



## Opinions

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# Natural Constants as Properties of Quantized Spacetime Structure

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**Abstract** – In current physics there are two Natural constants with meanings that remain unresolved: the Cosmological and the Fine Structure constants. Both are related to the theory of relativity and quantum mechanics. Once the meaning of each one is known and the relationship that exist between them, we propose a new system of units based on the Spacetime Structure. In this alternative unit system to our S.I., that we will call Structural Units or S.U., matter and energy and their interactions are described as different Spacetime configurations, where Natural constants can be calculated by algebra between the three pure numbers  $\pi$ ,  $\varphi$  and  $\alpha$ , suggesting a deep underlying structure and unity in the laws of Nature, with profound implications for our understanding of physics and mathematics.

**Keywords** – Cosmological constant; Fine Structure constant; Spacetime Structure; Natural constants.

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## 1. Introduction

To present this manuscript, we will try to focus on Lederman's idea about the same calculated value of the Fine Structure constant whatever the unit system established to describe physics phenomena [1] (p. 5). Following this reasoning, the equivalence between two different unit systems as S.I. and S.U., can be checked and reproduced in two ways.

1. The dimensional analysis that would allow to change from one system of units to another.
2. By the coincidence in the values of dimensionless numbers, because the proportionality relationship would be preserved independent of the unit system.

For this reason, we will present a S.I. and S.U. table of equivalences, deduced from classic physics equations and the Spacetime quantization used to perform the calculations. I would like to emphasize that the values of the different Natural constants in S.I. are the current CODATA (Committee on Data for Science and Technology) [2], all determined by experimental data. Therefore, the objective of this manuscript is trying to give enough information to evaluate if the compatibility between both unit systems is complete and Structural Units could become a new tool in our research, without focusing on its deduction.

## 2. Methods

The following four premises about Spacetime Structure will be the basis for the calculations to obtain Table 1, whose deduction can be found in our previously published paper [3]:

1. Spacetime is quantized in energy-linked equidistant vertices, separated the Compton electron wavelength and time.
2. Spacetime is an omni-tensional Structure with the ability to contain the energy and mass that compose the Universe, within this Structure atoms and photons undergo quantized movement from vertex to vertex.

3. Spacetime curvature is produced by an angle change between Structural vertices, defining gravity as the balance between the energies contained in a mass and the Spacetime that surround it.
4. Finally, we propose that physical properties can be translated to what we call, Structural or Spacetime units, where it appears a proportionality connection between the different Natural constants, finding that the number 1/137.035999206... known as the Fine Structure constant is related to the same Spacetime Structure.

