

The Evans's ECE Theory and the Einstein's Tetrad Field

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ABSTRACT : In this note, it is shown that the electromagnetic field defined as the torsion form of differential geometry proposed by Myron W. Evans, in his *Einstein–Cartan–Evans theory*, is in contradictions with the Einstein Tetrad Field. Mathematically in the sector Gravitation-Electromagnetism, we found a severe refutation when it is compared with the Einstein tetrad Field.

KEYWORDS: Tetrad, Einstein, Evans theory, gravitation, electromagnetism.

I. INTRODUCTION

In this short note we discuss the **Einstein–Cartan–Evans theory (ECE)**, proposed by Myron W. Evans, which claimed to unify general relativity, quantum mechanics and electromagnetism. According Evans unification is achieved straightforwardly with the principles of standard Cartan geometry and the Evans Ansatz. The latter shows that electromagnetism is spinning spacetime, gravitation is curving spacetime and that they are unified with the structure (or master) equations of Cartan. Quantum mechanics is unified with general relativity using the Evans Lemma and wave equation [1-5]. Namely the tetrad coefficients q_{μ}^a , are introduced by Evans who believes to be an essential tool of argumentation leading far beyond the limitations of General Relativity because of giving the opportunity of modelling several other forces of modern physics in addition to gravitation. However, as we shall see in this note, that the main errors of that “theory” are the invalid definition of tetrad field due to some mismatch. This is caused by Evans’ habit of suppressing seemingly unimportant latin indices (a, b) of tetrad fields. Einstein show in original papers of 1928 [6, 7] that these indices cannot be suppressed. The ECE theory cannot be repaired if one wants to reincorporate the tetrad indices. This theory has a severe internal contradiction even in very simple concrete application as radiation in the Maxwell equations and vacuum gravitation.

The following affirmations of the AIAS group are controversial: (a) "The contemporary view that classical electromagnetism is a U(1) gauge theory, relies on the restricted received view of transverse plane waves, U(1) being isomorphic with O(2), the group of rotations in a plane" [sic]. (b) "If there are longitudinal components available from the Heaviside-Maxwell equations then these cannot be represented by a U(1) gauge theory. www.aias.us. But mathematically it can be proven that **U(1) is not isomorphic with O(2)**."

According [8] "*Einstein–Cartan–Evans theory was an attempted unified theory of physics proposed by Myron W. Evans, which claimed to unify general relativity, quantum mechanics and electromagnetism. The hypothesis was largely published in the journal Foundations of Physics Letters between 2003 and 2005. Several of Evans' central claims were later shown to be mathematically incorrect and, in 2008, the editor (Nobel prize laureate) of Foundations of Physics published an editorial note effectively retracting the journal's support for the hypothesis [9]*".

In this short paper, we discuss mathematically the differences between Einstein tetrad field and the Evans theory related to unify electromagnetism and gravitation.

II. ECE THEORY - EINSTEIN TETRAD FIELD

In Einstein Cartan Evans (ECE) field theory [1-4] the fundamental field is the tetrad, which is a rank two mixed index tensor that transforms as such under the general coordinate transformation, and is thus generally covariant. Therefore according to Evans, the fundamental fields of physics are tetrad of various kinds: the gravitational, electromagnetic, weak, strong and matter fields. The tetrad is defined as follows:

$$v^a = q_{\mu}^a v^{\mu} \quad (1)$$

Where v^a and v^{μ} are column vectors which are also generally covariant. The tetrad field is therefore defined by the way in which v^a and v^{μ} are related geometrically, and the tetrad in turn defines the torsion tensor $T_{\mu\nu}^a$.

In ECE theory the electromagnetic field for example is defined by the ansatz:

$$A_{\mu}^a = A^{(0)} q_{\mu}^a \quad (2)$$

$$F_{\mu\nu}^a = A^{(0)} T_{\mu\nu}^a \quad (3)$$

Where $cA^{(0)}$ is the primordial voltage, c being the speed of Light in vacuo and $A^{(0)}$ the potential magnitude of the electromagnetic field. The gravitational field is also defined by the tetrad, the symmetric metric being:

$$g_{\mu\nu} = q_\mu^a q_\nu^b \eta_{ab} \tag{4}$$

Where η_{ab} is the metric in the tangent space-time of Cartan geometric at point P in the base manifold. Evans has proposed the hypothesis that each circularly polarized plane electromagnetic wave -in addition to its Maxwellian transversal components -should have a longitudinal component of magnetic field B_3 compared with the real magnetic flux amplitude of the circularly polarized plane wave. The assumption of a longitudinal field B_3 leads to a contradiction with the Lorenz gauge. $A_{,a}^a = 0$. By application of the superposition of two circularly plane waves to a linearly polarized wave, the Evans's theory cannot hold such superposition so this theory can be refuted. With the Einstein Theory, the longitudinal magnetic component $B_3 = 0$.

In Evans's paper, it is shown that the tetrad $A_\mu^a = A^{(0)} q_\mu^a$ is also the potential field for generally covariant electromagnetism. It is also well known that the second Maurer Cartan structure relation of differential geometry defines the gauge invariant gravitational field as the Riemann form from the tetrad one form. In this note, it is shown that the electromagnetic field is defined as the torsion form of differential geometry from the same tetrad one form by the first Maurer Cartan structure relation. In this way, both fields are shown to stem from the tetrad; a vector valued one form of differential geometry. Here again, we found contradictions with the Einstein theory.

