

THE ECE2 LAW OF PRECESSION

by

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ABSTRACT

An ECE2 covariant universal law of precession is developed by rotating the infinitesimal line element at a given angular velocity. The resulting phase change explains all observable precessions in terms of the angular velocity of clockwise or anticlockwise frame rotation. The law of precessions is applied to planetary precessions in the solar system, the Hulse Taylor binary pulsar and the S2 star orbiting the centre of the Milky Way.

Keywords: The universal law of precession, ECE theory.

UFT410



1. INTRODUCTION

Recently in this series {1 - 41} the Einsteinian theory of general relativity (EGR) has been refuted in many new ways, so there nearly a hundred refutations of EGR in the UFT series of papers on www.aias.us and www.upitec.org. These complement many more refutations by scholars such as Stephen Crothers and Myles Mathis. Some of these refutations, such as that in UFT406, are very simple, and require no mathematics for their understanding. UFT406 shows that EGR erroneously describes planetary precession in terms of only one component, the Einsteinian precession, while inconsistently omitting from consideration the geodetic and Lense Thirring precessions, and any other EGR precession which may be present. So the fabled precision of EGR cannot be true. The inconsistency is shown up vividly through the fact that EGR applied to Gravity Probe B claims to have observed the geodetic and Lense Thirring precessions of the satellite. When EGR is applied to planets it completely omits consideration of the geodetic and Lense Thirring precessions. So even within the deeply flawed context of EGR, even if we accept its obsolete claims, the way in which it has been applied is clearly incorrect and completely self inconsistent. The total EGR precession of planets, Gravity Probe B, and all orbiting objects must always be the sum of the Einsteinian precession, geodetic or de Sitter precession and Lens Thirring precession, plus any other precessions that EGR itself predicts. In view of this simple reasoning the claim that the data are explained precisely by the Einsteinian precession alone is clearly false, and in this paper an entirely new law of precession is proposed.

This paper is a short synopsis of detailed calculations given in the notes accompanying UFT410 on www.aias.us. Note 410(1) shows that the EGR theory of geodetic precession, given dogmatically by wikipedia, is very obscure, and corrects it straightforwardly using simple algebra. Clearly, the claim that Gravity Probe B has detected EGR geodetic precession cannot be true, and geodetic precession could not have been isolated

experimentally from the other precessions that always accompany it in EGR: the Einsteinian and Lense Thirring and so on. The only thing that can ever be observed experimentally is the total precession, the rest is theory. Note 410(2) gives details of the relation between precession, time dilatation and length contraction. It is shown that the latter can only be interpreted in one way, otherwise the ideas behind them produce diametrically self inconsistent results. This is a fundamental and well known problem of special relativity itself. Note 410(3) discusses invariance under four rotation. Note 410(4) is the derivation of the phase equation at the root of the new law of precession, a new phase equation that clarifies the obscure treatment of Thomas precession usually found with difficulty in the literature. Note 410(5) applies the new law of precession to the Hulse Taylor binary pulsar and Note 410(6) applies the new law to the planets. Note 410(7) applies the new law to the S2 star system, in which the rotation of the infinitesimal line element must be in the opposite sense to that of some of the planets and the Hulse Taylor binary pulsar.

Section 2 derives the new phase law and universal law of precessions and corrects the standard model derivation of geodetic precession. Section 3 gives tables of results and graphical analysis.

2. DERIVATION OF THE UNIVERSAL LAW OF PRECESSION

Consider the invariance of phase under four rotation:

$$\phi = \kappa^\mu x_\mu = \kappa^{\mu'} x_{\mu'} \quad - (1)$$

where

$$\kappa^\mu = \left(\frac{\omega}{c}, \frac{\kappa}{-} \right) \quad - (2)$$

is the wave four vector and

$$x^{\mu} = (ct, \underline{r}) \quad - (3)$$

the position four vector. The invariance of phase can therefore be described as:

$$\phi = \omega dt - \underline{\kappa} \cdot d\underline{r} = \omega' dt' - \underline{\kappa}' \cdot d\underline{r}' \quad - (4)$$

where ω is the angular frequency, $\underline{\kappa}$ the wave vector. A particle in frame K' does not move with respect to the frame K' , so:

$$d\underline{r}' = \underline{0} \quad - (5)$$

The infinitesimal dt is the infinitesimal of proper time $d\tau$, so

$$\phi = \omega dt - \underline{\kappa} \cdot d\underline{r} = \omega_0 d\tau \quad - (6)$$

where ω_0 is the rest frequency of the particle. The de Broglie / Einstein equations are:

$$E = \hbar \omega = \gamma mc^2 \quad - (7)$$

$$\underline{p} = \hbar \underline{\kappa} = \gamma m \underline{v}_N \quad - (8)$$

where γ is the Lorentz factor, \hbar is the reduced Planck constant and m the particle mass.