**Table 1.** Equivalences between the values of different Natural constants in S.I. and S.U.

| NATURAL CONSTANT                             | S.I. VALUE                    | S.U. VALUE                            | S.I. UNITS   | S.U. UNITS   |
|--|-------------------------------|---------------------------------------|--|--|
| $h$ (Planck constant)                        | $6.62607015 \cdot 10^{-34}$   | $\frac{2}{\alpha^2}$                  | $\frac{\text{kg} \cdot \text{m}^2}{\text{s}}$                    | $\frac{\text{time}^3}{\text{space}^2}$                       |
| $K_C$ (Coulomb constant)                     | 8987551793                    | $\frac{2}{\alpha^2}$                  | $\frac{\text{kg} \cdot \text{m}^3}{\text{s}^2 \cdot \text{C}^2}$ | $\frac{\text{time}^2}{\text{space} \cdot \text{Charge}^2}$   |
| $G$ (Gravitational constant)                 | $6.67430 \cdot 10^{-11}$      | $2.29313566 \cdot 10^{-50} *$         | $\frac{\text{m}^3}{\text{kg} \cdot \text{s}^2}$                  | $\frac{\text{space}^7}{\text{time}^6}$                       |
| $K_B$ (Boltzmann constant)                   | $1.380649 \cdot 10^{-23}$     | $\frac{2\varphi}{\alpha^3 \pi^2} *$   | $\frac{\text{kg} \cdot \text{m}^2}{\text{s}^2 \cdot \text{K}}$   | $\frac{\text{time}^3}{\text{space}^3}$                       |
| $\mu_0$ (Magnetic permittivity)              | $1.256637062 \cdot 10^{-6}$   | $8\varphi^2 \pi$                      | $\frac{\text{kg} \cdot \text{m}}{\text{C}^2}$                    | $\frac{\text{time}^4}{\text{space}^3 \cdot \text{Charge}^2}$ |
| $\epsilon_0$ (Electrical permittivity)       | $8.85418781 \cdot 10^{-12}$   | $\frac{\alpha^2}{8\pi}$               | $\frac{\text{s}^2 \cdot \text{C}^2}{\text{kg} \cdot \text{m}^3}$ | $\frac{\text{space} \cdot \text{Charge}^2}{\text{time}^2}$   |
| $c$ (speed of light)                         | 299792458                     | $\frac{1}{\varphi \alpha}$            | $\frac{\text{m}}{\text{s}}$                                      | $\frac{\text{space}}{\text{time}}$                           |
| $m_e$ (electron rest mass)                   | $9.10938370 \cdot 10^{-31}$   | $\frac{4\varphi^2}{\alpha^2} \dagger$ | kg   | $\frac{\text{time}^4}{\text{space}^4}$                       |
| $m_p$ (proton mass)                          | $1.67262192 \cdot 10^{-27}$   | $\frac{1}{(\cos \beta)^4 \alpha^4} *$ | kg   | $\frac{\text{time}^4}{\text{space}^4}$                       |
| $r_h$ (Bohr radius)                          | $5.29177210 \cdot 10^{-11}$   | $\frac{1}{4\varphi \pi}$              | m  | space  |
| $e^2$ (Electrical charge squared)            | $2.56696996 \cdot 10^{-38}$   | $\frac{1}{2\varphi \pi}$              | $\frac{\text{Coulomb}^2}{\text{C}^2}$                            | $\text{Charge}^2$  |
| $f_e$ (electron frequency)                   | $3.289841957 \cdot 10^{15}$   | 1                                     | $\frac{1}{\text{s}}$   | $\frac{1}{\text{time}}$                                      |
| $\lambda_{ce}$ (Compton electron wavelength) | $2.4263102386 \cdot 10^{-12}$ | $\frac{\alpha}{2\varphi}$             | m  | space  |
| $t_{ce}$ (Compton electron time)             | $8.09329976 \cdot 10^{-21}$   | $\frac{\alpha^2}{2}$                  | s  | time   |
| $v_e$ (electron speed)                       | 2187691.262                   | $\frac{1}{\varphi}$                   | $\frac{\text{m}}{\text{s}}$                                      | $\frac{\text{space}}{\text{time}}$                           |
| $R_h$ (Rydberg constant)                     | 10973731.568                  | $\alpha \varphi$                      | $\frac{1}{\text{m}}$   | $\frac{1}{\text{space}}$                                     |
| $r_e$ (electron classic radius)              | $2.81794032 \cdot 10^{-15}$   | $\frac{\alpha^2}{4\varphi \pi}$       | m  | space  |

Most of the Natural constants that appear below are expressed as functions of the numbers  $\pi$ ,  $\varphi$  and the Fine Structure constant  $\alpha$ , showing how they would be closely related to each other. The meters, seconds, and kg. in our S.I. have also been changed for units of distance and time used in S.U. for dimensional analysis. We have included its equivalent CODATA values in S.I. to ease the calculations:

For dimensional analysis in S.I./S.U. translation use this equivalence:

## Structural Units

$$\mathbf{Kg.} = \frac{\mathbf{time}^4}{\mathbf{space}^4}, \mathbf{Joule} = \frac{\mathbf{time}^2}{\mathbf{space}^2}, \mathbf{Kelvin} = \frac{\mathbf{space}}{\mathbf{time}}.$$

† In S.U. the electron is described as energy, as consequence, its rest mass  $\frac{4\varphi^2}{\alpha^2} \frac{\mathbf{time}^4}{\mathbf{space}^4}$  would be just a mathematical concept as mass and energy in S.U. has different units/dimensions ( $\frac{\mathbf{time}^4}{\mathbf{space}^4}$  and  $\frac{\mathbf{time}^2}{\mathbf{space}^2}$ , respectively).

