

# MATHEMATICAL TRICKS OF TODAY. PHYSICAL TRUTHS OF TOMORROW: THE SYMMETRY, THE QUEEN OF THE PHYSICS.

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ABSTRACT. The beginning of the mathematical physics goes back to the investigations, principally, of Newton and Leibniz. With the development of the differential and integral calculus, the physics turned into an exact science. Newton, the excellent physicist of the whole history, could apply this calculation newly developed; to obtain the props of the kinematics and the clarification of the planetary movements with the law of the universal gravitation. Name all the physicists and mathematicians who from Newton have contributed of notable form to the advance of both disciplines, this one out of the area of this essay. But the names like Legendre, Gauss, Abel, Galois and a long list. Up to our days with: Schrödinger, Planck, Einstein, De Broglie, Lorentz, Feynman, Higgs, Nin Yang, Robert Mills, Edward Witten,...

All of them have had to use or invent new mathematical tools that have contributed to both disciplines. Sometimes the direction of mathematics to physics and vice versa. This essay will examine the mathematical concept of symmetry and its fundamental importance both current and in the classical physics. This small study on the symmetry will be relations with the existence of dimensional constants as Planck's constant, the speed of light, gravitational constant, etc. Likewise the symmetry, as already demonstrated Emmy Noether, expresses that any differentiable symmetry of a physical system, has its corresponding conservation law. Finally we will establish profound relations of symmetries with dimensionless constants or pure numbers.

These symmetries will come from the hand of groups of Lie and especially the possibility of connection of the order of the Monster group with the laws of physics. We will devote a small section to the partition function, obtained with imaginary parts non trivial zeros Riemman zeta function. Some of the mathematical tricks, of this essay, perhaps may be a day truths of the physical sciences.

I thank God for showing me a tiny part of the infinite beauty of his creation. Creator of all things. And his son Jesus Christ, our Savior.

## 1. THE ROLE OF SYMMETRIES IN CURRENT PHYSICS

The development of the mathematical basis of the current standard model of particles, is based on intensive use of the symmetries of certain lie groups,  $SU(n)$ ; local gauge symmetry and supersymmetry (So far, no experimental confirmation). We have several very successful examples: the unification of the weak and the electromagnetic force by the groups  $SU(2) \cdot U(1)_Y$  to  $U(1)_{em}$

Subsequently, developed the theory of the great unification of the strong force with electro-weak force, using the groups  $SU(3) \cdot SU(2) \cdot U(1) \equiv SU(5)$

But not alone, there are these symmetries of groups. There are also symmetries of equivalence and are equally remarkable. Examples : Vacuum , being neutral to the electric charges ; however in the set of elementary particles of the standard model ( Higgs vacuum limit ) the sum of the electric charges of the six leptons is equal and opposite to the sum of the electric charges of the quarks 18 , counting multiplicity 3 color charge .Another symmetry of equivalence is that the amount of leptons equals that of quarks. this amount, being the permutations of dimension three; is in turn the first perfect number  $3!=6=\sigma(6)$ . Another symmetry of equivalence exists between the sum of the six leptons, more six quarks; and twelve bosons of exchange of the fields associated with the fermions: eight gluons, 3 bosons (W, Z and Photon) and a graviton.

Another very important symmetry equivalence is between five spines and five types of existing electric charge ( If the great unification theory is assumed , SU (5) )

The reason that the symmetries are the foundations of the current physics ( quantum mechanics , models of unification , superstrings , etc ) , is based precisely on being an ideal tool that unifies the different types of particles and associated fields. In fact, symmetry implies indistinguishability , exchange rotation of a particle in another , its transformation . All within a certain energy level.

If you count the three states of color, are to the limit of the value of the Higgs vacuum, twenty-four fermions, and twelve bosons (8 gluons , one W, one Z and one photon). To add the Higgs boson, and an axion, total, are twenty-six elementary particles at the maximum of the value of the Higgs vacuum threshold.

Here is two physical mathematical tricks that leave no doubt of the deep connection between five exceptional simple Lie groups ; the dimension of the Monster group , and the elementary particles of the standard model , to the limit value of the Higgs vacuum.

$$[Dim_C(E8) \cdot Dim_C(E7) \cdot Dim_C(E6) \cdot Dim_C(F4) \cdot Dim_C(G2)/\sqrt[4]{2}(V_h/m_e)] + (\ln(m_\tau/m_\mu) - \cos^{-1}(2\pi/15)) = (m_\tau/m_e) - (m_\mu/m_e)$$

