410(1): The Correct Theory of de Sitter Precession

The standard model de Sitter precession is the rotation of an infinitesimal line element of the type:

$$ds^2 = n(r,t)c^2dt^2 - \frac{dr^2}{n(r,t)} - r^2 d\phi^2 \quad -(1)$$

in plane polar coordinates, where $n(r,t)$ is a function of r and t. The ECE2 metric is characterized by:

$$n(r,t) = 1 \quad -(2)$$

and the so called Schwarzschild metric by:

$$n(r,t) = 1 - \frac{2MG}{rc^2} := 1 - \frac{r_0}{r} \quad -(3)$$

The rotation is defined for all $n(r,t)$ by:

$$\phi' = \phi + \omega t \quad -(4)$$

and

$$v_\phi = \omega r \quad -(5)$$

The rotation (4) is the de Sitter rotation and was originally applied in 1916 to the Schwarzschild metric, defined by eq. (3). It is now known that this procedure is entirely incorrect because it is based on an incorrect geometry without torsion (UFT88, UFT99, UFT313). The Wikipedia article on this subject is entirely obscure, so in this note the correct mathematics of the de Sitter precession are given in order to compare the result with the ECE2 theory.

From eqs. (1) to (5), following the method of UFT409:

$$ds^2 = \left(n(r,t)c^2 - v_\phi^2\right)dt^2 - \frac{dr^2}{n(r,t)} - r^2d\phi^2 - 2\omega r^2 d\phi dt \quad -(6)$$

in which

$$d\phi = \omega dt \quad -(7)$$

so it follows that:

1) $$ds^2 = \left(m(r,t)c^2 - 3v_\phi^2\right)dt^2 - \left(\frac{dr^2}{m(r,t)} + r^2 d\phi^2\right) \quad - (8)$$

Define:
$$v_1^2 = \frac{1}{m(r,t)}\left(\frac{dr}{dt}\right)^2 + r^2\left(\frac{d\phi}{dt}\right)^2 \quad - (9)$$

to find that
$$ds^2 = \left(m(r,t)c^2 - 3v_\phi^2 - v_1^2\right)dt^2 \quad - (10)$$
$$= c^2 d\tau^2$$
$$= \left(m(r,t) - \frac{(3v_\phi^2 + v_1^2)}{c^2}\right)c^2 dt^2$$

It follows that:
$$d\tau = \left(m(r,t) - \frac{v^2}{c^2}\right)^{1/2} dt \quad - (11)$$

Now define:
$$\gamma_1 := \frac{dt}{d\tau} = \left(m(r,t) - \frac{v^2}{c^2}\right)^{-1/2} \quad - (12)$$

where
$$v^2 = 3v_\phi^2 + v_1^2 \quad - (13)$$

Note that eq. (12) reduces to the Lorentz factor:
$$\gamma = \frac{dt}{d\tau} = \left(1 - \frac{v_N^2}{c^2}\right)^{-1/2} \quad - (14)$$

when:
$$m(r,t) = 1 \quad - (15)$$

and
$$v_\phi = 0 \quad - (16)$$

Time dilatation is defined by:
$$dt = \gamma_1 d\tau \quad - (17)$$

Note that the line element is defined by:

$$ds^2 = \left(n(r,t) - \frac{v^2}{c^2} \right) c^2 dt^2 \quad -(18)$$

$$:= c^2 dt_1^2$$

in the observer frame. By definition:

$$dt_1 = d\tau. \quad -(19)$$

Note that

$$dt_1 < dt \quad -(20)$$

and that a precession can be defined by:

$$\boxed{\Delta \phi = \omega_0 (dt - dt_1)} \quad -(21)$$

For a rotation of 2π:

$$\omega_0 dt_1 := 2\pi \quad -(22)$$

So the de Sitter precession is:

$$\boxed{\Delta \phi_g = 2\pi (\gamma_1 - 1)} \quad -(23)$$

This is the correct calculation of the Standard Model's de Sitter precession.

It reduces to the ECE precession when:

$$n(r,t) = 1. \quad -(24)$$

When there is no de Sitter rotation, eq. (23) reduces to

$$\Delta \phi = 2\pi (\gamma - 1) \quad -(25)$$

where γ is the Lorentz factor:

$$\gamma = \left(1 - \frac{v_N^2}{c^2} \right)^{-1/2} \quad -(26)$$

The precession (25) occurs in the untwisted ECE2 ...ine element:

$$ds^2 = c^2 d\tau^2 = (c^2 - v_N^2)\, dt^2 \quad -(27)$$

...d is defined by:

$$\boxed{\begin{aligned}\Delta\phi &= \omega_0 (dt - d\tau) \\ &= 2\pi(\gamma - 1)\end{aligned}} \quad -(28)$$

for a rotation of 2π.

Time dilation or dilatation, is defined as

$$dt = \gamma\, d\tau \quad -(29)$$

so:

$$dt > d\tau \quad -(30)$$

...nd the time interval in the observer frame dt is larger ... in the moving frame, the proper time interval $d\tau$. This ... the traditional interpretation of special relativity, ...ut eq. (19) shows that $d\tau$ can be thought of as ... interval dt_1 in the observer frame, so dt and dt_1 are ... the same observer frame.

There is therefore only one source of precession, ... difference between dt and dt_1.

The only correct source of precession is the ...ECE2 theory, because this does not rely on the Einstein ...eld equation. Furthermore, it is not possible to isolate the ...rious contributions to precession, as explained in UFT406.