Comment on the Paper "Nonlinear Models for Relativity Effects in Electromagnetism" by S. Devasia, Z. Naturforsch. 64a, 327 (2009)

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The results by S. Devasia seem to miss the invariance properties of special relativity and of relativistic electromagnetism. Incorrect conclusions are pointed out and the correct ones as well as the physical consequences are presented. These include the covariant formulation of the laws of physics, the correct formulation of the Doppler effect, and of the invariance of light propagation.

Key words: Covariant Formulation for Electromagnetism; Transverse Doppler Effect; Ballistic Theory of Light; Experimental Falsification.
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1. The Confusion about Galilean Invariance for the Equations of Electromagnetism

In [1] the author S. Devasia thinks that the equations of electromagnetism are invariant with respect to Galilei transforms (see Paragraph 4.1 of [1]). This has been known to be manifestly wrong for about 130 years since the wave equation in a frame S,

$$\nabla^2 E - \frac{1}{c^2}\frac{\partial^2 E}{\partial t^2} = 0, \tag{1}$$

is known [2 – 4] to transform under the Galilei transforms

$$\begin{aligned} x' &= x + vt, \\ t' &= t \end{aligned} \tag{2}$$

into

$$\nabla^2 E - \frac{1}{c^2}\frac{\mathrm{d}^2 E}{\mathrm{d}t'^2} = 0 \tag{3}$$

in another inertial frame S′, where

$$\frac{\mathrm{d}E}{\mathrm{d}t'} = \frac{\partial E}{\partial t'} + (\mathbf{v}\cdot\nabla)E. \tag{4}$$

Note that the wave equations in the two inertial frames are different, i. e. the formulation in the paper (75 – 76 in [1]) is not covariant. The laws of physics have been long since then reformulated in a covariant form, the Maxwell laws are no exception to this. The reason is that they need to conform to the principle of relativity. The above mentioned aspect is precisely what led to the discovery of the Lorentz transforms and to the covariant formulation of the laws of physics in general and the laws of electromagnetism on particular. Relatively recent [2 – 4] experiments falsify the formulation produced by Devasia in Paragraph 4.1. One experiment is always sufficient in falsifying a theory, in this case there is a long list of experiments that disagree with the formulation proposed in the paper [1].

2. The Confusion about the Doppler Effect

In Paragraph 4.4 the author attempts to use his "Weber-type" theory in order to re-derive the equations of the Doppler effect. He ends up, again, with a number of errors and misconceptions.

The formula:

$$\omega' = \omega\gamma(1 + \beta\cos\theta) \tag{5}$$

represents the correct general formula for the relativistic Doppler effect. The correct formula (5) is in direct contradiction with the paper [1] derivation in Paragraph 4.4 where the author concludes that

$$\omega' = \omega(\beta\cos\theta + \sqrt{1 - \beta^2\sin^2\theta}). \quad (92) \text{ in } [1]$$

The relativistic Doppler effect is tested with a very high precision by a large number of experiments [5 – 22], thus these experiments contradict the conclusion reached by S. Devasia in Paragraph 4.4.

3. The Confusion about the "Propagation Speed of Light"

In Paragraph 4.2 the author arrives to the conclusion that

$$V_{\text{light}} = c + v_z. \quad (88) \text{ in } [1]$$

The origin of this error is the non-covariant wave equation (3) resultant from employing Galilean relativity. It is only in Galilean relativity that light speed is additive.

This error has been corrected once and for all by Einstein [16]. The ballistic theory of light and any theory that assumes light speed of the type $V_{\text{light}} = c + kv_z$ has been long falsified by yet another array of experiments [23 – 30].

4. The Errors in "Convection of Light in Moving Media"

The equations are manifestly incorrect. For a correct formulation, the author should check reference [31] for example. Again, the paper is at odds with correct theory as well as with prior experiment.

5. Conclusions

The paper by S. Devasia has been found to be theoretically unsound and is falsified by a large number of existent experiments.

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