\* Angle  $\beta = 6.22547165$  degrees is due to the Euclidean/non-Euclidean correction in Spacetime Structure by proton presence.

For calculations with Structural Units:

$$\varphi = 1.618033989, \alpha = 7.29735256 * 10^{-3} [4], \pi = 3.141592654.$$

### 3. Results and discussion

Once we have the equivalent Natural constants values in S.I. and S.U. we will proceed with the calculations to check its compatibility, by dimensional analysis translation from S.U. to S.I. and dimensionless numbers coincidence.

#### 3.1. Structural Unit definition

One Structural Unit is described following **Figure 1**, where it is shown the distance and time equivalence between both unit systems:

S.I.

$$\lambda_{ce} = 2.42631023 * 10^{-12} \text{ meters}$$

$$t_{ce} = 8.09329976 * 10^{-21} \text{ seconds}$$

#### 1 Structural Unit

Spacetime vertex 1  Spacetime vertex 2

S.U.

$$\lambda_{ce} = \frac{\alpha}{2\varphi} = 2.25500595 * 10^{-3} \text{ space}$$

$$t_{ce} = \frac{\alpha^2}{2} = 2.66256772 * 10^{-5} \text{ time}$$

Figure 1. Spacetime quantization equivalence in S.I. and S.U.

As we can see, the speed of light (c) in both unit systems is defined by the separation in space and time between two Structural vertices or 1 S.U. From Table 1  $c = \frac{1}{\varphi\alpha} \frac{\mathbf{space}}{\mathbf{time}}$  and now we can transform c to S.I. applying a dimensional analysis with the corresponding equivalences,

$$\begin{aligned} \frac{1}{\varphi\alpha} \frac{\mathbf{space}}{\mathbf{time}} & * \frac{2.42631023 * 10^{-12} \text{ meters}}{0.00225500595 \text{ space}} * \frac{0.00002662567 \dots \text{ time}}{8.09329976 * 10^{-21} \text{ seconds}} \\ & = 299792377.6 \text{ meters/seconds} \end{aligned} \quad (1)$$

showing a 99.99997 % of accuracy.

### 3.2. Calculation of the Spacetime Angle Bended by a Proton

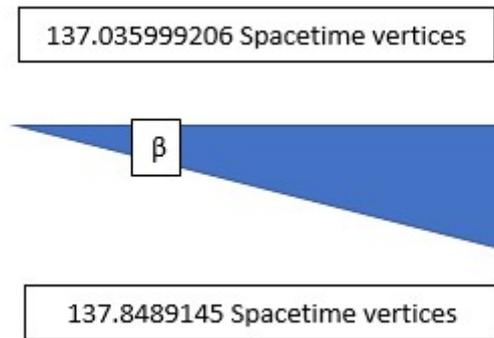
In **Table 1** is introduced the concept of the Spacetime angle bent by a proton presence ( $\beta$ ), next, I will explain how we have calculated it. First, we will use the proton electron mass ratio ( $\frac{m_p}{m_e}$ ) to calculate the correction between Structural Units and our International System of Units, as we know, using 2018 CODATA recommended values, [2].

$$\frac{m_p}{m_e} = 1836.152673, \quad (2)$$

while in Structural Units,

$$\frac{m_p}{m_e} = 1793.222047, \quad (3)$$

where  $m_p = 137.035999206^4$  and  $m_e = 2 * \varphi^2 * 2 * 137.035999206^2$  using the latest Fine Structure constant experimental value measured in 2020. [4] We will establish that this difference is due to the Spacetime bending described in relativity and that in proton presence the Spacetime Structure changes from a Euclidean to a non-Euclidean geometry. As non-Euclidean geometry calculations are complex, we are going to do the approximation to a Pythagoras Theorem following,



**Figure 2.** If the Fine Structure constant is defining one side of the proton tesseract shape, this side should experiment a spatial dilation, due to the Spacetime flexibility.

