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IS EVANS' LONGITUDINAL GHOST FIELD $B^{(3)}$ UNKNOWABLE?

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M.W. Evans has hypothesized every photon to have a longitudinal "ghost" magnetic field and commented extensively on this field, most recently in this journal. It is pointed out that Evans' field—being time-independent and spatially uniform—is unknowable, and thus lies outside the pale of physics.

Key words: longitudinal ghost field, electromagnetism

In a series of papers [1–3], Evans hypothesized every photon to have a longitudinal "ghost" magnetic field and commented thereupon with co-workers [4, 5]. This field was also discussed extensively in two major works by Evans [6, 7]. Although objections of others to Evans' field were published [8–10], and it was pointed out that the angular momentum [11] is a sounder alternative to Evans' hypothetical field, the most recent exposition of his field—in this journal [12]—by Evans has prompted this communication. *It is my contention that Evans' field is unknowable.*

The "ghost" magnetic field in question has been variously denoted as $\mathbf{B}^{(3)}$ and $\mathbf{B}_{\Pi}$ by Evans, and an electric field $\mathbf{E}^{(3)}$ or $\mathbf{E}_{\Pi}$ is similarly possible. Briefly, Evans begins with the free space Maxwell postulates,

$$\nabla \bullet \mathbf{E}(\mathbf{r},t) = 0, \tag{1a}$$

$$\nabla \bullet \mathbf{B}(\mathbf{r},t) = 0, \tag{1b}$$

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$$\nabla \times \mathbf{E}(\mathbf{r},t) = -\frac{\partial}{\partial t}\mathbf{B}(\mathbf{r},t), \tag{1c}$$

$$\nabla \times \mathbf{B}(\mathbf{r},t) = \varepsilon_o \mu_o \frac{\partial}{\partial t}\mathbf{E}(\mathbf{r},t), \tag{1d}$$

and contends that [7, pp. 256-257]

$$\mathbf{E}(\mathbf{r},t) = \frac{1}{\sqrt{2}} E_o (\mathbf{i} + i\mathbf{j})\, e^{i\omega(t - z/c)} + \mathbf{E}_\Pi, \tag{2a}$$

$$\mathbf{B}(\mathbf{r},t) = \frac{1}{\sqrt{2}} B_o (\mathbf{j} - i\mathbf{i})\, e^{i\omega(t - z/c)} + \mathbf{B}_\Pi, \tag{2b}$$

are solutions thereof. Here, $i = \sqrt{-1}$; $\mathbf{i}$, $\mathbf{j}$ and $\mathbf{k}$ are the unit Cartesian vectors, ω is the angular frequency, $c = 1/\sqrt{\varepsilon_o \mu_o}$ is the speed of light in free space, while E_o and B_o are scalar amplitudes. Evans specifically chooses the first parts on the right sides of Eqs. (2a) and (2b) to represent a circularly polarized plane wave propagating along the Z axis. Then he uses the circularly polarized plane wave to *create* the fields $\mathbf{E}_\Pi$ and $\mathbf{B}_\Pi$.

Let me not worry about the confusion Evans has between real-valued fields and the corresponding complex-valued phasors [9, 10], but concentrate solely on $\mathbf{E}_\Pi$ and $\mathbf{B}_\Pi$. To my knowledge, no *direct* measurements *of* the "ghost" magnetic field—or the "ghost" electric field—have been reported.

Let me also not worry about the exact mathematical expressions of $\mathbf{E}_\Pi$ and $\mathbf{B}_\Pi$, it being enough to note that Evans [7, p. 256] correctly deduced that:

> ..... $\mathbf{E}_\Pi$ and $\mathbf{B}_\Pi$ are uniform, time-independent, electric and magnetic fields directed in the propagation axis Z of the plane wave.

He then went on to remark in the same publication that:

> It appears always to have been implicitly assumed that $\mathbf{E}_\Pi$ and $\mathbf{B}_\Pi$ are both zero in free space... There is no mathematical reason for this supposition...

The Maxwell postulates do not involve the electromagnetic field components per se. Even a casual glance at Eqs. (1) reveals that *the Maxwell postulates involve the temporal and the spatial derivatives of the*

electromagnetic field components. Thus, a field that does not vary with space and time is a trivial solution of the Maxwell postulates.

More importantly, a field is identified by its spatial and temporal variations. Therefore, a spatially uniform and temporally constant field is unknowable; since its existence cannot be detected, we might as well set it to be null-valued.

An unknowable field is not only ghostly, but also ghastly! Ascribing any phenomenon to unknowable fields is an *act of faith*, and acts of faith lie outside the pale of physics. Therefore, it is incumbent on Evans to answer two simple questions:

1. Can a field that is unchanging in time and unvarying in space ever be detectable?
2. Has he or anyone else actually measured $\mathbf{E}_\Pi$ and $\mathbf{B}_\Pi$ directly? (Direct measurements are necessary to eliminate false proportionalities [9] that can creep in indirect measurements.)

I trust Evans will give straightforward and unambiguous replies: "yes" or "no" would be satisfactorily concise.

NOTE

Webster's *Third New International Dictionary of the English Language* (Unabridged, 1976) defines the word *unknowable* as *of a kind that cannot be comprehended.*

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POSTSCRIPT

The reader should note that three more papers by M. W. Evans have appeared in the later issues of Volume 7 of this journal on the ghost field; see also a relevant book review by D. Buckingham in *Science* **266**, 665 (1994).