$m_\tau$  = tau mass,  $m_\mu$  = muon mass,  $m_e$  = electron mass,  $V_h$  = Value Higgs vacuum

$$Dim(E8) = 248, Dim(E7) = 133, Dim(E6) = 78, Dim(F4) = 52, Dim(G2) = 14$$

Dimension Monster group: 196883. (6 quarks)3c = 18q, 18q + 6l = 24 fermions; 8g + 1W + 1Z + 1photon + 1graviton = 12 bosons.  $24^2 + 12^2 = 6!$

$$2 \cdot (24^2 + 12^2) / \alpha(0) - \sqrt{2 \cdot (24^2 + 12^2) / \alpha(0)} - \varphi^2 - 2 = 196883.0003 ; \alpha(0) = (137.035999173)^{-1} ; \varphi = \frac{1+\sqrt{5}}{2}$$

Order Monster group:  $O_r(M) = 2^{46} \cdot 3^{20} \cdot 5^9 \cdot 7^6 \cdot 11^2 \cdot 13^3 \cdot 17 \cdot 19 \cdot 23 \cdot 29 \cdot 31 \cdot 41 \cdot 47 \cdot 59 \cdot 71$

$$\prod_{p/O_r(M)} p = 2 \cdot 3 \cdot 5 \cdot 7 \cdot 11 \cdot 13 \cdot 17 \cdot 19 \cdot 23 \cdot 29 \cdot 31 \cdot 41 \cdot 47 \cdot 59 \cdot 71$$

$$\left\{ \left[ \prod_{p/O_r(M)} p \right] / \sqrt{26 \cdot 196883} \cdot \left( \text{Dim}_C(E8) \cdot \text{Dim}_C(E7) \cdot \text{Dim}_C(E6) \cdot \text{Dim}_C(F4) \cdot \text{Dim}_C(G2) \right) \right\} + \left( \sqrt{-\ln \ln \ln \ln \ln(O_r(M)) \cdot 196883} \right)^{-1} = 2\pi/\alpha(0)$$

Color charges, electromagnetism, and electroweak bosons force charges. Colored torus genus-six.  $N_c(g) = \frac{7+\sqrt{1+48g}}{2}$  ;  $N_c(6) = 12 = 8 \text{ gluons} + 3 \text{ Bosons } (W, Z, \gamma) + 1 \text{ graviton}$

Number of charges, electromagnetism, gravitation and strong force plus five spins.  $SU(4)$ . Colored torus genus-eleven.  $N_c(11) = 15 = SU(4) = 3c \cdot 1_{em} \cdot 1_G \cdot 5s$

## 2. SYMMETRIES AND DIMENSIONAL CONSTANTS OF PHYSICS.

Everyone is familiar with using the dimensional constants such as the speed of light in vacuum, the constant of gravitation, Planck's constant, elementary electric charge, etc. But the most important question about these constants have not yet been answered satisfactorily by physics. Because there are these constants and what is its physical mathematical basis?. Our way of thinking only found the explanation most simple possible: functional symmetry. By functional symmetry, you will understand the invariance of a certain dimensional quantity expressible using a function math that describes a physical law; and in which variables can be space or length, time and mass. To be more graphics. The law of universal gravitation defined by function  $F = G_N \cdot m_1 \cdot m_2 / d^2$  ; represents an invariant (Gn), since that, regardless of the variables, in this case the masses and distance; always you will get the universal gravitation constant.  $F \cdot d^2 / m_1 \cdot m_2 = G_N$

But we still unfinished to answer the question. Only if allowed a quantified minimum mass units, length and time is possible to establish the invariance of dimensional constants of physics. An arbitrary infinite cascade of continuous values leads to the unwanted infinities. And by pure experience knows that when appear the infinities in physics theory, then something is wrong.

## 3. MATHEMATICAL TRICKS WITH THE MONSTER GROUP AND ITS POSSIBLE CONNECTIONS WITH THE PHYSICS OF THE MICROCOSM.

It is well known that the dimension of the Monster group, the number 196883, appears in the theory of Superstrings in twenty-six dimensions. Without deepening, the following mathematical tricks seem to indicate a deep connection between symmetries inherent in the Monster group and certain dimensionless invariants. By its accuracy, simplicity and repetition, you could infer that there is a very beautiful physical mathematical theory; in which symmetries are the foundation.

