ON THE UBIQUITOUS NATURE OF THE THOMAS PRECESSION IN ECE2 PHYSICS

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## ABSTRACT

It is shown that the Thomas precession per radian ( $\beta$ ) and its low velocity limit, the Thomas half ( $\beta_0$ ) occur throughout the whole of ECE2 physics on the classical and quantum levels, both non-relativistic and relativistic. This means that Einsteinian general relativity (EGR) is refuted entirely in many ways, because EGR is a theory that describes the effect of gravitation by essentially changing the Thomas precession and Thomas half by changing the metric. EGR was bound to collapse because it is a torsionless theory.

Keywords: ECE2 physics, the ubiquitous Thomas precession, multiple refutation of EGR.

4FT 408

## 1. INTRODUCTION

In UFT407 of this series {1 - 41} it was shown that the energy levels of the hydrogen atom can be described elegantly in terms of the Thomas half ( $\beta_0$) the low velocity limit of the Thomas precession per radian ( $\beta$ ). In Section 2 of this paper it is shown that $\beta$ and $\beta_0$ are ubiquitous i.e. occur throughout ECE2 physics on the classical and quantum levels, both relativistic and non - relativistic. For example the relativistic and non relativistic kinetic energies can be described in terms of $\beta$ and $\beta_0$ respectively, and Schroedinger quantization can be described in terms of $\beta$ and $\beta_0$ . This paper is a short synopsis of extensive calculations found in the notes accompanying UFT408 on www.aias.us. Note 408(1) describes the energy levels of the Dirac atom using $\beta$ . Note 408(2) is a discussion of the role of $\beta$ in relativistic quantum mechanics, Note 408(3) is a discussion of the role of $\beta$ in the exact Dirac equation {1 - 41}, in which the Dirac approximation is not used as in some previous UFT papers. Note 408(4) is a simple refutation of Einsteinian general relativity (EGR) by expressing the classical hamiltonian in terms of the Thomas half ( $\beta_0$). It is shown that the rotation of the Schwarzschild metric in EGR leads to the absurd result that the hamiltonian is purely kinetic and that gravitation vanishes. Note 408(5) is a discussion of various metrical solutions of EGR. All these metrics give absurd results when applied to the non relativistic kinetic energy once the latter is expressed in terms of $\beta_0$. As shown in "Criticisms of the Einstein Field Equation", UFT301 on www.aias.us. all these metrics fail because they are derived from an incorrectly torsionless field equation, the Einstein field equation. Note 408(6) is the basis for Section 2 and is a discussion of the ubiquitous occurrences of $\beta$ and $\beta_0$ in physics. They occur throughout the whole of physics, and throughout the whole of physics the effect of gravitation according to EGR is never observed.

## 2. THOMAS PRECESSION IN PHYSICS

Consider the Thomas precession per radian:

$$\beta = \frac{\Delta \phi_T}{2\pi} = \gamma - 1 \quad -(1)$$

where $\gamma$ is the Lorentz factor. It follows that:

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

where $\underline{v_N}$ is the Newtonian velocity. The Thomas half $\beta_0$ is defined by:

$$\beta_0 = \frac{1}{2}\frac{v_N^2}{c^2} = \beta(v_N \ll c). \quad -(3)$$

The Lorentz factor is defined by the ECE2 covariant metric:

$$ds^2 = c^2 d\tau^2 = (c^2 - v_N^2)\, dt^2 \quad -(4)$$

so:

$$\gamma = \frac{dt}{d\tau} = \left(1 - \frac{v_N^2}{c^2}\right)^{-1/2} \quad -(5)$$

where $\tau$ is the proper time. The factor $\beta$ is defined by rotation of the metric ( 4 ) as shown in the Notes to UFT408 and in UFT407. The Thomas precession in radians is defined by:

$$\Delta \phi_T = 2\pi \beta. \quad -(6)$$

It follows as in Note 408(6) that all the results of ECE2 covariant physics can be described elegantly in terms of $\beta$ or $\beta_0$ . The latter can be defined as the most fundamental quantities of physics. For example the relativistic kinetic energy is:

$$T = E - mc^2 = \beta mc^2 \quad -(7)$$

and the non relativistic kinetic energy is:

$$T = \frac{1}{2} m v_N^2 = \beta_0 m c^2. \quad -(8)$$

The transition from ( 7 ) to ( 8 ) is achieved simply by replacing $\beta$ with $\beta_0$.