Here E is the relativistic total energy, \underline{p} is the relativistic momentum and \underline{v}_N is the Newtonian velocity. The rest angular frequency of a particle in frame K' is the angular frequency in a frame K' which is at rest with respect to the particle. The angular frequency in frame K , the laboratory or observer frame in which the particle is moving with respect to K is:

$$\omega = \gamma \omega_0 \quad - (9)$$

Note that the particle is fixed in frame K' , which moves with respect to frame K . So the particle moves with respect to frame K .

It follows that the phase change between frame K and frame K' is:

$$\Delta \phi = \omega t - \omega_0 \tau = \omega t \left(1 - \frac{1}{\gamma^2}\right) = \underline{\kappa} \cdot \underline{r} \quad - (10)$$

For one revolution or orbit:

$$\omega t = 2\pi \quad - (11)$$

so:

$$\Delta \phi = 2\pi \left(1 - \frac{1}{\gamma^2}\right) = \underline{\kappa} \cdot \underline{r} \quad - (12)$$

The universal law of precession is therefore based on the phase change:

$$\Delta \phi = 2\pi \left(1 - \frac{1}{\gamma^2}\right) \quad - (13)$$

For all γ and v :

$$\Delta \phi = 2\pi \frac{v^2}{c^2} \quad - (14)$$

In Cartesian and plane polar coordinates:

$$\underline{dr} \cdot \underline{dr} = dx^2 + dy^2 = dr^2 + r^2 d\phi^2 \quad - (15)$$

so

$$v_N^2 = \left(\frac{dr}{dt}\right)^2 + r^2 \left(\frac{d\phi}{dt}\right)^2 = \left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2 \quad - (16)$$

From these equations:

$$\underline{dr} \cdot \underline{dr} = dr^2 + r^2 d\phi^2 = dx^2 + dy^2 = v_N^2 dt^2 \quad - (17)$$

and the invariance under four rotation can be expressed as:

$$ds^2 = (c^2 - v_N^2) dt^2 = c^2 d\tau^2 \quad - (18)$$

By definition:

$$c^2 dt_1^2 := (c^2 - v_N^2) dt^2 \quad - (19)$$

It follows that:

$$dt = \gamma dt_1 = \gamma d\tau \quad - (20)$$

where the Lorentz factor is:

$$\gamma = \left(1 - \frac{v_N^2}{c^2}\right)^{-1/2} \quad - (21)$$

Note carefully that frame rotation has not yet been considered. The correct method of applying the theory of frame rotation is to consider the rotated infinitesimal line element:

$$ds^2 = c^2 dt^2 - dr^2 - r^2 d\phi'^2 \quad - (22)$$

where:

$$d\phi' = d\phi + \omega dt. \quad - (23)$$

Here ω is the angular velocity of frame rotation defined by:

$$\omega = \frac{d\phi}{dt} \quad - (24)$$

for a positive sense of rotation and by:

$$d\phi' = d\phi - \omega dt \quad - (25)$$

for a negative sense of rotation. In both cases the angular velocity is defined by:

$$v_{\phi} = \omega r. \quad - (26)$$

For the positive sense of rotation:

$$\begin{aligned} ds^2 &= c^2 dt^2 - dr^2 - r^2 d\phi^2 - 2\omega r^2 d\phi dt - \omega^2 r^2 dt^2 \\ &= (c^2 - v_{\phi}^2) dt^2 - 2\omega r^2 d\phi dt - dr^2 - r^2 d\phi^2 \end{aligned} \quad - (27)$$