- (1) First Trick : ratio mass of the Higgs boson/electron mass.  $m_h/m_e = 196883/2^2 + 196883 = 246103.75 \rightarrow m_h = 125.7587 \text{ GeV}$

- (2) Second Trick : ratio vacuum Higgs/electron mass.  $\sqrt[4]{\alpha^{-1}(0)/4\pi}-1 = \sqrt[4]{137.035999173/4\pi}-1$  ;  $2 \cdot 196883 / \left( \sqrt[4]{\alpha^{-1}(0)/4\pi} - 1 \right) = V_h/m_e = 481839.2033 \rightarrow V_h = 246.2193162 \text{ GeV}$
- (3) Third Trick: Order Monster group and Hubble constant:  $O_r(M) = 2^{46} \cdot 3^{20} \cdot 5^9 \cdot 7^6 \cdot 11^2 \cdot 13^3 \cdot 17 \cdot 19 \cdot 23 \cdot 29 \cdot 31 \cdot 41 \cdot 47 \cdot 59 \cdot 71$  ;  $t_{PK} = \sqrt{\frac{\hbar \cdot G_N}{c^5}} : (O_r(M) \cdot 10^7 \cdot t_{PK})^{-1} = H_0 = (4.356397592 \cdot 10^{17} s)^{-1} \equiv 13814 \cdot 10^6 \text{ years}$
- (4) Fourth Trick: The order of the Monster group and the equation of the main constants of quantum mechanics.  $\frac{e_{\pm}^2 \cdot c^2}{\hbar \cdot G_N \cdot m_{PK} \cdot H_0} = \frac{O_r(M) \cdot \ln \ln(\alpha^{-1}(0))}{196883}$
- (5) Five Trick: Black hole entropy, the Higgs vacuum: dimension Monster group.  $4\pi = \ln(196883) - e^{-(4\pi - \pi/5\sqrt{2})} + \ln(\alpha^{-1}(0)) / \ln(V_h/m_e)$
- (6) Six trick: Permutations of twenty-six dimensions. electromagnetic fine structure constant and dimension monster group. Ratio Planck mass, mass of the electron.
- $$(m_{PK}/m_e) = \left( \left( 1 + \frac{\alpha^2(0)}{4\pi^2 \cdot \sin \theta_W} \right) \cdot 26! \cdot \sqrt{\alpha^{-1}(0) - 1} \right) / 196883$$
- (7) Seven trick:  $(Dim^{-2}(E8) + Dim^{-2}(E7) + Dim^{-2}(E6) + Dim^{-2}(F4) + Dim^{-2}(G2))^{-1} - (\pi^2/2 - 1) = \ln^2(V_h/m_e)$

#### 4. SYMMETRIES, DIMENSIONLESS CONSTANTS AND QUANTIZATION OF GRAVITY.

Quantization of gravity and its union with quantum mechanics is the Achilles heel of current physics. At the moment there are partial results applying something of quantum mechanics. The fundamental result is Hawking radiation of black holes. This same result was, subsequently, obtained using superstring theory. On the other hand; alternative models such as the Supergravity, could not be confirmed all orders of Feynman diagrams, by what still is not known if they are renormalizable.

Very little attention, or none; It has had with a dimensionless quantization that should meet both gravitation and quantum mechanics. An example: the value of the energy density of the vacuum. Be the quantum harmonic oscillator. As it is well known your energy levels are given by:  $E_n = \hbar \cdot \omega \left( n + \frac{1}{2} \right)$

We can manipulate the previous equation, to obtain a pure number. We will establish three additional conditions: 1) The pure number must be less than unity. (2) Must include the summation of all the possible particle-antiparticle pairs. (3) There must be an asymmetry

due to parity. With these conditions is obtained the following equation:  $2 \cdot \sum_{n=0}^{\infty} \left( \frac{2 \cdot (-1)^n}{2n+1} \right) =$

$2 \cdot \sum_{n=0}^{\infty} \frac{(-1)^n \cdot \hbar \cdot \omega}{E_n} = \pi$ . Now, since all forms of energy experiences gravitational forces and

assuming that we are trying to the original primordial vacuum. The equation that we have obtained has to be exactly the inverse of the density of matter, namely:  $\Omega_m = 1/\pi = 0.31809 \dots$ . So the energy density of the vacuum would be:  $\Omega_\Lambda = 1 - \frac{1}{\pi} = 0.6816901 \dots$

**4.1. Dimensionless Quantization Of Gravity. Matter Density and energy vacuum density.** General relativity of Einstein measures the curvature or deflection of photons produced by the mass of an object with the following equation:

$$\theta_C = 4 \cdot m \cdot G_N / c^2 \cdot d \quad \text{This angle } \theta_C \text{ of deflection depending on the distance } d$$

If the geometry of space-time that determines the curvature thereof; and besides this curvature depends on the infinite sum of quantum oscillators as dimensionless ratios of circular curvatures; then a natural choice for these circular curvatures is to consider the following series:

