379(6): Covariant Condition for Zero Gravitation

By antisymmetry the gravitational field is defined by:

$$\underline{g} = -\frac{\partial \underline{Q}}{\partial t} - \omega_0 \underline{Q} = -\underline{\nabla}\Phi + \Phi\underline{\omega} \quad -(1)$$

If we assume the particular solution:

$$\omega_0 \underline{Q} = \underline{\nabla}\Phi \quad -(2)$$

then

$$\underline{g} = -\frac{\partial \underline{Q}}{\partial t} - \underline{\nabla}\Phi = -\omega_0\underline{Q} + \Phi\underline{\omega} \quad -(3)$$

Zero gravitation from Eq. (1) means:

$$\left(\frac{\partial}{\partial t} + \omega_0\right)\underline{Q} = \underline{0} \quad -(4)$$

and

$$\left(\underline{\nabla} - \underline{\omega}\right)\Phi = \underline{0} \quad -(5)$$

Defining the covariant derivative:

$$D_\mu = \partial_\mu + \omega_\mu \quad -(6)$$

where

$$\partial_\mu = \left(\frac{1}{c}\frac{\partial}{\partial t}, -\underline{\nabla}\right) \quad -(7)$$

and

$$\omega_\mu = \left(\frac{\omega_0}{c}, -\underline{\omega}\right) \quad -(8)$$

and defining:

$$Q^\mu = \left(\frac{\Phi}{c}, \underline{Q}\right) \quad -(9)$$

then

$$D_\mu Q^\mu = \left(\left(\frac{1}{c}\frac{\partial}{\partial t} + \frac{\omega_0}{c}\right)\frac{\Phi}{c} + \left(\underline{\nabla} - \underline{\omega}\right)\cdot\underline{Q}\right) \quad -(10)$$

2) The condition for vanishing g is described by the Aharonov Bohm effect in Cartan geometry:

$$T = D \wedge q = 0 \quad -(11)$$

i.e. $$T^a_{\mu\nu} = D_\mu q^a_\nu - D_\nu q^a_\mu = 0 \quad -(12)$$

By antisymmetry: $$D_\mu q^a_\nu = - D_\nu q^a_\mu \quad -(13)$$

and removing indices:

$$(\partial_\mu + \omega_\mu) q_\nu = (\partial_\nu + \omega_\nu) q_\mu = 0 \quad -(14)$$

so $$\boxed{(\partial_\mu + \omega_\mu) Q_\nu = 0} \quad -(15)$$

Eq. (4) is $$(\partial_0 + \omega_0) Q_i = 0 \quad -(16)$$
$$i = 1, 2, 3.$$

Eq. (5) is $$(\partial_i + \omega_i) Q_0 = 0 \quad -(17)$$
$$i = 1, 2, 3.$$

Under condition (15) the gravitational field $\underline{g}$ vanishes. Similarly the electric field strength $\underline{E}$ vanishes when

$$\boxed{(\partial_\mu + \omega_\mu) A_\nu = 0} \quad -(18)$$

These equations should be used to fit results from counter gravitational experiments.