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ECE Theory of the Equinoctial Precession and Galactic Dynamics

by

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Abstract

The equinoctial precession of the earth is shown to be due to the gravitomagnetic equation of ECE dynamics. The gravitomagnetic precession is caused by the almost constant orbital velocity of the sun around the galactic centre. The sun's orbit is non-Newtonian, as is explained by another ECE law of dynamics without the assumption of dark matter. These are straightforward relativistic explanations of phenomena that cannot be explained in standard physics without ad hoc assumptions such as dark matter.

Keywords: ECE theory, equinoctial precession, galactic dynamics.

26.1 Introduction

Recently it has been shown that there are four generally covariant equations of dynamics whose structure is the same as the generally covariant equations of electrodynamics of Einstein Cartan Evans (ECE) unified field theory [1–10]. The basic hypothesis of unification requires the existence gravitomagnetic equations of dynamics in addition to the familiar Newtonian structure. In paper 117 of this series (www.aias.us), the precession due to the earth's daily spin was explained with one of the ECE gravitomagnetic equations, giving plausible results of order of magnitude about 0.1 arcseconds a year. In this paper the simplest type of gravitomagnetic equation explains straightforwardly the earth's equinoctial precession, which is currently 50.29 arcseconds

a year. In section 26.2, a summary of Cruttenden's arguments [11] is given. This paper [11] clearly shows that the equinoctial precession is that of the solar system with respect to a distant star, a precession caused by the motion of the sun. The earth does not show an equinoctial precession with respect to objects within the solar system. Cruttenden [11] argues for the existence of a binary star system of which the sun is one star. This is a partially correct argument, because the precession according to ECE gravitomagnetic theory is due to the velocity of the sun with respect to the galactic centre. This is a non-Newtonian orbit with almost constant velocity because the sun is positioned on that part of the Milky Way's galactic velocity curve. The ECE theory gives a straightforward explanation for galactic dynamics in terms of general relativity with torsion. In this theory no concepts extraneous to relativity (notably dark matter) are required and so the ECE theory is preferred by Ockham's Razor.

In Section 26.2 a summary of Cruttenden's arguments are given and concepts defined. In Section 26.3 the equinoctial precession is explained straightforwardly with the simplest type of gravitomagnetic equation, and in Section 26.4 galactic dynamics are explained starightforwardly with ECE theory (general relativity with torsion correctly incorporated).

26.2 The Equinoctial Precession of the Earth

Cruttenden argues convincingly [11] that the equinoctial precession is observed to be a precession with respect to distant objects, not with respect to objects within the solar system. The equinox is defined as the point when the earth's axis is at right angles to a line drawn from the centre of the sun to the centre of the earth. The solar year is defined as the time it takes for the earth to complete one rotation from equinox to equinox, and the sidereal year is defined as the time taken by the earth to realign with a fixed distant star. The solar year is 365.2422 earth spins, and the sidereal year is 365.2563 earth spins. The entire solar system is well known to be moving through space around the galactic centre, and it is this movement that causes the precession of the equinox. There is no precession of the earth relative to the sun, or planets, or any object in the solar system [11]. The precession is a term used to describe a reorientation of the earth's axis, the earth is held in a synchronous position and this causes the reorientation. The time form equinox to equinox is a 360 degree rotation of the earth around the sun, but due to to the velocity v of the sun around the galactic centre, the earth appears to fall short of 360 degrees by 50.29 arcseconds every sidereal year. In other words the entire solar system has moved with respect to a distant star by this amount. The earth has not moved by this amount with respect to Perseid showers for example [11]. These occur inside the solar system. The equinox moves by 50.29 arcseconds per sidereal year but does not move with respect to the ecliptic, i.e. with respect to the sun. Another way of stating

this result is that the earth does not align with the fixed or distant stars at the vernal equinox, it shifts by 50.29 arcseconds clockwise every sidereal year. This means that the entire solar system is moving clockwise because of the sun's well known velocity with respect to the galactic centre of the Milky Way. In addition to this, the entire Milky Way Galaxy is now known to be moving towards the Hydra constellation. The earth moves 360 degrees relative to the fixed stars in a sidereal year, but the sun also moves at an almost constant 210 kilometres per second with respect to the galactic centre, which is itself moving with respect to fixed stars and constellations such as Hydra. These are the causes of the equinoctial precession, not gravitation of the sun and moon as postulated originally by Newton in a time where nothing was known about the sun's motion or the structure of galaxies.

