346(5): New General Theory of Precessions

Consider the expression for magnetic flux density in the ECE2 field equations (UFT315 - UFT319):

$$\underline{B} = \underline{\nabla} \times \underline{W} \quad -(1)$$
$$= \underline{\nabla} \times \underline{A} + 2\underline{\omega} \times \underline{A}$$

The analogous expressions for the gravitomagnetic field are:

$$\underline{\Omega} = \underline{\nabla} \times \underline{W}_g \quad -(2)$$
$$= \underline{\nabla} \times \underline{A}_g + 2\underline{\omega} \times \underline{A}_g$$

where
$$A_g^\mu = (\Phi, c\underline{A}_g) \quad -(3)$$

Note that $\underline{W}_g$ has the units of linear velocity $\underline{v}_g$, so:

$$\boxed{\underline{\Omega} = \underline{\nabla} \times \underline{v}_g} \quad -(4)$$

where
$$\underline{\nabla} \cdot \underline{\Omega} = 0 \quad -(5)$$

Eqs. (4) and (5) are precisely analogous to the equations of motion of an inviscid fluid, where $\underline{\Omega}$ is the vorticity ("Vector Analysis Problem Solver", Problem 11.19).

Therefore the gravitomagnetic field is a vorticity in a spacetime with the properties of an inviscid fluid.

The precession is:

$$\boxed{\Omega = \frac{1}{2}|\underline{\Omega}| = \frac{1}{2}|\underline{\nabla} \times \underline{v}_g|} \quad -(6)$$

2) The equation of magnetostatics in ECE 2 theory (UFT315 - UFT319) is:

$$\underline{\nabla} \times \underline{\Omega}_g = \underline{\kappa} \times \underline{\Omega}_g = \frac{4\pi G}{c^2} \underline{J}_m \quad -(7)$$

where

$$\underline{\kappa} = \frac{1}{r^{(0)}} \underline{q} - \underline{\omega} \quad -(8)$$

Here $\underline{J}_m$ is a localized current density and $\underline{\kappa}$ has the units of m^{-1}. It is defined in terms of the tetrad vector $\underline{q}$ and the spin connection vector $\underline{\omega}$. The scalar $r^{(0)}$ has the units of distance.

It follows from eq. (7) that:

$$\underline{\nabla} \cdot (\underline{\nabla} \times \underline{\Omega}_g) = \underline{\nabla} \cdot (\underline{\kappa} \times \underline{\Omega}_g) = 0 \quad -(9)$$

Now use:

$$\underline{\nabla} \cdot (\underline{\kappa} \times \underline{\Omega}_g) = \underline{\Omega}_g \cdot (\underline{\nabla} \times \underline{\kappa}) - \underline{\kappa} \cdot (\underline{\nabla} \times \underline{\Omega}_g) \quad -(10)$$
$$= 0$$

so

$$\underline{\Omega}_g \cdot (\underline{\nabla} \times \underline{\kappa}) = \underline{\kappa} \cdot \underline{\nabla} \times \underline{\Omega}_g \quad -(11)$$

One possible solution of eq. (11) is:

$$\underline{\Omega}_g = v_g \underline{\kappa} \quad -(12)$$

where

$$v_g = |\underline{v}_g| \quad -(13)$$

3) Therefore:

$$\boxed{\underline{\Omega}_g = \underline{\nabla} \times \underline{V}_g = V_g \underline{\kappa}} \quad -(14)$$

and any precession in astronomy is given by:

$$\boxed{\Omega_g = \frac{1}{2} \left| \underline{\nabla} \times \underline{V}_g \right| = \frac{1}{2} V_g \left| \underline{\kappa} \right|} \quad -(15)$$

where

$$|\underline{\kappa}| = \frac{v}{r^{(0)}} - \omega \quad -(16)$$

These are generally valid equations without approximation.

In the dipole approximation:

$$\underline{\Omega}_g = \frac{G}{c^2 r^3} \left(\frac{3 \underline{r}}{r} \left(\frac{\underline{r}}{r} \cdot \underline{m}_g \right) - \underline{m}_g \right) \quad -(17)$$

where

$$\underline{m} = \frac{1}{2} \underline{L} \quad -(18)$$

Here $\underline{m}_g$ is the gravitomagnetic dipole moment and $\underline{L}$ is an angular momentum. Eq. (17) can be written as:

$$\underline{\Omega}_g = \frac{G}{2c^2} \underline{\nabla} \times \left(\frac{\underline{L} \times \underline{r}}{r^3} \right) \quad -(19)$$

Comparing eqs. (14) and (19):

4)

$$\boxed{\underline{v}_g = \frac{G}{2c^2 r^3} \underline{L} \times \underline{r}} \quad -(20)$$

and

$$\underline{\kappa} = \frac{G}{2c^2 v_g} \underline{\nabla} \times \left(\frac{\underline{L} \times \underline{r}}{r^3} \right),$$

$$\boxed{\underline{\kappa} = r^3 \underline{\nabla} \times \left(\frac{\underline{L} \times \underline{r}}{r^3} \right) \Big/ \left| \underline{L} \times \underline{r} \right|} \quad -(21)$$

<u>Units Check</u>

Eq. (20) is $m\,s^{-1}$ ✓✓, Eq (21) is $s^{-1} / (m\,s^{-1}) = m^{-1}$ ✓✓

This is a new and original theory of precession.