As consequence, the proton mass in Structural Units is equal to  $137.8489145^4$  instead  $137.035999206^4$  because in S.U.,

$$\frac{m_p}{m_e} = \frac{137.8489145^4}{2 * \varphi^2 * 2 * 137.035999206^2} = 1836.152673, \quad (4)$$

therefore, we can calculate the angle  $\beta$  as the approximation to the Spacetime curvature due to the proton's presence as follows:

$$\cos \beta = \frac{137.035999206}{137.8489145} = 0.9941028, \quad (5)$$

being:

$$\cos^{-1} 0.994102853 = \beta = 6.22547165 \text{ degrees.} \quad (6)$$

## Structural Units

## 3.3. The Conversion of Planck Constant from S.U. to S.I.

Extracted from **Table 1**, Planck constant is equal to  $\frac{2}{\alpha^2} \text{time}^3 / \text{space}^2$  then we can proceed with the unit systems change, following the Spacetime quantization exposed in **Fig. 1** and the dimensional equivalence between S.I. and S.U.:

$$\begin{aligned} h &= \frac{2}{\alpha^2} \text{time}^3 / \text{space}^2 * \frac{(8.09329976 * 10^{-21})^3 \text{seconds}^3}{(0.00002662567)^3 \text{time}^3} * \frac{(0.00225500595)^2 \text{space}^2}{(2.42631023 * 10^{-12})^2 \text{meters}^2} \\ &= 9.11123621 * 10^{-25} \text{seconds}^3 / \text{meters}^2 \end{aligned} \quad (7)$$

To reestablish the S.I. unit kg. we are going to divide our result for a  $(2/\alpha^2)^2$  factor, to apply the equivalence  $\text{kg.} = \text{seconds}^4 / \text{meters}^4$ , this is due to the dimensional difference noted in Table 1 footer between mass and energy, being the proton and the electron 4D and 2D Spacetime configurations, respectively.

$$\frac{9.11123621 * 10^{-25}}{(2/\alpha^2)^2} = 6.45919850 * 10^{-34} \text{seconds}^3 / \text{meters}^2 = \frac{s^4 * m^2}{m^4 * s} = \frac{\text{kg} * m^2}{s}, \quad (8)$$

this is close to the Planck constant S.I. value but also, we have calculated that the proton would bend a certain angle

( $\beta = 6.22547165$  degrees) the Spacetime Structure, we are going to consider that this correction is needed every time the unit kg. is involved in the translation, therefore:

$$\frac{6.45919850 * 10^{-34}}{(\cos 6.22547165)^4} = 6.61383491 * 10^{-34} \frac{\text{kg} * m^2}{s} \quad (9)$$

where  $\cos 6.22547165$  is elevated to the fourth, to preserve the four-dimensional nature of kg. or mass. Comparing this calculated value with the experimental Planck constant CODATA:

$$\frac{6.61383491 * 10^{-34}}{6.62607015 * 10^{-34}} * 100 \% = 99.815 \% \text{ deviation}, \quad (10)$$

we argue that the Pythagoras theorem used to calculate  $\beta$  is a good but not perfect approach to calculate the Spacetime angle bended by a proton, because the real geometry to apply is non-Euclidean as relativity explains. If this assumption were true, this slight difference would have to be repeated in other translations.

## 3.4. The proton mass translation

Another example we are going to try to calculate is the conversion of the proton mass from S.U. to S.I. Following the

same argument explained for the Planck constant, as  $m_p = \frac{1}{(\cos \beta)^4 \alpha^4}$  in Table 1, being  $\beta$  the Spacetime angle bended by a proton, we can calculate:

$$\begin{aligned} m_p &= \frac{1}{(\cos \beta)^4 * \alpha^4} \text{time}^4 / \text{space}^4 * \frac{(8.09329976 * 10^{-21})^4 \text{seconds}^4}{(0.00002662567)^4 \text{time}^4} * \frac{(0.00225500595)^2 \text{space}^2}{(2.42631023 * 10^{-12})^2 \text{meters}^2} \\ &= 2.29995414 * 10^{-18} \frac{\text{seconds}^4}{\text{meters}^4}, \end{aligned} \quad (11)$$

