The Actual Value of the Electric Field around the Moving Electron

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Abstract. Based on the earlier developed by author hypothesis of the exploding electron the actual value of the electric field around the electron in motion is proposed.

Instantaneous electrical field around the electron has empty regions and axial symmetry. Owing to the space isotropy the axis of symmetry takes equiprobable positions in space, and thus the averaged field acquires the central symmetry. Relationship for the actual electric intensity of the field around the moving electron is proposed which differs from that based on the special relativity theory. With increasing speed the electric intensity of the field around the moving electron tends to the *finite value* in the direction orthogonal to the movement.

Keywords: the actual electric intensity of the moving electron, hypothesis of the exploding electron.

1. Introduction

According to the classical electrodynamics the electric field around the electron at rest has the central symmetry (Fig. 1). The intensity observed in a point A distanced at r_A from the source-electron is given by the expression

$$\overline{E}_A = \frac{e}{4\pi\varepsilon_0 r_A^2},$$ (1)

where ε_0 is the electrical constant, e is the elementary charge. We will consider further why the intensity must be seen as a time mean value.
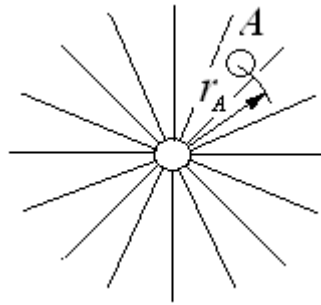

Fig. 1. The electron at rest radiates electrostatic field in all directions of surrounding space symmetrically.

If the source-electron moves, the field is deformed. It becomes weaker in the direction of movement and stronger in a plane orthogonal to the movement direction (Fig. 2).

According to Special Relativity Theory (*SRT*) intensity of the field created by an electron moving with constant speed, v, obeys the following expression

$$E_A(\beta,\vartheta) = \overline{E}\,\frac{1-\beta^2}{\left(1-\beta^2\sin^2\vartheta\right)^{3/2}},$$ (2)
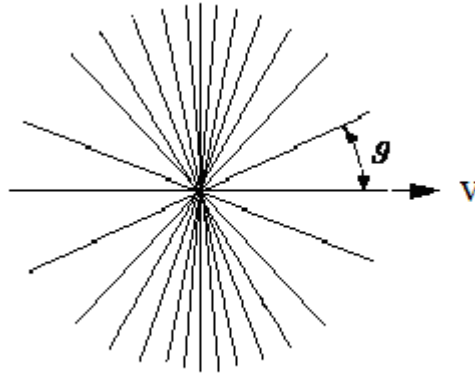
where $\beta = v/c$, c is the light speed.

Figure 2. The picture of the electric field around the electron moving with a velocity v. It becomes weaker in the direction of movement and stronger in a plane orthogonal to the movement direction.

As is easily seen from (2), if $\beta \to 1$, then $E(\vartheta = \pi/2) \to \infty$ in a plane orthogonal to the movement direction, and $E(\vartheta = 0) \to 0$ in the movement direction.

As I aware, the theoretical formula (2) is not verified experimentally. Here I will give a possible more precise formula based on the proposed by me hypothesis of the exploding electron [1, 2].

2. The electric field around the exploding electron at rest

In my earlier published works this hypothesis was described in detail; therefore here we will consider it shortly in connection with the problem of the field surrounding the moving electron.

I have assumed that until unknown de Broglie's periodical process in the electron can be interpreted as *its periodical explosions*. In doing so, a very small negatively charged core of the electron ($<10^{-46}$ m [2]) remains in stable state by the pressure of the hypothetical fation[1] gas. This gas fills the space and causes gravity. As a result of the bombardment by fations, a *layer of charged sub-particles* is created on the core surface[2]. This layer explodes with period T. The explosion has two stages. The explosion corona, in the course of the first stage, expands similarly to a condensed matter in that sense only that direct interaction between the new sub-particles, from which the corona consists, conserve during the process of the corona expanding and that the corona is not penetrable for an external electric field[3]. Hereafter the first stage of the explosion will be referred to as the *E-corona*. The E-corona front expands with the velocity of light in vacuum, c, inasmuch as it is supposed that the E-corona *components* (ECC) are massless, or their inertial masses are extremely small. At the end of the each explosion the E-corona radius equals $R_m = \lambda + r_c$, where $\lambda = cT$. Inasmuch as the core radius $r_c << \lambda = 3.86 \times 10^{-13}$ m [3], then we can take

$$R_m \cong \lambda = cT . \tag{3}$$

At the explosion end the E-corona disintegrates into separate sub-particles. This is the beginning of the second stage. One after another, flows of these new sub-particles produce spherical λ *layers* radiated with velocity c, like the classical electric field. In [1] these new sub-particles were named by the *Electric Field Sub-particles* (EFS). The thickness of each moving λ layer is constant.

