

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 (β) and its low velocity limit, the Thomas half (β_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.

UFT 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 (β_0) the low velocity limit of the Thomas precession per radian (β). In Section 2 of this paper it is shown that β and β_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 β and β_0 respectively, and Schroedinger quantization can be described in terms of β and β_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 β . Note 408(2) is a discussion of the role of β in relativistic quantum mechanics, Note 408(3) is a discussion of the role of β 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 (β_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 β_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 β and β_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 γ 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 β_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 τ is the proper time. The factor β 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 β or β_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 β with β_0 .

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

Whenever γ 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:

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

5) The relativistic lagrangian:

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

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:

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

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 β_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 α is the fine structure constant and n the principal quantum number. The energy

levels are the expectation values of the hamiltonian:

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

where:

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

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 β_0 multiplied by the rest energy:

$$E_0 = m c^2 \quad - (25)$$

The classical relativistic kinetic energy is:

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

and is β multiplied by the rest energy.

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

$$\underline{P}_N \psi = -i \hbar \underline{\nabla} \psi \quad - (27)$$

and

$$P_N^2 \psi = -\hbar^2 \nabla^2 \psi \quad - (28)$$

respectively, where

ψ

is the wave function. Using

$$\alpha_0 := \beta_0^{1/2} = \frac{1}{\sqrt{2}} \frac{P_N}{m c} \quad - (29)$$

and defining:

$$\underline{\alpha}_0 = \frac{1}{\sqrt{2}} \frac{\underline{P}_N}{m c} \quad - (30)$$

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

$$|\underline{d}_0| = (d_0^2)^{1/2} = d_0 = \beta_0^{1/2} \quad (31)$$

then momentum and energy quantization can be defined as:

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

and

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

respectively. Here

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

where λ_c is the Compton wavelength.

Therefore β and β_0 define the foundations of quantization. Energy quantization is:

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

i.e.

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

and momentum quantization is:

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

i.e.

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

where:

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

The factors β and β_0 are also responsible for the Einstein de Broglie equations:

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

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

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 β and β_0 . Therefore EGR is refuted completely by the rest of physics because as shown in Note 408(5), EGR incorrectly changes β_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 :

$$H_0 = \frac{1}{2} m c^2 \beta_0 - \frac{m m G}{r} \quad - (43)$$

Eq. (42) produces an absurd result:

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

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 β and β_0 .

3: GRAPHICS AND DISCUSSION

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