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Comment to *Guynn*'s Fine-Structure Constant Approach

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Abstract

Sommerfeld's fundamental fine-structure constant α once more gives reason to be amazed. This comment is a Chapter of a publication in preparation dealing mainly with golden ratio signature behind *Preston Guynn*'s famous matter/space approach. As a result we present a relation of α to the galactic velocity $\beta_g = \frac{v_g}{c}$, mediated by the circle constant π, which points to an omnipresent importance of this constant and its intrinsic reciprocity pecularity: $\alpha \approx \pi^2 \left|\beta_g\right|$ respectively $\pi \cdot \left|\beta_g\right| \approx \frac{1}{\pi \cdot \alpha^{-1}}$. The designation fine-structure constant should be replaced simply by *Sommerfeld*'s constant. We present golden mean-based approximations for α as well as for electron's charge and mass and connect the word average value of interaction coupling constant $\alpha_s(m_z)$ with $\left|\beta_g\right|$.

Keywords

Structure-Matter Theory, Thomas Precession, Sommerfeld' Constant, Galactic Velocity, Reciprocity Relation, Goldem Mean, Gyromagnetic Factor, Unification of Science

1. Introduction

Sommerfeld's fine-structure constant α describes the coupling respectively measure of the strength of the electromagnetic force that determines the interaction between electrically charged elementary particles (electron) and photons (light). This coupling is given by the relation [1]

$$\alpha = \frac{1}{4\pi\epsilon_0} \cdot \frac{e^2}{\hbar c} \tag{1}$$

where e is the elementary charge of the electron, ϵ_0 is the permittivity of the vacuum, $\hbar$ is the reduced *Planck* constant, and c is the speed of light. The precisely determined *CODATA* value is [2]

$$\alpha = 7.2973525693(11)\times 10^{-3} \tag{2}$$

A new evaluation of coupling values of fundamental forces like the α constant paves the way to a unification of sciences and a full understanding of the world's very existence. We comment on an impressive new approach given by *Guynn* [3] that contributes to this topic. In Chapter 2 *Sommerfeld*'s fine-structure constant α was recast to indicate an impressive paradigmatic reciprocity relation of terms that contain the galactic velocity $|\beta_g|$. This relation was further simplified finally yielding $\alpha \approx \pi^2 |\beta_g|$. Chapter 2 also deals with approximations for the electron charge, mass and gyromagnetic factor. Indications of a golden mean signature behind *Guynn*'s approach were shortly discussed in Chapter 3, but should be explained in more detail in a separate contribution. Golden mean approximations of the maximum of *Guynn*'s difference velocity β_m were summarized. A relation to *Mozafari*'s world average value for the interaction coupling constant α_s is suggested in Chapter 4 [4].

The interested reader may also follow the contribution of *Stergios Pellis* about relationships connecting physical constants [5] [6].

2. Comment to Guynn's Approach

Guynn's pioneering relation for *Sommerfeld*'s fine-structure constant α [3] can be rewritten in a form that indicates a nice reciprocity relation using the galactic rotation velocity v_g due to *Thomas* precession [7]

$$\alpha = \frac{2\pi}{c}\sqrt{|v_g|}\left(\frac{1}{\varphi'}\sqrt{|v_g|} + \frac{\varphi' \cdot k_2}{\sqrt{|v_g|}}\right) \tag{3}$$

With $$\varphi' = \left(2 - 2^{1/3}\right)^{3/2} = 0.63667394565092 \approx \frac{2}{\pi} = 0.636619772 \tag{4}$$

where $k_2 \equiv m/s$ is a dimension-preserving factor [3].

Such reciprocity relations, frequently found in nature, point again to the golden mean dominance of physical science and life in general [8] [9].

When using the approximation (4) and choosing

$\beta_g = \frac{v_g}{c} = -0.000739437964740$ [3], the fine-structure constant can be estimated simply as

$$\alpha \approx \pi^2 |\beta_g| = 0.00729760191 \tag{5}$$

However, the difference to the experimentally estimated value is only 0.000000249. Alterations of "fundamental" constants recommended by the *IRT* theory [10] are quite well in this reliability range [7]. Therefore, we cannot exclude that the conjecture $\frac{\alpha}{|\beta_g|} = \pi^2$ is correct.

Again a paradigmatic reciprocity relation can be formulated using $\alpha^{-1} = 137.03599\cdots$ [8]

$$\pi \cdot \left|\beta_g\right| \approx \frac{1}{\pi \cdot \alpha^{-1}} \tag{6}$$

This is the real mystery behind number 137, if any mystery can be seen at all. It may be considered as a signature of matter-wave duality and galactic entanglement. *Schwinger*'s intuitive α/π is cutting edge [11], but *QED* is not.

