

# Evidence for Unique Steady-State Flickering Tachyonic Determinist Cyclic Computing Cosmos

F. M. Sanchez

*The observed fine tuning between Physical dimensionless parameters is interpreted as relations between optimal calculation basis of a Deterministic Grandcosmos Computer. The Eddington's Large Number gives a good approximation of the equivalent number of neutrons in the canonical trivial fraction 3/10 of the visible universe critical mass. The Monster Group cardinal order appears in three c-free analysis. The unique cosmic hypothesis implies that differential equations must be replaced by integral ones. Indeed, Holographic relations ties the cosmic Background wavelength to micro-physics ones. The mathematical constants  $\pi$ ,  $e$  and  $\gamma$  enter fine-tuning relations with the Hierarchical numbers 137 and  $2^{127}$ , specifying micro-physics main constants and the gravitational constant  $G$  to ppb precision ( $10^{-9}$ ). The formula simplifies by introducing Atiyah constant, and show a 9D reduction to 3D, confirming Superstring Theory. In particular, this unification Physics-Mathematics excludes the Multiverse hypothesis.*

To Michaelangelo Francis Atiyah

## Introduction: the Hierarchy Principle

It was observed that the physical constants are tightly contrived, but only three dimensionless parameters:  $a$ ,  $p$ , and  $a_G$ , are sufficient to explain the main structures of the world [1]. Two of them are precisely measured: the electric constant  $a \approx 137.035999139(31)$ , measured with 0.23 ppb precision and the proton-electron mass ration  $p \approx 1836.15267245(75)$ , known with 0.41 ppb precision. By contrast, the gravitational coupling constant  $a_G$  was neither well defined nor measured, due to the relatively large imprecision on  $G$  measurement ( $10^{-4}$ ).

This is called 'fine tuning', signaling the existence of a fundamental theory. But, as about 30 dimensionless parameters appear as 'free parameters' in the Particle standard model, a large majority of theoreticians believe rather they are due to chance. Among founder's, only Eddington [2] did not fall in such a fatal regression of science, which leads now to a splitting between Mathematics, Physics and Biology. Through a so-called Anthropic Principle, a majority believe in the Multiverse conundrum, a multiplicity of sterile Universe [1]. *The present article refutes the Multiverse Hypothesis by showing precise fine-tuning between main physical parameters and also ppb ( $10^{-9}$ ) relations with main mathematical constants,  $\pi$ ,  $e$  and  $\gamma$ .* The type of relations confirms the rehabilitation of String Theory due to the Topological Axis [3].

A magic of physics is the energy conservation. Theorists associate it with time uniformity, but a more logical explication is that cosmos is a computer, so Intelligent Life receive a justification: to help the Cosmos computation. This *Inverted Anthropic Principle* answers the first of all questions : why do we ask questions ? We proposed that the parameters are optimal basis in a deterministic Computing Cosmos, and they appear indeed in DNA characteristics [3]. Note that well-known references could be found in this article [3].

The fact that three parameters, out of about 30, are so clearly emerging means that *physics, and more generally science, is hierarchic: one can progress in science without knowing the details of the underlying fundamental theory.* So, when Dalton found whole numbers in chemical reactions, he was prefiguring the atoms. The same for Balmer, spectral lines and wave mechanics. The same for Mandeleiev, atomic masses and nuclear physics. Also when Mandel found whole numbers in Biology, he was prefiguring genetics. In the same manner, this article prefigures *the fundamental theory which must be based on arithmetics, indeed a characteristic of deterministic computation.*

## I. Physical Fine Tuning

## I.I The resolution of the Famous Double Cosmic Fine-Tuning

The most famous fine tuning implies cosmic quantities, but this is awkwardly called the 'Double Large Number Problem' by a majority. In fact it is only a problem for standard *evolutionary* cosmology, while it is a precious hint in steady-state cosmology based on the Perfect (spatial and temporal) Cosmological Principle [3].

