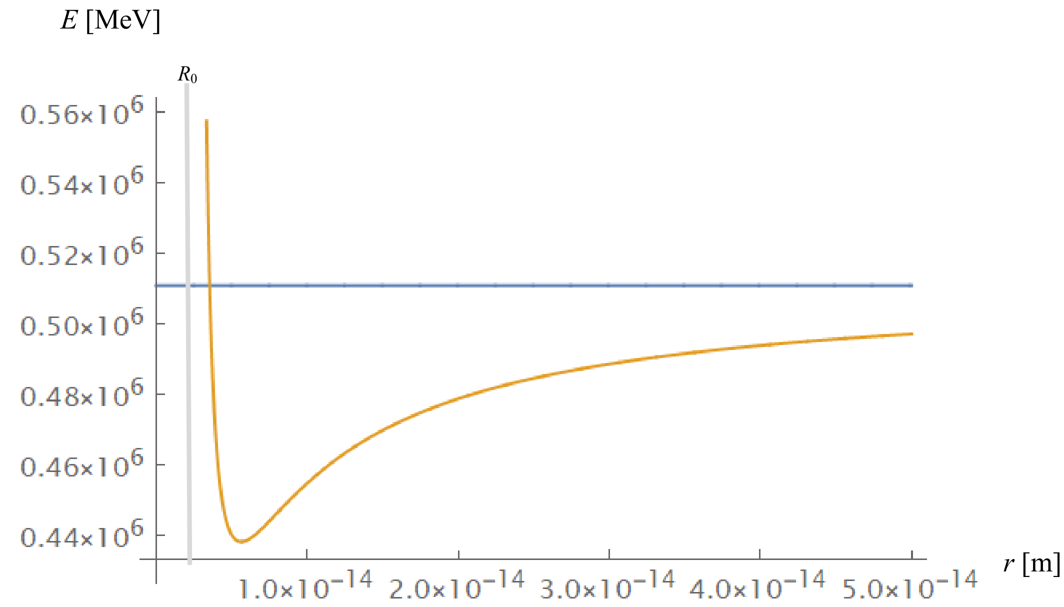

Fig. 3. The white barrier.

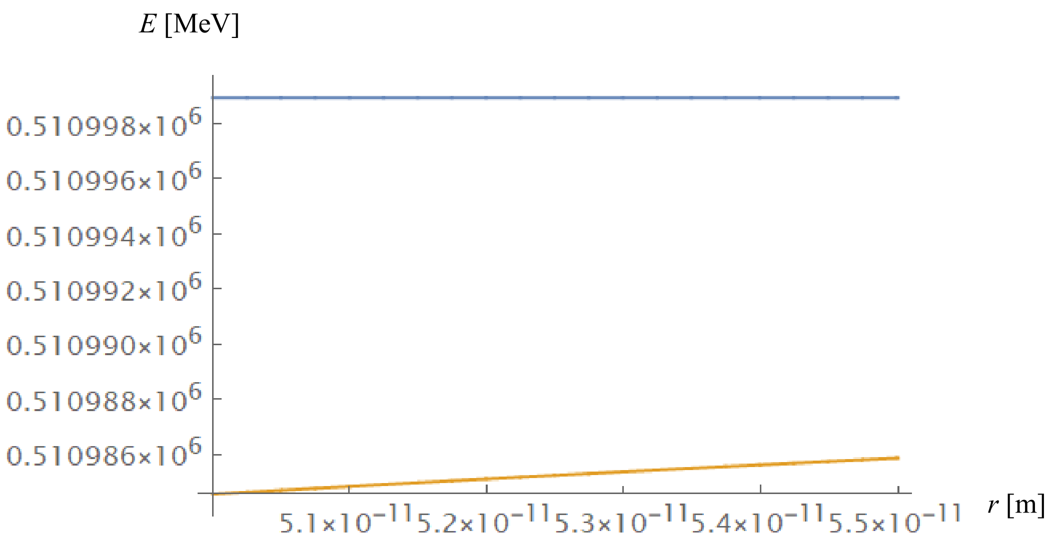

Fig. 4. The energy of the electron near the Bohr radius.

4. Calculated the gamma line

We calculated the point $x = \frac{r}{R_0}$ of the electron, the proton and the neutron, and the following formula is the energy of the electron, the proton, and the neutron.

$$E_{\{m_e,m_p,m_n\}} = \frac{m_e c^2}{\sqrt{1-\frac{R_0}{xR_0}}} e^{-\frac{R_0}{xR_0}} [\mathrm{J}] = \frac{m_e c^2}{\sqrt{1-\frac{1}{x}}} \frac{e^{-\frac{1}{x}}}{e} [\mathrm{eV}], \tag{10}$$

$$E_{\{m_e\}} = \frac{m_e c^2}{e} = 0.5109998458300283[\mathrm{MeV}], E_{\{m_p\}} = \frac{m_p c^2}{e} = 938.272088058285[\mathrm{MeV}],$$

$$E_{\{m_n\}} = \frac{m_n c^2}{e} = 939.5654139749439[\mathrm{MeV}].$$

By the energy, the point is

$$x_{m_e} = 1.254999084712615[-], x_{m_p} = 1.000000040141493[-], x_{m_n} = 1.000000040031057[-].$$

When the neutron decays the electron is emitted and the neutron is a proton.

