THE HOMOGENEOUS AND INHOMOGENEOUS EVANS FIELD EQUATIONS.

by

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ABSTRACT

The homogeneous (HE) and inhomogeneous (IE) Evans unified field equations are deduced from differential geometry and the Hodge dual in the general four dimensional manifold (Evans spacetime) of unified field theory. The HE is the first Bianchi identity of differential geometry multiplied on both sides by the fundamental voltage $A^{(0)}$, a scalar valued electromagnetic potential magnitude. The IE is deduced by evaluating the Hodge dual of the Riemann form and the Hodge dual of the torsion form in the first Bianchi identity, then multiplying both sides of the resultant equation by $A^{(0)}$. This procedure generalizes the well known Hodge dual relation between the anti-symmetric electromagnetic field tensors of the homogeneous and inhomogeneous Maxwell Heaviside field equations of the standard model. The resulting HE and IE equations are correctly objective, or generally covariant, whereas the MH equations are valid only in the Minkowski spacetime of special relativity, and so are not generally covariant or objective equations of physics. For this reason the HE and IE field equations are able to analyze the mutual effects of gravitation on electromagnetism and vice versa, whereas the MH equations fail qualitatively in this objective.

Keywords: Homogeneous and inhomogeneous Evans field equations; Hodge dual; Evans unified field theory.

1. INTRODUCTION.

It is well known that the homogeneous and inhomogeneous Maxwell Heaviside (MH) field equations of the standard model are respectively {1, 2}:

$$d \wedge F = 0 \qquad -(1)$$

$$d \wedge \tilde{F} = \mu_0 J \qquad -(2)$$

in differential geometry. Here $d \wedge$ is the exterior derivative, F is the scalar valued electromagnetic field two-form; $\tilde{F}$ is the Hodge dual {1} of F in Minkowski spacetime and so is another scalar valued two-form, and J is the scalar valued charge-current density three-form. Eqs. (1) and (2) are written in S.I. units and μ_0 is the S.I. permeability in vacuo. In Section 2 the MH equations of the standard model are made objective or generally covariant equations of the Evans unified field theory {3-32}. Eq. (1) is developed into the homogeneous Evans field equation (HE) and Eq. (2) is developed into the inhomogeneous Evans field equation (IE). The resulting equations are written in the general four dimensional manifold known as Evans spacetime and are:

$$d \wedge F^a = R^a{}_b \wedge A^b - \omega^a{}_b \wedge F^b = \mu_0 j^a \qquad -(3)$$

$$d \wedge \tilde{F}^a = \tilde{R}^a{}_b \wedge A^b - \omega^a{}_b \wedge \tilde{F}^b = \mu_0 J^a \qquad -(4)$$

Here

$$D \wedge F^a = d \wedge F^a + \omega^a{}_b \wedge F^b \qquad -(5)$$

is the covariant exterior derivative where $\omega^a{}_b$ is the spin connection {1} of differential geometry. In Eqs (3) and (4) F^a is the vector valued electromagnetic field two-form; $\tilde{F}^a$ is its Hodge dual {1} in Evans spacetime, $R^a{}_b$ is the tensor valued Riemann or curvature two-form; $\tilde{R}^a{}_b$ is the Hodge dual of $R^a{}_b$ in Evans spacetime; A^a is the vector-valued

$\tilde{R}^a{}_b$

electromagnetic potential one-form. Eq. (3) is the first Bianchi identity of differential geometry {1} mutiplied on both sides by the fundamental voltage $A^{(0)}$ {3-32}; a scalar valued electromagnetic potential magnitude in volts. Thus the HE equation is:

$$A^{(0)}\left(D \wedge T^a\right) = A^{(0)}\left(R^a{}_b \wedge q^b\right). \quad -(6)$$

Similarly the IE equation is:

$$A^{(0)}\left(D \wedge \tilde{T}^a\right) = A^{(0)}\left(\tilde{R}^a{}_b \wedge q^b\right). \quad -(7)$$

In Eqs. (6) and (7) T^a is the vector-valued torsion two-form of differential geometry and q^b is the vector valued tetrad one-form of differential geometry. Thus {3-32}:

$$F^a = A^{(0)} T^a \quad -(8)$$

$$A^a = A^{(0)} q^a \quad -(9)$$

Eqs. (8) and (9) convert differential geometry to the unified field theory.

In Section 2 the current terms j^a and J^a are developed in terms of the fundamental differential forms of geometry. In section 3 the mutual effects of gravitation and electromagnetism are discussed in some detail and suggestions made for numerical solutions of the HE and IE field equations. Essentially this work shows that all of physics originates in spacetime geodynamics {33}.

2.