$\sum_{n=0}^{\infty} \frac{4m \cdot G_N \cdot c^2 \cdot (-1)^n}{m \cdot c^2 (d_n/d_0) \cdot G_N}$ ;  $d_n/d_0 = 2n+1$ ; And this choice has to be adequate, since on the one hand you have all the spins, because:  $2n+1 = 2(\frac{3}{2} + \frac{1}{2} + 0)n+1$ ; As can be seen, the spin 2 graviton as decay, through gravitino, a fermion a scalar boson and a photon. Where n is the number of particles. The alternate sign positive negative, determined by  $(-1)^n$  be related to parity and baryogenesis by the following rule: For n even the vacuum decays into particle antiparticle pairs symmetrically; ie:  $2n_+ + 1 \rightarrow m_{3/2} + \bar{m}_{3/2} + \dots + f + \bar{f} + \dots + \gamma + \gamma$ . For n odd vacuum decays into particle-antiparticle pairs form antisymmetric; ie:  $2n_- + 1 \rightarrow m_{3/2} + \bar{m}_{3/2} + \dots + f + \bar{f} + m_{3/2} + f + \dots + \gamma$

$\Omega_m = 1 / \left( \sum_{n=0}^{\infty} \frac{4 \cdot (-1)^n}{2n+1} \right) = 1/4(\frac{\pi}{4}) = 1/\pi = 0.3183098862$ . This result allows us to obtain both the vacuum energy density; as well as the mater density , by:

$$\Omega_\Lambda = 1 - \frac{1}{\pi} = 0.6816901138$$

**4.2. Gravitational waves amplitudes: GR.** Amplitudes of gravitational waves, according to the theory of General Relativity are given by:  $h(R, t) = \frac{4 \cdot G_N^2 \cdot m_1 m_2}{z \cdot c^4 \cdot r} \cos[2\pi f(z - ct)/c]$

Where f is the frequency, r is the (constant) distance and z is the distance from source to observer. For the quantization of the sum of all the amplitudes of the gravitational waves, z, r will be equal. As the angle equal to  $2\pi i$ , or zero.

In this way, with the modifications dimensionless curvatures, this time due to quantum dimensionless spherical curvatures; must be the sum of the quantum amplitudes, we have:

$$\sum_{n=0}^{\infty} \frac{4 \cdot G_N^2 \cdot m_1 m_2 \cdot c^4 \cdot (-1)^{2n}}{G_N^2 \cdot c^4 \cdot (r_n/r_0)^2 \cdot m_1 m_2} = 4 \cdot \sum_{n=0}^{\infty} \left( \frac{(-1)^n}{2n+1} \right)^2 = \frac{\pi^2}{2} \quad (1)$$

## 5. SYMMETRY, OR EQUALITY, OF THE RATE OF CHANGE OF ACCELERATION AND SPEED AT THE BEGINNING OF THE UNIVERSE. ITS GRAVITATIONAL ORIGIN.

### 5.1. Conditions to be Fulfilled by the Inflation Factor.

- (1) First condition: inflation should not distinguish between acceleration and speed; or what is the same: acceleration = velocity in the form of differential equation
- (2) The dimensionless factor of inflation must be derived from the dimensionless quantization of gravity. Dimensionless quantum curvatures
- (3) The inflation factor is, as in special relativity, a twist in a hyperbolic space.
- (4) The inflationary vacuum corresponds to a hyperbolic de Sitter space.

*Inflation Factor: Acceleration = Velocity in the Form of Differential Equation.*  $\frac{dx^2}{dt^2} = \frac{dx}{dt}$  (2). This equation has the solution:  $dt = \ln x + C \rightarrow e^t = xe^C$ ,  $C = 0$ ;  $e^t = x$  (3)

*Factor inflation: quantum dimensionless curvatures.* 
$$\sum_{n=0}^{\infty} \frac{4 \cdot G_N^2 \cdot m_1 m_2 \cdot c^4 \cdot (-1)^{2n}}{G_N^2 \cdot c^4 \cdot (r_n/r_0)^2 \cdot m_1 m_2} = 4 \cdot \sum_{n=0}^{\infty} \left( \frac{(-1)^n}{2n+1} \right)^2 =$$

$$\frac{\pi^2}{2} \cdot \frac{dx}{x} = t \cdot dt \leftrightarrow x = e^{t^2/2}; t^2/2 = 4 \cdot \sum_{n=0}^{\infty} \left( \frac{(-1)^n}{2n+1} \right)^2 = \frac{\pi^2}{2}$$

**Final Inflation Factor : Relativistic Twist on a Hyperbolic Space.** *Substituting the solution of equation (2); the results of (1); and making a twist on a relativistic hyperbolic space. That is: 1)  $e^{\pi^2/2} = x = \phi$  2)  $R_\gamma \cdot (y/c) = t_0$ ;  $R_\gamma \cdot t_0 \cdot (\cosh \phi + \sinh \phi)$ ;  $R_\gamma = \sqrt{\alpha^{-1}(0)/4\pi}$ .  $R_\gamma$  is for the expansion of the cone of light. Quantum dimensionless length associated with the fine structure constant (Photons ).*

$$4\pi \cdot (\pi / \sin^2(\pi^2/2))^2 - \left( \frac{m_\tau}{m_e} - \frac{m_\mu}{m_e} - \frac{m_e}{m_e} \right)^{-1} - e^{(-\ln 196883 - \ln(\sqrt{2\pi}))} = \alpha^{-1}(0)$$

