1)

Part 9: Some Technical Notes for Paper 53 : OVERVIEW

The overall aim of the paper is to develop the ECE field equations to define the effect of electromagnetism on gravitation. In order to do this the Riemann term is isolated in the field equations as follows:

$$d \wedge F + \omega \wedge F = A^{(0)} R \wedge q \quad -(1)$$

$$d \wedge \tilde{F} + \omega \wedge \tilde{F} = A^{(0)} \tilde{R} \wedge q \quad -(2)$$

$$F = d \wedge A + \omega \wedge A \quad -(3)$$

In the standard model the equations are:

$$d \wedge F = 0 \quad -(4)$$

$$d \wedge \tilde{F} = \mu_0 J \quad -(5)$$

$$F = d \wedge A \quad -(6)$$

so the spin connection is missing and J is not recognized as originating in elements of the Riemann tensor. Furthermore, eqs (1) and (2) are linear inhomogeneous differential equations while eqs (4) and (5) are d'Alembert equations. Also in the standard model:

$$R \wedge q = 0 \quad -(7)$$

which is a consequence of the use of the Christoffel connection. Eqn (7) is the Ricci cyclic equation, and this is an implicit part of Einstein Hilbert theory.

So in defining eqs. (1) and (2) it has been assumed that there is interaction between electromagnetism and gravitation.

2)

Paper 53 systematically develops eqs (1) and (2) in vector notation. These notes are intended to define the way in which the condensed notation of eqs. (1) to (3) is translated into vector notation for engineers.

<u>Tensor Notation</u>

Eq (1) is:

$$\partial_\mu F^a_{\nu\rho} + \partial_\nu F^a_{\rho\mu} + \partial_\rho F^a_{\mu\nu} + \omega^a_{\mu b} F^b_{\nu\rho} + \omega^a_{\nu b} F^b_{\rho\mu} + \omega^a_{\rho b} F^b_{\mu\nu}$$
$$= A^{(0)} \left(R^a{}_{b\nu\mu} q^b_\rho + R^a{}_{b\rho\nu} q^b_\mu + R^a{}_{b\mu\rho} q^b_\nu \right) \quad - (8)$$

Now use:

$$R \wedge q = - q \wedge R \quad - (9)$$

so the right hand side of eqn (8) — the Riemann term — becomes:

$$- A^{(0)} \left(q^b_\mu R^a{}_{b\nu\rho} + q^b_\nu R^a{}_{b\rho\mu} + q^b_\rho R^a{}_{b\mu\nu} \right)$$

Eq. (8) is the same as:

$$\boxed{\partial_\mu \tilde{F}^{a\mu\nu} + \omega^a_{\mu b} \tilde{F}^{a\mu\nu} = -A^{(0)} q^b_\mu \tilde{R}^a{}_b{}^{\mu\nu}} \quad - (10)$$

Similarly eq. (2) becomes:

$$\boxed{\partial_\mu F^{a\mu\nu} + \omega^a_{\mu b} F^{a\mu\nu} = - A^{(0)} q^b_\mu R^a{}_b{}^{\mu\nu}} \quad - (11)$$

3)

In the standard model, eq. (10) is

$$\partial_\mu \tilde{F}^{\mu\nu} = 0 \quad -(12)$$

and eq. (11) is:

$$\partial_\mu F^{\mu\nu} = \mu_0 J^\nu \quad -(13)$$

From eqn (12) we obtain the standard model Gauss law and Faraday law of induction. From eq. (13) we obtain the standard model Coulomb law and Ampère Maxwell law. In ECE theory these vector laws are obtained from eqs. (10) and (11). This is worked out in Appendix K of volume 1 of M. W. Evans, "Generally Covariant Unified Field Theory" (Abramis 2005).

