GENERALIZATION OF THE CLASSICAL ELECTRODYNAMICS

Idea

To make some changes in classical electrodynamics and receive the description of the relativistic effects without use of the special relativity theory and without the velocity restrictions.

Mathematical model

The standard differential equations of the Maxwell electrodynamics in physical space $R^3 \times T^1$ are used. Connections between fields and inductions are changed. For them it is used metric tensor θ_{ij}, depending on the new physical magnitude w named a rate of the relation. New electrodynamics is based on the equations:

$$\partial_{[k}F_{mn]} = 0,\ \partial_k \widetilde{H}^{ik} = \tilde{s}^i, \widetilde{H}^{ik} = w^{1/2}\sqrt{\theta}\Omega^{im}\Omega^{kn}F_{mn}, d\theta^2 = \theta_{ij}dx^i dx^j,$$

$$\Omega^{im} = \frac{1}{\sqrt{\mu}}\left[\theta^{im} + \left(\frac{\varepsilon\mu}{w} - 1\right)u^i u^m\right], u^i = (1-w)u^i_{fs} + wu^i_m, u^i = \frac{dx^i}{d\theta},$$

$$\theta^{im} = diag(1,1,1,w), w = 1 - exp[-P_0(n-1)], \theta = det\theta_{mj,}\theta^{im}\theta_{mj} = \delta^i_j,$$

$$dx^1 = dx, dx^2 = dy, dx^3 = dz, dx^0 = icdt$$

Used magnitudes are

$$F_{mn} = \begin{pmatrix} 0 & B_z & -B_y & -iE_x \\ -B_z & 0 & B_x & -iE_y \\ B_y & -B_x & 0 & -iE_z \\ iE_x & iE_y & iE_z & 0 \end{pmatrix} \quad H^{ik} = \begin{pmatrix} 0 & H_z & -H_y & -iD_x \\ -H_z & 0 & H_x & -iD_y \\ H_y & -H_x & 0 & -iD_z \\ iD_x & iD_y & iD_z & 0 \end{pmatrix}$$

The point of view is accepted, that all relativistic effects should be obtained in the form of solution of the new model of the electromagnetic phenomena with the account of the concrete experimental conditions.

New elements of the physical theory

In addition to the rate of the refraction n in electrodynamics the rate of the relation w is introduced. On its basis stages the dynamic process of the electromagnetic field interaction with the physical environment (which role, in particular, can carry out the measuring device) are considered. At $w = 0$ the process of the field interaction with medium yet has not begun, at $w = 1$ it is already finished. The connection between the rates of the relation w and the rate of the relation n has the form:

$$w = 1 - exp[-P_0(\lambda)(n-1)]$$

Scalar w is introduced in the transformations of the coordinates, concerning symmetry properties of the electromagnetic field:

$$dx' = \frac{dx - vdt}{\sqrt{1 - w\frac{v^2}{c^2}}}, dy' = dy, dz' = dz, dt' = \frac{dt - w\frac{v^2}{c^2}dx}{\sqrt{1 - w\frac{v^2}{c^2}}}$$

If the rate of relation is $w = 0$ these transformations correspond to Galilee group, if $w = 1$ these transformations correspond to Lorentz group.

Scalar w in material equations of the electrodynamics is introduced:

$$\vec{D} + w\left[\frac{\vec{U}}{c} \times \vec{H}\right] = \varepsilon\left(\vec{E} + \left[\frac{\vec{U}}{c} \times \vec{B}\right]\right),$$

$$\vec{B} + w\left[\vec{E} \times \frac{\vec{U}}{c}\right] = \mu\left(\vec{H} + \left[\vec{D} \times \frac{\vec{U}}{c}\right]\right)$$

New expression for the velocity, named associated velocity, depending on the velocity $\vec{u}_{fs}$ of a primary source of radiation, a rate of the relation w and the velocity $\vec{u}_m$ of the medium is used. The law of change of the associated velocity for a case of the dynamic relaxation process is found

$$\vec{U} = (1 - w)\vec{u}_{fs} + w\vec{u}_m$$

We use in generalized electrodynamics the velocity of a primary source of the radiation $\vec{u}_{fs}$, and the velocity of the medium $\vec{u}_m$ It is shown, that in the phase equation by means of which it is necessary to consider the change of the frequency of the electromagnetic field, it is correct to use another expression for associated velocity

$$\vec{U}_\omega = \vec{u}_{fs} + w\vec{u}_m$$

The distinction of expressions for associated velocities, from the physical point of view, is caused by the distinction in asymptotic behavior in relaxation process the pair of the coordinated physical characteristics: the frequencies and the velocities of the electromagnetic field. The distinction of the expressions for associated velocities, from the mathematical point of view, is caused by the necessity of use in model the pair of the different conditions for the electromagnetic field: the dispersive equation and the phase condition equation.

New results in the electrodynamics theory

1. The influence of measurement devices on parameters of the electromagnetic field is analyzed. It is shown, that its account changes understanding and interpretation of the experimental data.

2. Physical complementarities of the Galilee and the Lorentz groups in electrodynamics of moving medium are proved.

3. Variants of introduction of the magnitude w in the electrodynamics differential equations are offered.

4. The description of all set of the experimental data in classical electrodynamics of the moving media in the model of macroscopically physical space and time without restriction on the velocity is given.

4. It is shown, that in new model of the electromagnetic phenomena the principle of the constancy of the light velocity in vacuum will be coordinated with the condition of limitlessness of such velocity.

5. The finiteness of frequency of the electromagnetic field moving in the gas medium is proved at velocity of movement of a source of radiation with the velocity equal to a velocity of light in vacuum. It is caused by difference of the rate of refraction from unit. Dependence looks like

$$\omega = \omega_0 \frac{1 + \frac{u_{fs}^2}{c^2}\Psi}{\left(1 - \frac{u_{fs}^2}{c^2}\right) + \sqrt{1 - \frac{u_{fs}^2}{c^2} - \left(1 + \frac{u_{fs}^2}{c^2}\Psi\right)\left(1 - \frac{u_{fs}^2}{c^2}(1+\Psi)\right)}}, \Psi = 2Q + Q^2, n = 1 + Q$$

The frequency has final value at the velocity of the radiation source equal of the light velocity in vacuum, as

$$\omega^* = \lim \omega(u_{fs} \to c) = \omega_0 \left(1 + \frac{1}{\Psi}\right)^{1/2}$$

6. The law of the dynamic change of the electromagnetic field frequency in the phenomenon of the aberration is found

$$\omega = \omega_0 \left[\left(1 - w\frac{u_{fs}^2}{c^2}\right)^{1/2} + \Phi\frac{u_{fs}^2}{c^2}\right]$$

$$\Phi = w\left[(2 - w) - (1 - w)^{1/2}\right]$$

7. New formula for the dependence of nonzero weight on the velocity is derived:

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

8. Exact solution of the electrodynamics equations at $w = const$ is found. In particular, new expression for group velocity of an electromagnetic field is received

$$\vec{V}_g = \frac{c}{n}\frac{\vec{k}}{k} + \left(1 - \frac{w}{n^2}\right)\left[(1 - w)\vec{U}_{fs} + w\vec{U}_m\right].$$