379(1): Preparatory Notes for Faraday Cage Experiment

The experiment consists of observing gyroscope motion inside and outside a Faraday cage, so it is presumed at the outset that a gyroscope in the atmosphere is affected by electric charges which are removed by the Faraday cage. It is also an aim of UFT379 to work out a gravitational theory of the gyroscope developed in recent UFT papers.

As in UFT318 and UFT319, the electric field strength in ECE2 is defined by:

$$\underline{E} = -\underline{\nabla}\phi - \frac{\partial \underline{A}}{\partial t} + 2\left(c\omega_0 \underline{A} - \phi\underline{\omega}\right) \quad - (1)$$

where the spin connection four vector is:

$$\omega^\mu = \left(\omega_0, \underline{\omega}\right) \quad - (2)$$

and where the four potential is:

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

The charge current density is:

$$J^\mu = \left(c\rho, \underline{J}\right) \quad - (4)$$

The gravitational field is defined by:

$$\underline{g} = -\underline{\nabla}\Phi - \frac{\partial \underline{Q}}{\partial t} + 2\left(c\omega_0 \underline{Q} - \Phi\underline{\omega}\right) \quad - (5)$$

where the gravitational four potential is:

$$Q^\mu = \left(\frac{\Phi}{c}, \underline{Q}\right) \quad - (6)$$

The Coulomb law of ECE2 is:

$$\underline{\nabla}\cdot\underline{E} = \underline{\kappa}\cdot\underline{E} = \frac{\rho}{\epsilon_0} \quad - (7)$$

where $\underline{\kappa}$ is the kappa vector of ECE2 and ρ the electric charge density, ϵ_0 the vacuum permittivity. The gravitational Coulomb law is:

$$\underline{\nabla} \cdot \underline{g} = \underline{\kappa} \cdot \underline{g} = 4\pi G \rho_m \quad -(8)$$

here G is Newton's constant and ρ_m the source mass density.

By ECE2 antisymmetry:

$$-\underline{\nabla}\phi + 2c\omega_0 \underline{A} = -\frac{\partial \underline{A}}{\partial t} - 2\phi\underline{\omega} \quad -(9)$$

and

$$-\underline{\nabla}\Phi + 2c\omega_0 \underline{Q} = -\frac{\partial \underline{Q}}{\partial t} - 2\Phi\underline{\omega} \quad -(10)$$

The magnetic flux density is:

$$\underline{B} = \underline{\nabla} \times \underline{A} + 2\underline{\omega} \times \underline{A} \quad -(11)$$

and the gravitational gravitomagnetic field is:

$$\underline{\Omega} = \underline{\nabla} \times \underline{Q} + 2\underline{\omega} \times \underline{Q} \quad -(12)$$

A particular solution of eq. (9) is:

$$-\frac{\partial \underline{A}}{\partial t} = 2c\omega_0 \underline{A} \quad -(13)$$

and

$$-\underline{\nabla}\phi = -2\phi\underline{\omega} \quad -(14)$$

Similarly, a particular solution of eq. (10) is:

$$-\frac{\partial \underline{Q}}{\partial t} = 2c\omega_0 \underline{Q} \quad -(15)$$

and

$$-\underline{\nabla}\Phi = -2\Phi\underline{\omega} \quad -(16)$$

Using these particular solutions:

$$\underline{E} = -\underline{\nabla}\phi - \frac{\partial \underline{A}}{\partial t} \quad -(17)$$

and

$$\underline{g} = -\underline{\nabla}\Phi - \frac{\partial \underline{Q}}{\partial t} \quad -(18)$$

Here:

$$\phi = 2\phi_{sm} \; ; \; \underline{A} = 2\underline{A}_{sm} \quad -(19)$$
$$\Phi = 2\Phi_{sm} \; ; \; \underline{Q} = 2\underline{Q}_{sm}$$

where sm denotes the usual standard model potentials. Usually in the standard model there is no vector gravitational potential.

For both gravitation and electromagnetism the spin connection vector is:

$$\underline{\omega} = -\frac{1}{r^2}\underline{r} \quad -(20)$$

Using the equations:

$$\underline{E} = -\underline{\nabla}\phi - \frac{\partial \underline{A}}{\partial t} \quad -(21)$$

and

$$\underline{\nabla} \cdot \underline{E} = \rho / \epsilon_0 \quad -(22)$$

it follows that:

$$\nabla^2 \phi + \frac{\partial}{\partial t}\left(\underline{\nabla} \cdot \underline{A}\right) = -\rho / \epsilon_0 \quad -(23)$$