Since *Sommerfeld* had investigated the spectrum of hydrogen and assigned the speed of the electron in the first *Bohr* orbit as fine-structure constant $\beta_1 = \alpha$ [1], this "constant" has been found to be more universal and connected to rotating entities "from particle scale to galactic scale" [3]. Therefore, it is recommended to replace the designation fine-structure constant simply by *Sommerfeld* constant.

Some other approximate relations for α have been applied in Chapter 4.

Another approximation for $\left|\beta_g\right|$ using the golden mean $\varphi = \frac{\sqrt{5}-1}{2}$ is [12]

$$\left|\beta_g\right| \approx \frac{\varphi^6}{24 \cdot \pi} = 0.000739116\cdots \tag{7}$$

Also the elementary charge e can be approximated using the galactic velocity v_g

$$e \approx -\pi \cdot \sqrt{2\epsilon_0 h \left|v_g\right|} = -1.602243 \times 10^{-19}\ \text{C} \tag{8}$$

The exact *CODATA* value is =1.602176634 × 10^{-19} C.

With $\sqrt{\epsilon_0 hc} = 1.32621132174 \times 10^{-18}\ \text{C}$ as a calibration constant, Equation (8) can be recast into

$$e \approx -\pi \cdot \sqrt{2\left|\beta_g\right|} \cdot \sqrt{\epsilon_0 hc} \tag{9}$$

Using *Guynn*'s v_g, the mass of the electron can be approximated in the same way giving (see **Appendix A2**)

$$m_e \approx \pi \cdot \frac{\sqrt{3} \cdot k_1}{c^4 \left|\beta_g\right|} = 9.1101587\cdots \times 10^{-31}\ \text{kg} \tag{10}$$

where $k_1 \equiv \text{kg} \cdot \text{m}^4 \cdot \text{s}^{-4}$ is again a dimension-preserving factor [3].

The concise *CODATA* value is $m_e = 9.1093837015(28) \times 10^{-31}\ \text{kg}$.

The quotient e/m_e then delivers

$$\frac{e}{m_e} \approx -\frac{\sqrt{\epsilon_0 hc}}{k_1} \cdot \sqrt{\frac{2}{3}} \cdot \left|\beta_g\right|^{\frac{3}{2}} \cdot c^4 = -1.7587436\cdots \times 10^{11}\ \text{C} \cdot \text{kg}^{-1} \tag{11}$$

compared to the *CODATA* value of $\frac{e}{m_e} = -1.75882001070(53) \times 10^{11}\ \text{C} \cdot \text{kg}^{-1}$.

One could more precisely adapt these approximations by a small variation of the involved "fundamental" physical constants.

Guynn's convincing formula for the mass m_e of the electron used, besides v_g, the maximum v_m of the difference velocity (see Chapter 3).

$$m_e = \frac{\sqrt{2}\sqrt{3}k_1}{\left|v_g\right| v_m c^2} = 9.10938356006879 \times 10^{-31}\,\text{kg} \tag{12}$$

In our approximate approach for m_e in Equation (10) we used the simple relation (23) given in Chapter 3.

With respect to the importance of the circle constant π an excerpt from reference [8] is given:

… the area A enclosed by a circle of radius 1 yields

$$A = \pi = 4\int_0^1 \sqrt{1-x^2}\,\mathrm{d}x, \tag{13}$$

where π is *Archimedes*' constant, the well-known circle constant. One obtains the circumference C by using the reciprocal of the integrand

$$C = 2\pi = 4\int_0^1 \frac{1}{\sqrt{1-x^2}}\,\mathrm{d}x. \tag{14}$$

This connection between the boundary and the enclosed area is of fundamental importance. It may be thought of as a geometrical analog to the more general matter-wave duality…

The *Lorentz* integral angular limit in *Guynn*'s approach is equivalent to relation (13) [3]

$$\theta_{L\max} = \int_0^1 \gamma(x)\,\mathrm{d}x = \int_0^1 \frac{1}{\sqrt{1-x^2}}\,\mathrm{d}x = \frac{\pi}{2} \tag{15}$$

The value of φ' in relation (4) is $\varphi' \approx \theta_{L\max}^{-1}$.