This Cosmic Fine-Tuning leads directly to a Gravitational Hydrogen model [3] defining the Universe horizon radius  $R = 2a_G\lambda_e$ , the factor 2 coming from the two atoms in Hydrogen molecule, where  $\lambda_e = \hbar/cm_e$  and with gravitational coupling constant  $a_G = \hbar c/Gm_Hm_p$ , so *the speed c is eliminated*. This is conform with Coherent Cosmology which needs signal celerity far exceeding  $c$ . In standard cosmology this is known as the so-called 'horizon problem', and is at the origin of the awkward inflation hypothesis, claimed to justifies the critical condition, but we have shown [3] that the simple application of the standard Holographic Principle [4] justifies the critical condition tying the observable Universe horizon  $R$  to its mass  $M = Rc^2/2G$ , simply by introducing the wavelength  $d = \hbar/Mc \approx 4 \cdot 10^{-96}$  m of the observable Universe. Indeed the Bekeinstein-Hawking entropy [4] writes:

$$\pi(R/l_p)^2 = 2\pi R/d$$

This breaks the Planck wall by a factor  $l_p/d = R/2l_p \approx 10^{61}$ , interpreted as the ratio of tachyonic speed  $C$  by respect to  $c$ . Moreover *this resolves the vacuum energy  $E_v$  dilemma* since the Universe critical mass  $M = Rc^2/2G$ , is close to  $E_v/C^2$  and enters the following double correlation, where  $\lambda_H = \hbar/cm_H$ , and  $m'_e = m'_e p/H$  is the effective electron mass in Hydrogen atom:

$$R/\lambda_H = \hbar c/Gm_em_p = \sqrt{(M/m'_e)}$$

This is the definitive interpretation of the Double Large Number Fine-tuning. It is a special case of Eddington's statistical critical cosmology, with the 'reference particle' identified with the Electron: this single-electron cosmology uses *the electron indeterminacy, which is the real basis of the Exclusion Principle*. So, while the two pillars of Physics, Relativity and Quantum Theory are unable to conciliate Gravitation and Particle Physics, the third pillar, Statistical Physics, directly makes this connection in cosmology [2].

Recall that, contrary to what is often stated, Quantum Physics do not limits to Micro-physics. Indeed the exclusion principle applies in both solid state physics and in stellar physics. For instance, the exclusion radius of a star containing  $N$  atoms is  $R/N^{1/3}$ , so the formula giving the Hubble radius  $R$ , a very difficult measurement which puzzled a whole century, was already contained in astrophysics textbooks. Eddington dared to apply the exclusion principle to cosmology. Since this contradicted the big bang dogma, he was rejected.

Until now, the physics communality is not ready to accept they were wrong during a century. The first error was to follow Dirac, with his unscientific temporal variation of  $G$ , instead of the elementary Eddington's statistic theory. The second error was, when Dirac's approach proved wrong, to refer to the above unscientific anthropic principle. The third error was to abandon the String theory approach, in favor of the Multiverse hypothesis, invoking again the anthropic principle. A reason for this obstinate non-scientific attitude is that any observation which contradict the dogma is censured, after what it is claimed that standard cosmology is the best fit to observations. Some decisive, but censored, observations are described in the following.

## I.II. Evidences for a Tachyonic Flickering Space-Time

The above Gravitational Hydrogen Molecule model gives  $R \approx 13.812$  billion light-years, while standard cosmology claims that the Universe age is 13.8 billion years. This is, of course, misinterpretation since what is *really* measured in the galaxy recession is not a time, but a length: the visible Universe horizon radius. But this means there is something correct in the standard cosmology, so we proposed a synthesis between the two cosmologies, by admitting a flickering

space-Time: an oscillation between Universe construction and destruction, at frequency  $10^{104}$  Hertz, corresponding to the above 'Topon'  $d$ . This resolves another problem of the standard cosmology, the asymmetry mater-antimatter. It suffices to admit that this oscillation is a mater-antimatter one [5]. So a century has vainly searched for an antimatter which was present everywhere. Black Matter would be simply a quadrature oscillation [3].

The tachyonic hypothesis is consistent with the non-local character of quantum mechanics. The following observations confirm this hypothesis.

