Experiment on detection of monopole charge radiation in vacuum electrodynamics

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Maxwell-Lorentz electrodynamics relates the system's charge radiation to dipole nature [1]. This property of radiation is conditioned by the charge conservation law . Meanwhile vacuum electrodynamics [2], where the particles' charges and masses can be variable, has got monopole charge radiation as well. Let us have a look at the solution of vacuum equations [2]

$$\nabla_{[k}e^{a}{}_{m]} - e^{b}{}_{[k}T^{a}{}_{|b|m]} = 0, \qquad (A)$$

$$T^{a}_{m} = \frac{1}{\nu}(R^{a}{}_{m} - \frac{1}{2}g^{a}{}_{m}R), \qquad (B.1)$$

$$C^{a}{}_{bkm} + 2\nabla_{[k}T^{a}{}_{|b|m]} + 2T^{a}{}_{f[k}T^{f}{}_{|b|m]} = -\nu J^{a}{}_{bkm}, \qquad (B.2)$$

which in non relativistic limit result in variable Coulomb-Newton potential and can viewed as [2]:

Solution with variable Coulomb-Newton potential

(1)

1. Coordinates: $x^0 = u, x^1 = r, x^2 = \theta, x^3 = \varphi$.
2. Components of Newman-Penrose symbols :

$$\sigma^{i}_{0\dot{0}} = (0,1,0,0), \quad \sigma^{i}_{1\dot{1}} = (1,U,0,0), \quad \sigma^{i}_{0\dot{1}} = \rho(0,0,P,iP),$$

$$\sigma^{0\dot{0}}_{i} = (1,0,0,0), \quad \sigma^{1\dot{1}}_{i} = (-U,1,0,0), \quad \sigma^{0\dot{1}}_{i} = -\frac{1}{2\rho P}(0,0,1,i),$$

$$U(u) = -1/2 + \Psi^0(u)/r, \quad P = (2)^{-1/2}(1+\zeta\overline{\zeta}/4), \quad \zeta = x^2 + ix^3,$$
$$\Psi^0 = \Psi^0(u).$$

3 . Spinor components of the torsion field (Ricci rotation coefficients):

$$\rho = -1/r, \quad \alpha = -\overline{\beta} = -\alpha^0/r, \quad \gamma = \Psi^0(u)/2r^2,$$

$$\mu = -1/2r + \Psi^0(u)/r^2, \quad \alpha^0 = \zeta/4.$$

4. Spinor components of the Riemannian tensor:

$$\Psi_2 = \Psi = -\Psi^0(u)/r^3, \quad \Phi_{22} = \Phi = -\dot{\Psi}^0(u)/r^2 = -\frac{\partial \Psi^0}{\partial u}\frac{1}{r^2}.$$

Here we used the designations, introduced by E.Newman and R.Penrose in [3].

In quazi-Cartesian coordinates from the solution (1) the Riemannian metric, created by variable charge $Q(t)$, will be written as

$$ds^2 = \left(1 - \frac{e}{m}\frac{2Q(t)}{rc^2}\right)c^2dt^2 - \left(1 + \frac{e}{m}\frac{2Q(t)}{rc^2}\right)(dx^2 + dy^2 + dz^2.) \tag{2}$$

In quazi inertial reference system the relativistic motion equations of a prob charge e will be presented as [2]

$$\frac{d^2x^i}{ds^2} = \frac{e}{mc^2}E^i{}_{jk}\frac{dx^j}{ds}\frac{dx^k}{ds}, \tag{3}$$

where $E^i{}_{jk} = -\frac{c^2}{2}g^{im}(a_{jm,k} + a_{km,j} - a_{jk,m})$ -is intensity of the strong electromagnetic field, $g_{ik} = \eta_{ik} + ka_{ik}$ - the metric of vacuum electrodynamics, $\eta_{ik} = \eta^{ik} = \mathrm{diag}(1 - 1 - 1 - 1)$ –the metric tensor of pseudo-Euclidean space, $k = e/m$ specific charge of a prob particle with a charge e and mass m as well as a_{ik} –tensor potential of the electromagnetic field in vacuum electrodynamics [2].