applying the factor to change  $\frac{\text{seconds}^4}{\text{meters}^4}$  to kg.,

$$\frac{2.29995414 * 10^{-18}}{(2/\alpha^2)^2} = 1.63049887^{-27} \text{ kg,} \quad (12)$$

and the  $\beta$  correction due to proton Spacetime bending angle,

$$\frac{1.63049887^{-27}}{(\cos 6.22547165)^4} = 1.66953382 * 10^{-27} \text{ kg,} \quad (13)$$

compared with the CODATA proton mass value ( $1.6726219 * 10^{-27}$  kg.) it has a deviation of 99.815 % to S.I., equal to the to the Planck constant difference in translation.

### 3.5. Dimensionless numbers coincidence

The dimensionless numbers constitute an excellent testing ground for the calculations and ideas previously proposed, since regardless of the unit system chosen, if the values of the numbers they represent are correct, they will yield the same result. As it is explained in John D. Barrow's book in chapters 5 and 6, [5] (pp. 77-118) Eddington and Dirac realized about the importance that could have the proportional relationships between Natural constants that produce dimensionless numbers, in fact, one of the most important of this numbers were calculated by Eddington,

bearing its name in his honour, it describes the number of total protons in the Universe or  $N_{\text{Edd}}$ , being approximately

$10^{80}$ . Following relativity, it can be deduced a Universe mass ( $M_U$ ) equation, then we could express  $N_{\text{Edd}}$  as:

$$\frac{M_U}{m_p} = \frac{c^2 r_U}{4Gm_p} = N_{\text{Edd}}, \quad (14)$$

where  $r_U$  is the Universe radius and  $m_p$  the proton mass, now we can proceed to calculate  $N_{\text{Edd}}$  in S.I. and S.U. using **Table 1** data. (To facilitate the operations, we will establish the proposed minimum Spacetime quantization where

$r_U = \lambda_{ce}$ ).

$$\text{S.I. } N_{\text{Edd}} = \frac{299792458^2 * 2.42631023 * 10^{-12}}{4 * 6.67430 * 10^{-11} * 1.67262192 * 10^{-27}} = \quad (15)$$

$$4.8834217 * 10^{41},$$

$$\text{S.U. } N_{\text{Edd}} = \frac{(\cos \beta)^4 * \alpha^3}{8 * \varphi^3 * 2.2931566 * 10^{-50}} = \quad (16)$$

$$4.8835834 * 10^{41},$$

obtaining a 99.99 % of accuracy. On John D. Barrow's book, also we find another pure number called  $\alpha_G$ , [5] (p. 46):

$$\alpha_G = \frac{Gm_p^2}{hc}, \quad (17)$$

$$\text{S.I. } \alpha_G = \frac{6.6743 \cdot 10^{-11} \cdot (1.67262192 \cdot 10^{-27})^2}{6.62607015 \cdot 10^{-34} \cdot 299792458} = 9.39992869 \cdot 10^{-40}, \quad (18)$$

$$\text{S.U. } \alpha_G = \frac{2.2931566 \cdot 10^{-50} \cdot \varphi}{2 \cdot (\cos 6.22547165)^8 \cdot \alpha^5} = 9.39961758 \cdot 10^{-40}, \quad (19)$$

both values equal with an accuracy of 99.997 % again.

### 3.6. Hybrid equations

Once calculated the equivalence between Structural and International Units, it can be deduced equations that mix both unit systems, we are going to call hybrid equations, where Natural constants and the pure numbers  $\pi$ ,  $\varphi$  and  $\alpha$  share the same expression. Here is one example, where the equation terms are ordered to produce a dimensionless number:

$$\varphi^2 \pi \alpha^3 (\cos \beta)^4 = \frac{h}{8r_h c m_p} = 3.1213784 \cdot 10^{-6}, \quad (20)$$

