WHAT'S REALLY AN ELECTRON? WHAT IS THE MASS REALLY?

INTRODUCTION

In this article, I would like to show a new model for the electron, understood as a current loop, like a real microscopic coil crossed by electric current. The electric charge which determines this current, moves around a central point, at a tangential velocity equal to that of light. I affirm that my work is inspired by an article written by researcher Giorgio Vassallo of the University of Palermo.
I apologize to readers if my English is not of a good standard. I will try to write in the best possible way.
My name is Francesco Ferrara, I am a teacher of physics and I love, very much, the world of science.

Abstract

The electron is a loop of current having intensity of 19,97 A, and radius equal to 0,380 pm.
The real nature of the mass is electrical.

STATEMENT OF PHYSICAL QUANTITIES

TABLE N° 1

PHYSICAL QUANTITIES	**SYMBOL**	**UNIT OF MEASURE**
Current of the coil representing the model of an electron without relativistic effect	I_0	*[A]*
Current of the coil representing the model of an electron with relativistic effect	I	*[A]*
Radius of the current loop representing an electron	R_0	*[m]*
Frequency with which the charge that forms the current ring rotates	f_0	*[Hz]*
mass at rest of the rotating charge	$m_0 = 9,109\,382\,6 \times 10^{-31}\,kg$	
rotation frequency of the charge, taking into account relativity	**f**	**[Hz]**
magnetic moment of the electron	μ_B	**[A m^2]**
relativistic mass of the rotating charge	**m**	**[kg]**
mass of the electron	m_0	**[kg]**

THE MODEL ADOPTED FOR THE ELECTRON
FIGURA 1

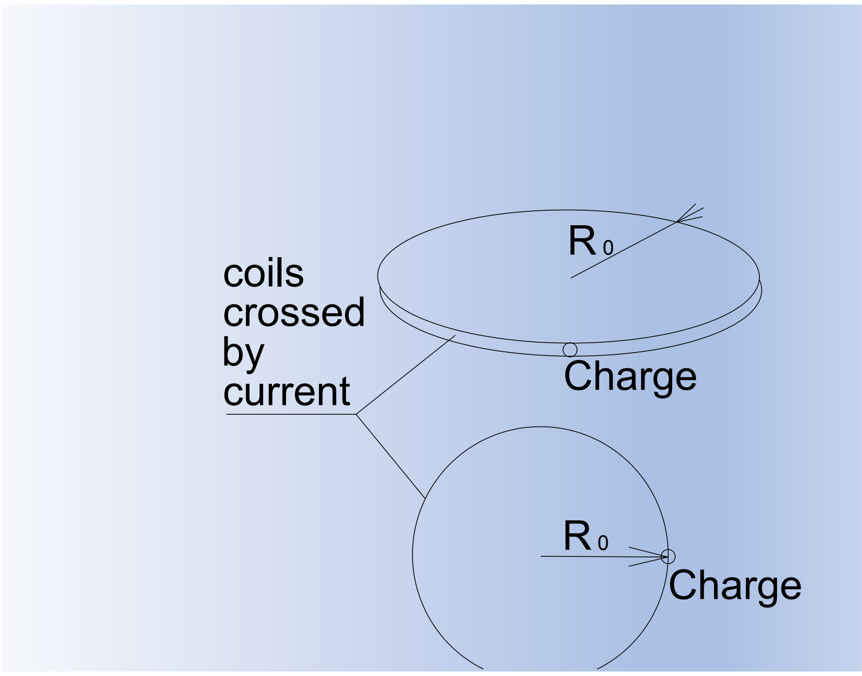
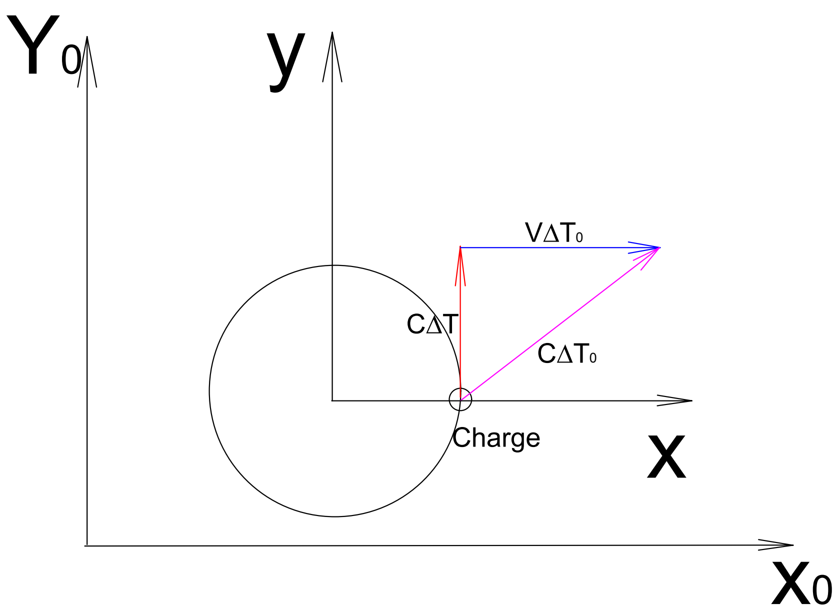


