Note 260(1): Absence of Curvature in the Vacuum

Consider the tetrad postulate:

$$D_\mu q^a_\nu = \partial_\mu q^a_\nu + \omega^a_{\mu\nu} - \Gamma^a_{\mu\nu} = 0 \quad -(1)$$

then:

$$\Gamma^a_{\mu\nu} = \partial_\mu q^a_\nu + \omega^a_{\mu\nu}. \quad -(2)$$

The vacuum is defined by:

$$T^a_{\mu\nu} = \Gamma^a_{\mu\nu} - \Gamma^a_{\nu\mu} \quad -(3)$$

$$= 2\Gamma^a_{\mu\nu} = 0$$

so in the vacuum: $\Gamma^a_{\mu\nu} = 0 \quad -(4)$

i.e.

$$\partial_\mu q^a_\nu + \omega^a_{\mu\nu} = 0 \quad -(5)$$

The ECE hypothesis is:

$$A^a_\mu = A^{(0)} q^a_\mu \quad -(6)$$

so the vacuum is defined by:

$$\boxed{\partial_\mu A^a_\nu + A^{(0)} \omega^a_{\mu\nu} = 0} \quad -(7)$$

and by:

$$T^\lambda_{\mu\nu} = 0 \; ; \; R^\lambda_{\rho\mu\nu} = 0 \quad -(8)$$

Therefore the potential A^a_μ exists in the

2) vacuum but the torsion and curvature vanish. The gamma connection is zero in the vacuum but the spin connection is non-zero. Therefore in the vacuum the fields $\underline{B}^a$ and $\underline{E}^a$ vanish but the potential $\underline{A}^a$ exists.

This explains the Aharonov Bohm effects.

The Coulomb law for ECE theory is:

$$\underline{\nabla} \cdot \underline{E}^a = \underline{\omega}^a{}_b \cdot \underline{E}^b - c \underline{A}^b(\text{vac}) \cdot \underline{R}^a{}_b(\text{orb}) \quad -(9)$$

which gives the Euler Bernoulli equation:

$$\nabla^2 \phi^a + (\underline{\omega}^a{}_b \cdot \underline{\omega}^b{}_c) \phi^c = \frac{\rho^a(\text{vac})}{\epsilon_0} \quad -(10)$$

where

$$\rho^a(\text{vac}) = \frac{\epsilon_0 c}{2} \underline{A}^b(\text{vac}) \cdot \underline{R}^a{}_b(\text{orb}) \quad -(11)$$

The source of the curvature $\underline{R}^a{}_b(\text{orb})$ must be material matter, such as a nucleus. This interacts with the vacuum potential.