99(6): ECE2 Precession from the Infinitesimal Line Element and the Effect of Rotating the Line Element.

Consider the infinitesimal line element of ECE2 covariant general relativity:

$$ds^2 = c^2 d\tau^2 = (c^2 - v_N^2)\, dt^2 \quad -(1)$$

where the Newtonian velocity is:

$$v_N^2 = \left(\frac{dr}{dt}\right)^2 + r^2 \left(\frac{d\phi}{dt}\right)^2 \quad -(2)$$

In eq. (1), τ is the proper time, or time in the moving frame. It follows from eq. (1) that:

$$ds^2 = c^2 d\tau^2 = \left(1 - \frac{v_N^2}{c^2}\right) c^2 dt^2 \quad -(3)$$

i.e.

$$d\tau^2 = \left(1 - \frac{v_N^2}{c^2}\right) dt^2 \quad -(4)$$

or

$$dt = \gamma\, d\tau \quad -(5)$$

where

$$\gamma = \left(1 - \frac{v_N^2}{c^2}\right)^{-1/2} \quad -(6)$$

is the Lorentz factor. There is therefore a phase shift:

$$\Delta\phi = 2\pi(\gamma - 1) = \omega(dt - d\tau) \quad -(7)$$

brought about purely by the rotation of the axes of the plane polar system. For every orbit of 2π, there is a precession of:

$$\Delta\phi = 2\pi\left(\left(1 - \frac{v_N^2}{c^2}\right)^{-1/2} - 1\right) \quad -(8)$$

In the Cartesian system of coordinates:

$$v_N^2 = \dot{X}^2 + \dot{Y}^2 \quad -(9)$$

so

$$v_N^2 = \left(\frac{dX}{dt}\right)^2 + \left(\frac{dY}{dt}\right)^2 = \left(\frac{dr}{dt}\right)^2 + r^2\left(\frac{d\phi}{dt}\right)^2 \quad -(10)$$

The fundamental origin of the precession (8) is:

$$x^\mu x_\mu = x^{\mu\prime} x_\mu^{\prime} \quad -(11)$$

i.e.

$$c^2t^2 - X^2 - Y^2 = c^2t'^2 - X'^2 - Y'^2 \quad -(12)$$

and

$$c^2dt^2 - dX^2 - dY^2 = c^2dt'^2 - dX'^2 - dY'^2 \quad (13)$$

The particle does not move with respect to the moving frame, so

$$dX'^2 + dY'^2 = 0 \quad -(14)$$

and

$$c^2dt'^2 = c^2d\tau^2 = c^2dt^2 - (dX^2 + dY^2) \quad -(15)$$

$$= c^2dt^2 - (dr^2 + r^2d\phi^2)$$

Q.E.D.

It follows from eq. (15) that:

$$c^2d\tau^2 = c^2dt^2 - v_N^2dt^2 \quad -(16)$$

where

$$v_N^2 = \left(\frac{dX}{dt}\right)^2 + \left(\frac{dY}{dt}\right)^2 = \left(\frac{dr}{dt}\right)^2 + r^2\left(\frac{d\phi}{dt}\right)^2 \quad -(17)$$

is the Newtonian velocity.

Therefore it has been shown that invariance under four rotation, eq. (11), produces the precession (8), which is experimentally observable.

3) The theory of Thomas and de Sitter precession relies on the frame rotation:

$$d\phi' = d\phi + \omega dt \quad -(18)$$

where the angular velocity is:

$$\omega = \frac{d\phi}{dt} \quad -(19)$$

and where

$$v_\theta = \omega r \quad -(20)$$

is the magnitude of the transverse velocity.

It follows that the Newtonian velocity is changed to:

$$v^2 = \left(\frac{dr}{dt}\right)^2 + r^2 \frac{d\phi'^2}{dt^2}$$

$$= \left(\frac{dr}{dt}\right)^2 + r^2\left(\frac{d\phi}{dt}\right)^2 + r^2\omega^2 + 2r^2\omega\frac{d\phi}{dt}$$

$$= v_N^2 + 3v_\theta^2 \quad -(21)$$

So

$$c^2 d\tau^2 = c^2 dt^2 - \left(v_N^2 + 3v_\theta^2\right) dt^2 \quad -(22)$$

and the precession (8) is changed to:

$$\Delta\phi = 2\pi\left(\left(1 - \frac{\left(v_N^2 + 3v_\theta^2\right)}{c^2}\right)^{-1/2} - 1\right) \quad -(23)$$

in which:

$$v^2 = v_N^2 + 3v_\theta^2 = v_N^2 + 3\omega^2 r^2 \quad -(24)$$

For planetary motion:

$$\boxed{\Delta\phi \sim \pi\frac{v^2}{c^2} = \pi\left(\frac{v_N^2 + 3\omega^2 r^2}{c^2}\right)} \quad -(25)$$

It is proposed that eq. (25) accounts for

) observable precession of m orbiting M.

In previous work it has been shown that the lagrangian and hamiltonian of ECE2 produce precessing orbits. The method of eq. (18) was originally introduced by de Sitter in 1916 in order to rotate the Schwarzschild metric, but the latter is now known to be fundamentally incorrect due to neglect of torsion. The conventional theory of Thomas precession was:

$$
\begin{aligned}
ds^2 &= c^2 dt^2 - dr^2 - r^2 d\phi'^2 \\
&= c^2 dt^2 - dr^2 - r^2 d\phi^2 - 2\omega r^2 d\phi\, dt - \omega^2 r^2 dt^2 \\
&= c^2 dt^2 - dr - 2\omega r^2 d\phi\, dt - dr^2 - r^2 d\phi^2 \\
&= \left(c^2 - v_\theta^2\right) dt^2 - 2\omega r^2 d\phi\, dt - dr^2 - r^2 d\phi^2 \\
&= \left(1 - \frac{v_\theta^2}{c^2}\right)\left(c^2 dt^2 - 2\Omega r^2 d\phi\, dt\right) - dr^2 - r^2 d\phi^2
\end{aligned}
\quad -(26)
$$

where

$$
\Omega := \omega \left(1 - \frac{v_\theta^2}{c^2}\right)^{-1}. \quad -(27)
$$

The subsequent precession is defined as:

$$
\begin{aligned}
\Delta \phi &= \Omega\, d\tau - \omega\, dt \\
&= 2\pi \left(\left(1 - \frac{v_\theta^2}{c^2}\right)^{-1} - 1 \right)
\end{aligned}
\quad -(28)
$$

However, the correct result is eq. (23), suggesting that the definition (27) is somewhat arbitrary. This is another one of numerous flaws and errors in the standard model. Clearly, the correct result (23) should be used.