Note carefully that the rest energy occurs in non relativistic physics, an entirely new result.

Whenever $\gamma$ occurs on ECE2 covariant physics it is replaced by 1 + $\beta$. For example:

1) The relativistic velocity:

$$\underline{v} = (1+\beta)\, \underline{v}_N. \quad -(9)$$

2) The relativistic total energy:

$$E = (1+\beta) m c^2 \quad -(10)$$

3) The relativistic kinetic energy:

$$T = \beta m c^2. \quad -(11)$$

4) The relativistic hamiltonian:

$$H = (1+\beta) m c^2 + U. \quad -(12)$$

5) The relativistic lagrangian:

$$\mathcal{L} = -\frac{m c^2}{1+\beta} - U \quad -(13)$$

6) The Einstein energy equation:

$$E = H - U = (1+\beta) m c^2 = (c^2 p^2 + m^2 c^4)^{1/2}, \quad -(14)$$

$$p = \gamma m v_N. = (1+\beta) m v_N \quad -(15)$$

7) The Dirac approximation:

$$T = E - mc^2 = \frac{p^2}{m(2+\beta)} \rightarrow \frac{p_N^2}{2m}\left(1 - \frac{U}{2mc^2}\right)^{-1} \quad (16)$$

in which:

$$U = -\frac{e^2}{4\pi\epsilon_0 r} \quad (17)$$

for the H atom is the well known Coulombic attraction between the electron and the proton.

The energy levels of the H atom are given by the expectation value of $\beta_0$:

$$\langle \beta_0 \rangle = \frac{1}{2}\frac{\alpha^2}{n^2} \quad (18)$$

From which

$$E = \langle H_0 \rangle = -\langle \beta_0 \rangle mc^2 \quad (19)$$

where $\alpha$ is the fine structure constant and n the principal quantum number. The energy levels are the expectation values of the hamiltonian:

$$E = \langle H_0 \rangle = \left\langle \frac{p_N^2}{2m} \right\rangle + \langle u \rangle \quad (20)$$

where:

$$\left\langle \frac{p_N^2}{2m} \right\rangle = \langle \beta_0 \rangle mc^2 \quad (21)$$

and

$$\langle u \rangle = -2\langle \beta_0 \rangle mc^2 \quad (22)$$

The expectation value of the Thomas half is:

$$\langle \beta_0 \rangle = \frac{1}{2}\left\langle \frac{v^2}{c^2} \right\rangle = \frac{1}{2}\frac{\alpha^2}{n^2} \quad -(23)$$

The classical, non relativistic, kinetic energy is:

$$T = \frac{1}{2} m v_N^2 = \beta_0 m c^2 \quad -(24)$$

so is $\beta_0$ multiplied by the rest energy:

$$E_0 = mc^2. \quad -(25)$$

The classical relativistic kinetic energy is:

$$T = E - mc^2 = (\gamma - 1) mc^2 = \beta mc^2 \quad -(26)$$

and is $\beta$ multiplied by the rest energy.

Momentum and energy quantization on the non relativistic level are defined by:

$$\underline{p}_N \phi = -i\hbar \underline{\nabla} \phi \quad -(27)$$

and

$$p_N^2 \phi = -\hbar^2 \nabla^2 \phi \quad -(28)$$

respectively, where $\phi$ is the wave function. Using

$$\alpha_0 := \beta_0^{1/2} = \frac{1}{\sqrt{2}} \frac{p_N}{mc} \quad -(29)$$

and defining:

$$\underline{\alpha}_0 = \frac{1}{\sqrt{2}} \frac{\underline{p}_N}{mc} \quad -(30)$$

where the modulus of the vector $\underline{\alpha}_0$ is:

$$|\underline{\alpha}_0| = \left(\alpha_0^2\right)^{1/2} = \alpha_0 = \beta_0^{1/2} \quad -(31)$$

then momentum and energy quantization can be defined as:

$$\underline{\alpha}_0 \phi = -\frac{i}{\sqrt{2}} \frac{\hbar}{mc} \underline{\nabla} \phi \quad -(32)$$

and

$$\beta_0 \phi = -\frac{1}{2}\left(\frac{\hbar}{mc}\right)^2 \nabla^2 \phi \quad -(33)$$

respectively. Here

$$\frac{\hbar}{mc} = \frac{1}{2\pi}\frac{h}{mc} = \frac{\lambda_c}{2\pi} \quad -(34).$$

where $\lambda_c$ is the Compton wavelength.

