6$\not{4}$(7): Simultaneous Equations for ϕ and $\underline{\omega}$.

The general resonance equation for the Coulomb Law is:

$$\boxed{\nabla^2 \phi + \underline{\nabla} \phi \cdot \underline{\omega} + (\underline{\nabla} \cdot \underline{\omega}) \phi = -\rho / \epsilon_0} \quad -(1)$$

The standard model is regained when:

$$\underline{\nabla} \phi = \underline{\omega} \phi \quad -(2)$$

i.e.

$$\nabla^2 \phi = \underline{\nabla} \phi \cdot \underline{\omega} + (\underline{\nabla} \cdot \underline{\omega}) \phi \quad -(3)$$

and

$$\phi = -\frac{e}{4\pi \epsilon_0 r} \quad -(4)$$

so

$$\underline{\omega} = -\frac{1}{r} \underline{e}_r \quad -(5)$$

where $\underline{e}_r$ is the radial unit vector. So:

$$\boxed{\omega_r = -\frac{1}{r}} \quad -(6)$$

Eq. (3) is a special case of the general resonance equation (1). There is not sufficient information in eq. (1) to determine ϕ and $\underline{\omega}$ under all conditions, because eq. (1) is one equation in two variables, ϕ and $\underline{\omega}$. In order to proceed therefore it has been assumed that eq. (6) holds under all conditions, so eq. (1) becomes:

$$\frac{\partial^2 \phi}{\partial r^2} + \frac{1}{r}\frac{\partial \phi}{\partial r} - \frac{1}{r^2}\phi = -\frac{\rho(0)}{\epsilon_0}\cos(\kappa r). \quad -(7)$$

Eq. (7) is equivalent to the undamped resonator:

$$\frac{\partial^2 \phi}{\partial R^2} + \kappa^2 R = \frac{\rho(0)}{\epsilon_0} e^{2i\kappa R} \cos\left(e^{i\kappa R}\right) \quad -(8)$$

and eq. (8) has been solved numerically and analytically to show the presence of an infinite number of resonance voltage peaks at which the voltage goes to infinity.

More information can be obtained about $\underline{\omega}$ and ϕ by using the Faraday Law of induction without a magnetic field:

$$\underline{\nabla} \times \underline{E}^a = \mu_0 \underline{j}^a \quad -(9)$$

where $\underline{j}^a$ is the homogeneous current of ECE theory. Since eq. (9) holds for all a:

$$\underline{\nabla} \times \underline{E} = \mu_0 \underline{j} \quad -(10)$$

where

$$\underline{E} = -(\underline{\nabla} + \underline{\omega})\phi. \quad -(11)$$

From eqs. (10) and (11):

$$\underline{\nabla} \times (\underline{\nabla}\phi + \underline{\omega}\phi) = -\mu_0 \underline{j} \quad -(12)$$

3) Using the vector relations:

$$\underline{\nabla} \times \underline{\nabla} \phi = \underline{0} \quad -(13)$$

$$\underline{\nabla} \times (\underline{\omega} \phi) = \phi \underline{\nabla} \times \underline{\omega} + \underline{\nabla} \phi \times \underline{\omega} \quad -(14)$$

eq. (12) is:

$$\boxed{\phi \underline{\nabla} \times \underline{\omega} + \underline{\nabla} \phi \times \underline{\omega} = -\mu_0 \underline{j}} \quad -(15)$$

Thus eqs. (1) and (15) are two equations in two unknowns, ϕ and $\underline{\omega}$. Thus ϕ and $\underline{\omega}$ can be found under all conditions.

If it is assumed that gravitation does not interact with electromagnetism:

$$\underline{j} = \underline{0}, \quad -(16)$$

so:

$$\phi \underline{\nabla} \times \underline{\omega} + \underline{\nabla} \phi \times \underline{\omega} = \underline{0} \quad -(17)$$

$$\nabla^2 \phi + \underline{\nabla} \phi \cdot \underline{\omega} + (\underline{\nabla} \cdot \underline{\omega}) \phi = -\frac{\rho}{\epsilon_0} \quad -(1)$$

These simultaneous equations must be solved numerically in general. In the far off resonance condition they reduce to the Poisson equation:

4)

$$\nabla^2 \phi = -\frac{\rho}{\epsilon_0} \quad -(18)$$

and the Coulomb potential (4) with spin connection (6).

Therefore eq. (5) is a valid solution of the simultaneous eqs. (1) and (17) because from eq (5):

$$\underline{\nabla} \times \underline{\omega} = 0 \quad -(19)$$

so:

$$\underline{\nabla} \phi \times \underline{\omega} = \underline{0}. \quad -(20)$$

If

$$\underline{\nabla} \phi = \underline{\omega} \phi \quad -(21)$$

eq. (20) is true identically. Also, if we restrict consideration to the radial component of $\underline{\nabla}$:

$$\underline{\nabla} = \frac{\partial}{\partial r} \underline{e}_r \quad -(22)$$

then eq. (20) is always true for any radial spin connection of the type:

$$\underline{\omega} = \omega_r \underline{e}_r \quad -(23)$$

because:

$$\underline{e}_r \times \underline{e}_r = \underline{0}. \quad -(24)$$

So eq. (1) is true for any radially directed spin connection. The one that gives the correct standard model limit is eq. (6), Q.E.D.