Vector Notation

Coulomb Law

$$\boxed{\underline{\nabla} \cdot \underline{E}^a + \underline{\omega}^a{}_b{}' \cdot \underline{E}^b = -c\,\underline{A}^{b\prime} \cdot \underline{R}^a{}_b} \quad -(14)$$

Ampère Maxwell Law

$$\boxed{\underline{\nabla} \times \underline{B}^a + \underline{\omega}'^a{}_b \times \underline{B}^b - \frac{1}{c^2}\left(\frac{\partial \underline{E}^a}{\partial t} + \omega'^a{}_{0b}\, \underline{E}^b\right) = \mu_0 \underline{J}^{a\prime}} \quad -(15)$$

4)

The notation has been fully explained in previous notes for paper 53. These laws are the vector formulation of eq. (2). The ECE Gauss Law and Faraday Law of induction must be obtained from the vector formulation of eq. (1). The Riemann terms are the right hand sides of eqs. (14) and (15). These equations show that Riemann tensor elements can be affected by electric and magnetic fields. For the purposes of paper 53, this deduction is needed to increase or decrease gravitation. Finally paper 53 develops eqs. (14) and (15) into linear inhomogeneous differential equations using the vector formulation of eq. (3):

$$\underline{E}^a = -\frac{\partial \underline{A}^a}{\partial t} - c\underline{\nabla} A^{0a} - c\,\omega^{0a}{}_b \underline{A}^b + c\,\underline{\omega}^a{}_b A^{0b} \quad -(16)$$

$$\underline{B}^a = \underline{\nabla} \times \underline{A}^a - \underline{\omega}^a{}_b \times \underline{A}^b. \quad -(17)$$

So in generally covariant unified field theory the d'Alembert wave equation is developed into linear inhomogeneous differential equations with resonant solutions. In the standard model the Lorentz gauge is used to obtain the d'Alembert wave equation. In ECE theory

5) The Lorentz gauge assumption is not used. The resonance equations are solved numerically. Analytical methods are used to give an idea of the solutions using approximations. In the standard model the solution of the d'Alembert wave equation is the Lienard Wiechert potential. This has no resonance property. However, resonance is the key to effective counter-gravitational technology.

Ampère Law of Magnetostatics

$$\boxed{\underline{\nabla} \times \underline{B}^{a} + \underline{\omega}'^{a}{}_{b} \times \underline{B}^{b} = \mu_0 \underline{J}^{a'}} \quad -(16)$$

Application of Eqs. (14) and (16)

It is known that the standard model's Coulomb law and Ampère law hold to high precision. By reference to eqs (1) and (2) this is understood by writing these equations as:

$$d \wedge F = A^{(0)} (R \wedge q - \omega \wedge T) = \mu_0 j \quad -(17)$$

$$d \wedge \tilde{F} = A^{(0)} (\tilde{R} \wedge q - \omega \wedge \tilde{T}) = \mu_0 J. \quad -(18)$$

The interaction of electromagnetism and gravitation in the vast majority of applications is insignificant. This means that eq. (17) simplifies to:

6)

$$d \wedge F \rightarrow 0 \qquad -(19)$$

and eq. (18) to:

$$d \wedge \tilde{F} \rightarrow \mu_0 J_{grav.} \qquad -(20)$$

Interaction between e/m and gravitation occurs if and only if:

$$R \wedge q \neq \omega \wedge T \qquad -(21)$$

i.e.

$$j \neq 0. \qquad -(22)$$

If e/m is decoupled from gravitation g is eq. (20), then

$$\left(\tilde{R} \wedge q\right)_{e/m} = \left(\omega \wedge \tilde{T}\right)_{e/m} \qquad -(23)$$

$$\left(R \wedge q\right)_{e/m} = \left(\omega \wedge T\right)_{e/m} \qquad -(24)$$

and there is no opportunity for resonance, the spin connection terms disappear from eqs. (14) and (15), and for each index a we regain Coulomb and Ampère – the standard model Maxwell laws.

More generally the Mexican group and others are beginning to show that the standard model is only an approximation, and this is consistent with the fact that all physics must be generally covariant.