Guynn's famous and stunningly simple relation for the anomalous gyromagnetic factor g_e of the electron [3] can also be treated in a different way. The second term of his relation

$$g_e = \frac{5}{8}\frac{\sqrt[3]{2}}{\theta_{ea}} - \frac{v_g}{c}\cdot\frac{2}{\frac{2\pi}{\alpha}+3} = 2.00231930436122 \tag{16}$$

is reformulated giving a function of solely the galactic velocity

$$-\frac{v_g}{c}\cdot\frac{2}{\frac{2\pi}{\alpha}+3} = \frac{2\cdot\beta_g^2}{\varphi' + 3\cdot\left|\beta_g\right|} \tag{17}$$

Using *Guynn*'s $\theta_{ea} = \arcsin\left(\frac{v_0}{c}\right) - \arcsin\left(\frac{v_1}{c}\right) = 0.3932960869637$, (18)

The approximation holds $\frac{\theta_{ea}}{\varphi'} = 0.61769389 \approx 0.6180339887 = \varphi$ (19)

respectively $\theta_{ea}\cdot\frac{\pi}{2} = 0.61778804 \approx 0.6180339887 = \varphi$ (20)

where φ is the golden ratio; $\frac{v_0}{c} = \frac{\sqrt{3}}{2}$, $\frac{v_1}{c} = 0.6083087004577$ [3].

The theoretical background behind the experimental value of electron's gyromagnetic factor includes among other things the relativistic mass correction, given by the *Lorentz* transform in accordance with *Guynn*'s approach [3], whereas the present author already had applied the *IRT* theory leading to a reduced g_e value of $g_e \approx 2.00231909$ [8]?

This comment is a Chapter of a paper in preparation about "Golden Ratio Signature Behind *Guynn*'s Matter/Space Approach", scanning the different sides of the same coin [13] [14]. The puzzling question is whether frequently observed values have exact golden mean ratio. It has been illustrated in **Figure 1** that the maximum of the *Hardy-Suleiman* relation of $e_{\max} = \varphi^5$ at $\beta_{\max} = \varphi = 0.6180339887$ [15] is clearly related to the maximum of *Guynn*'s difference velocity curve of $v_m \approx \frac{3}{2}\sqrt{\varphi^5}$ at $\beta_{\max} \approx 0.6083087$ [3]. The number φ^5 can be considered as fundamental, because it is connected to phase transformations from particle dimension to galactic ones [16].

Turning back to *Sommerfeld*'s constant, an approximation of α using φ^5 can be formulated as

$$\alpha \approx \frac{\pi^2 k_1}{2\varphi^5 c^2 E_e} = 0.0074376569\cdots \tag{21}$$

where E_e is the rest energy of the electron.

3. Maximum Velocity β_m and Golden Mean

The maximum velocity v_m of the difference curve between rotation velocity and precession velocity according to *Guynn* [3] can be approximated by golden mean based quantities or π based ones, remembering that φ^5 is the maximum of the *Hardy-Suleiman* relation [10] [16], before used by *El Naschie* and coworkers in the ε-infinity theory [17] [18]. Both numbers φ and π are related to each other [19]. One can confirm the following approximations

$$\frac{v_m}{c} = \beta_m = \sqrt{3}\cdot\left(\sqrt[3]{2}-1\right) = 0.450196459\cdots \tag{22}$$

$$\approx \frac{\sqrt{2}}{\pi} = 0.450158158\cdots \tag{23}$$

$$\approx 5\cdot\varphi^5 = 0.4508497\cdots \tag{24}$$

$$\approx \frac{3}{2}\cdot\sqrt{\varphi^5} = 0.450424549\cdots \tag{25}$$

Following **Figure 1**, a simple golden mean based relation approximates well only the left side of the blue *Guynn* curve up to the maximum of $\beta_m = 5\varphi^5$ at $\beta = \varphi$, allowing the right side to reach a value of zero at $\beta = 1$

$$\beta_d = \beta - \varphi\beta^3 - \varphi^2\beta^6 \tag{26}$$

Using this relation, *Guynn*'s starting difference velocity relation (27) can tentatively be approximated by a more complicated golden mean based limited power series expansion (28).