Using the metric (2), we find from (3) nonrelativistic three-dimensional motion equations

$$m\frac{d^2x^\alpha}{dt^2} = -eE^\alpha{}_{00} - eE^\alpha{}_{\alpha 0}\frac{dx^\alpha}{cdt}, \qquad \alpha, \beta ... = 1, 2, 3, \tag{4}$$

where

$$E^\alpha{}_{00} = \frac{c^2}{2}\eta^{\alpha\alpha}a_{00,\alpha} = -\frac{Q(t)}{r^3}x^\alpha \tag{5}$$

presents Coulomb field of variable charge $Q(t)$, and

$$E^\alpha{}_{\alpha 0} = -\frac{c^2}{2}\eta^{\alpha\alpha}a_{\alpha\alpha,0} = \frac{1}{r}\frac{\partial Q}{c\partial t} \tag{6}$$

- is a scalar electric field, created by the charge variable in time (monopole radiation). Let us write the motion equations (4) in vector form

$$m\frac{d\mathbf{v}}{dt} = e\mathbf{E} - e\frac{\mathbf{v}}{cr}\frac{\partial Q(t)}{c\partial t}. \tag{7}$$

From equations (7) we can see that the scalar field causes the force, which acts only upon moving charges. The direction of action of this force depends upon the velocity vector $\mathbf{v}$ of the prob charge. The monopole radiation decreases with distance slower, than the Coulomb field, and, perhaps, has got higher permeability! The value of monopole radiation depends upon the magnititude of the charge $Q(t)$ as well as upon the speed of change of the charge $\partial Q(t)/\partial t$ meanwhile the field's sign depends upon the increase or reduction of the charge.

On can observe the scalar field $S = \partial Q/rc\partial t$ in the following simple experiment (Fig. 1). The charged metal sphere, suspended on the string, is surrounded by a ring conductor with electric current (the electric current might be connected via the

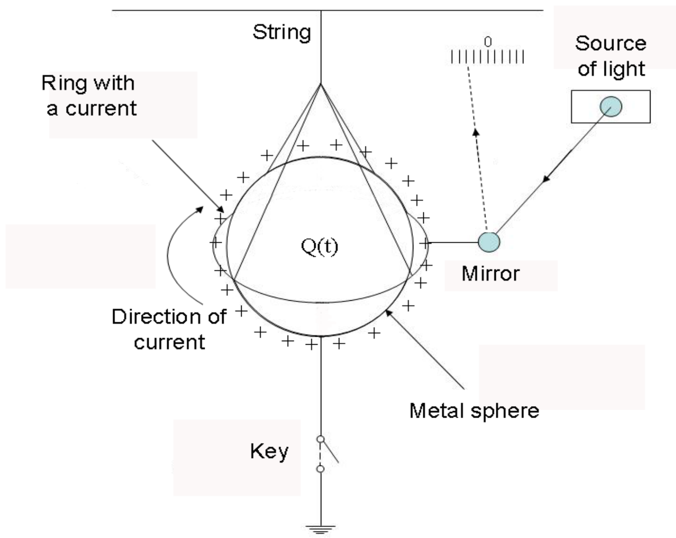

Figure 1: The principal scheme for the experiment on detection of monopole radiation of a metal sphere

pendant). The circuit ring is equipped with a mirror, where the light ray points at. The circuit ring should be placed around the sphere's equator area, which in its turn positioned perpendicular to the sphere's axis aligned along the hanging string.

If the charge of the sphere does not vary in time, then we obtain the static Coulomb field at large distances from the sphere and in the equations (7) the scalar field that equals zero. If the key, connecting the charged sphere with the Earth, is switched on, then the sphere's charge varies. In this case the sphere will be surrounded by the vector variable electric field (5) and the scalar field (6, which acts upon the charged ring conductor. From equations (7) it follows that the force acting upon each minor element of the conductor will be directed as tangent towards the conductor and against the velocity of electron motion in the ring conductor. As a result there will appear angular momentum force relatively the axis aligned along the hanging string and the conductor should twist the string, while the ray of light should from equilibrium state (fig. 1). The change of the current's direction in the ring conductor will correspondingly change the direction of the string's rotation and then the ray of light should deviate from the equilibrium state in the opposite direction.

References

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[2] *Shipov G.I.* A Theory of Physical Vacuum. A New Paradigm M.: GART, 1998, p.312 (in English).

[3] *Newman E., Penrose R.* // J. Math. Phys. 1962. Vol. 3, No 3. P.566 – 587.