In the gravitational sector, according the Einstein Theory 1928, the symmetrical Riemann connection is in modern notation where we set that $e_\nu \cdot e_\beta$ is the dot product of e_ν and e_β , and so on..

$$\Gamma_{\mu\nu}^\alpha = \frac{1}{2} g^{\alpha\beta} (\partial_\mu e_\nu \cdot e_\beta + \partial_\mu e_\beta \cdot e_\nu + \partial_\nu e_\mu \cdot e_\beta) + \frac{1}{2} g^{\alpha\beta} (\partial_\nu e_\beta \cdot e_\mu - \partial_\beta e_\mu \cdot e_\nu - \partial_\beta e_\nu \cdot e_\mu) \tag{5}$$

where $\Gamma_{\mu\nu}^\alpha$ is symmetrical and we make $e_\nu = q_\nu$ of Evans and $e_\nu = h_\nu$ of Einstein notation,

$$\Gamma_{\mu\nu}^\alpha = \Gamma_{\nu\mu}^\alpha \tag{6}$$

The tetrad field allows define the Einstein connection as

$${}^E \Gamma_{\mu\nu}^\alpha - \Gamma_{\mu\nu}^\alpha = K_{\mu\nu}^\alpha \tag{7}$$

and the torsion is

$${}^E \Gamma_{\mu\nu}^\alpha - {}^E \Gamma_{\nu\mu}^\alpha = T_{\mu\nu}^\alpha \tag{8}$$

where ${}^E \Gamma_{\mu\nu}^\alpha$ is the connection with absolute paralellism, $K_{\mu\nu}^\alpha$, is the contortion tensor [6, 7]

$$K_{\mu\nu}^\alpha = \frac{1}{2} (-e^\alpha f_{\mu\nu} + f_{\mu\nu}^\alpha e_\nu + f_{\nu\mu}^\alpha e_\mu) \tag{9}$$

This tensor is equivalent to

$$K_{\mu\nu}^\alpha = \frac{1}{2} (-T_{\mu\nu}^\alpha + T_{\nu\mu}^\alpha + T_{\mu\nu}^\alpha)$$

where $T_{\mu\nu}^\alpha = e^\alpha F_{\mu\nu}$ is the torsion tensor [10, 11] and e^α is a vector tetrad.

With the Einstein Theory for the curvature tensor we obtain

$$R_{\mu\beta\nu}^\alpha ({}^E \Gamma) = 0 \tag{10}$$

So with the Einstein theory without matter-energy tensor we obtain the Einstein tensor $G_{\mu\nu}$

$$G_{\mu\nu} = R_{\mu\nu} - 1/2 (R g_{\mu\nu}) = 0 \tag{11}$$

However Evans define this Riemann connection in antisymmetrical form

According Evans and collaborators [12], . "It has been shown (www.aias.us Paper 122) that the Riemannian connection is antisymmetric, and that in consequence, the Riemannian torsion is identically non-zero. The Einstein field equation is therefore fundamentally incorrect because of its arbitrary neglect of spacetime torsion. All metrics and inferences based on the Einstein field equation are also incorrect, notably the Einsteinian gravitational theory, the theory of Big Bang and black holes, and derivative dogma such as dark matter.

so",

$$\Gamma_{\mu\nu}^\alpha = -\Gamma_{\nu\mu}^\alpha \tag{12}$$

and the torsion tensor is

$$T_{\mu\nu}^\alpha = 2\Gamma_{\mu\nu}^\alpha \tag{13}$$

so

$$T^{\alpha}_{\mu\nu} = e^{\alpha} F_{\mu\nu} = 2\Gamma^{\alpha}_{\mu\nu} \quad (14)$$

from here, Evans obtains

$$T^{\alpha}_{\mu\nu} = e^{\alpha} F_{\mu\nu} \quad (15)$$

$$R^{\alpha}_{\mu\beta\nu}(\Gamma) = 2(\partial_{\beta}\Gamma^{\alpha}_{\nu\mu} + \Gamma^{\alpha}_{\beta\rho}\Gamma^{\rho}_{\mu\nu}) \quad (16)$$

This equation corresponds to Eq. (10.50) of reference [12]. which is not zero unless $\Gamma^{\alpha}_{\mu\nu} = 0$ so Evans et al, obtain

$$G_{\mu\nu} \neq 0 \quad (17)$$

However with tetrad Einstein theory (see Eq. (11)), $G_{\mu\nu} = 0$.

The main result of this short paper is equation (10 of Einstein which can be compared with equation (16) of Evans. With the Evans Theory, equation (14) of Evans [12], we founded a contradiction for vacuum gravitation where there are not matter and electrical current. Also, the reference [5], based on the equation (16), which in addition presents some mathematical errors and supported by the editor of *Ingeniare*, shows that there is an electric current density for Maxwell equations in a vacuum. However, this current does not appear in Einstein theory.

III. CONCLUSION

In summary, papers [1-5] of Evans and the AIAS group do not make reference to the original tetrad fields and the teleparallelism of Einstein [6, 7]. The Evans and AIAS group did not follow the original theory of A Einstein [6, 7] where tetrad indices must be taking into account in mind. In very simple applications like Maxwell equations the Evans theory shows negative experimental evidence. Evans has proposed the hypothesis that each circularly polarized plane electromagnetic wave in addition to its Maxwellian transversal components should have a longitudinal component of magnetic field compared with the real magnetic flux amplitude of the circularly polarized plane wave [3]. The assumption of a longitudinal field leads to a contradiction with the Lorenz gauge [13]. Also, by considering the chiral approach we have that $B_3 = 0$ in plasma media when the plasma frequency goes to zero [14, 15]. In references [10, 11, 16-20] we can find consistent approaches based on the original Einstein tetrad field.

Evans shows that electromagnetism is spinning spacetime and gravitation is torsional spacetime and that they are unified with the structure equations of Evans. However we find that the Einstein equations (6-7-8-9-10-11) are different to Evans equations (12-13-14-15-16-17), so it appears a strong contradiction in vacuum gravity which invalidates many claims done by Evans and the AIAS group.

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