Note 405(4): New General Theory of All Precessions.

The origin of all observable precessions is the isotropic average of the vacuum fluctuation: $\langle \delta r \cdot \delta r \rangle$. In general, any precession is:

$$\Delta\phi = \frac{r^2}{2}\left(\frac{\omega}{r} - \frac{d\omega}{dr}\right) - (1)$$

$$= \frac{4}{3}\frac{\langle \delta r \cdot \delta r \rangle}{r^2} - \frac{1}{3r}\frac{\partial}{\partial r}\langle \delta r \cdot \delta r \rangle$$

where ω is the magnitude of the spin connection vector $\underline{\omega}$ defined by the ECE2 covariant force law and acceleration:

$$\underline{g} = -\underline{\nabla}\phi_0 + \underline{\omega}\phi_0 - (2)$$

where ϕ_0 is the gravitational potential:

$$\phi_0 = -\frac{mG}{r} - (3)$$

Here:

$$\underline{F} := m\underline{g} - (4)$$

Therefore due to the vacuum is:

$$\underline{F}(vac) = m\underline{\omega}\phi_0, - (5)$$

and this produces any observable precession.

The origin of any precession is the notation of the ECE2 covariant:

$$ds^2 = c^2 d\tau^2 = c^2 dt^2 - dr^2 - r^2 d\phi^2, - (6)$$

a notation defined by:

$$\phi' = \phi + \omega_0 t - (7)$$

where ω_0 is the angular velocity of the notation, not to be confused with the spin connection ω.

) Eqs. (6) and (7) produce:

$$ds'^2 = \left(1-\frac{v^2}{c^2}\right)\left(c^2dt^2 - 2r^2\Omega\, d\phi\, dt\right) - dr^2 - r^2 d\phi^2 \qquad -(8)$$

Use the ECE2 covariant angular velocity is:

$$\Omega = \omega_0\left(1-\frac{v^2}{c^2}\right)^{-1} \qquad -(9)$$

and the square of the ECE2 infinitesimal time element is:

$$d\tau^2 = \left(1-\frac{v^2}{c^2}\right)dt^2 \qquad -(10)$$

So the ECE2 covariant change of plane in a rotation of 2π is:

$$\Delta\phi = 2\pi\left(\left(1-\frac{v^2}{c^2}\right)^{-1/2} - 1\right) \qquad -(11).$$

where

$$v := \omega_0 r \qquad -(12)$$

If:

$$v << c \qquad -(13)$$

then

$$\boxed{\Delta\phi \sim \pi\left(\frac{v}{c}\right)^2} \qquad -(14)$$

Gravitational Precession

In contemporary astronomy, it is claimed that this is

$$\Delta\phi_g = \frac{6\pi MG}{c^2 a(1-\epsilon^2)} \qquad -(15)$$

for any object in orbit around any object M. From eqs. (14) and (15):

$$v^2 = \frac{6mG}{a(1-\epsilon^2)} \quad \text{---(16)}$$

This is the ECE2 covariant velocity needed to produce the claimed observational result (15).

For Gravity Probe B:

$$\begin{aligned} M &= 5.98 \times 10^{24}\ \text{kg} \\ G &= 6.67 \times 10^{-11}\ \text{m}^3\ \text{kg}^{-1}\ \text{s}^{-2} \\ a &= 7.0274 \times 10^{6}\ \text{m} \\ \epsilon &= 0.0023 \end{aligned} \quad \text{---(17)}$$

so

$$\Delta\phi_g = 1.19 \times 10^{-8}\ \text{radians per GPB orbit} \quad \text{---(18)}$$

The geodetic precession is claimed experimentally to be:

$$\Delta\phi_{\text{deSitter}} = 5.48 \times 10^{-9}\ \text{radians per GPB orbit} \quad \text{---(19)}$$

and the Lense-Thirring precession is claimed to be:

$$\Delta\phi_{LT} = 3.25 \times 10^{-11}\ \text{radians per GPB orbit} \quad \text{---(20)}$$

The theories of the de Sitter and Lense Thirring precessions are given in the preceding note. Using eq. (14) with eqs. (18) to (20), it is found that:

$$\begin{aligned} v(\text{grav}) &= 1.84 \times 10^{5}\ \text{m s}^{-1} \\ v(\text{de Sitter}) &= 1.25 \times 10^{5}\ \text{m s}^{-1} \\ v(\text{Lense Thirring}) &= 5.70 \times 10^{3}\ \text{m s}^{-1} \end{aligned} \quad \text{---(21)}$$

from

$$v = 1.691 \times 10^{9} (\Delta\phi)^{1/3} \quad \text{---(22)}$$

Eq. (21) shows that ECE2 covariant relativity

4) produces the three claimed precessions of the standard model with the velocities (21) of rotation of the ECE2 covariant infinitesimal line element. The gravitational precession is the largest, followed by the de Sitter precession and followed by the Lense Thirring precession.

The relevant $\langle \delta r \cdot \delta r \rangle$ for the three precessions are found from eqs. (1) and (18) to (20).

Therefore ECE2 covariant relativity gives an exact description of all three experimental claims using the velocities (21) of rotation of the ECE2 metric (6).

However there are severe problems with the claims of GPB because the precession of the spacecraft is dominated by the gravitational precession, and this is not even reported. It is impossible to see how the Lense Thirring precession could be isolated experimentally from the gravitational and de Sitter precessions, or how the de Sitter precession could be isolated from the gravitational precession.