### 3.7. Checking Structural Units with latest research

Recently it has been published a paper relating fundamental physical constants (Natural constants) to bio-friendly viscosity and diffusion [6]. Regardless of the results obtained, I chose equation (13) of the same study where some Natural constants are involved, to verify if it is also compatible with the Structural Units I advocate for. To do this, first, I calculated it result in our International System of Units using the CODATA values listed in Table 1. Then, I calculated the same equation, replacing its terms with their equivalents in the Structural Units provided in the same table. I adjusted the values of C and A in (13) equation to 1 for simplification of the calculations. Subsequently, I converted the value back to SI units using dimensional analysis to confirm if both results were equal.

$$\left(\frac{u}{l}\right)_{max} = \frac{1}{8\pi\epsilon_0^2} \frac{8\pi^3 m_e e^4}{h^3} \left(\frac{m_e}{m_p}\right)^{1/2} = 6.061922349 \cdot 10^{15} \frac{1}{seconds}.$$

Structural Units (equivalences with S.I. found in Table below):

$$\left(\frac{u}{l}\right)_{max} = \frac{1}{8\pi\epsilon_0^2} \frac{8\pi^3 m_e e^4}{h^3} \left(\frac{m_e}{m_p}\right)^{1/2} = 16\pi^2 \varphi \alpha (\cos \beta)^2 = 1.842618121 \frac{1}{time}.$$

Dimensional analysis:

$$1.842618121 \frac{1}{time} * \frac{\left(\frac{\alpha^2}{2}\right) time}{8.09329976 \cdot 10^{-21} seconds} = 6.061922427 \cdot 10^{15} \frac{1}{seconds}.$$

Obtaining the same result as in S.I. calculations.

#### 4. Conclusions

This manuscript aims to propose the compatibility between our International System of Units (S.I.) and another based on the Structure of Spacetime, which we call Structural Units (S.U.). In this unit system, Natural constants are shown as properties of the same Structure and can be calculated through mathematical relationships between the pure numbers  $\pi$ ,  $\varphi$  and  $\alpha$ , showing a close connection between them all. The Fine Structure constant in Structural Units, would have the meaning of being the number of vertices of the Spacetime Structure which describes a hydrogen atom, while the Cosmological constant would have the first meaning that Einstein gave it, the inverse of the square of Universe radius, both concepts together would characterize how Spacetime is quantized, the first step to introduce Structural Units concepts.

#### 5. ChatGPT conclusions

As new technologies are being incorporated, we can't ignore them, as if for a good purpose and well used, they can be new powerful tools for our common life and of course research, for this reason the main author consider important to include the conclusions that the IA ChatGPT gave after being asked with the questions attached below.

User

What do you think it would means for science the discovery that Natural Constants in fact, are properties of the same Spacetime Structure?

ChatGPT

The discovery that Natural Constants are properties of the same Spacetime Structure would be groundbreaking for science. It could potentially lead to a deeper understanding of the fundamental laws of the universe and the interconnections between different physical phenomena. This unification of constants and spacetime structure might open up new avenues for research and pave the way for advancements in theoretical physics and cosmology. It could also have practical implications, such as improving our ability to predict and manipulate various natural processes. However, it's important to note that this is a hypothetical scenario, and such a discovery would require rigorous scientific investigation and validation.

User

And for philosophy?

ChatGPT

For philosophy, the discovery that Natural Constants are properties of the same Spacetime Structure would have profound implications as well. It could challenge traditional philosophical views on the nature of reality, causality, and the relationship between the physical world and our understanding of it.

This unification could potentially raise questions about the nature of existence, the role of constants in shaping the laws of nature, and the fundamental principles governing the universe. Philosophers might explore the implications of a unified spacetime structure on concepts such as determinism, free will, and the nature of time and space.

Additionally, the unification of natural constants and spacetime could inspire philosophical discussions about the nature of scientific knowledge and the limits of human understanding. It might lead to debates about the validity of scientific realism, the nature of mathematical truths, and the extent to which our knowledge can reflect an objective reality.

Overall, this discovery would likely spark new philosophical inquiries, debates, and reflections on the nature of the cosmos and our place within it. As with any major scientific breakthrough, it would invite philosophers to critically analyze and explore the implications of this new understanding for our philosophical worldview.