Making the initial time of inflation, the Planck time; we finally obtain a value for the Hubble constant:  $t_0 = t_{PK}$ ;  $t_{PK} \cdot R_\gamma \cdot \left[ \cosh(e^{\pi^2/2}) + \sinh(e^{\pi^2/2}) \right] = H_0^{-1} = 5.391464909495279 \cdot 10^{-44} s \cdot 8.0457241354872 \cdot 10^{60} = 4.3378239347958496 \cdot 10^{17} s$

$$8.0457241354872 \cdot 10^{60} \simeq 10^7 \cdot O_r(M) = (2^{46} \cdot 3^{20} \cdot 5^9 \cdot 7^6 \cdot 11^2 \cdot 13^3 \cdot 17 \cdot 19 \cdot 23 \cdot 29 \cdot 31 \cdot 41 \cdot 47 \cdot 59 \cdot 71) \cdot 10^7$$

$$\left\{ \left[ \cosh(e^{\pi^2/2}) + \sinh(e^{\pi^2/2}) \right] \cdot \left( \frac{21}{13} \right)^2 \right\} / \left( m_{PK} / \sqrt{\pm e^2 / 16\pi G_N} \right) \Bigg\} - e^{(\cos \theta_{s=2} \cdot e^{\pi^2/2})} \approx O_r(M)$$

$$\cos \theta_{s=2} = \cos(\text{spin } 2)$$

The final conclusion of this section , is clear: the universe is much younger than is currently thought . The Hubble constant is actually the value of the energy of the vacuum . Since that being a frequency ; have, that the value of the energy of the vacuum meets the equation :  $2 \cdot \ln(E_{PK}/E_v) = \ln \left( R_\gamma \cdot \left[ \cosh(e^{\pi^2/2}) + \sinh(e^{\pi^2/2}) \right] \right) \rightarrow 2E_v = \text{Planck Energy} / \sqrt{R_\gamma \cdot [\cosh(e^{\pi^2/2}) + \sinh(e^{\pi^2/2})]} = 4.30404096 \cdot 10^{-3} eV$

The vacuum energy: twenty-four-dimensional lattice, and their vector sum.  $2E_v \approx \left( e^{-\sqrt{\sum_{n=1}^{24} n^2} = 70^2} \right)$ .

$$m_{PK} \cdot c^2 \rightarrow E_v \approx 2.42669 \cdot 10^{-3} eV$$

6. The zeros of the Riemann zeta function: derivation of elementary electric charge, and mass of the electron.

The relativistic invariance of the elementary electric charge. The relativistic invariance of the elementary electric charge, is based on that solely depends on the canonical partition function of the imaginary parts of the non trivial zeros of the Riemann zeta function. And since the imaginary parts of the zeros of the zeta function, are pure and constant numbers; immediately relativistic invariance of electric charge is derived. Being the Planck mass other relativistic invariant, since there can be no higher mass to the Planck mass, this invariance is guaranteed.

Partition function (statistical mechanics). Be considered, the coupling of the electromagnetic field to gravity, as represented by a bath of virtual particles, whose thermodynamic state is in equilibrium and there is no exchange of matter. Being a thermal bath whose temperature is constant, invariant, then its energy is infinite (in principle, ideally). Thermodynamic temperature canonical ensemble system can vary, but the number of particles is constant, invariant. That this theoretical approach, is exactly according to the values of the elementary electric charge, and mass of the electron, suggests that space-time-energy to last the unification scale, would behave like black holes, or even, as we shall see later, with wormholes with throat open. These wormholes, following a hyperbolic de Sitter space can explain the quantum entanglement, and the call action at a distance, or non-locality of quantum mechanics.

This partition function of the canonical ensemble, as is well known, is:

$$Z = \sum_s \exp -\beta E_s ; \text{ where the "inverse temperature", } \beta , \text{ is conventionally defined as } \beta \equiv \frac{1}{k_B T} ; \text{ with } k_B \text{ denoting Boltzmann's constant. Where } E_s , \text{ is the the energy.}$$

Will use for the dimensionless factor;  $\beta E_s$ , the change by the imaginary parts of the nontrivial zeros of the Riemann function  $\zeta(s)$

