Magnetic moment of an electron, it's spin and de Broglie oscillations.

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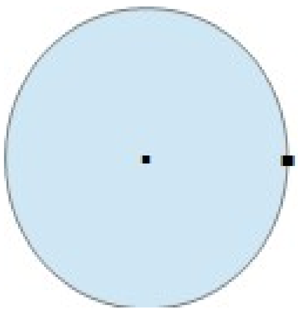
Abstract: Using the idea of de Broglie oscillations in elementary particles, for example, in an electron, it is easy to obtain quantitative values of the magnetic moment of an electron and the electron spin. Based on the oscillations the gyromagnetic ratio is logically explained. The calculations presented in the work once again confirm the reality of the existence of a periodic process in elementary particles, that is, de Broglie oscillations.

Keywords: De Broglie oscillations, de Broglie wave, electron spin, electron magnetic moment, Compton electron wave, gyromagnetic ratio.

INTRODUCTION.

Using de Broglie oscillations [1, 2], one can easily obtain quantitative values of the magnetic moment of an electron and the electron spin. All this is obtained logically, without using any additional hypotheses anymore.

Before the calculations, let us recall some of the points developed on the basis of de Broglie oscillations. Using the oscillation hypothesis of Louis de Broglie, together with the principle of PQS, an elementary particle can be represented as an oscillator, in which the kinetic and potential energy completely transform into each other with a certain frequency [3]: "...since energy cannot be transferred at a speed greater than the speed of light in a vacuum, it is natural that the periodic process associated with an electron occurs at the speed of light in a vacuum. That is, for illustrative purposes, we can imagine this periodic process as a classic rotator in which a material point moves in a circle with the speed of light in a vacuum (the mass of a material point is equal to the mass of an elementary particle)."



RESULTS AND DISCUSSION.

If de Broglie oscillations are represented as a classical rotator, then calculating the magnetic moment is not difficult, since the magnetic moment of the circle (with electric current) is calculated by the formula:

$$M = I * S$$

where M — is the magnetic moment,

I – is the current strength in the circle,

S – is the area of the contour.

Our contour during de Broglie oscillations is a closed Compton wave, that is, it is a circle limited by the Compton wave of electron.

“Note that the first observer who, according to Louis de Broglie, is "stationary relative to the electron", is an observer who, in our model, moves along with the material point along a circle with the speed of light in a vacuum. This assumption is confirmed by the calculation of the length of such a circle. In fact, we calculate the wavelength, which is closed on itself along a circle, and which the observer according to de Broglie, who is "stationary relative to the electron", will see. Naturally, it is easy to understand that we get the Compton wavelength of an elementary particle. This value was received by Louis de Broglie in 1925 in his work on the electron oscillation [5, p. 205]. Let's demonstrate these calculations.” [3, p. 6].

The current strength, by definition, is the amount of charge that has passed through the circle (surface) for a certain time:

$$I = \Delta Q/\Delta T$$

where I — is the electric current strenght,

ΔQ — is the charge that passed through the circle (surface),

ΔT — is the time during which the charge passed through the circle (surface).

In our case, for de Broglie oscillations, ΔQ is the electron charge (e), and the time ΔT is the oscillation period, so the oscillation time is easy to calculate:

$$\Delta T = 1/\gamma 0$$

where $\gamma 0$ — is the frequency of the zero-point oscillation (de Broglie oscillations).

“...But, to take into account the quantum nature of oscillations, it is necessary to make one essential clarification: we must consider the oscillating elementary particle as a quantum system in the ground state ("zero oscillations"). That is, oscillations at the quantum approach are the fluctuations of an elementary particle with "zero oscillations", and the energy of "zero oscillations" is calculated using the wellknown formula:

$$E0 = (h*\gamma 0)/2.$$

But then, if we follow the logic of Louis de Broglie, we must (h*γ0)/2 equate with the Einstein formula divided by 2 (that is, with (me*c^2)/2), otherwise the energy balance will not be maintained. As a result of this operation, we get the same values of the oscillation frequency (γ0) and the "time quantum of electron" (ΔT0):

$$E = me*c^2 = h*\gamma$$

$$E0 = (h*\gamma 0)/2 = (me*c^2)/2$$

$$(h*\gamma 0)/2 = (me*c^2)/2$$

$$h*\gamma 0 = me*c^2$$

$$\gamma 0 = (me*c^2)/h$$

$$\gamma 0 = (me*c^2)/h = 1.236 * 10^{(20)} \text{ Hz}$$

$\Delta T0 = 1/\gamma 0 = h/(me*c^2) = 8.09*10^{(-21)}$ s ” [3, pp. 6 – 7], clarification in the text: the values are the same, that is, like Louis de Broglie.