Analysis shows that the instants of the E-corona disintegration and the beginning of the next explosion must be simultaneous [1].

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1 The term "fation" is introduced, in [2], in honour of Nicolas Fatio de Duillier, who, in 1690, had offered the idea of the mechanical gravitation and had assumed the existence of sub-particles, from which this gas consists. This hypothesis, for the historical reasons, is far-famed as Lesage's theory

2 The fations are assumed to be neutral sub-particles, which decay, on the core surface into new charged components. Owing to the symmetry breaking a surplus of negatively charged components is created. These components are retained on the core surface by pressure of the fation gas and the foregoing corona matter. In [1, 2] this scenario was described in more detail.

3 In [1] it was shown that electric field can be considered as flows of *charged sub-particles*, rather than the neutral photons

On Fig. 3 it is shown only two λ layers, corresponding to two explosions. Owing to isotropy of space the axis z occupy equiprobable direction in space. On the Fig. 3 two random instantaneous positions z_1 and z_2 are shown, which correspond to first and second explosions.

In [1] I have found (*for the first time*) that the field created by the electron has a complicated structure with empty B and nonempty D regions (Fig. 3). In the stationary case an observation point A gets into the region D randomly with probability

$$P_D = \frac{(2L+\lambda)(L+\lambda)}{3(L+\lambda)L+\lambda^2}, \qquad L \geq 0, \tag{4}$$

where denotations are clear from Fig. 3. Thereby we can consider the observed electric intensity, in the observation point A, as an averaged in time magnitude, $\overline{E}_A$, described as

$$\overline{E}_A = E_D P_D = E_D \frac{(2L+\lambda)(L+\lambda)}{3(L+\lambda)L+\lambda^2}, \tag{5}$$

where E_D is an instantaneous value of the electric intensity in any point located in the region D of the field.
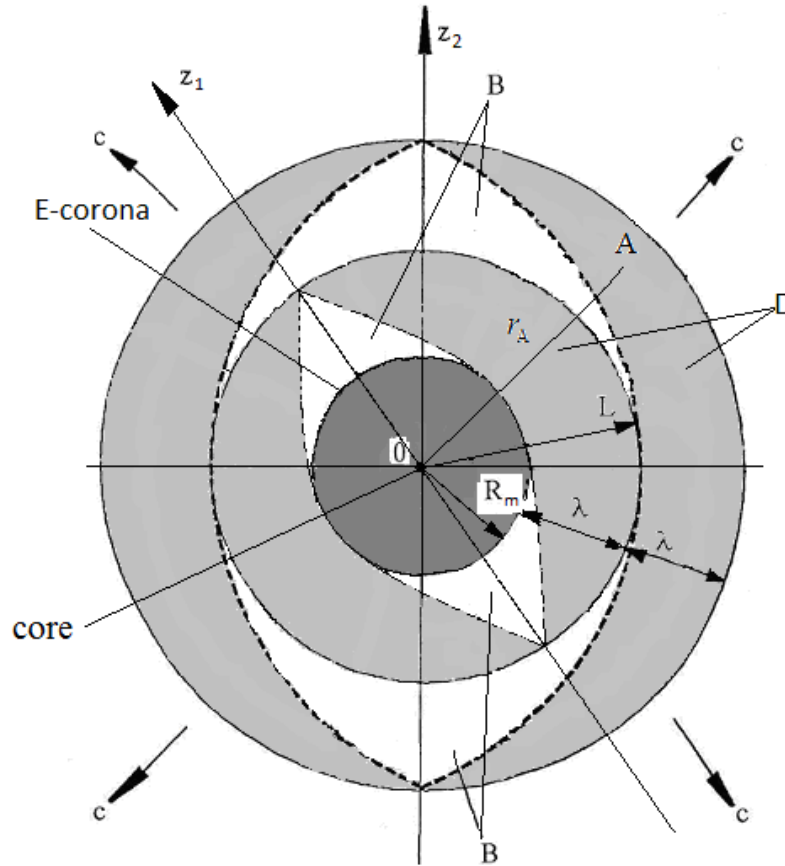

Figure 3. A cross-section of the E-corona explosion (at its disintegration instant), and periodical flows of electrical field sub-particles (EFS). There is shown only two λ layers of these flows. $R_m \approx \lambda$ is the E-corona radius.

Note, that the observation point A *has the determinate position in space*, but the instantaneous electrical intensity E has a random value ($E=E_D$ or $E=0$) because empty B and nonempty D regions *appear randomly in the point A*. Thereby the Copenhagen interpretation of the atomic physics, it seems, to be some corrected.

3. The electric field around the exploding electron in motion.

As we specified above, any point located in an electric field appears in empty B and nonempty D regions randomly, because owing to isotropy of space axis z occupy *equiprobable* direction in space. However,

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when the electron moves the axis z takes, with some probability, *the allocated direction* – to the direction of movement. In doing so the empty regions B tend to take place on the line of motion, therefore an averaged meaning of the intensity reduced at the line of motion, whereas it is increased in the plane orthogonal to motion. As is easily seen, when v is comparable to c, E is comparable to zero at the line of motion, and it is comparable to E_D in the plane orthogonal to motion.