Therefore $\beta$ and $\beta_0$ define the foundations of quantization. Energy quantization is:

$$T\phi = mc^2 \beta_0 \phi = -\frac{\hbar^2}{2m} \nabla^2 \phi \quad -(35)$$

i.e.

$$\beta_0 \phi = -\frac{1}{2}\left(\frac{\hbar}{mc}\right)^2 \nabla^2 \phi \quad -(36)$$

and momentum quantization is:

$$\underline{p}_N \phi = \sqrt{2}\, mc\, \underline{\alpha}_0 \phi = -i\hbar \underline{\nabla} \phi \quad -(37)$$

i.e.

$$\underline{\alpha}_0 \phi = -\frac{i}{\sqrt{2}}\left(\frac{\hbar}{mc}\right)\underline{\nabla}\phi \quad -(38)$$

where:

$$|\underline{\alpha}_0| = \alpha_0 = \beta_0^{1/2} \quad -(39)$$

The factors $\beta$ and $\beta_0$ are also responsible for the Einstein de Broglie equations:

$$E = \gamma mc^2 = (1+\beta)mc^2 = \hbar\omega \quad -(40)$$

$$\underline{p} = \gamma m\underline{v} = (1+\beta)m\underline{v} = \hbar\underline{\kappa} \quad -(41)$$

and therefore for Planck Einstein quantization, the de Broglie wave particle dualism, and for quantum mechanics on the relativistic and non relativistic levels. Essentially all of physics can be described by $\beta$ and $\beta_0$. Therefore EGR is refuted completely by the rest of physics because as shown in Note 408(5), EGR incorrectly changes $\beta_0$ in the presence of its version of gravitation. For example rotation of the Schwarzschild metric produces:

$$\beta_0 = \frac{1}{2c^2}\left(v_N^2 + \frac{2mG}{r}\right) \quad -(42)$$

When used in the classical hamiltonian :

$$H_0 = \frac{1}{2}mc^2\beta_0 - \frac{mMG}{r} \quad -(43)$$

Eq. ( 42) produces an absurd result:

$$H_0 =? \ \frac{1}{2}mv_N^2 \quad -(44)$$

meaning that the gravitational potential vanishes, reductio ad absurdum. These absurdities of EGR appear throughout physics once it is realized that the latter is described by $\beta$ and $\beta_0$

3: GRAPHICS AND DISCUSSION

Section by Horst Eckardt

# On the ubiquitous nature of the Thomas precession in ECE2 physics

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## 3 Graphics and discussion

Rotation of various Einstein metrics is considered as in note 408(5). These are described by specific $\mathrm{m}(r,t)$ functions in the line element

$$ds^2 = \mathrm{m}(r,t)c^2dt^2 - \frac{dr^2}{\mathrm{m}(r,t)} - r^2d\phi^2. \tag{45}$$

In the numerical example we used unity constants so that the m functions take the form as listed in Table 1. The Thomas precession angle is

$$\Delta\phi = 2\pi\left(\frac{1}{\sqrt{\mathrm{m}\,(r,t) - \frac{v^2}{c^2}}} - 1\right). \tag{46}$$

| Name | $\mathrm{m}\,(r,t)$ |
|---|---|
| Schwarzschild | $1-\frac{1}{r}$ |
| Kerr-Newman, Reissner-Nordstrom | $1-\frac{1}{r}+\frac{1}{r^2}$ |
| Einstein-Rosen, Reissner-Weyl | $1-\frac{1}{r}-\frac{1}{r^2}$ |
| Static de-Sitter | $1-0.05r^2$ |
| Flat space | 1 |

Table 1: Normalized metric functions of Einstein metrics.

We evaluated Eq. (46) for a ratio of $v/c = 0.5$, i.e. a highly relativistic case. The choice of constants in Table 1 is arbitrary but may give an impression on the behaviour of $\Delta\phi$. Its radial dependence is graphed in Fig. 1. For flat space,

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$\Delta\phi$ is constant as expected. For all metrics except the static de-Sitter metric, the Thoas precession angle diverges for $r \to 0$. For the static de-Sitter metric, it diverges for $r \to \infty$. Such a behaviour has never been observed. This is another refutation of the Einstein field equation. In the book "Criticism of the Einstein Field Equation", chapter 4, all Einstein metrics were shown to lead to non-zero torsion which is at variance with the assumption of null-torsion in the Einstein field equation.

