Notes for Paper 53

Resonance Equations in Dielectric Formulation

1) Faraday Law of Induction

In the dielectric formulation of ECE ~~theory~~ the Faraday law of induction is:

$$\nabla \times (\epsilon_r \mathbf{E}^a) + \frac{\partial}{\partial t}\left(\frac{\mathbf{B}^a}{\mu_r}\right) = 0, \quad -(1)$$

with:

$$\tilde{\mathbf{j}}^a = \frac{\partial \mathbf{M}^a}{\partial t} - c^2 \nabla \times \mathbf{P}^a, \quad -(2)$$

$$\mathbf{M}^a = \left(\frac{1}{\mu_0} - \frac{1}{\mu}\right)\mathbf{B}^a, \quad -(3)$$

$$\mathbf{P}^a = (\epsilon - \epsilon_0)\mathbf{E}^a. \quad -(4)$$

We now have the additional information:

$$\mathbf{B}^a = \nabla \times \mathbf{A}^a - \boldsymbol{\omega}^a{}_b \times \mathbf{A}^b, \quad -(5)$$

$$\mathbf{E}^a = -\frac{\partial \mathbf{A}^a}{\partial t} - c\nabla A^{0a} - c\omega^{0a}{}_b \mathbf{A}^b + c\boldsymbol{\omega}^a{}_b A^{0b}. \quad -(6)$$

Now use eqns. (5) and (6) in eqn (2) to obtain one of the resonance equations in dielectric formulation. For meaning of symbols refer to previous papers.

Limit of No Interaction

In the limit of no interaction between electromagnetism and gravitation:

$$\tilde{\underline{J}}^a = \underline{0}, \quad \mu = \mu_0, \quad \epsilon = \epsilon_0 \quad -(7)$$

and

$$\epsilon_r = 1, \quad \mu_r = 1. \quad -(8)$$

Therefore we regain the Faraday law of induction for free electromagnetism in general relativity:

$$\underline{\nabla} \times \underline{E}^a + \frac{\partial \underline{B}^a}{\partial t} = \underline{0}. \quad -(9)$$

In this limit the spin connection is dual to the tetrad:

$$\omega^a_{\ \mu b} = -\frac{\kappa}{2} \epsilon^a_{\ bc} q^c_{\ \mu} \quad -(10)$$

where κ is scalar valued and has the units of inverse metres or wavenumber. So in the complex circular basis (see previous notes for paper 53) the we regain the Evans spin field for free e/m in circular polarization:

$$\underline{B}^{(3)*} = -ig\, \underline{A}^{(1)} \times \underline{A}^{(2)}. \quad -(11)$$

First Approximation

In the first approximation one may use:

$$\omega^a_{\ \mu b} \sim -\frac{\kappa}{2}\epsilon^a_{\ bc}\, q^c_\mu \quad -(12)$$

and so:

$$\tilde{\underline{j}}^a \neq 0. \quad -(13)$$

In this approximation the circular polarization of pure electromagnetism is perturbed by gravitation. One may still use the approximate tetrads:

$$\underline{A}^{(1)} \sim \frac{A^{(0)}}{\sqrt{2}}(\underline{i} - i\underline{j})\, e^{i(\omega t - \kappa Z)}, \quad -(14)$$

$$\underline{A}^{(2)} \sim \frac{A^{(0)}}{\sqrt{2}}(\underline{i} + i\underline{j})\, e^{-i(\omega t - \kappa Z)}. \quad -(15)$$

The same expressions (14) and (15) may then be used for the spin connection, in the first approximation. This minimize the number of parameters in the spin connection, but it must always be borne in mind that this is an approximation. The input parameters are then ϵ_r and μ_r.

4)

Structure of the Resonance Equation

The magnetization of electromagnetism due to gravitation is:

$$\underline{M}^a = \left(\frac{1}{\mu_0} - \frac{1}{\mu}\right)\left(\underline{\nabla} \times \underline{A}^a - \underline{\omega}^a{}_b \times \underline{A}^b\right) \quad -(16)$$

$$= \left(\frac{1}{\mu_0} - \frac{1}{\mu}\right) A^{(0)}\left(\underline{\nabla} \times \underline{q}^a - \underline{\omega}^a{}_b \times \underline{q}^b\right)$$

The polarization of electromagnetism due to gravitation is:

$$\underline{P}^a = (\epsilon - \epsilon_0)\left(-\frac{\partial \underline{A}^a}{\partial t} - c\underline{\nabla} A^{0a} - c\omega^{0a}{}_b \underline{A}^b + c\underline{\omega}^a{}_b A^{0b}\right)$$

$$= (\epsilon - \epsilon_0) A^{(0)}\left(-\frac{\partial \underline{q}^a}{\partial t} - c\underline{\nabla} q^{0a} - c\omega^{0a}{}_b \underline{q}^b + c\underline{\omega}^a{}_b q^{0b}\right) \quad -(17)$$

These concepts do not exist in the standard model, yet are directly given by general relativity.

The current set up in free space by the interaction of electromagnetism and gravitation is:

$$\underline{\tilde{j}}^a = \frac{\partial}{\partial t}\left(\left(\frac{1}{\mu_0}-\frac{1}{\mu}\right)\left(\underline{\nabla}\times\underline{A}^a - \underline{\omega}^a{}_b\times\underline{A}^b\right)\right)$$
$$-c^2\,\underline{\nabla}\times\left((\epsilon-\epsilon_0)\left(-\frac{\partial\underline{A}^a}{\partial t} - c\,\underline{\nabla}A^{0a} - c\,\omega^{0a}{}_b\underline{A}^b + c\,\underline{\omega}^a{}_b A^{0b}\right)\right) \quad -(18)$$

Using approximations (12)-(15) this equation contains only two parameters, μ and ϵ. These are the permeability and permittivity respectively of ECE spacetime. These concepts do not exist in the standard model.

Resonance Solutions

The task now is to find resonance solutions of eqn. (18). This may be done analytically or numerically. In general:

$$\epsilon = \epsilon(ct, X, Y, Z) \quad -(19)$$
$$\mu = \mu(ct, X, Y, Z) \quad -(20)$$

so: $\frac{\partial}{\partial t}\left(\frac{1}{\mu}\right) \neq 0$, and μ and ϵ are tensorial, but in the first approximation they can be considered as scalars. If furthermore we use a time independent ϵ and μ the structure of eqn. (18) simplifies to the point where an analytical solution may be looked for. In this approximation we may use:

$$\frac{\partial}{\partial t}\left(\left(\frac{1}{\mu_0}-\frac{1}{\mu}\right)\underline{\nabla}\times\underline{A}^a\right)=\left(\frac{1}{\mu_0}-\frac{1}{\mu}\right)\underline{\nabla}\times\frac{\partial\underline{A}^a}{\partial t} \quad -(21)$$

$$c\,\underline{\nabla}\times\left(\left(\epsilon-\epsilon_0\right)\underline{\nabla}A^{0a}\right)=0 \quad -(22)$$