ON THE POSSIBILITY OF THE FASTER-THAN-LIGHT MOTIONS IN NONLINEAR ELECTRODYNAMICS

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A version of nonlinear electrodynamics is proposed in which the faster-than-light motion of a particle with real mass m is permitted:

$$\nabla \mathrm{X}\mathbf{E} + \frac{1}{c}\frac{\partial \mathbf{H}}{\partial t} = 0; \qquad \nabla \cdot \mathbf{E} = 4\pi\rho;$$

$$\nabla \mathrm{X}\mathbf{H} - \frac{1}{c}\frac{\partial \mathbf{E}}{\partial t} = 4\pi\rho\frac{\mathbf{v}}{c}; \quad \nabla \cdot \mathbf{H} = 0;$$

$$m\frac{d\mathbf{v}}{dt} = \frac{c}{c_o}e\mathbf{E} + \frac{e}{c_o}\mathbf{v}\mathrm{x}\mathbf{H}; \quad m\frac{dc}{dt} = \frac{e}{c_0}\mathbf{v} \cdot \mathbf{E}.$$

Here $\nabla c = 0$, $c_0' = c_0 = 3 \cdot 10^{10}$ cm/sec, $c = c_0(1 + v^2/{c_0}^2)^{1/2}$ is the velocity of light corresponding to a particle moving with a velocity v, $\mathbf{p} = m\mathbf{v}$ is the momentum of a particle, $\mathcal{E} = mc_0c = m{c_0}^2(1 + v^2/{c_0}^2)^{1/2}$ is the "relativistic" energy, $T = m{c_0}^2[(1 + v^2/{c_0}^2)^{1/2} - 1]$ is the kinetic energy of a particle, e is the electrical charge. The meaning of the remaining values is standard. The energy $\mathcal{E}$ and the momentum $\mathbf{p}$ of a free particle are the integrals of motion. They are related by the well-known expression $\mathcal{E}^2 - {c_0}^2p^2 = m^2{c_0}^4$.