This change is justified, for the simple reason that the vacuum is neutral with respect to the electric charges, ie the value of the electric charge of the vacuum is zero. These zeros can be expressed by the Riemann function, applying the Kaluza-Klein formulation for electric charges; dependent Planck mass, and as we will show by the partition function of canonical ensemble. Thus the zeros of the vacuum to the electric charge is expressed as:

$$\sum_{n=1}^{\infty} \frac{(-1)^{n-1} m_{Pk}}{n^s \cdot \sqrt{\pm e^2 / 16\pi \cdot G_N}} = 0 ; s = \frac{1}{2} + it_k ; \zeta(s) = 0 \quad (26)$$

Equation (26), and therefore the behavior of the electric field strength with distance, depends on the value of  $s$ , because of (26) is obtained, using the conjugate of  $s$ :  $\frac{(-1)^{n-1}m_{Pk}}{n^s \cdot n^{\bar{s}-\frac{1}{2}} \cdot (\pm e^2/16\pi \cdot G_N)} = \frac{m_{Pk}}{\pm \sqrt{(\pm e)^2/16\pi \cdot G_N}}$

Therefore, by using the canonical partition ensemble, making the substitution of the imaginary parts of the nontrivial zeros of the Riemann function, and taking into account the deviation of the electric charge, the equation is obtained relating the gravity with electric charge and the nontrivial zeros of the Riemann function. The calculation of the partition function has been performed with wolfram math program, version 9. For this calculation we used the first 2000 nontrivial zeros, value more than enough for the accuracy required. Although using the first six zeros, would also be sufficient. The code of this calculation is as follows:

$$\frac{1}{\sum_{n=1}^{2000} e^{-N[\Im(\rho_n), 15]}} = \frac{1}{\sum_{n=1}^{2000} \exp -(N [Im [ZetaZero[n]], 15])} = 1374617.45454188 ; \text{ Given that for values greater than 2000; } \exp -Im(\rho_n) \approx 0 ; \text{ You can write the equality as (by changing rho to s) as: } \left( \sum_{s_n}^{\infty} \exp -Im(s_n) \right)^{-1} \approx 1374617.45454188 \quad (27)$$

Finally, the equation that unifies the gravitational and electromagnetic field, by elementary electric charge, is:  $m_{Pk} = \left( \sum_{s_n}^{\infty} \exp -Im(s_n) \right)^{-1} \cdot \sqrt{(\pm e \cdot \sigma(q))^2 / G_N} = 2.176529059 \cdot 10^{-8} \text{ Kg} \quad (28) ;$  The value obtained for the Planck mass is in excellent agreement. The very slight difference, surely is that the constant of gravitation has a very high uncertainty about the other universal constants. Thus, making a speculative exercise, we can give a value for the gravitational constant:

$$G_N = \left[ \left( \sum_{s_n}^{\infty} \exp -Im(s_n) \right)^{-2} \cdot (\pm e \cdot \sigma(q))^2 \right] / m_{Pk}^2 = 6.674841516 \cdot 10^{-11} \text{ N} \cdot \text{m}^2 / \text{Kg}^2 \quad (29)$$

Derivation of the partition function of canonical ensemble by the special and unique properties of the Riemann zeta function, for complex values  $s$ , with real part  $1/2$ . The function  $x^r$ , to a value of  $1/2$ , in the set of real numbers, is the only one that has the property, for which its derivative is  $1/2$  the inverse of this function, that is:  $d(x^{1/2}) = \frac{1}{2 \cdot x^{1/2}}$  This function has the same property, for complex values of the exponent, such that:  $r = s = \frac{1}{2} + it ; dx^{\bar{s}}/\bar{s} = 1/x^s ; dx^s/s = 1/x^{\bar{s}} \quad (31)$

Commutation properties

From equation (31), the following four identities are derived: **1)**  $x^s dx^{\bar{s}} = \bar{s} ;$  **2)**  $x^{\bar{s}} dx^s = s ;$  **3)**  $\frac{dx^{\bar{s}}}{\bar{s}} - \frac{1}{x^s} = 0 ;$  **4)**  $\frac{dx^s}{s} - \frac{1}{x^{\bar{s}}} = 0$

Of the identities (1) and (2) are derived, by commutation of the conjugates of the exponents,  $s, \bar{s}$ ; the following identities:



$$\mathbf{1)} \ x^s dx^{\bar{s}} + x^{\bar{s}} dx^s = 1 \ \mathbf{2)} \ x^s dx^{\bar{s}} - x^{\bar{s}} dx^s = -2it \ \mathbf{3)} \ x^{\bar{s}} dx^s - x^s dx^{\bar{s}} = 2it \ (32)$$

From the identities (31) and (32) immediately derives the following corollary:

**Corollary 1.** *Only for complex values,  $s$ , with real part  $1/2$ , the three conmutation properties, expressed in differential equations are satisfied.*

Conditions that must meet the equation derived from the conmutators (32), and the identities (31).