FIGURA 2



We consider two references system: one of this, O X_0 Y_0, is in agreement with fixed stars, the other, oxy, is in agreement with the center around which the charge of the current loop rotates. We suppose that the electron moves in the direction of the X_0 axis, with a velocity "v", and at the same time the charge, that constitutes the electron, rotates around an orbit having radius R_0, at the speed of light.

We, now, fix an interval time T_0, for example the time taken by the charge to make a complete revolution along the orbit, thus describing the current loop.
In the time range T_0, the electron describes a space range, equal to product between "T_0" and "v". We remember that "v", is the velocity of electron along the direction set by the X_0 axis.

The movement upward of electron refers to the "o x y" system: in this system it is necessary to consider an elapsed time interval "T" different from "T_0". If we consider the same range of time, we would fall into a paradox.

The movement of electron upwards, referred to the "o x y" system, is equal to product of the time "T" and the speed of light "c".

To demonstrate that the time spent with respect to the reference system "O X_0 Y_0" is different from the time elapsed with respect to the reference system "o x y", we can reason by absurd.

We suppose that, the time elapsed respect, to the reference "o X_0 Y_0", is equal to the time elapsed respect to reference system o x y.
In this situation, considering displacements triangle, (look at picture 2), applying the Pythagorean theorem we should have:

$$c^2 \Delta {T_0}^2 = V^2 \Delta T_0^2 + c^2 \Delta T_0^2$$

We will have $V^2 \Delta T_0^2 = 0$; The last relation is, of course, false.

The only way out of the impasse is to admit that the time spent with respect to the reference system "o x y" is different from the time elapsed with respect to the reference system O X_0 Y_0

Applying the Pythagorean theorem, after having made the right considerations, taking into account the rectangle of displacements of picture 2, it is possible to write:

$$c^2 \Delta {T_0}^2 = v^2 \, \Delta {T_0}^2 + c^2 \Delta T^2$$

We have:

$$(c^2 - v^2) \Delta {T_0}^2 = c^2 \Delta T^2$$

We have:

$$\Delta T_0{}^2 = \frac{c^2 \Delta T^2}{(c^2 - v^2)} = \frac{1}{(1 - (\frac{v}{c})^2)} \Delta T^2$$

We have:

RELAZIONE 1

$$\Delta T_0 = \sqrt{\frac{1}{(1 - (\frac{v}{c})^2)}} \Delta T$$

We put

RELATION 2

$$\gamma = \frac{1}{\sqrt{(1 - (\frac{v}{c})^2)}}$$

We have:

RELATION 3

$$\Delta T_0 = \gamma \Delta T$$

So far nothing new: we have shown that the time measured "*on board*" of the electron is not equal to the measured time, compared to a fixed reference system.

<u>IN THE HEART OF THE PROBLEM</u>

We imagine, now, that the range of time $\Delta T_0 = T_0$ is own the time elapsed, when the charge completes a complete turnaround the center of rotation and "ΔT =T" is the same range of time, considering the relativist effects.