The Kotov non-Doppler cosmic oscillation [6] is not considered seriously, since it seems to violate the most basic prerequisite of physics, the generality of Doppler phenomena. Interpreting this as a *tachyonic phenomena*, we identified the Kotov period  $t_K \approx 9600.06(2)$  s, taking the electron characteristic time  $t_e = \lambda_e/c$  as unit, to the simplest relation eliminating  $c$  between  $a_G$  and  $a_w = \hbar^3/G_F m_e^2 c$ , the well measured ( $10^{-7}$ ) dimensionless electroweak coupling constant  $a_w$ :

$$t_K / t_e = \sqrt[3]{(a_G a_w)}$$

The weak coupling constant  $a_w = (E_F / m_e c^2)^2$  is defined [1] from the Fermi energy  $E_F \approx 292.806161(6)$  GeV  $\approx 573007.33(25) m_e c^2$ , itself tied to the weak force constant  $G_F \equiv (\hbar c)^3 / E_F^2 \approx 1.4358509(7) \times 10^{-62}$  Joule  $\times$  m<sup>3</sup> [7]. This introduces the product of two area speeds, confirming the flickering hypothesis:

$$(\lambda_e^2 / t_K) (\hbar / \sqrt{(m_p m_H)}) = \sqrt{(G G_F)}$$

so *the best measured cosmic quantity, the Kotov period, implies a symmetrization between gravitation and weak nuclear force*. This specifies the  $G$  value to  $10^{-6}$  precision (ppm). It is compatible with the well-elaborate  $10^{-5}$  BIPM measurement [8], at several sigmas from the Codata value [7], but the later is the mean between discordant measurements.

With  $t = R/c$ , the relation  $(t t_K^2)^{1/3} \approx 10.8$  years, compatible with the famous 11 years sun period was noted. It was proposed that this unexplained phenomena, responsible for moderate periodic climate variation, was also of flickering cosmic origin [9] (in this reference, the editors did not propose a final checking and 10.8 became  $10^8$ ). This hypothesis has been recently confirmed by the straight edge in the temporal profile of the phenomena, showing it is tied to a quantum process [10].

Another unexplained effect is the 75 km/s periodicity in the galactic redshift [11]. Now this speed verifies  $c/v_1 \approx \sqrt{a_w/a}$ , corresponding to the quantum resonance  $v_n = n v_1 = n \hbar / r_e m_F$ , where  $r_e = \lambda_e/a$  is the electron classical radius and  $m_F = m_e \sqrt{a_w}$  is the Fermi mass, close to the mean DNA nucleotide mass [3].

The Halton Arp observations of chains of galaxies with different redshifts [12] was also rejected. But it could be sign of the galactic regeneration maintaining constant the visible Universe mass: this is confirmed by the following, showing the invariance of the mean mass density  $\rho_c$ .

### I.III. The magic of Dimensional Analysis

The elimination of  $c$  in the above  $R$  formula means that the simplest basic dimensional analysis starting from  $\hbar$ ,  $G$  and  $m$ , the Electron-Proton-Neutron mean mass gives a good approximation for  $R/2$ . This has not been observed during one century, since  $c$  is believed to be the single mandatory foundation of Space-Time. Moreover, the dimensional analysis has not theoretical explanation so many theorists, apart in Fluid Mechanics, discard it as an investigation tool.

But in virtue of the above Hierarchy Principle, the lack of justification is not a reason to neglect Dimensional Analysis. In the Hypothesis of a Coherent Cosmos, it is logical to discard  $c$  which is far too small a speed. In his three first minutes of cosmology, one of the author obtained the length:

$$l(\hbar, G, m) = \hbar^2 / G m^3 \approx R/2$$

but it took 9 years to get this published [9]. The above critical condition relies the time  $t = R/c$  and

the mean mass density by the *c-free* formula  $\rho_c = 3/8\pi Gt^2 \approx 9.41198 \times 10^{-27} \text{ kg m}^{-3}$ . Now the following associated *c-free* times are closed each over to 0.7 %:

$$T\{\hbar, \rho_c, G_F\} = \hbar^4 / \rho_c^{3/2} G_F^{5/2} \approx 5.4829 \cdot 10^{57} \text{ s}$$

$$T'\{\hbar, G, m\} = \hbar^3 / G^2 m^5 \approx 5.5224 \times 10^{57} \text{ s}$$

Analysis shows that this is tied to  $a_w^{5/2} \approx P a^3$ , where  $P = m_P/m_e$ , presenting a deviation 0.48 %. This remarkable quasi-equality is symptomatic of the above Hierarchy Principle. Another example is the fact that comparing  $T$  with the Kotov Non-Doppler Cosmic Oscillation period  $t_K \approx 9600.60(2) \text{ s}$ , one observes, to 0.04 %:

$$T/t_K \approx O_M/\sqrt{2}$$

where  $O_M$  is the cardinal order of the Monster Group, the largest of the 26 sporadic groups, which is suspected by some researchers to play a central role in Physics: indeed string theory allows a bridge between apparently no-connected mathematical theories [13]. *The simplest interpretation of  $T$  is the period of all events, in a perfectly deterministic and periodic Universe.*