Then, the energy is $\Delta E = \frac{(m_n c^2 - m_p c^2) - m_e c^2}{e} = 0.782326\mathrm{MeV}.$

We calculated the frequency with the new Planck constant as follows:

$$C(x_{m_n}) = c\sqrt{x_{m_n} - 1} R_0 = 1.6902502831312807\times10^{-10}, n_f(x_{m_n}) = \sqrt{\frac{x_{m_n}}{x_{m_n}-1}} = 4998.06,$$

$$h(x_{m_n}) = 2\pi m_e C(x_{m_n}) \cdot n_f(x_{m_n}) = 2\pi m_e c\sqrt{x_{m_n}} R_0 = 4.835276210006947\times10^{-36}, x = \frac{r}{R_0}.$$

Then, the frequency is

$$\nu_{m_n} = \frac{\Delta E}{h(x_{m_n})} = \frac{0.782326\times10^{6}\times1.602176634\times10^{-19}}{4.835276210006947\times10^{-36}} = 2.592249921\times10^{22}\mathrm{Hz}\cdot$$

And the wavelength is

$$\lambda_{m_n} = \frac{c}{\nu_{m_n}} = \frac{299792458}{2.592249978\times10^{22}} = 1.15649517\times10^{-14}\mathrm{m}.$$

Therefore, the event generates the gamma line with the energy 0.782326MeV and the high frequency 2.59225×10^{22} Hz or short wavelength 1.156495×10^{-14} m.

Compare $h(x_B)$ to $h(x_{m_n})$.

$$\frac{h(x_B)}{h(r_{m_n})} = \frac{6.626068974366999\times10^{-34}[\mathrm{J}\cdot\mathrm{s}]}{4.835276210006947\times10^{-36}[\mathrm{J}\cdot\mathrm{s}]} = 137.036\cdot$$

We get the fine structure.

5. The graph of the electron orbit in the neutron

We calculated the index of the neutron as follows:

$$x_{m_n} = 1.000000040031057[-],$$

$$x_{m_n} R_0 = 2.81794040021582327277 \times 10^{-15},$$

$$C = c\sqrt{x_{m_n} - 1} R_0 = 1.6902501565620994 \times 10^{-10}, \tag{11}$$

$$n_f = \sqrt{\frac{x_{m_n}}{x_{m_n} - 1}} = 4998.060546773912,$$

$$C_0 = \frac{c}{\sqrt{1 - \frac{1}{x_{m_n}}}} e^{-\frac{1}{x_{m_n} - 1}} = 0,$$

$$\boldsymbol{e} = \sqrt{x_{m_n}\left(\left(\frac{C_0}{c}\right)^2 - 1\right) + 1} = i0.0002000776122372093,$$

where x is the point of r/R_0, R_0 is the classical electric radius, r is the distance of the center of the electron and the center of the proton.

$$y = r + R_0 = \frac{xR_0}{1 + e^2 \sin^2(n_f \theta)}.$$

Therefore, the neutron orbit is

$$y = \frac{2.81794040021582327277 \times 10^{-15}}{1 + 0.0002000776122372093^2 \sin^2(4998.060546773912\theta)}. \tag{12}$$

Fig. 5 shows the graph of the electron orbit in the neutron of n_f= 4998.060546773912.

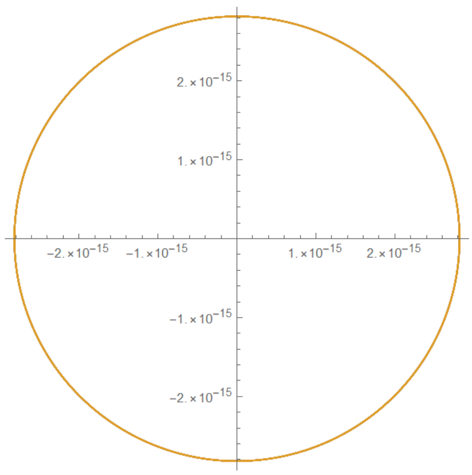

Fig.5. n_f = 4998.060546773912.