- (1) Must include the invariance of the sum of the quantized electric charges. This sum is equivalent to the difference between the standard deviation of the electric charges with zero arithmetic mean, and the standard deviation, which has been developed previously, that is:  $\sigma^2(q, \mu(q) = 0) = \sum_q q^2 = \frac{31}{9} \ (33) \ ; \ \sigma^2(q, \mu(q) = 0) - \sigma_0^2(q) =$

$$1 = \sum_q q \ (34)$$

- (2) The neutrality of the vacuum, in relation to the electric charges, or zero value of the electric charges of the vacuum, is the sum of infinite "oscillators", whose function is the Riemann zeta function applied to the ratio of Planck mass and the mass derived, from elementary electric charge and gravitational constant; fulfilling the equation obtained by Kaluza-Klein, to unify electromagnetism and gravity, adding a fifth dimension compactified on a circle.  $\sum_{n=1}^{\infty} \frac{(-1)^{n-1} m_{pk} \sqrt{G_N}}{\pm e \cdot n^s} = \left( \frac{m_{pk} \sqrt{G_N}}{\pm e} \right) \cdot \left( \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n^s} \right) = 0 \ (35)$
- (3) The complex value  $s$ , can only be with real part  $1/2$ , since only for  $s = 1/2 + it$ , it is possible to derive from the conmutators, both the invariance of the sum of the electric charges and the function of canonical ensemble, as will be demonstrated below.
- (4) The value of the energy is the lowest possible, with integer values. [See endnotes for full details of calculation](#)

**Electron mass:**  $m_e = \pi^4 (\pm e)^2 \left[ \sum_n^{\infty} \exp(-t_n) \right]^2 / m_{Pk} \cdot G_N = 9.10938291 \cdot 10^{-31} Kg \ ; \ G_N = 6.674841516 \cdot 10^{-11} N \cdot m^2 / Kg^2 \ ; \ m_{Pk} = \sqrt{\frac{\hbar c}{6.674841516 \cdot 10^{-11}}}$

## 7. CONCLUSIONS.

In this assay has been well substantiated the crucial role played by symmetries in physics; and specifically in quantum mechanics. Similarly, its extraordinarily rich importance in the development of a theory of unification. As we have shown: there are some mathematical tricks that prove beyond doubt the enormous power of mathematics and its complete symbiosis with mathematical physics. The separation between mathematics and physics is becoming more dim and blurred.

## Endnotes

With these four conditions, we have: 1)  $E^s dx^{\bar{s}} + E^{\bar{s}} dx^s = 1 = \sigma^2(q, \mu(q) = 0) - \sigma_0^2(q) = \sum_q q$ ;  $E = \text{energy}$

2)  $E^s dE^{\bar{s}} = \bar{s}$ ;  $E^{\bar{s}} dE^s = s$ ; 3)  $[(E^s dE^{\bar{s}})E - E/2]/Ei = -t_n$

$$4) \sum_{n=1}^{\infty} \frac{(-1)^{n-1} m_{pk} \sqrt{G_N}}{\pm e \cdot n^s} = 0 = \sum_{E=1}^{\infty} \frac{dE^{\bar{s}}}{\bar{s}} - \frac{1}{E^s} = \sum_{E=1}^{\infty} \frac{dE^s}{s} - \frac{1}{E^{\bar{s}}}$$

Derivation of partition function of canonical ensemble: ratio, elementary electric charge and kalulaza-Klein equation.

The introduction of a fifth coordinate; allowed obtaining Theodor Kaluza, the quantization of electric charge; unifying Maxwell's equations (electromagnetism) and the RG Albert Einstein's equations. The derivation of a much higher mass, that the mass of electron, and other problems of the theory, led to dismiss it as a realistic theory, according to experimental physical data.

As we will demonstrate shortly, this theory lacked renormalization by canonical partition function of statistical mechanics (thermodynamics), derived from the imaginary parts of the zeros of the Riemann function  $\zeta(s) = 0$ ;  $s = \frac{1}{2} + it_n$

In the framework of the theory we are developing in this work, this fifth dimension corresponds to the three isomorphisms: five electric charges, five spines, five solutions of the energy equation momentum.

