REBUTTAL OF A PSEUDO-PAPER BY G. BRUHN IN PHYSICA SCRIPTA (2006):

WAVE EQUATION WITH VACUUM CURRENT.

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ABSTRACT

It is shown using standard and elementary vector analysis that the derivation of a vacuum current given originally in ref. {1} is correct. G. Bruhn's pseudo-paper {2} on the subject is therefore trivially erroneous and must be regarded as a pseudo-paper designed to deceive, not a genuine scientific paper.

Keywords: Wave equation with vacuum current, Lorenz condition.

1 INTRODUCTION

It is well known {3} that the d'Alembert wave equation in vacuo is derived from the Lorenz condition. This is available in innumerable standard texts on classical electrodynamics. The Lorenz condition was originally a convenience introduced to eliminate terms. The condition may be expressed covariantly in special relativity as:

$$\partial_\mu A^\mu = 0 \qquad -(1)$$

where the four potential is:

$$A^\mu = \left(\frac{\phi}{c}, \underline{A} \right) \qquad -(2)$$

Here ϕ is the scalar potential and $\underline{A}$ is the vector potential, c being the vacuum velocity of light, the universal constant of relativity theory.

In ref. {1} it was suggested that if the Lorenz condition is not used, a vacuum current may be defined. This was also suggested by Lehnert and Roy {4}. In Section 2 elementary vector analysis is used to show that the mathematics of ref. {1} are correct, and so is its interpretation. It is well known (www.aias.us) that G. Bruhn is a pseudo-scientist who attempts to contrive errors where none exist. Apparently, this is part of a subjectively motivated campaign against Einstein Cartan Evans (ECE) theory. Section 3 shows clearly that Bruhn attempts to deceive scientists by mis-representing ref. {1}. The latter is simple in conception, so a misrepresentation is easily revealed as such by use of elementary vector analysis found in any textbook.

2. DERIVATION OF THE VACUUM CURRENT

The equations used in ref. {1} are standard model equations, namely the Ampère Maxwell Law in the vacuum:

$$\underline{\nabla} \times \underline{B} - \frac{1}{c^2}\frac{\partial \underline{E}}{\partial t} = \underline{0} \qquad -(1)$$

and the scalar and vector potentials defined by:

$$\underline{E} = -\frac{\partial \underline{A}}{\partial t} - \underline{\nabla}\phi, \quad \underline{B} = \underline{\nabla} \times \underline{A}. \qquad -(2)$$

Here $\underline{B}$ is magnetic flux density in tesla and $\underline{E}$ is electric field strength in volts per meter. In any textbook it is found that by using the vector identity:

$$\underline{\nabla} \times (\underline{\nabla} \times \underline{A}) = \underline{\nabla}(\underline{\nabla} \cdot \underline{A}) - \nabla^2 \underline{A} \qquad -(3)$$

a wave equation is obtained by substituting eq.(2) in eq. (1):

$$\left(\frac{1}{c^2} \frac{\partial^2 \underline{A}}{\partial t^2} - \nabla^2 \underline{A} \right) + \underline{\nabla} \left(\frac{1}{c^2} \frac{\partial \phi}{\partial t} + \underline{\nabla} \cdot \underline{A} \right) = \underline{0} . \quad -(4)$$

In ref. (1) this wave equation was rewritten as:

$$\Box \underline{A} = - \underline{\nabla} \left(\frac{1}{c^2} \frac{\partial \phi}{\partial t} + \underline{\nabla} \cdot \underline{A} \right) \quad -(5)$$

in order to define the vacuum current:

$$\underline{j}_A := - \frac{1}{\mu_0} \underline{\nabla} \left(\frac{1}{c^2} \frac{\partial \phi}{\partial t} + \underline{\nabla} \cdot \underline{A} \right) . \quad -(6)$$

In vector notation and S.I. units the Lorenz condition (1) is:

$$\frac{1}{c^2} \frac{\partial \phi}{\partial t} + \underline{\nabla} \cdot \underline{A} = 0 . \quad -(7)$$

So if the Lorenz condition is used we obtain the usual result:

$$\Box \underline{A} = \underline{0} \quad -(8)$$

The rest of ref. (1) discusses the vacuum current (6) if the Lorenz condition is not used.

3. DELIBERATE DECEPTIONS BY BRUHN.

It is unpleasant to have to use the phrase "deliberate deception", but this has become unavoidable. In this case the deceptions are as follows.

1) Bruhn introduces a matter current density $\underline{j}$ in his eq. (1.1) - this is not used in ref. (1).

2) It is then asserted, in a deliberately false manner, that there is "confusion" in eqs. (1) to (5). If so hundreds of textbooks may be throw away.

3) Deliberate attempts are made to confuse the reader by asserting that there is confusion

between " Lorenz gauged" and "Lorenz ungauged" (sic). Such a confusion does not exist, the analysis in Section 2 is entirely standard.

4) The nonsensical nature of ref. (2) may be revealed by quoting a sentence from it as follows. "Now we come to the magic trick: our author remembers equation (2.2) to belong (sic) to the Ampere Maxwell equation and so he concludes:

$$\underline{\nabla} \times \underline{H} = \underline{j}_A + \underline{D}_t \quad -(9)$$

ignoring that this is true only under Lorenz gauge (case (a)) while he had decided (sic) to consider the Lorenz-free case (a)". This sentence is convoluted nonsense because it is based on an attempt to confuse and deceive. The argument of Section 2 is too simple and well known for this deceit to work. Eq. (5) is the same as:

$$\underline{\nabla} \times \underline{B} - \frac{1}{c^2}\frac{\partial \underline{E}}{\partial t} = \mu_0 \underline{j}_A . \quad -(10)$$

Reinstating the matter current $\underline{J}$ we obtain:

$$\underline{\nabla} \times \underline{B} - \frac{1}{c^2}\frac{\partial \underline{E}}{\partial t} = \mu_0 (\underline{j}_A + \underline{J}). \quad -(11)$$

This is the result without the Lorenz condition. The result with the Lorenz condition is:

$$\underline{\nabla} \times \underline{B} - \frac{1}{c^2}\frac{\partial \underline{E}}{\partial t} = \mu_0 \underline{J} . \quad -(12)$$

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REFERENCES

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