The current standard model of the earth's equinoctial precession has not changed since the time of Newton, and is a complicated concoction of ideas based on the gravitational pull of objects inside the solar system. This is contrary to data [11] and also violates basic theory. This has been argued by Santagata [12], who has pointed out several problems [11] in the development of the gravitational theory of equinoctial precession by Newton, d'Alembert and many others. Negut [11] has pointed out that the earth cannot precess or nutate in the absence of a support point. The dynamics of a spinning top with one point fixed were first worked out by Lagrange [13] as is well known, but the earth obviously has no support point. The usual explanation of the equinoctial precession is that a net torque is present on the earth due to the moon and sun, but as ref. (26.13), problem 10.10 shows, this torque can only result in precession of a symmetrical top if the origins of the laboratory and rigid body fixed frames are the same, i.e. if the point of the top is fixed in space and coincides with the origin of the symmetric top frame. This is not the case for the earth, even if it were a symmetric top and not a spherical top. It is well known that the earth is indeed a slightly oblate symmetric top due to a bulge at the equator. The dynamics of the spinning top with one point fixed and of mass m in a gravitational field of acceleration g are due to the torque:

$$|\boldsymbol{T}q| = |\boldsymbol{r} \times \boldsymbol{F}| = mgr \sin \phi \tag{26.1}$$

created by the force of gravity:

$$\boldsymbol{F} = m\boldsymbol{g} \tag{26.2}$$

on the top's centre of mass. Here r is the distance between the top's fixed support point and the centre of mass, and ϕ is the angle between the vectors F and r. If the point is not fixed, the force F would cause the arm r simply to spin. No such spin occurs for the earth because its centre of mass is approximately that of a sphere located at the origin of the sphere. The origin of the

earth's daily spin is not the sun's gravity, and is not the moon's gravity. The moon itself for example does not spin in the earth's gravity or sun's gravity. The torque (26.1) is also:

$$\boldsymbol{T}q = \boldsymbol{\omega}_p \times \boldsymbol{L} \tag{26.3}$$

where the spin angular momentum vector $\boldsymbol{L}$ is parallel to $\boldsymbol{r}$ and $\boldsymbol{\omega}_p$ is the angular precession vector. The precession of the spinning top is therefore the angular frequency defined by eq. (26.1). Its magnitude is:

$$\omega_p = \frac{mgr}{L} = \frac{g}{v} = \frac{d\theta}{dt}. \tag{26.4}$$

However, in order for the torque (26.2) to exist, the point of the top must be fixed, so that there is a leverage and lever arm $r\sin\theta$. Otherwise the top would be put into a spinning motion only, meaning that the lever arm would not be stable. The angular momentum $\boldsymbol{L}$ is spin angular momentum defined by the moment of inertia I and the spin angular velocity vector $\boldsymbol{\omega}$. When the top slows down it begins to nutate, as first shown by Lagrange. This nutation is what is known as "wobbling". However, neither precession nor nutation occur if the point of the top is not fixed, as first shown by Lagrange in the eighteenth century. Numerous other criticisms of this standard model are summarized by Cruttenden [11], both on experimental and theoretical grounds.

