379(8): Relativistic ECE2 Equations and Counter Gravitation

In note 379(7) $\underline{Q}$ was regarded as the particle velocity. More generally it can be a generic velocity. It acts in the same way as the vector potential $\underline{A}$ in electrodynamics. So:

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

and

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

by antisymmetry.

If $\underline{\omega}$ is regarded as a small perturbation, then:

$$\Phi \sim -\frac{MG}{r}. \quad -(3)$$

The acceleration due to gravity is defined by:

$$\underline{F} = m\underline{g} = -\frac{mMG}{r^3}\underline{r} - \frac{mMG}{r}\underline{\omega}. \quad -(4)$$

The presence of the spin connection vector shows that this is a relativistic theory. It is ECE2 covariant, so:

$$H = \gamma mc^2 + U \quad -(5)$$

and

$$\mathcal{L} = -\frac{mc^2}{\gamma} - U \quad -(6)$$

where H and $\mathcal{L}$ are the hamiltonian and lagrangian respectively, as in previous papers, notably UFT378.

2) It is known that the lagrangian (6) produces forward and retrograde precession, a major discovery of ECE2 theory.

Therefore eq. (4) can be solved by computer for various models of the spin connection $\underline{\omega}$. In Cartesian coordinates:

$$\ddot{X} = -\frac{mG\,X}{(X^2+Y^2)^{3/2}} - \frac{mG\,\omega_X}{(X^2+Y^2)^{1/2}} \quad -(7)$$

$$\ddot{Y} = -\frac{mG\,Y}{(X^2+Y^2)^{3/2}} - \frac{mG\,\omega_Y}{(X^2+Y^2)^{1/2}} \quad -(8)$$

The orbit obtained from eqs. (7) and (8) should be the same as the orbit obtained from eqs. (5) and (6) using the method of UFT 378. This result can be achieved by varying ω_X and ω_Y using for example a two variable least means squares fit. Therefore:

$$\underline{\omega} = \omega_X\,\underline{i} + \omega_Y\,\underline{j} \quad -(9)$$

can be found.

Similarly:

$$\ddot{X} = -\frac{dQ_X}{dt} - \omega_0 Q_X \quad -(10)$$

$$\ddot{Y} = -\frac{dQ_Y}{dt} - \omega_0 Q_Y \quad -(11)$$

3) From eqs. (7) and (10):

$$-\frac{\partial Q_X}{\partial t} - \omega_0 Q_X = -\frac{mGX}{(X^2+Y^2)^{3/2}} - \frac{mG\omega_X}{(X^2+Y^2)^{1/2}} \quad -(12)$$

From Eqs. (8) and (11):

$$-\frac{\partial Q_Y}{\partial t} - \omega_0 Q_Y = -\frac{mGY}{(X^2+Y^2)^{3/2}} - \frac{mG\omega_Y}{(X^2+Y^2)^{1/2}} \quad -(13)$$

Therefore Q_X and Q_Y can be found. In the Newtonian limit:

$$-\frac{\partial Q_X}{\partial t} = -\frac{mGX}{(X^2+Y^2)^{3/2}} \quad -(14)$$

$$-\frac{\partial Q_Y}{\partial t} = -\frac{mGY}{(X^2+Y^2)^{3/2}} \quad -(15)$$

Knowing the time dependence of $X = X(t)$ and $Y = Y(t)$, Q_X and Q_Y can be found. So

$$\underline{Q} = Q_X \underline{i} + Q_Y \underline{j} \quad -(16)$$

can be found by numerical integration.

In addition:

$$\underline{\nabla} \cdot \underline{g} = \underline{\kappa} \cdot \underline{g} = 4\pi G \rho_m \quad -(17)$$

where

$$\underline{g} = -\underline{\nabla}\,\underline{\Phi} + \underline{\Phi}\,\underline{\omega} \quad -(18)$$

†) The mass density ρ_m is measurable experimentally, so $\underline{\Phi}$ can be expressed in terms of ρ_m:

$$\underline{\nabla} \cdot \left(-\underline{\nabla}\,\underline{\Phi} + \underline{\Phi}\,\underline{\omega} \right) = 4\pi G \rho_m \quad -(19)$$

i.e.

$$-\nabla^2 \underline{\Phi} + \underline{\nabla} \cdot \left(\underline{\Phi}\,\underline{\omega} \right) = 4\pi G \rho_m \quad -(20)$$

in which:

$$\underline{\nabla} \cdot \left(\underline{\Phi}\,\underline{\omega} \right) = \underline{\Phi}\,\underline{\nabla} \cdot \underline{\omega} + \underline{\nabla}\,\underline{\Phi} \cdot \underline{\omega} \quad -(21)$$

So

$$\nabla^2 \underline{\Phi} - \underline{\omega} \cdot \underline{\nabla}\,\underline{\Phi} - \underline{\Phi}\,\underline{\nabla} \cdot \underline{\omega} = -4\pi G \rho_m \quad -(22)$$

$$= \underline{\kappa} \cdot g$$

In the Newtonian limit eq. (22) becomes the Poisson equation:

$$\nabla^2 \underline{\Phi} = -4\pi G \rho_m \quad -(23)$$

Zero Gravitation

This occurs when:

$$\nabla^2 \underline{\Phi} = \underline{\omega} \cdot \underline{\nabla}\,\underline{\Phi} + \underline{\Phi}\,\underline{\nabla} \cdot \underline{\omega} \quad -(24)$$

$$= \underline{\nabla} \cdot \left(\underline{\Phi}\,\underline{\omega} \right)$$

i.e.

$$\boxed{\underline{\nabla}\,\underline{\Phi} = \underline{\omega}\,\underline{\Phi}} \quad -(25)$$

In the Newtonian limit this is equivalent to the Laplace equation

$$\nabla^2 \underline{\Phi} = 0 \quad -(26)$$

If $\underline{g}$ vanishes, $\underline{\Phi}$ and $\underline{A}$ are in general non-zero, an Aharonov Bohm effect.

The spin connection for zero gravitation can be found from solving eqs. (25) and (26). From eqs. (7) and (8) the result for zero gravitation is:

$$\frac{X}{X^2+Y^2} = -mG\omega_X \quad -(27)$$

$$\frac{Y}{X^2+Y^2} = -mG\omega_Y \quad -(28)$$