The relation number three becomes:

RELATION 5

$$T_0 = \gamma T$$

Looking at table N°1, where we have defined the physical quantities which appear in our calculations, it is possible to write:

$$T_0 = \frac{1}{f_0}$$
$$T = \frac{1}{f}$$

Considering the last relations wrote, we can write the relation number five in the following way:

$$\frac{1}{T_0} = \gamma \frac{1}{T} \rightarrow \frac{1}{T_0} = \gamma \frac{1}{T} \rightarrow f_0 = \gamma f \rightarrow f = \frac{f_0}{\gamma}$$

RELATION 6

$$f = \frac{f_0}{\sqrt{(1 - (\frac{v}{c})^2)}}$$

Let us now examine the relation number 6.
If the electron speed, along X_0, is equal to zero, the denominator of the relation 6, becomes equal to one. As a result, we will have f = f0. Suppose that the electron's speed along the x_0 axis, of the is different from zero but less than the speed of light "c". In this case the denominator quantity, of relation number six, will certainly be less than unity, therefore, by dividing the quantity "f_0 " for a smaller number of the unit, we obtain a larger number of "f_0" itself.

This result is most important:

The electron behaves like a current loop, whose frequency, relative to the fixed reference system, O X_0 Y_0, depends on the speed with which the particle itself moves along the X_0 axis

If the velocity is increasing, the same frequency is increasing.

IMPORTANT CONSIDERATION N ° 1

If we multiply the first and the second member of the relation six by the quantity "q", charge of the electron, we obtain the current of the current ring under examination.

We obtain:

$$I = \frac{I_0}{\sqrt{(1 - (\frac{v}{c})^2)}}$$

If we try to increase the speed of the electron, with respect to the reference system O X_0 Y_0, the ring current will increase. Assuming, for the electron, a model similar to an inductance, the variation in time of the electric current, produces an electromotive force, according to the analytical relationship

$$V_L = L\frac{di}{dt}$$

This shows that the inertia at the motion has a purely electric nature

IMPORTANT CONSIDERATION N ° 2

RELATION 6

$$f = \frac{f_0}{\sqrt{(1-(\frac{v}{c})^2)}}$$

We have two way to write the energy of electron in this situation:

1. $E = m\,c^2$: the energy of the electron is writeable as the mass "m" of the electron same, for the speed of the light squared.
2. $E = h\,f$: the energy of the electron is writeable as the Planck constant for the frequency

By using the two expressions indicated above, one has:

$$mc^2 = hf$$

Resolving the last written relation with respect to the quantity "m" we have:

$$m = \frac{hf}{c^2}$$

Similarly:

$$m_0 = \frac{hf_0}{c^2}$$

We multiplicate, now, the first and the second member of equation number six, for the quantity "h/c^2 ", we obtain:

RELATION 7

$$m = \frac{m_0}{\sqrt{(1 - (\frac{v}{c})^2)}}$$

CALCULATION OF THE RADIUS OF THE CURRENT

1. Calculation of “f_0” quantity

$$m_0 = \frac{hf_0}{c^2} \rightarrow$$

$$f_0 = \frac{m_0 c^2}{h} = \frac{9{,}109\ 383\ 56 \times 10^{-31}\ kg \times 299\ 792\ 458^2}{6{,}62606957 \times 10^{-34} Js} \cong 1{,}235590053 \times 10^{20}\ Hz$$

$$f_0 \cong 1{,}235590053 \times 10^{20}\ Hz$$

2. Calculation of “T_0” quantity

$$T_0 = \frac{1}{f_0} = \frac{1}{1{,}235590053 \times 10^{20}\ Hz} = 8{,}093299212 \times 10^{-21}\ s$$

$$T_0 \cong 8{,}093299212 \times 10^{-21}\ s$$

3. Calculation of quantity R_0

To calculate “R_0”, we can consider this relation:

$$T_0 = \frac{2\pi R_0}{c}$$

Solving with respect to the quantity R_0 we have:

$$R_0 = \frac{T_0 c}{2\pi} = \frac{8{,}093299212 \times 10^{-21} \times 299\ 792\ 458}{2\pi} \cong 0{,}3861592402 \times 10^{-12} m$$

$$R_0 \cong 0{,}3861592402\ pm$$

4. I_0 Calculation of loop current

$$I_0 = f_0 q = 1{,}235590053 \times 10^{20}\ s^{-1} \times 1{,}602176565 \times 10^{-19} C$$
$$\cong 19{,}79633427\ A$$

$$I_0 \cong 19{,}79633427\ A$$

5. Calculation of magnetic moment of electronic loop current

$$\mu_B = I\ S = I\ \pi\ R_0^2 = 19{,}79633427 \times \pi \times\ (0{,}3861592402 \times 10^{-12})^2$$
$$\cong 9{,}274009016 \times 10^{-24}\ Am^2$$

$$\mu_B \cong 9{,}274009016 \times 10^{-24}\ Am^2$$