26.3 Gravitomagnetic Explanation of the Equinoctial Precession

The equinoctial precession is described straightforwardly by the simplest ECE gravitomagnetic equation (paper 117 of www.aias.us):

$$\boldsymbol{\Omega} = -\frac{1}{c^2}\boldsymbol{v} \times \boldsymbol{g} \tag{26.5}$$

where g is the earth's acceleration due to gravity and v is the velocity of the sun around the galactic centre. Eq. (26.5) is the precise analogue of the magnetic equation:

$$\boldsymbol{B} = -\frac{1}{c^2}\boldsymbol{v} \times \boldsymbol{E} \tag{26.6}$$

obtained from the inverse Lorentz transform in the non-relativistic limit $v \ll c$. Therefore from eq. (26.5):

$$\Omega = \frac{vg}{c^2}\sin\theta \tag{26.7}$$

where θ is the angle between v and g. For an observed precession of 50.29 arcseconds per year, $v\ \sin\theta$ is 70.8 kilometres per second. The sun's orbital velocity around the galactic centre is 220 kilometres per second, so the angle between v and g is 18.8°. The equinoctial precession magnitude is:

$$\Omega = 7.10 \times 10^{-4}\ v \sin\theta \tag{26.8}$$

in arcseconds a year. It is known that the sun's velocity v is almost constant, and that the sun orbits the galactic centre towards Cygnus, taking 220 million years to complete one orbit. The local standard of rest (LSR) is a reference frame in circular orbit around the galactic centre. The gravity of nearby stars causes the sun to move at 20 kilometres a second with respect to the LSR. The sun's orbit is 10% off from circular and it is falling slowly towards the centre of the Milky Way galaxy. At the centre of the Milky Way there is a mass of about 1 to 2.3 million sun masses. The sun is situated in the outer part of the galaxy, between the third and fourth arms, about 20 light years above the galactic plane and 28,000 light years from the galactic centre. It is on the non-Newtonian part of the galactic velocity curve (paper 76 of this series on www.aias.us) because its orbital velocity is nearly constant. It is not therefore governed by Kepler's laws but by the relevant ECE equation of motion as developed in the next section.

26.4 ECE Equation of Motion of Galaxies

Galactic dynamics are explained straightforwardly in ECE theory by the generally covariant law of dynamics:

$$\boldsymbol{\nabla} \cdot \boldsymbol{g} = 4\pi G\rho \tag{26.9}$$

where G is Newton's constant and ρ is mass density. Eq. (26.9) is a direct consequence of general relativity with torsion, and of the Bianchi identity as developed by Cartan [1–10] If spacetime torsion is represented by the shorthand symbol T (without indices for clarity) and if R represents curvature, then:

$$\boldsymbol{\nabla} \cdot \boldsymbol{g} = c^2 \boldsymbol{\nabla} \cdot \boldsymbol{T} = c^2(R - \omega T) \tag{26.10}$$

where ω represents the connection of spacetime [1–10], in this case the spin connection. In the Newtonian limit, the spin connection approaches zero so that:

$$\boldsymbol{\nabla} \cdot \boldsymbol{g} = c^2 R. \tag{26.11}$$

This equation is the familiar Newtonian equation for continuous mass contained within a volume, and from it the Newtonian inverse square law emerges as a limit. In the opposite limit:

$$R = \omega T \tag{26.12}$$

of pure rotational dynamics [1–10]:

$$\boldsymbol{\nabla} \cdot \boldsymbol{g} = \boldsymbol{\nabla} \cdot \boldsymbol{T} = 0 \tag{26.13}$$

and

$$g = Tc^2 = \text{constant} \tag{26.14}$$

meaning that g and T are constants independent of distance. These are the non-Newtonian dynamics that govern the constant v region of a galactic velocity curve. For stars close to the galactic centre, Newtonian dynamics apply as in eq. (26.11), and in intermediate regions the dynamics are governed by a balance of T, R and ω. These are direct results of standard four dimensional general relativity with torsion [1–10], the ECE theory. There is no need to postulate dark matter and it is well known that big bang, black holes and dark matter are the erroneous results of the flawed Einstein equation [1–10]. String theory is merely mathematical hyper-complexity due to lack of understanding of torsion in general relativity. The mass at the centre of galaxies such as the Milky Way can be calculated with Kepler's third law applied to stars near the centre that obey Newtonian dynamics. It is not a black hole, which is an erroneous mathematical notion.