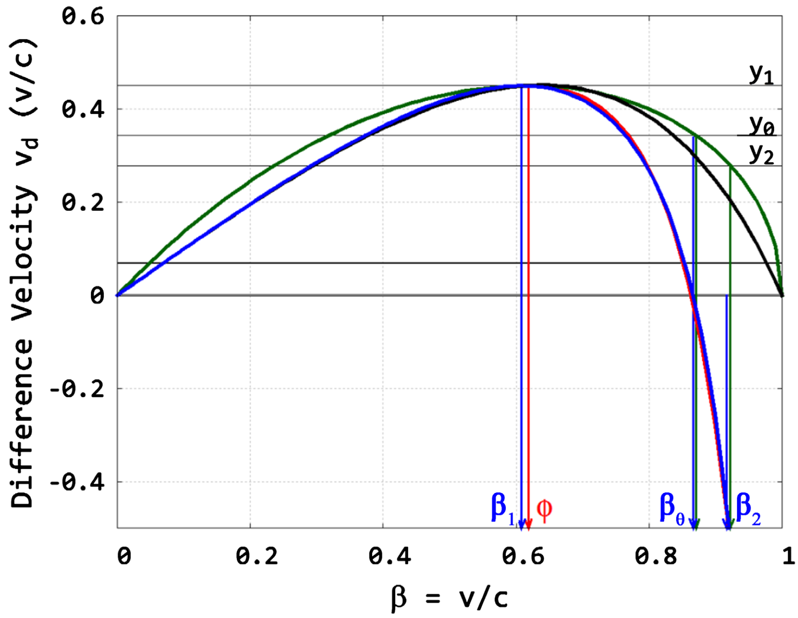

Figure 1. Difference velocity v_d versus velocity β (blue) according to [3] compared to an approximation (relation (28) red). The green curve represents the scaled square root of matter energy density given by [10]. The scale factor is 3/2 (see relation (25)). The black curve depicts relation (26).

$$\beta_d = \beta(2-\gamma) \tag{27}$$

$$\beta_d = \beta - 0.961\left(\varphi\beta^3 + \varphi^2\beta^6 + \varphi^3\beta^9 + 2\varphi^2\beta^{12} + \left(1+2\varphi^5\right)\beta^{15}\right) \tag{28}$$

The obtained results were depicted in **Figure 1**. A slightly less well-fitted but simpler approximation is $\beta_d = \beta - \varphi\beta^3 - \varphi^2\beta^6 - \dfrac{\beta^{15}}{\varphi^2}$.

4. Sommerfeld's Constant and Mozafari's Coupling Constant

One can obtain a further approximation of *Sommerfeld*'s constant by using β_m

$$\alpha \approx 2\sqrt{3}\cdot\pi\cdot\frac{k_1 k_2^2}{\beta_m^2 c^4 E_e} = 0.0072973391\cdots \tag{29}$$

Remarkably, a reciprocal term connected with this relation resembles *Mozafari*'s recently published world average value for the interaction coupling constant $\alpha_s\left(m_z^2\right)$ [4] giving

$$\frac{\beta_m^2}{\sqrt{3}} = 0.117055 \approx \alpha_s = \frac{\sqrt{\pi}}{10\cdot\sqrt{\ln(10)}} = 0.1168065 \tag{30}$$

This value was precisely confirmed by measurement and *QCD* analysis at *CERN* [20]:

$$\alpha_s(m_z) = 0.1170 \pm 0.0019 \tag{31}$$

with uncertainties ± 0.0014 (fit) ± 0.0007 (scale) ± 0.0008 (model) ± 0.0001 (param).

One can formulate another numerical relation for the coupling constant α_s using relation (23)

$$\alpha_s \approx \frac{2}{\sqrt{3}\pi^2} = 0.1169956 \tag{32}$$

Turning to results of the *IRT* theory and matter—dark matter coupling in disk galaxies [21], one can give a further relation for α_s (notice the factor 5 combined with the *IRT* maximum of e_m/e_0 in relation (24))

$$\alpha_s \approx \frac{1}{5}\cdot\frac{r_c}{r_s} = \frac{1}{5}\left(\frac{\ln(3)}{\ln(2)} - 1\right) = 0.1169925 \tag{33}$$

where r_c is the core radius of the galaxy, representing the distance from the galaxy center to the core where matter density is one half of the central matter density, and r_s is the half-velocity radius.

A golden mean based sketching of the value for α_s used a simple reciprocity relation [22]. One cansplitthis relation delivering a term that represents the inverse circumsphere radius $\frac{1}{r_{circ}} = \frac{2}{\sqrt{3+\varphi}}$ of a regular icosahedron of unit edge length

$$\frac{1}{5\sqrt{\frac{2}{\varphi} - \frac{\varphi}{2}}} = \frac{1}{5}\sqrt{\frac{\varphi}{2}}\cdot\frac{2}{\sqrt{3+\varphi}} = 0.116900 \tag{34}$$

We see that the *grand unification of the sciences, arts and consciousness* has made some progress again [6] [23].

5. Conclusion

Guynn's approach is a cornucopia of overflowing ideas inspiring metrologists to confirm or measure anew fundamental physical constants. The relation between *Sommerfeld*'s α constant and the galactic velocity v_g points towards a more global importance of this fundamental forces' coupling value. Also the world average value for the interaction coupling constant α_s was found to be related to the maximum of the galactic velocity. It is evident that the *grand unification of the sciences, arts and consciousness* has made some progress again. It is also evident that *QED* seems to be not more than a sometimes helpful construct.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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