1) 98(2): Canonical Interpretation of the Electromagnetic Field and the Cartan Torsion.

In ECE theory the electromagnetic field is a rank three tensor proportional to the Cartan torsion tensor:

$$F^{\mu}_{\ \rho\sigma} = A^{(0)} T^{\mu}_{\ \rho\sigma}. \quad -(1)$$

It is also known that the canonical angular momentum density tensor from Noether's Theorem is:

$$J^{\mu}_{\ \rho\sigma} = -\frac{1}{2}\left(T^{\mu}_{\ \rho} x_{\sigma} - T^{\mu}_{\ \sigma} x_{\rho}\right) \quad -(2)$$

where

$$T^{\mu}_{\ \rho} = g^{\mu\kappa} T_{\kappa\rho}, \quad -(3)$$

$$T_{\kappa\rho} = T_{\rho\kappa}. \quad -(4)$$

It is known experimentally (Beth 1936) that the electromagnetic field carries mechanical angular momentum density, so $F^{\mu}_{\ \rho\sigma}$ is proportional to $J^{\mu}_{\ \rho\sigma}$.

Also:

$$T^{\mu}_{\ \rho\sigma} = - T^{\mu}_{\ \sigma\rho} \quad -(5)$$

$$J^{\mu}_{\ \rho\sigma} = - J^{\mu}_{\ \sigma\rho} \quad -(6)$$

$$F^{\mu}_{\ \rho\sigma} = - F^{\mu}_{\ \sigma\rho} \quad -(7)$$

Therefore:

2)

$$J^{\mu}{}_{\rho\sigma} = \frac{e}{c} E^{(0)} T^{\mu}{}_{\rho\sigma} \quad -(8)$$

$$F^{\mu}{}_{\rho\sigma} = \frac{c}{e\omega} J^{\mu}{}_{\rho\sigma} \quad -(9)$$

$$J^{\mu}{}_{\rho\sigma} = eA^{(0)} \frac{\omega}{c} \left(\Gamma^{\mu}{}_{\rho\sigma} - \Gamma^{\mu}{}_{\sigma\rho} \right) \quad -(10)$$

where $\Gamma^{\mu}{}_{\rho\sigma}$ is the general gamma connection. Using:

$$eA^{(0)} = \hbar \kappa \quad -(11)$$

we obtain:

$$J^{\mu}{}_{\rho\sigma} = \hbar \kappa^2 \left(\Gamma^{\mu}{}_{\rho\sigma} - \Gamma^{\mu}{}_{\sigma\rho} \right) \quad -(12)$$

and

$$\Gamma^{\mu}{}_{\rho\sigma} = -\frac{1}{2\hbar\kappa^2} g^{\mu\kappa} T_{\kappa\rho} x_{\sigma} \quad -(13)$$

$$= -\Gamma^{\mu}{}_{\sigma\rho} \quad -(14)$$

This is a self-consistent result because in Einstein Hilbert theory there is no angular momentum and

$$\Gamma^{\mu}{}_{\rho\sigma} = \Gamma^{\mu}{}_{\sigma\rho} \quad -(15)$$

i.e. there is no Cartan torsion.

So it is concluded that individual components of the magnetic flux density and the electric field strength are defined as follows:

$$E_x = E^1{}_{01} = \frac{c^2}{e\omega} J^1{}_{01} \quad -(16)$$

$$E_y = E^2{}_{02} = \frac{c^2}{e\omega} J^2{}_{02} \quad -(17)$$

$$E_z = E^3{}_{03} = \frac{c^2}{e\omega} J^3{}_{03} \quad -(18)$$

$$B_x = B^1{}_{23} = \frac{c}{e\omega} J^1{}_{23} \quad -(19)$$

$$B_y = B^3{}_{12} = \frac{c}{e\omega} J^3{}_{12} \quad -(20)$$

$$B_z = B^2{}_{31} = \frac{c}{e\omega} J^2{}_{31} \quad -(21)$$

$$-(22)$$

where:

$$E^1{}_{01} = \partial_0 A^1{}_1 - \partial_1 A^1{}_0 + \omega^1{}_{0b} A^b{}_1 - \omega^1{}_{1b} A^b{}_0$$

etc.

$$B^1{}_{23} = \partial_2 A^1{}_3 - \partial_3 A^1{}_2 + \omega^1{}_{2b} A^b{}_3 - \omega^1{}_{3b} A^b{}_2$$

etc. $-(23)$

$$J^1{}_{01} = -\frac{1}{2}\left(T^1{}_0 x_1 - T^1{}_1 x_0\right) \quad -(24$$

etc.

$$J^1{}_{23} = -\frac{1}{2}\left(T^1{}_2 x_3 - T^1{}_3 x_2\right) \quad -(25$$

etc.