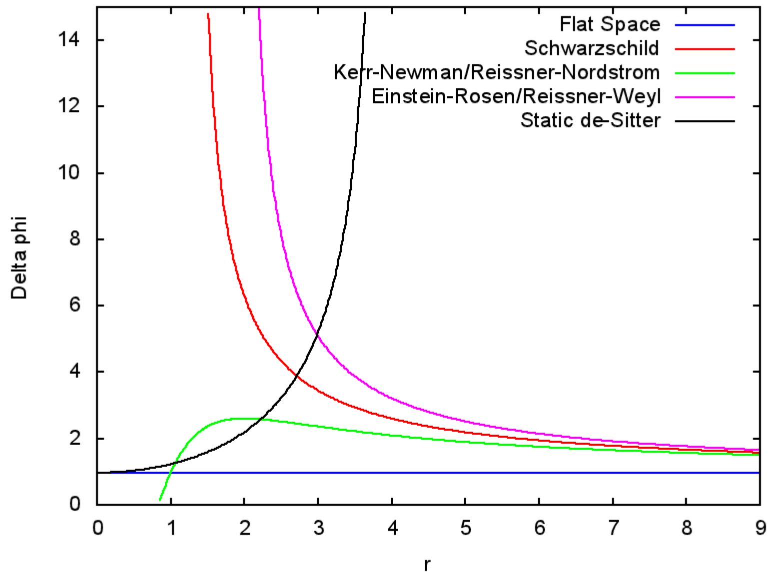


Figure 1: Radial dependence of $\Delta\phi$ for several functions m$(r)$.

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REFERENCES

{1} M. W. Evans, H. Eckardt, D. W. Lindstrom, D. J. Crothers and U. E. Bruchholtz, "Principles of ECE Theory, Volume Two" (ePubli, Berlin 2017).

{2} M. W. Evans, H. Eckardt, D. W. Lindstrom and S. J. Crothers, "Principles of ECE Theory, Volume One" (New Generation, London 2016, ePubli Berlin 2017).

{3} M. W. Evans, S. J. Crothers, H. Eckardt and K. Pendergast, "Criticisms of the Einstein Field Equation" (UFT301 on www.aias.us and Cambridge International 2010).

{4} M. W. Evans, H. Eckardt and D. W. Lindstrom "Generally Covariant Unified Field Theory" (Abramis 2005 - 2011, in seven volumes softback, open access in various UFT papers, combined sites www.aias.us and www.upitec.org).

{5} L. Felker, "The Evans Equations of Unified Field Theory" (Abramis 2007, open access as UFT302, Spanish translation by Alex Hill).

{6} H. Eckardt, "The ECE Engineering Model" (Open access as UFT203, collected equations).

{7} M. W. Evans, "Collected Scientometrics" (open access as UFT307, New Generation, London, 2015).

{8} M .W. Evans and L. B. Crowell, "Classical and Quantum Electrodynamics and the B(3) Field" (World Scientific 2001, open access in the Omnia Opera section of www.aias.us).

{9} M . W. Evans and S. Kielich, Eds., "Modern Nonlinear Optics" (Wiley Interscience, New York, 1992, 1993, 1997 and 2001) in two editions and six volumes, hardback, softback and e book.

{10} M. W. Evans and J. - P. Vigier, "The Enigmatic Photon" (Kluwer, Dordrecht, 1994 to 1999) in five volumes hardback and five volumes softback, open source in the Omnia Opera Section of www.aias.us).

{11} M. W. Evans, Ed. "Definitive Refutations of the Einsteinian General Relativity" (Cambridge International Science Publishing, 2012, open access on combined sites).

{12} M. W. Evans, Ed., J. Foundations of Physics and Chemistry (Cambridge International Science Publishing).

{13} M. W. Evans and A. A. Hasanein, "The Photomagneton in Quantum Field Theory (World Scientific 1974).

{14} G. W. Robinson, S. Singh, S. B. Zhu and M. W. Evans, "Water in Biology, Chemistry and Physics" (World Scientific 1996).

{15} W. T. Coffey, M. W. Evans, and P. Grigolini, "Molecular Diffusion and Spectra" (Wiley Interscience 1984).

{16} M. W. Evans, G. J. Evans, W. T. Coffey and P. Grigolini", "Molecular Dynamics and the Theory of Broad Band Spectroscopy (Wiley Interscience 1982).

