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Neutrino and electromagnetism

In [1] the following assumption has been put forward:

"Taking for a basis neutrino and antineutrino, it is necessary to see: the electromagnetic interaction is caused by that the 4-potential of an electromagnetic field is a neutrino current of transition which well interface with the electron-positron current of transition." In present article this assumption develops and specified.

The electromagnetic field is defined by the 4 - potential usually marked as A [4]. It has 4 projections: A_0 - a projection to a time axis, A_i - three projections to space axes. All projections are functions of coordinates: time ($x_0 = c \cdot t$) and three spatial. Each projection submits to the wave equation:

$$\frac{1}{c^2} \cdot \frac{\partial^2 A_m}{\partial t^2} - \frac{\partial^2 A_m}{\partial x^2} - \frac{\partial^2 A_m}{\partial y^2} - \frac{\partial^2 A_m}{\partial z^2} = 0, \quad \text{где } m = 0,1,2,3. \tag{1}$$

Here c – speed of light.

Taking combinations of various derivative of A, it is possible to receive intensity of electric and magnetic fields. In quantum electrodynamics photons are as though particles of A.

Photons are strongly absorbed by substance, but neutrinos possess huge penetration capacity.

A neutrino current of transition, equivalent to 4-potential A, it is possible to define as follows [2, §30]:

$$j_m = \left(d^+ s_m h\right), \quad m = 0,1,2,3, \tag{2}$$

where h - spinor, defining a neutrino condition and satisfying to the equation

$$\left(\frac{\partial}{c\partial t} + s_1 \frac{\partial}{\partial x} + s_2 \frac{\partial}{\partial y} + s_3 \frac{\partial}{\partial z}\right) h = 0, \tag{3}$$

d - constant spinor, corresponding to zero condition of a neutrino field, d^+ - spinor, hermitian conjugated to d,

$s_0 = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix}$, s_1, s_2, s_3 - Pauli's matrixes, c – speed of light.

It is possible to show that components j, the same as components A, satisfy to the wave equation. Let us take, for example, $d^{+}s_{1}h$ and multiply it at the left by the operator of the wave equation. As in the operator of the wave equation there are no matrixes it can be moved direct to h. It is possible to present the wave operator as a product of the operator $\left(\frac{\partial}{c\partial t}-s_{1}\frac{\partial}{\partial x}-s_{2}\frac{\partial}{\partial y}-s_{3}\frac{\partial}{\partial z}\right)$ and the operator of the equation (3). From here it seems clear that $d^{+}s_{1}h$ satisfies to the wave equation. The same operations can be done with all components j.

If to mark $j^{m}=d^{+}s_{m}h$, by virtue of the equation (3) it is possible to record the equation of a continuity in a relativistic proper type: $\frac{\partial j^{m}}{\partial x^{m}}=0$. The similar condition can be imposed on components of 4-potential A - it is known as Lorentz's condition.

Special feature of use j_{m} consists in that the given 4-vector is complex unlike the real A. But as the wave equation and the equation of continuity do not contain complex factors the real and complex part of j_{m} satisfy to these equations. It is possible to identify these parts with A, but it will not result in any new possibilities. It is much more substantially to use j_{m} as A.

j_{m} contains two complex functions of time and coordinates (spinor components), that is 4 real functions; there are too four of them in 4-potential A, therefore electromagnetism is full described by j_{m} as well as A.

Quantum electrodynamics asserts, that two photons can interact among themselves, forming pair « electron – positron ». Such initial photons enter into a matrix of dispersion in the form of product $A_{1m}(x_{1})A_{2n}(x_{2})$, where under x_{1} and x_{2} sets of four coordinates in two points are marked. We shall present this product in the form of product of components of a 4-vector j. As these components are complex the components of the first vector should be taken hermitian conjugated:

$h_{1}^{+}(x_{1})s_{m}d_{1}d_{2}^{+}s_{n}h_{2}(x_{2})$.

In the given product the matrix $d_1 d_2^+$ characterizes a zero condition of neutrino field, therefore it can be taken unit. Remains:

$$h_1^+(x_1) s_m s_n h_2(x_2) . \qquad (3)$$

Apparently, two neutrino fields are interact, and this interaction is similar to interaction of two photons, that is electromagnetic interaction.

Intensity of interaction of two photons with formation of pair « electron – positron » is small, but perceptible. Calculation of an example under the formula from [3, p.282], received in 2-nd order of the theory of perturbation, gives following result: at energy of photons that is greater energy of rest electrons on 5% the section of the given reaction approximates 12,6 % from the maximal section of Compton-effect.

From this follows, that interaction of photons and consequently neutrino, should be observable. Frequency of such photons and neutrino conforms to g -range, formed at nuclear reactions.

If photons energies are less than necessary for formations of pairs it is a phenomenon of dispersion of photon on photon. Calculation is conduct on 4-order of the theory of perturbation, and the section turns out on 6 and more orders smaller than at formation of pairs [3, p.379].

The given materials speak that it is possible to observe occurrence of pairs « electron – positron » at impacts neutrino from counter or crossed beams of high energy. Such impacts should influence electromagnetic conditions on the Earth and, in particular, on terrestrial organisms.

References

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