Using:

$$d\phi = \omega dt \quad - (28)$$

it follows that:

$$2\omega r^2 d\phi dt = 2\omega^2 r^2 dt^2 = 2v_{\phi}^2 dt^2 \quad - (29)$$

and the infinitesimal line element is:

$$ds^2 = (c^2 - 3v_{\phi}^2) dt^2 - (dr^2 + r^2 d\phi^2). \quad - (30)$$

Finally using:

$$dr^2 + r^2 d\phi^2 = v_N^2 dt^2 \quad - (31)$$

invariance under four rotation reduces to:

$$ds^2 = (c^2 - v_N^2 - 3v_{\phi}^2) dt^2 \quad - (32)$$

This can be written as:

$$ds^2 = \left(1 - \frac{v^2}{c^2}\right) c^2 dt^2 \quad - (33)$$

where:

$$v^2 = v_N^2 + 3v_\phi^2 \quad - (34)$$

Defining:

$$dt_2^2 = \left(1 - \frac{v^2}{c^2}\right) dt^2 \quad - (35)$$

it follows that invariance under four rotation can be expressed as the following invariance of infinitesimal time elements:

$$dt_2^2 = d\tau^2 \quad - (36)$$

The Lorentz factor is generalized under rotation to:

$$\gamma_1 = \left(1 - \frac{v^2}{c^2}\right)^{-1/2} \quad - (37)$$

and the universal law of precession is:

$$\Delta\phi = 2\pi \frac{v^2}{c^2} = 2\pi \left(\frac{v_N^2}{c^2} + 3\frac{v_\phi^2}{c^2}\right) \quad - (38)$$

For a negative sense of frame rotation Eq. (23) becomes:

$$d\phi' = d\phi - \omega dt \quad - (39)$$

and it follows that:

$$\begin{aligned} ds^2 &= c^2 dt^2 - dr^2 - r^2 d\phi'^2 \\ &= c^2 dt^2 - dr^2 - r^2 d\phi^2 + 2\omega r^2 d\phi dt - \omega^2 r^2 dt^2 \end{aligned} \quad - (40)$$

Defining:

$$dr^2 + r^2 d\phi^2 = v_N^2 dt^2 \quad - (41)$$

and using:

$$d\phi = \omega dt \quad - (42)$$

it follows that:

$$ds^2 = \left(1 - \frac{v^2}{c^2}\right) c^2 dt^2 \quad - (43)$$

in which:

$$v^2 = v_N^2 - \omega^2 r^2 \quad - (44)$$

In this case:

$$v_N^2 > v^2 \quad - (45)$$

For the positive rotation (23):

$$v^2 > v_N^2 \quad - (46)$$

and

$$v_N^2 - \omega^2 r^2 > 0. \quad - (47)$$

Using these methods it becomes possible to calculate the EGR de Sitter or geodetic precession simply and correctly. The de Sitter precession of 1916 rotates the so called Schwarzschild line element:

$$ds^2 = m(r, t) c^2 dt^2 - \frac{dr^2}{m(r, t)} - r^2 d\phi^2 \quad - (48)$$

where:

$$m(r, t) = 1 - \frac{2mG}{rc^2} = 1 - \frac{r_0}{r} \quad - (49)$$

Note carefully that Eq. (48) is a solution of the incorrect Einstein field equation and so Eq. (48) can never give physically meaningful results. Using Eq. (23), the rotated

Schwarzschild line element is:

$$ds^2 = (m(r,t)c^2 - \omega^2 r^2) dt^2 - \frac{dr^2}{m(r,t)} - r^2 d\phi^2 - 2\omega r^2 d\phi dt \quad (50)$$

and it follows that:

$$ds^2 = (m(r,t)c^2 - 3\omega^2 r^2) dt^2 - \left(\frac{dr^2}{m(r,t)} + r^2 d\phi^2 \right) \quad (51)$$

Define:

$$v_1^2 = \frac{1}{m(r,t)} \left(\frac{dr}{dt} \right)^2 + r^2 \left(\frac{d\phi}{dt} \right)^2 \quad (52)$$

to find that:

$$ds^2 = c^2 d\tau^2 = \left(m(r,t) - \frac{(3v_\phi^2 + v_1^2)}{c^2} \right) c^2 dt^2 \quad (53)$$

where:

$$v_2^2 := v_1^2 + 3v_\phi^2 \quad (54)$$

The Lorentz factor for de Sitter rotation is generalized to:

$$\gamma_1 = \frac{dt}{d\tau} = \left(m(r,t) - \frac{v_2^2}{c^2} \right)^{-1/2} \quad (55)$$

and the phase change of de Sitter rotation is given by:

$$\Delta\phi = 2\pi \frac{v_2^2}{c^2} \quad (56)$$

The wikipedia article on de Sitter rotation is very obscure and does not resemble the above simple algebra.

The next section applies the universal law of precession to planets of the solar system, the Hulse Taylor binary pulsar and S2 star.

3. NUMERICAL RESULTS AND GRAPHICS

(Section by co author Horst Eckardt).

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