256(1): Summary of the Basic Equations of the Vector Engineering Model for Electrodynamics.

In electrodynamics the ECE hypothesis is:

$$A^a_\mu = A^{(0)} q^a_\mu \quad -(1)$$

where

$$A^a_\mu = \left(\frac{\phi^a}{c}, -\underline{A}^a \right) \quad -(2)$$

$$= \left(A^a_0, -\underline{A}^a \right)$$

and

$$A^{a\mu} = \left(\frac{\phi^a}{c}, \underline{A}^a \right). \quad -(3)$$

This means that:

$$\underline{E}^a = c A^{(0)} \underset{\sim}{T}^a (\text{orb}) \quad -(4)$$

$$\underline{B}^a = A^{(0)} \underset{\sim}{T}^a (\text{spin}) \quad -(5)$$

The first Cartan structure equation gives:

$$\underline{E}^a = -c \underline{\nabla} A^a_0 - \frac{\partial \underline{A}^a}{\partial t} - c\omega^a{}_{0b} \underline{A}^b + c A^b_0 \underline{\omega}^a{}_b \quad -(6)$$

$$\underline{B}^a = \underline{\nabla} \times \underline{A}^a - \underline{\omega}^a{}_b \times \underline{A}^b \quad -(7)$$

and the Cartan and Evans identities give:

$$\underline{\nabla} \cdot \underline{B}^a = 0 \quad -(8)$$

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

$$\underline{\nabla} \cdot \underline{E}^a = \rho^a / \epsilon_0 \quad -(10)$$

$$\underline{\nabla} \times \underline{B}^a - \frac{1}{c^2} \frac{\partial \underline{E}^a}{\partial t} = \mu_0 \underline{J}^a \quad -(11)$$

). The spacelike part of the Cartan identity gives:

$$\underline{\nabla} \cdot \underline{\omega}^b{}_c \times \underline{A}^c = \underline{\omega}^a{}_b : \underline{\nabla} \times \underline{A}^b - \underline{A}^b \cdot \underline{\nabla} \times \underline{\omega}^a{}_b \quad -(12)$$

which is a well known vector identity. If it is accepted that there is no magnetic monopole q in eqn. (8), then:

$$\underline{\nabla} \cdot \underline{\omega}^a{}_b \times \underline{A}^b = 0 \quad -(13)$$

Eqs. (7) and (13) are self consistent because:

$$\underline{\nabla} \cdot \underline{B}^a = \underline{\nabla} \cdot \underline{\nabla} \times \underline{A}^a - \underline{\nabla} \cdot \underline{\omega}^a{}_b \times \underline{A}^b = 0 \quad -(14)$$

The timelike Cartan identity gives:

$$\frac{1}{c}\frac{\partial T^{a0}}{\partial t} + \omega^a{}_{0b} T^{b0} = R^a{}_0{}^0 \quad -(15)$$

The absence of a magnetic monopole means that:

$$\underline{\omega}^a{}_b \cdot \underline{B}^b = \underline{A}^b \cdot \underline{R}^a{}_b(\text{spin}) \quad -(16)$$

The absence of a magnetic charge density means:

$$\omega^a{}_{0b}\underline{B}^b + \frac{1}{c}\underline{\omega}^a{}_b \times \underline{E}^b = A^b{}_0 \underline{R}^a{}_b(\text{spin}) + \underline{A}^b \times \underline{R}^a{}_b(\text{orb}) \quad -(17)$$

The electric charge-current density is:

$$J^{\mu a} = (c\rho^a, \underline{J}^a) \quad -(18)$$

where the charge density is

$$\rho^a = \epsilon_0\left(\underline{\omega}^a{}_b \cdot \underline{E}^b - c\,\underline{A}^b \cdot \underline{R}^a{}_b(\text{orb})\right) \quad -(19)$$

3) The current density is:

$$\underline{J}^a = \epsilon_0 c \left(\omega^a{}_{0b} \underline{E}^b + c \underline{\omega}^a{}_b \times \underline{B}^b - c \left(A^b_0 \underline{R}^a{}_b(\mathrm{orb}) + \underline{A}^b \times \underline{R}^a{}_b(\mathrm{spin}) \right) \right) \quad -(20)$$

This is eq. (81) of UFT 255 and is derived as follows:

$$\underline{j}^a = \omega^a{}_{0b} \underline{T}^b(\mathrm{orb}) + \underline{\omega}^a{}_b \times \underline{T}^b(\mathrm{spin}) - \left(q^b_0 \underline{R}^a{}_b(\mathrm{orb}) + \underline{q}^b \times \underline{R}^a{}_b(\mathrm{spin}) \right) \quad -(21)$$

with:

$$\underline{J}^a = \frac{A^{(0)}}{\mu_0} \underline{j}^a = \epsilon_0 c^2 A^{(0)} \underline{j}^a, \quad -(22)$$

$$\underline{E}^a = c A^{(0)} \underline{T}^a(\mathrm{orb}) \quad -(23)$$

$$\underline{B}^a = A^{(0)} \underline{T}^a(\mathrm{spin}) \quad -(24)$$

so eq. (20) is obtained. The orbital and spin curvatures are defined by:

$$\underline{R}^a{}_b(\mathrm{orb}) = -\underline{\nabla} \omega^a{}_{0b} - \frac{1}{c} \frac{\partial \underline{\omega}^a{}_b}{\partial t} - \omega^a{}_{0c} \underline{\omega}^c{}_b + \omega^c{}_{0b} \underline{\omega}^a{}_c \quad -(25)$$

$$\underline{R}^a{}_b(\mathrm{spin}) = \underline{\nabla} \times \underline{\omega}^a{}_b - \underline{\omega}^a{}_c \times \underline{\omega}^c{}_b \quad -(26)$$

where

$$\omega^a{}_{\mu b} = \left(\omega^a{}_{0b}, -\underline{\omega}^a{}_b \right) \quad -(27)$$