First, we calculate the electric current strength:

$$I = \Delta Q/\Delta T$$

$$\Delta T = 1/\gamma 0$$

$$\gamma 0 = (me*c^2)/h$$

Given the above formulas, we obtain the current strength during de Broglie oscillation:

$$I = \Delta Q/\Delta T = \Delta Q* \gamma 0 = e * \gamma 0 = (e * me * c^2)/h$$

The contour area will be equal (do not forget that the contour is limited by the Compton wave of electron):

$$S = \pi * r^2$$

$$\lambda c.e. = 2 * \pi * r$$

$$r = \lambda c.e./(2*\pi)$$

Given the above formulas, we obtain the expression for the area of the contour:

$$S = (\lambda c.e. * \lambda c.e.)/(4*\pi)$$

Now, we can easily calculate the magnetic moment of the electron according to the classical formula:

$$M = I * S$$

Considering that

$$I = (e * me * c^2)/h$$

$$S = (\lambda c.e. * \lambda c.e.)/(4*\pi)$$

$$\lambda c.e. = h/(me*c)$$

we obtain the value of the magnetic moment of the electron, which is similar to that generally accepted in physics:

$$M = I * S = (e * me * c^2)/h * (\lambda c.e. * \lambda c.e.)/(4*\pi) = (e*h)/(4*\pi*me)$$

$$M = (e*h)/(4*\pi*me)$$

$$M = (e*h)/(4*\pi*me) = 9.274 * 10^{(-24)}\ J/T$$

Thus, using de Broglie oscillations for the electron, we obtained the exact value of the magnetic moment of the electron, that is, the Bohr magneton.

Using this approach, one can calculate the numerical value of the electron spin. The electron spin is the intrinsic angular momentum of the electron. And if the oscillations are real, then the angular momentum should be obtained automatically. In fact, it is, the numerical value of the spin is easily obtained from de Broglie oscillations.

So, the spin is the intrinsic angular momentum of the electron, that is, using the concept of the rotator we can write:

$$S = m * v * r.$$

Given that these are de Broglie oscillations, then $v = c$. We calculate the radius of the rotator as before ($\lambda = 2 * \pi * r$), but take into account the fact that the wave will be twice as large as the Compton wave of the electron. Do not forget that we calculate the mechanical angular momentum, so the wavelength (real) will play an important role. Recall that:

“...That is, considering the oscillation of an elementary particle, we still have "two zero oscillations" (with the energy of each $E0 = (h*\gamma 0)/2$), two matched particle oscillations that lead to the resulting oscillation. If we proceed to the wave description, then as a result of two traveling waves (more precisely, all the same two semi-waves $\lambda/2$) we get the resulting standing wave. Therefore, the wavelength, which will describe the given periodic process (this oscillation), will be twice as long as the particle's Compton wavelength:

$$\lambda o. = \lambda c. + \lambda c.$$

$$\lambda o.e. = 2*\lambda c.e. = 4.8526 * 10^{(-12)}\ m.$$

For an electron, we obtain the value λo.e. = 4.8526*10^(-12) m, which, as will be shown in further works, plays a fundamental role in understanding and describing chemical bonds.

For clarity, this standing wave (the resulting particle oscillation) can be represented using our classic rotator: two half-waves are moving around the circumference of the rotator through each other, at the speed of light in vacuum, each half-wave is closed around itself. It is interesting to note that, despite such a simple model, it is well representative of the process of formation of a standing wave during particle oscillations according to Louis de Broglie" [3, p. 7].

Thats why,

$$\lambda o. = 2*\lambda c.e. = 2 * 2 * \pi * r1 = 4 * \pi * r1$$

From here we get the "radius of the mechanical rotator":

$$r1 = \lambda o./(4 * \pi)$$

Given the formula of Louis de Broglie:

$$\lambda = h /(m*v)$$

we will get

$$h = \lambda * m * v$$

Now in this formula we substitute the values for the electron (v = c, m = me, λ = λo.):

$$h = \lambda * m * v = \lambda o.* me * c$$

$$h = \lambda o.* me * c$$

$$h = \lambda o.* me * c = 4 * \pi * r1 * me * c$$

From here we get the exact value of the electron spin:

$$h/(4*\pi) = me * c * r1 = \hbar/2$$

Or

$$S = \hbar/2$$

where S — is the electron spin.

That is, using de Broglie oscillations, we got the exact value of the electron spin. At the same time, the gyromagnetic ratio received a logical explanation.

CONCLUSION.

Thus, using the concept of a periodic process occurring in elementary particles, that is, of de Broglie oscillations, we were able to elementarily calculate the quantitative values of the electron spin and the electron magnetic moment. And also explain the gyromagnetic ratio. When calculating the magnetic moment, we take into account the area of the circle of the electron limited by the Compton wave, which is the resulting standing wave. That is, the real wavelength will be twice as long. When calculating the spin, since the spin is the mechanical angular momentum, we should already take into account the real wavelength, hence we obtain a ratio equal to two (and the corresponding gyromagnetic ratio).

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