As a beginning assumption, assume that a thermodynamically large system is in thermal contact with the environment, with a temperature  $T$ , and both the volume of the system and the number of constituent particles are fixed. This kind of system is called a canonical ensemble. Let us label with  $s = 1, 2, 3, \dots$  the exact states (microstates) that the system can occupy, and denote the total energy of the system when it is in microstate  $s$  as  $E_s$ . Generally, these microstates can be regarded as analogous to discrete quantum states of the system.

$$Z = \sum_s \exp\left(-\frac{E_s}{k_B T}\right)$$

The equation for the elementary electric charge, according to the initial theory of Kaluza (see bibliography) is:  $q_n = m_n \cdot \sqrt{16\pi G_N}$

From equations (31), (32) and (34) with the conditions imposed, the following development is obtained, leading to accurate calculation of the elementary electric charge, as a partition function of the imaginary parts of the nontrivial zeros Riemann's function  $\zeta(s)$ . Partition function exactly equivalent to the canonical partition function of statistical mechanics (thermodynamics).

$$a) E_0/c^2 = m_0 \text{ b) } dm^s/s \cdot m^s = (1/m^s) \cdot (1/m^{\bar{s}}) = 1/m_0, \quad dm^{\bar{s}}/\bar{s} \cdot m^{\bar{s}} = (1/m^s) \cdot (1/m^{\bar{s}}) = 1/m_0$$

$$c) m_0(dm^s/m^s) = s; \quad m_0(dm^{\bar{s}}/m^{\bar{s}}) = \bar{s}; \quad m_0 \equiv \sigma^2(q, \mu(q) = 0) - \sigma_0^2(q) = \sum_q q = 1; \quad d)$$

$$(dm^s/im^s) - 1/2i = t_n$$

$$f) \text{ We make the change } (dm^s/im^s), \text{ by } (dm_1/m_1); \quad g) -(dm_1/m_1) + 1/2i = -t_n; \quad (dm^{\bar{s}}/im^{\bar{s}}) - 1/2i = (dm_2/m_2) - 1/2i = -t_n$$

$$h) -(dm_1/m_1) + 1/2i + (dm_2/m_2) - 1/2i = -t_n - t_n; \quad -(dm_1/m_1) + (dm_2/m_2) = -t_n - t_n$$

$$-(dm_1/m_1) + (dm_2/m_2) = -t_n - t_n \rightarrow (dm_2/m_2) = (d - m_3/m_3) = -(dm_3/m_3) = -(dm_1/m_1)$$

Having two elementary electric charges with signs -, +, because:  $\pm q_n = m_n \cdot \pm \sqrt{16\pi G_N}$ ; Then, the following two differential equations for the real value of the imaginary part of the nontrivials zeros Riemann's function is obtained:

$$i1) -(dm_1/m_1) = -t_n; \quad i2) -(dm_3/m_3) = -t_n; \quad j) \int_{m_5}^{m_4} -(dm_1/m_1) = -t_n; \quad m_4 < m_5; \quad \ln(m_4/m_5) = -t_n$$

$$\int_{m_5}^{m_4} -(dm_3/m_3) = -t_n; \quad m_4 < m_5; \quad \ln(m_4/m_5) = -t_n; \quad (m_4/m_5) = \exp(-t_n)$$

Finally, making the infinite sum nontrivial zeros Riemann's function (with the above approach; 7.2.2, with the first 2000 zeros), the two solutions (negative electric charge and positive), these are obtained, taking into account the standard deviation of the electric charge  $\sigma(q) = 0.8073734276$ :

$$\sigma(q) = 2 \cdot \sqrt{(\sigma_0^2(q))/3 \cdot 5} \quad (\text{five electric charges, three colors, and two sings +, -})$$

$$(35) \sum_n^{\infty} \frac{m_{n-}}{m_0} = \sum_n^{\infty} \exp(-t_n) = \sqrt{(-e \cdot \sigma(q))^2 \cdot G_N / m_{Pk}}; \quad m_{Pk} / \sqrt{(-e \cdot \sigma(q))^2 \cdot G_N} = \left[ \sum_n^{\infty} \exp(-t_n) \right]^{-1}$$

$$(36) \sum_n^{\infty} \frac{m_{n+}}{m_0} = \sum_n^{\infty} \exp(-t_n) = \sqrt{(e \cdot \sigma(q))^2 \cdot G_N / m_{Pk}}; \quad m_{Pk} / \sqrt{(e \cdot \sigma(q))^2 \cdot G_N} = \left[ \sum_n^{\infty} \exp(-t_n) \right]^{-1}$$

Performing the calculation with a value of the gravitational constant, the conjectured by equation (29), it has the value of the electric charge, with excellent accuracy:

$$\left[ \sum_n^{\infty} \exp(-t_n) \right]^{-1} \approx 1374617.45454188 = m_{Pk} / \sqrt{(e \cdot \sigma(q))^2 \cdot G_N} \rightarrow \dots$$

$$\dots \rightarrow \pm e = \sqrt{m_{Pk}^2 \cdot G_N} / \left( 1374617.45454188 \cdot \sigma(q) \right)^2$$

$$\pm e = \sqrt{m_{Pk}^2 \cdot G_N} / \left( 1374617.45454188 \cdot \sigma(q) \right)^2 = 1.602176565 \cdot 10^{-19} \text{ C } \quad (37)$$

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