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 $B^{(3)}$ and $B_{\Pi}$ by Evans, and an electric field $E^{(3)}$ or $E_{\Pi}$ is similarly possible. Briefly, Evans begins with the free space Maxwell postulates,

\[ \nabla \cdot E(r,t) = 0, \]

\[ \nabla \cdot B(r,t) = 0, \]

(1a)

(1b)
\[ \nabla \times \mathbf{E}(r,t) = -\frac{\partial}{\partial t} \mathbf{B}(r,t), \quad (1c) \]
\[ \nabla \times \mathbf{B}(r,t) = \varepsilon_0 \mu_0 \frac{\partial}{\partial t} \mathbf{E}(r,t), \quad (1d) \]

and contends that \cite[pp. 256-257]{Evans}

\[ \mathbf{E}(r,t) = \frac{1}{\sqrt{2}} \mathbf{E}_0 (i + ij) e^{i\omega(t - z/c)} + \mathbf{E}_\Pi, \quad (2a) \]
\[ \mathbf{B}(r,t) = \frac{1}{\sqrt{2}} \mathbf{B}_0 (j - ij) e^{i\omega(t - z/c)} + \mathbf{B}_\Pi, \quad (2b) \]

are solutions thereof. Here, \( i = \sqrt{-1} \); \( i, j \) and \( k \) are the unit Cartesian vectors, \( \omega \) is the angular frequency, \( c = 1/\sqrt{\varepsilon_0 \mu_0} \) is the speed of light in free space, while \( \mathbf{E}_0 \) and \( \mathbf{B}_0 \) 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 \cite{Evans,More}, 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 \cite[p. 256]{Evans} correctly deduced that:

\( \ldots \) \( \mathbf{E}_\Pi \) 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 $E_{\Pi}$ and $B_{\Pi}$ directly? (Direct measurements are necessary to eliminate false proportionalties [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.

REFERENCES


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).