In general, the following relationship satisfies the above boundary conditions

$$E(\beta,\vartheta) = \overline{E}\,\frac{\left(1-\beta^2\right)\left(1+0.5\beta^2\sin^2\vartheta\right)}{\left(1-\beta^2\sin^2\vartheta\right)}\,. \tag{5}$$

It differs from (2) by finite value, $E(\beta,\vartheta)\to 1.5\overline{E}$, if $\beta\to 1$ in the plane orthogonal to the movement direction (*viz* for $\vartheta=\pi/2$).

The expression (5) is valid if mass of the electron does not vary with velocity, i.e. if the consistent relativistic concept of mass holds [4, 5].

The above analysis is depicted in Fig. 4. As is easily seen, when $\beta<0.5$ formulae (2) and (5) give comparable results, but in relativistic cases they fundamentally diverge.
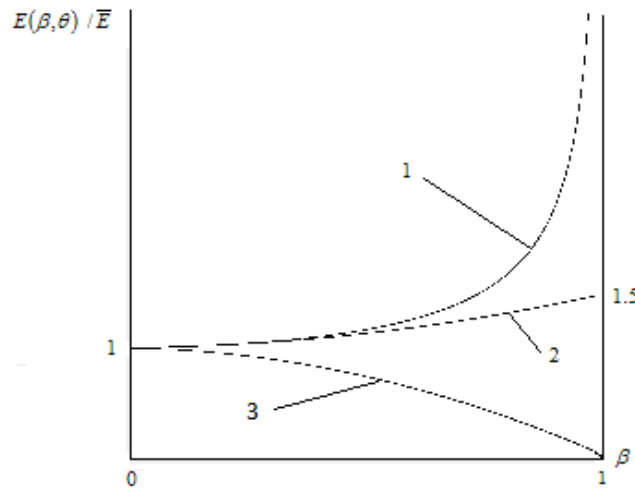

Figure 4. Diagrams of the relative values of electrical intensities depending on $\beta=\mathrm{v}/c$ and θ: 1 depicts relativistic relationship (2) for $\theta=\pi/2$, 2 is approximate actual plot according to the model of the exploding electron, relationship (5) for $\theta=\pi/2$ and 3 is diagram for both relativistic and actual relationships for $\theta=0$, which coincide with each other in this case.

4. Conclusion

In conclusion we emphasize that the *electrical field is flows of the positively and negatively charged sub-particles* (EFS)[4]. Such new notions supply us by the simple and physically clear mechanisms of an attraction of opposite charges and repulsion of the like ones [3]. These fundamentally differ from the mechanism of the quantum theory. In the quantum theory electric interaction is considered as a process of exchange by a continuous stream of virtual photons. But photons are considered as massles *neutral* bosons. In this connection it is not clear how photon distinguishes positive and negative charges to produce an attraction or repulsion.

In [3], by example of hydrogen atom, the nature of the binding energy was demonstrated. It is consequences of partial annihilations of the E-coronas. In events of the electron-positron annihilations the E-coronas are almost fully disappear.

It follows from the idea of the exploding electron that the electrical field around the moving electron substantially differs from that given by the Special Relativity Theory. We have obtained that in a plane orthogonal to the movement direction the electric intensity tends to finite value, whereas according to SRT it tends to infiniteness. The analogous result was obtained by Kljushin J.G. based on slightly generalized Maxwell's equations [6].

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[4] Whether we can consider EFS as *charged massless bosons* is a topic for further investigations.

The proposed here new formula (5) can be easily verified experimentally.

Although there are no experiments, which *directly* support the idea of the exploding electron, but there are experiments (for example [7]), where was shown that electron has *internal clock* with the frequency, which is compatible with the de Broglie frequency, $\nu_B = m_e c^2 / h \cong 1.24 \times 10^{20}$ s^{-1}. I think that these data can be interpreted as explosions of the electron with the frequency $\nu_e = m_e c^2 / \hbar \cong 7.8 \times 10^{20}$ s^{-1}, which corresponds to the corona radius $\lambda = \lambda_C / 2\pi$ [3], where λ_C is the Compton wavelength.

Some evidence for the electron explosions can be also the following well known facts. When the electron and the positron are annihilated, this can be considered as that their E-coronas are almost fully annihilated at small distance. In doing so bound systems of cores are created, which are observed as "massless" gamma quanta. It is known also an inverse process of disintegration of the gamma quantum on electron and positron. In this case the cores of the electron and positron are distanced from each other and the explosion coronas are restored. In doing so *masses of particles are revived owing to the absorption of the fation gas energy*.

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[a] The same author as Nikolay Dibrov or Nikolay V. Dibrov