The canonical angular energy momentum density tensor is well known to be defined by [14]:

$$J^{\kappa\mu\nu} = -\frac{1}{2}\left(T^{\kappa\mu}x^{\nu} - T^{\kappa\nu}x^{\nu}\right) \tag{26.15}$$

where $T^{\kappa\mu}$ is the symmetric canonical energy momentum density tensor:

$$T^{\kappa\mu} = T^{\mu\kappa} \tag{26.16}$$

(not to be confused with the three index torsion tensor). Here x^{μ} is the four-coordinate:

$$x^{\mu} = (ct, X, Y, Z). \tag{26.17}$$

The angular momentum tensor [14] is defined by integration:

$$J^{\mu\nu} = \int J^{\kappa\mu\nu} d^3 x_\kappa \tag{26.18}$$

over an infinitesimal hypersurface in four dimensions ($\mathrm{d}^3 x_\kappa$). In paper 103, Eq. (16) (www.aias.us) it was shown that:

$$T^{\kappa\mu\nu} = \frac{k}{c} J^{\kappa\mu\nu} \tag{26.19}$$

where is Einstein's constant and where $\mathrm{T}^{\kappa\mu\nu}$ is the three index torsion tensor of geometry. In paper 98, Eq. (62), it was shown that:

$$T^{\kappa\mu\nu} = \frac{1}{\hbar\kappa^2} J^{\kappa\mu\nu} \tag{26.20}$$

where $\hbar$ is Planck's constant κ and a fundamental wave-number. Comparing Eqns. (26.19) and (26.20):

$$\kappa = \left(\frac{c}{\hbar k}\right)^{\frac{1}{2}} \tag{26.21}$$

giving a wavelength akin to the Planck length. Therefore the torsion of spacetime is proportional to the canonical angular energy momentum density of matter. This is the correct version of the Einstein postulate between the Bianchi identity and Noether's Theorem. The Einstein postulate is well known to be incorrect because of neglect of torsion. Therefore the integral over torsion give angular momentum, and the constant v region of the galactic velocity curve is, self consistently, a region of constant angular momentum of stars and matter generated by the underlying constant torsion of spacetime. This is the correct relativistic explanation of galactic dynamics, and not dark matter.

The quantity [1–10] that defines g in Eq. (26.9) is an orbital torsion:

$$\boldsymbol{T} = T^{010}\boldsymbol{i} + T^{020}\boldsymbol{j} + T^{030}\boldsymbol{k} \tag{26.22}$$

so:

$$\boldsymbol{g} = c^2\boldsymbol{T} = ck\boldsymbol{J} \tag{26.23}$$

where

$$\boldsymbol{J} = J^{010}\boldsymbol{i} + J^{020}\boldsymbol{j} + J^{030}\boldsymbol{k} \tag{26.24}$$

is an orbital canonical angular energy momentum density vector formed from tensor elements. From paper 100, eq. (116) (www.aias.us) :

$$J^{\mu\nu} = \int J^{0\mu\nu} d^3x \tag{26.25}$$

i.e.:

$$\left.\begin{aligned} J^{01} &= \int J^{010} d^3x \\ J^{02} &= \int J^{020} d^3x \\ J^{03} &= \int J^{030} d^3x. \end{aligned}\right\} \tag{26.26}$$

In the galactic region where the sun is located, J^{01}, J^{02}, and J^{03} are constant:

$$\boldsymbol{J}_1 = J^{01}\boldsymbol{i} + J^{02}\boldsymbol{j} + J^{03}\boldsymbol{k},\ |\boldsymbol{J}_1| = mrv = \text{constant}. \tag{26.27}$$

and this is a region of constant spacetime torsion that gives rise to the earth's equinoctial precession. In the Newtonian region of the Milky Way the torsion is r dependent, because its divergence is not zero, i.e. g is given by the Newtonian $-GM/r^2$ where M is the mass at the centre of the galaxy, and r is the distance from an inner star to the galactic centre. This is as observed experimentally, the inner stars of a galaxy obey Newtonian dynamics in the non-relativistic approximation.

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