402(4): The Vacuum Fluctuation Responsible for the Relativistic Newton Equation

The relativistic Newton equation is:

$$\underline{F} = \gamma^3 m \ddot{\underline{r}} = -mMG\frac{\underline{r}}{r^3} \quad -(1)$$

where

$$\gamma^3 = \left(1 - \frac{v^2}{c^2}\right)^{-3/2} \quad -(2)$$

In ECE2 theory:

$$\underline{F} = -\underline{\nabla}\phi + \underline{\omega}\phi \quad -(3)$$

where

$$\underline{F}(\text{vac}) = \underline{\omega}\phi \quad -(4)$$

is the force due to the vacuum. Here:

$$\phi = -\frac{mMG}{r} \quad -(5)$$

is the gravitational potential and $\underline{\omega}$ is the vector spin connection. From eqs. (1) and (3):

$$-\frac{mMG}{\gamma^3}\frac{\underline{r}}{r^3} = -mMG\frac{\underline{r}}{r^3} + \underline{\omega}\phi \quad -(6)$$

so:

$$\underline{\omega} = \frac{\underline{r}}{r^2}\left(\frac{1}{\gamma^3} - 1\right) \quad -(7)$$

and

$$\omega = |\underline{\omega}| = \frac{1}{r}\left(\left(\frac{1}{\gamma^3} - 1\right)^2\right)^{1/2} \quad -(8)$$

i.e.

$$\omega = \frac{1}{r}\left|\frac{1}{\gamma^3} - 1\right| \quad - (9)$$

here $|\ |$ denotes the modulus or positive value:

$$\left|\frac{1}{\gamma^3} - 1\right| := \left(\left(\frac{1}{\gamma^3} - 1\right)^2\right)^{1/2} \quad - (10)$$

So

$$\omega = \frac{1}{r}\left|\left(1 - \frac{v^2}{c^2}\right)^{3/2} - 1\right| \quad - (11)$$

$$= \frac{1}{r}\left(1 - \left(1 - \frac{v^2}{c^2}\right)^{3/2}\right) \quad - (12)$$

Note that

$$\omega \xrightarrow[v \to 0]{} 0 \quad - (13)$$

and in this limit the Newton equation is defined as:

$$\underline{F} = m\underline{g} = -mMG\frac{\underline{r}}{r^3} \quad - (14)$$

and the orbit is a conic section, for example an ellipse. Therefore orbital precession from the relativistic Newton equation is due to the spin connection (7) and the vacuum force:

$$\underline{F}(\mathrm{vac}) = \underline{\omega}\,\phi = -\frac{mMG}{r}\,\underline{\omega} \quad - (15)$$

From UFT 401, the vacuum fluctuation due

) to the spin connection is:

$$\langle \delta \underline{r} \cdot \delta \underline{r} \rangle = \frac{3}{2} r^3 \omega$$

$$= \frac{3}{2} r^2 \left(1 - \left(1 - \frac{v^2}{c^2} \right)^{3/2} \right) \quad - (16)$$

For small precessions:

$$v^2 = mG \left(\frac{2}{r} - \frac{1}{a} \right) \quad - (17)$$

which is the Newtonian orbital velocity of an object m orbiting an object M on an ellipse. where a is the semi major axis:

$$a = \frac{\alpha}{1 - \epsilon^2} \quad - (18)$$

where α is the half right latitude and ϵ is the eccentricity.

Therefore $\langle \delta \underline{r} \cdot \delta \underline{r} \rangle$ can be worked out for any orbit, which is given in astronomy in terms of α and ϵ.

The angular frequency Ω_0 of the vacuum connection is given from UFT401 as:

$$\Omega_0^2 = \frac{2}{3} \frac{mG}{r^4} \langle \delta \underline{r} \cdot \delta \underline{r} \rangle^{1/2} = \frac{2}{3} \left(\frac{3}{2} \right)^{1/2} \frac{mG}{r^3} \left(1 - \left(1 - \frac{v^2}{c^2} \right)^{3/2} \right)^{1/2}$$

$$- (19)$$

and this can also be worked out for any orbit.