The ECE wave equation is:

$$(\Box + R) A^{\mu} = 0 \quad -(24)$$

) for each Cartan index a. In ECE2 the Cartan index is removed as in UFT 314 ff. In eq. (24), R is a scalar curvature defined by Cartan geometry. As a consequence of eq. (24):

$$(\square + R)\phi = 0 \quad - (25)$$

and

$$(\square + R)\underline{A} = \underline{0} \quad - (26)$$

The d'Alembertian is defined by:

$$\square = \partial^\mu \partial_\mu = \frac{1}{c^2}\frac{\partial^2}{\partial t^2} - \nabla^2 \quad - (27)$$

Therefore:

$$\frac{1}{c^2}\frac{\partial^2 \phi}{\partial t^2} - \nabla^2 \phi = -R\phi \quad - (28)$$

If it is assumed that:

$$\partial_\mu A^\mu = 0 \quad - (29)$$

i.e.

$$\frac{1}{c^2}\frac{\partial \phi}{\partial t} + \underline{\nabla} \cdot \underline{A} = 0 \quad - (30)$$

eq. (23) becomes:

$$\square \phi = \rho / \epsilon_0 \quad - (31)$$

i.e.

$$\frac{1}{c^2}\frac{\partial^2 \phi}{\partial t^2} - \nabla^2 \phi = \rho / \epsilon_0 \quad - (32)$$

Eq. (32) is the same as the ECE wave

) equation (28) if:

$$-R\phi = \rho / \epsilon_0 \quad -(33)$$

i.e.

$$\boxed{\phi = -\frac{\rho}{\epsilon_0 R}} \quad -(34)$$

Q.E.D.

Therefore in ECE2 covariance the scalar potential ϕ of electromagnetism is a function of the scalar curvature R.

The ECE2 wave equation can be written as:

$$\nabla^2 \phi - R\phi = \frac{1}{c^2}\frac{\partial^2 \phi}{\partial t^2} \quad -(35)$$

Define:

$$R = -\kappa_0^2 \quad -(36)$$

then:

$$(\nabla^2 + \kappa_0^2)\phi = \frac{1}{c^2}\frac{\partial^2 \phi}{\partial t^2} \quad -(37)$$

Finally define:

$$\frac{1}{c^2}\frac{\partial^2 \phi}{\partial t^2} = A_0 \cos \underline{\kappa} \cdot \underline{r} \quad -(38)$$

where A_0 is a constant and where $\underline{\kappa}$ is the kappa vector of ECE2, and eq. (37) becomes the Euler Bernoulli equation:

$$\left(\nabla^2 + \kappa_0^2\right)\phi = A_0 \cos \underline{\kappa} \cdot \underline{r} \quad -(39)$$

which has well known resonance solutions. At resonance:

$$\phi \rightarrow \infty. \quad -(40)$$

Similarly, the ECE wave equation for gravitation is:

$$(\square + R)\, q^{\mu} = 0 \quad -(41)$$

so

$$(\square + R)\, \underline{\Phi} = 0 \quad -(42)$$

and

$$(\square + R)\, \underline{q} = \underline{0} \quad -(43)$$

Therefore:

$$\frac{1}{c^2}\frac{\partial^2 \underline{\Phi}}{\partial t^2} - \nabla^2 \underline{\Phi} = -R\,\underline{\Phi} \quad -(44)$$

which transforms into the gravitational Euler-Bernoulli equation:

$$\left(\nabla^2 + \kappa_0^2\right)\underline{\Phi} = A_0 \cos \underline{\kappa} \cdot \underline{r} \quad -(45)$$

if eq. (36) is used and if:

$$\frac{1}{c^2}\frac{\partial^2 \underline{\Phi}}{\partial t^2} = A_0 \cos \underline{\kappa} \cdot \underline{r} \quad -(46)$$

At resonance:

7)

$$\Phi \to \infty \quad -(47)$$

Using:
$$\underline{g} = -\underline{\nabla}\,\underline{\Phi} - \frac{\partial \underline{Q}}{\partial t} \quad -(48)$$

and
$$\underline{\nabla}\cdot\underline{g} = 4\pi G \rho_m \quad -(49)$$

it follows that:
$$\nabla^2 \underline{\Phi} + \frac{\partial}{\partial t}\left(\underline{\nabla}\cdot\underline{Q}\right) = -4\pi G \rho_m \quad -(50)$$

The gravitational equivalent of eq. (29) is:
$$\partial_\mu Q^\mu = 0 \quad -(51)$$

i.e.
$$\frac{1}{c^2}\frac{\partial \underline{\Phi}}{\partial t} + \underline{\nabla}\cdot\underline{Q} = 0 \quad -(52)$$

which can be referred to as "the gravitational Lorenz condition".

Therefore:
$$\Box\,\underline{\Phi} = 4\pi G \rho_m \quad -(53)$$

which is "the gravitational d'Alembert equation".
From eqs. (44) and (53):
$$\boxed{\underline{\Phi} = -\frac{4\pi G \rho_m}{R}} \quad -(54)$$