By respect to the electron-time  $t_e = \hbar/m_e c^2$ , one observes (4 %):

$$T/t_e \approx f(30) = \exp(2^{30/4})$$

this is the lacking essential point  $n = 30$  in the Topological Axis [3], described by the function  $f(n) = \exp(2^{n/4})$  for which the special string bosonic value  $n = 26$  corresponds to the Universe, apart a factor 6:

$$R/\lambda_e \approx (2\pi^2 a^3)^5 \approx f(26)/6$$

precise to 0.056 % and -0.065 %, where  $2\pi^2 a^3$  is the area of the 4-sphere of radius  $a$ . Now  $f(30) = f^2(26)$ , so implies  $a^{30}$ , meaning a 30D Space is really involved: *the rehabilitation of Bosonic String Theory by the Topological Axis [3] is confirmed.* It has been discarded because it induces tachyons. Of course, in Coherent Cosmology, the presence of tachyons is a necessity. Note that  $n = 30$  is the single solution of a Perimeter Equal to Area non-decomposable Pythagorean triangle (12, 5, 13). The only other one, but decomposable, is the triangle 6,8,10, with perimeter = area = 24, which is the number of transverse dimensions in String Theory. The Topological Axis clearly shows the Cartan-Bott  $\Delta n = 8$  periodicity [14] for gauge bosons:  $30 - 8 = 22$  corresponds to the X (GUT) boson,  $22 - 8 = 14$ , corresponds to the intermediate (weak) boson,  $14 - 8 = 6$ , corresponds to non-standard massive gluon. This rehabilitation of String Theory will be confirmed in the following.

#### I.IV. The Cosmic Background

A decisive confirmation of Cosmic steady-state is the fine-tuning involving the background temperature  $\theta_{CMB} \approx 2.7255(6) \text{ Kelvin}$ , which is, apart the above Kotov period, the best measured cosmic quantity. The *c-free* dimensional analysis, starting from  $\hbar$ ,  $G$  and the characteristic energy  $k\theta_{CMB}$ , gives a length close to the Hydrogen molecule wavelength  $\lambda_{H2}$ . This has a direct interpretation: this wavelength  $\lambda_{H2}$  enters, to 0.2 %, the 3D term following the 1D-2D holographic formulation of the above  $R$  formula:

$$2\pi R/\lambda_e = 4\pi (\lambda_{\sqrt{(pH)}/l_P})^2 \approx (4\pi/3) (\lambda_{CMB}/\lambda_{H2})^3$$

where  $\lambda_{CMB} = \hbar c/k\theta_{CMB}$  is the CMB canonical wavelength. *So the cosmic fine-tuning is in fact triple.* and this confirms the Gravitational Hydrogene Molecule Model [3]. Note that this is the simplest imaginable topological relation and the quadratic term involves the standard Holographic Principle

[4] using the Planck area  $l_P^2$ . Note that real holography is by far the most efficient technique to deal with information. *Such a conjunction between physics and mathematics suggests a fusion of the two domains.* With the measured  $\theta_{CMB}$ , there is a small departure in the above relation which is compatible with  $(H/p_G)^2 p/6\pi^5$ , where  $p_G^2 = P^2/2^{127}$ , with  $P^2 = m_P^2/m_p m_H$ . This leads to the following relation, eliminating  $l_P$ :

$$2^{127} = 2\pi^2 \lambda_{CMB}^3 / \lambda_e \lambda_H^2 \quad \Rightarrow \quad \theta_{CMB} = 2.725820805 \text{ Kelvin}$$

This manifestation of the above Hierarchical Principle proves the pertinence of the Lenz-Wyler approximation  $p \approx 6\pi^5$  [15], as confirmed below.

The reason for introducing  $p_G^2 = P^2/2^{127}$  is the following:  $2^{127} - 1$  is *the most famous prime in number theory*, giving the first order of the gravitational coupling constant, and is the final term of the Combinatorial Hierarchy [16] of the connected Mersenne numbers 3, 7, 127, whose sum is 137, so giving also the first order of the electrical constant.