{17} M. W. Evans, "The Elementary Static Magnetic Field of the Photon", Physica B, 182(3), 227-236 (1992).

{18} M. W. Evans, "The Photon's Magnetic Field: Optical NMR Spectroscopy" (World Scientific 1993).

{19} M. W. Evans, "On the Experimental Measurement of the Photon's Fundamental Static Magnetic Field Operator, B(3): the Optical Zeeman Effect in Atoms", Physica B, 182(3), 237 - 143 (1982).

{20} M. W. Evans, "Molecular Dynamics Simulation of Induced Anisotropy: I Equilibrium Properties" , J. Chem. Phys., 76, 5473 - 5479 (1982).

{21} M. W. Evans, "A Generally Covariant Wave Equation for Grand Unified Theory" Found. Phys. Lett., 16, 513 - 547 (2003).

{22} M. W. Evans, P. Grigolini and P. Pastori-Parravicini, Eds., "Memory Function Approaches to Stochastic Problems in Condensed Matter" (Wiley Interscience, reprinted 2009).

{23} M. W. Evans, "New Phenomenon of the Molecular Liquid State: Interaction of Rotation and Translation", Phys. Rev. Lett., 50, 371, (1983).

{24} M .W. Evans, "Optical Phase Conjugation in Nuclear Magnetic Resonance: Laser NMR Spectroscopy", J. Phys. Chem., 95, 2256-2260 (1991).

{25} M. W. Evans, "New Field induced Axial and Circular Birefringence Effects" Phys. Rev. Lett., 64, 2909 (1990).

{26} M. W. Evans, J. - P. Vigier, S. Roy and S. Jeffers, "Non Abelian Electrodynamics", "Enigmatic Photon V olume 5" (Kluwer, 1999)

{27} M. W. Evans, reply to L. D. Barron "Charge Conjugation and the Non Existence of the Photon's Static Magnetic Field" , Physica B, 190, 310-313 (1993).

{28} M. W. Evans, "A Generally Covariant Field Equation for Gravitation and Electromagnetism" Found. Phys. Lett., 16, 369 - 378 (2003).

{29} M. W. Evans and D. M. Heyes, "Combined Shear and Elongational Flow by Non Equilibrium Electrodynamics", Mol. Phys., 69, 241 - 263 (1988).

{30} Ref. (22), 1985 printing.

{31} M. W. Evans and D. M. Heyes, "Correlation Functions in Couette Flow from Group Theory and Molecular Dynamics", Mol. Phys., 65, 1441 - 1453 (1988).

{32} M. W. Evans, M. Davies and I. Larkin, Molecular Motion and Molecular Interaction in the Nematic and Isotropic Phases of a Liquid Crystal Compound", J. Chem. Soc. Faraday II, 69, 1011-1022 (1973).

{33} M. W. Evans and H. Eckardt, "Spin Connection Resonance in Magnetic Motors", Physica B., 400, 175 - 179 (2007).

{34} M. W. Evans, "Three Principles of Group Theoretical Statistical Mechanics", Phys. Lett. A, 134, 409 - 412 (1989).

{35} M. W. Evans, "On the Symmetry and Molecular Dynamical Origin of Magneto Chiral Dichroism: "Spin Chiral Dichroism in Absolute Asymmetric Synthesis" Chem. Phys. Lett., 152, 33 - 38 (1988).

{36} M. W. Evans, "Spin Connection Resonance in Gravitational General Relativity", Acta Physica Polonica, 38, 2211 (2007).

{37} M. W. Evans, "Computer Simulation of Liquid Anisotropy, III. Dispersion of the Induced Birefringence with a Strong Alternating Field", J. Chem. Phys., 77, 4632-4635 (1982).

{38} M. W. Evans, "The Objective Laws of Classical Electrodynamics, the Effect of Gravitation on Electromagnetism" J. New Energy Special Issue (2006).

{39} M. W. Evans, G. C. Lie and E. Clementi, "Molecular Dynamics Simulation of Water from 10 K to 1273 K", J. Chem. Phys., 88, 5157 (1988).

{40} M. W. Evans, "The Interaction of Three Fields in ECE Theory: the Inverse Faraday Effect" Physica B, 403, 517 (2008).

{41} M. W. Evans, "Principles of Group Theoretical Statistical Mechanics", Phys. Rev., 39, 6041 (1989).