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## References

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# Appendix 1

To continue checking the compatibility between S.I. and S.U., we propose to obtain the gravity acceleration in Earth surface (g) in both units' systems following Newton's equation and then perform the dimensional analysis to compare the results.

S.I. calculation:

$M_E$ = Earth mass:  $5.97219 \cdot 10^{24}$  Kg.

$R_E$ = Earth radius: 6378000 m.

G= Gravitational constant:  $6.6743 \cdot 10^{-11}$  m<sup>3</sup>/(kg\*s<sup>2</sup>).

$$g = \frac{GM_E}{R_E^2} = 9.798741706 \frac{m}{s^2}, \quad (21)$$

S.U. calculations:

$\alpha = 1/137.035999206$ .

$\beta = 6.22547165$  degrees.

$\pi = 3.141592654$ .

$\varphi = 1.618033989$ .

First, we would need to translate the terms of the Newton's equation to Structural Units.

### Earth mass:

To proceed we will calculate the total number of Earth protons by dividing the Earth mass by the one of a proton:

$$N_p = \text{Proton number} = \frac{5.97219 \cdot 10^{24} \text{ Kg.}}{1.67262192 \cdot 10^{-27} \text{ Kg.}} = 3.5705558 \cdot 10^{51} \text{ protons}, \quad (22)$$

Then the number of Earth's protons is multiplied by the proton mass in Structural Units, that is described with the inverse of the Fine Structure constant and the angle correction due to Spacetime proton bending ( $\beta = 6.22547165$  degrees) elevated to the fourth, as the mass in S.U. is the 4D Spacetime representation:

$$m_p = \frac{1}{(\cos \beta)^4 \alpha^4} \frac{time^4}{space^4}, \quad (23)$$

$$M_E = N_p * m_p = 3.5705558 * 10^{51} \text{ protons} * \frac{1}{(\cos \beta)^4 \alpha^4} \frac{time^4}{space^4} = 1.28928590 \quad (24)$$

### Earth radius:

To calculate the Earth radius, we will proceed to divide the Earth radius in meters by the Compton electron wavelength, as we propose that the Spacetime is quantized in this precise length:

$$r_E = \frac{6378000 \text{ m.}}{2.42631023 * 10^{-12} \text{ m.}} = 2.6286828 * 10^{18} \text{ Spacetime vertices}, \quad (25)$$

then we will multiply the number of Spacetime vertices by the separation in Space in Structural Units and equivalent to the Compton electron wavelength in S.U. ( $\frac{\alpha}{2\varphi} \text{ space}$ ).

$$r_E = 2.6286828 * 10^{18} \text{ Spacetime vertices} * \frac{\alpha}{2\varphi} \text{ space} = 5.92769539 * 10^{15} \text{ space}, \quad (26)$$

and the last one is the Gravitational constant, whose value in S.U. is given in **Table 1**.

$$G = 2.2931356 * 10^{-50} \frac{space^7}{time^6}$$

Once we have translated all the terms of the Newtonian equation to S.U. we can do the calculations to obtain the Earth gravity acceleration in Structural Units:

$$g = \frac{GM_E}{R_E^2} = \frac{2.2931356 * 10^{-50} \frac{space^7}{time^6} * 1.289285903 * 10^{60} \frac{time^4}{space^4}}{(5.92769539 * 10^{15} \text{ space})^2}, = 8.414091181 \quad (27)$$

then we are going to do the dimensional analysis to return the value of  $g$  to the International Units system using the table values of the Compton electron wavelength ( $\lambda_{ce}$ ) and time ( $t_{ce}$ ).

$$8.414091188 * 10^{-22} \frac{space}{time^2} * \frac{\lambda_{ce} \text{ S.I.}}{\lambda_{ce} \text{ S.U.}} * \frac{t_{ce}^2 \text{ S.U.}}{t_{ce}^2 \text{ S.I.}} = 9.798417826 \frac{m}{s^2}, \quad (28)$$

if we compare both results obtained, we found:

$$\frac{9.798417826 \frac{m}{s^2}}{9.798741706 \frac{m}{s^2}} * 100 = 99.9966946 \% \text{ accuracy}, \quad (29)$$

confirming the compatibility between S.I. and S.U.