Notes for Paper 48

In paper 47 it was shown that the EMG coupling is equivalent to changing the Faraday law of induction to:

$$\underline{\nabla} \times \underline{E}^a + \frac{1}{n^2} \frac{\partial \underline{B}^a}{\partial t} = \underline{0} \quad -(1)$$

from:

$$\underline{\nabla} \times \underline{E}^a + \frac{\partial \underline{B}^a}{\partial t} = \underline{0} . \quad -(2)$$

Here n is the refractive index:

$$n^2 = \frac{\mu \epsilon}{\mu_0 \epsilon_0} . \quad -(3)$$

In general:

$$n = n' + i n'' \quad -(4)$$

$$\mu = \mu' + i \mu'' \quad -(5)$$

$$\epsilon = \epsilon' + i \epsilon'' , \quad -(6)$$

and the power absorption coefficient is given by:

$$\alpha(\omega) = \frac{\omega \epsilon''(\omega)}{n'(\omega) c} . \quad -(7)$$

Therefore the effect of gravitation on electromagnetism (EMG coupling) is to produce the spectrum $\alpha(\omega)$, a graph of α vs ω.

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Eq. (1) is equivalent to:

$$\underline{\nabla} \times \underline{E}^a + \frac{\partial \underline{B}^a}{\partial t} = \mu_0 \underline{\tilde{j}}^a \quad -(8)$$

So it is seen that the homogeneous current $\underline{j}^a$ produces the spectrum $\alpha(\omega)$. Under laboratory conditions eq. (2) is usually adequate, but under cosmological conditions:

$$\underline{\tilde{j}}^a \neq \underline{0}, \quad -(9)$$

where:

$$j^a = \frac{A^{(0)}}{\mu_0} \left(R^a{}_b \wedge q^b - \omega^a{}_b \wedge T^b \right) \quad -(10)$$

in form notation.

In the absence of EMG coupling:

$$R^a{}_b \wedge q^b = \omega^a{}_b \wedge T^b \quad -(11)$$

and:

$$n^2 = 1. \quad -(12)$$

Eqs (11) and (12) define the validity of the Faraday law of induction of the standard model. More generally eqs. (11) and (12) are not true.

3) Using the Cartan structure equations:

$$T^a = d \wedge q^a + \omega^a{}_b \wedge q^b \quad -(13)$$

and

$$R^a{}_b = d \wedge \omega^a{}_b + \omega^a{}_c \wedge \omega^c{}_b \quad -(14)$$

it is seen that eqn. (11) implies:

$$\omega^a{}_b = \kappa \epsilon^a{}_{bc} q^c \quad -(15)$$

$$R^a{}_b = \kappa \epsilon^a{}_{bc} T^c . \quad -(16)$$

Eqs (15) and (16) show that $\omega^a{}_b$ is dual to q^c and $R^a{}_b$ is dual to T^c.

Eqs. (15) and (16) give the geometrical origin of the Faraday law of induction of the standard model. Eqs (15) and (16) are equivalent to:

$$\underline{\tilde{j}}^a = \underline{0} \quad -(17)$$

$$n^2 = 1 \quad -(18)$$

$$\mu = \mu_0 \quad -(19)$$

$$\epsilon = \epsilon_0 . \quad -(20)$$

In eqs. (15) and (16) the spin connection $\omega^a{}_b$ is ~~du~~ antisymmetric in a and b, and the Riemann form $R^a{}_b$ is antisymmetric in a and b. The wavenumber κ in eqs. (15) and (16) is:

$$\kappa = \frac{\omega}{c} \quad -(21)$$

where c is the speed of light, the phase vel. of the electromagnetic wave in the absence of EMG coupling.

The Effect of Gravitation (EMG Coupling).

In this case:

$$\underline{\tilde{j}}^a \neq \underline{0} \quad -(22)$$

$$n^2 \neq 1 \quad -(23)$$

$$\mu \neq \mu_0 \quad -(24)$$

$$\epsilon \neq \epsilon_0 \quad -(25)$$

and from eq. (1):

$$\underline{\nabla} \times (n \underline{E}^a) + \frac{\partial (\underline{B}^a / n)}{\partial t} = \underline{0} \quad -(26)$$

i.e.:

$$\boxed{\begin{array}{l} \underline{E}^a \rightarrow n \underline{E}^a \\ \underline{B}^a \rightarrow \dfrac{\underline{B}^a}{n} \end{array}} \quad -(27)$$

In form notation eq. (27) means that the field form F^a is changed. The field form is defined by:

$$F^a = d \wedge A^a + \omega^a{}_b \wedge A^b \quad -(28)$$

where A^a is the vacuum potential. The latter obeys the ECE wave equation:

$$\square A^a = R A^a \quad -(29)$$

where

$$R = -kT. \quad -(30)$$

Therefore in general EMG coupling also changes the potential A^a from its vacuum value (i.e. its value in the absence of EMG coupling). EMG coupling changes the spin connection and the symmetry of the spin connection and the symmetry of the Riemann form, which both become asymmetric in general, no longer antisymmetric. The index contracted canonical energy-momentum T and the scalar curvature R are also changed by EMG coupling. Finally the current $\underline{J}^a$ is defined by the polarization $\underline{P}^a$ and magnetization $\underline{M}^a$ induced by EMG coupling:

$$\underline{J}^a = \frac{\partial \underline{M}^a}{\partial t} - \frac{1}{\mu_0 \epsilon_0} \underline{\nabla} \times \underline{P}^a \quad -(31)$$

6) So it is seen that there are many changes caused by the effect of gravitation on electromagnetism.

Approximations to the General Problem

The problem of describing cosmological shifts in ECE theory is described by these equations, i.e. by Cartan geometry together with eq. (30) and the Evans Ansatz:

$$A^a = A^{(0)} q^a . \quad -(32)$$

One way of approaching the problem is to set up a model for T or R and solve for A^a from the eigenequation (29). This is an equation of wave mechanics, whose solutions are eigenvalues or energy levels, giving spectral lines. These are related to quantized cosmological shifts, now routinely observable. The patterns of these shifts are governed by T. Similarly the patterns of atomic spectra are governed by the hamiltonian inputted to the Dirac or Schrödinger equation. Equally spaced lines are given by the harmonic oscillator, and

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this gives quantum electrodynamics. Therefore equally spaced cosmological shift spectra are also described by a harmonic oscillator model. Unequally spaced lines are given by a different model for T, or "model T". Therefore we describe this method as the "Model T".

A simpler method would be to fit the observed cosmological shift spectrum with a model for the refractive index and power absorption coefficient. From my experience in modelling the far infra-red spectra of materials such as liquids I know that we need a model for the correlation function, whose Fourier Transform is the power absorption coefficient. The relevant correlation function is the rotational velocity correlation function:

$$f_{\mu}(t) = \langle \underline{\mu}(t) \cdot \underline{\mu}(0) \rangle$$

where $\underline{\mu}$ is a dipole moment.

A third model is to produce a fit for the spin connection, and so on.