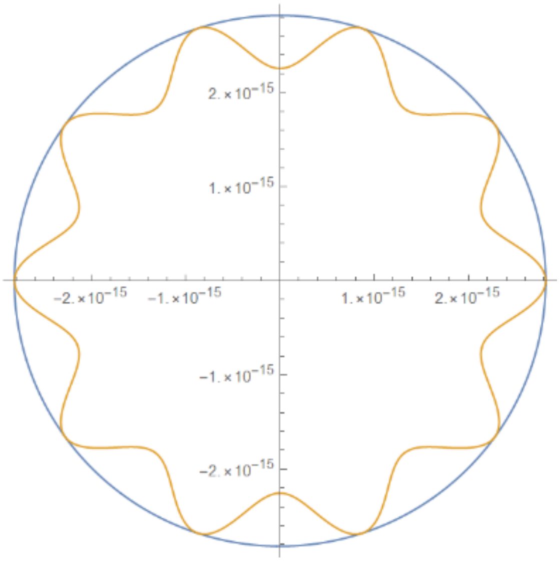

Fig. 6. n_f= 5.

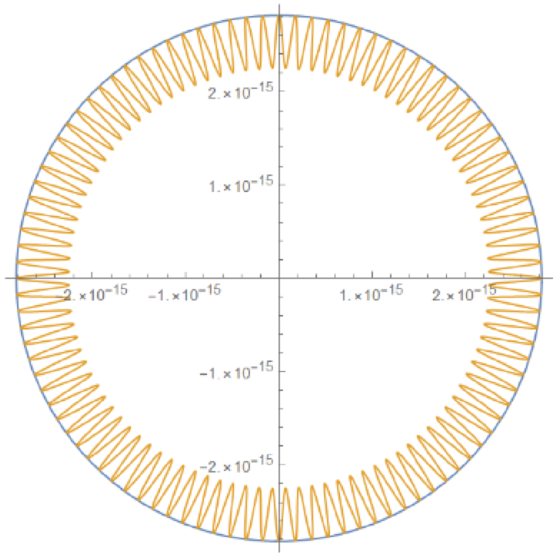

Fig. 7. n_f = 50.

This form as the equation (12) is hard to understand. When the position is the neutron, the orbit is nearly the form of the circle. Therefore, we exaggerate the orbit parameter. The eccentricity "***e***" is the value of 0.5 with the graph of the neutron. And perihelion parameter "n_f" is 5 and 50.

The graphs are

$$y = \frac{2.81794040021582327277 \times 10^{-15}}{1 + 0.5^2 \sin^2(5\theta)}, \tag{13}$$

$$y = \frac{2.81794040021582327277 \times 10^{-15}}{1 + 0.5^2 \sin^2(50\theta)}. \tag{14}$$

Fig. 6 shows the graph of the electron orbit in the neutron of n_f= 5. Fig. 7 shows the graph of the electron orbit in the neutron of n_f = 50.The blue line is the classical electric radius. And the yellow line is the electron orbit in the neutron.

6. Conclusion

In β-radiation, when a neutron decays to the proton and the electron, the mass of the emitted particle is a little small mass of the neutron. The particle is the proton and the electron.

Recently, the difference in the energy is thought of as the particle (the anti-neutrino $\overline{\nu}_e$). These are various theories about the particle. The neutrino and the light of neutron is the difference between energy and light emission. $n \to p + e^- + \overline{\nu}_e$. As the result, we show the difference in energy is an electromagnetic wave ν. $n \to p + e^- + \nu$. The calculated result suggested the decay of the neutron.

References
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[3] Y. Takemoto, S. Shimamoto, The inside of the Bohr radius, Bull. of NBU, Vol. 46, No.2 (2018- Oct.) pp.67-77.
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(The supplement) The radius of neutron

In section 4." Calculated the gamma line"

The distance between protons and electrons in the neutron is

$x_0(\textit{the ratio of distance}) = 1.0227$.

This is the solution of the equation

$$.\frac{mc^2}{\sqrt{1-\frac{1}{x}}} e^{-\frac{1}{x}} (Energy) = (939.56 - 938.27) \times 1.60218 \times 10^{-13} .$$

Therefore $h(x_0) = 2\pi m_e C(x_0) \cdot n_f(x_0) = 2\pi m_e \mathrm{c} \sqrt{x_0} R_0 = 4.889858338493112 \times 10^{-36}$

Then, the frequency is

$$\nu_0 = \frac{\Delta E}{h(x_0)} = \frac{0.782326 \times 10^6 \times 1.602176634 \times 10^{-19}}{4.889858338493112 \times 10^{-36}} = 2.563314416500963 \times 10^{22} \mathrm{Hz} \cdot$$

And the wavelength is

$$\lambda_0 = \frac{\mathrm{c}}{\nu_0} = \frac{299792458}{2.563314416500963 \times 10^{22}} = 1.1695500796551907 \times 10^{-14} \mathrm{m} .$$