Now, Unrhu [17] associates an acceleration  $g$  to a thermal bath of characteristic energy  $k\theta = \hbar g/2\pi c$ . The  $c$ -free dimensional analysis using  $\gamma_{CMB}$  gives:

$$l(G, m_e, g) = (Gm_e/g_{CMB})^{1/2} \approx (R'/R) \lambda_{CMB}^2 / 4\pi O_M$$

The correcting factor approaching  $R'/R$  to 0.7 %. This writes:  $(R'/R) O_M \approx \lambda_e \lambda_{CMB} / 2l_P^2$ . The same relation is obtained by looking for the mass  $m_{BH}$  of a black hole having a Bekenstein-Hawking temperature [4]  $\theta_{BH} = \hbar c^3 / 8\pi k G m_{BH}$  equal to  $\theta_{CMB}$ . Precise analysis leads to (0.4 ppm):

$$\beta^2 r_e'^3 \lambda_{CMB} / l_P^4 = 2^{128} O_M$$

where  $r_e' = r_e (137/a)^2$  is a corrected electron classical radius  $r_e = \lambda_e/a$  and  $\beta = (H-p)^{-1} = (1 - 1/2a^2)^{-1}$  the Rydbergh correction. The corresponding  $c$ -free time is, to 0.8 ppm:

$$t(G, m_e, \gamma) = (Gm_e/g_{CMB}^3)^{1/4} \approx t_K / (9\mu \times 137 O_M)^{1/2}$$

where  $9\mu$  is an approximation for  $p$ . This shows another connexion between the Monster order  $O_M$  and the Kotov period  $t_K$ . Now, introducing the Unrhu-Kotov length  $L_K = g_{CMB} t_K^2 = 2\pi l_K^2 / \lambda_{CMB}$ , which is of order  $R$ , the ratio  $L_K/R$  is compatible, within 0.1 ppm, with  $\pi(6a_w^{1/2})^{1/3}$ , so the  $\pi$  factor eliminates, and the following holographic relation emerges:

$$\pi a_w^{1/2} \approx (4\pi/3)(l_K^2/R\lambda_{CMB})^3$$

precise to 0.4 ppm. The length  $L_K$  connects to  $R$  and  $R_1 \approx 1.492365475 \times 10^{26}$  m the single-electron cosmic radius, which depends only on  $a' = aH/p$  the ratio Bohr radius/electron Compton wavelength  $\lambda_e$ :

$$L_K \approx 2R \times 3^{1/2} a/d_e \approx 3R_1 \times 44\pi d_e$$

precise to 3.5 and 3.3 ppm, where appears the electron magnetic excess  $d_e \approx 1.00115965218091(30)$  and the canonic term  $44\pi$  (see below). Eliminating  $d_e$  this leads to (0.013 %):

$$L_K^2/RR_1 \approx 6 \times 3^{1/2} \times 44\pi a \approx D$$

where  $D = 196883$  is the dimension number of the Monster Group, which appears in the so-called Moonlight Connexion [18].

## I.V. The Gravitational Constant physical fine-tuning

Fine tuning analysis leads to the holographic form, meaning a tight relation between  $\theta_{CMB}$  and  $G$ :

$$2\pi R/\lambda_H = (\lambda_{CMB}\lambda_H/\lambda_p^2)^3/d_e^2 \Rightarrow G = 6.675453818 \cdot 10^{-11} \text{ S.I}$$

where  $\lambda_{CMB} = hc/k\theta_{CMB}$ . So, while General Relativity is unable to define neither a value for  $G$  nor a Galilean referential, so cannot really explain the rotation of the Foucault oscillation plane, cosmic fine-tuning succeeds through holographic relations. Indeed the background radiation defines an absolute referential which is a special Galilean frame. The standard foundation of cosmology from differential equations was doomed from the start, because, as Poincaré stated '*l'Univers est tiré à un seul exemplaire*' [3]. Note that the above equations are of integral form. This is the deep role of holographic equations. Note that the Mach principle attributing the origin of inertia to far distance masses is confirmed by the formula for the observable universe critical mas:

$$M = m_p^4 m_p m_H m_e \approx (10/3) N_{Ed} m_{n'} \sim E_v/C^2$$

where  $m_p = (\hbar c/G)^{1/2}$  is the Planck mass,  $N_{Ed} = 136 \times 2^{256}$  the Eddington Large Number,  $n' = nH/p$  is the principal value of the neutron mass by respect to the electron effective mass in the Hydrogen atom. The precision is 41 ppm.  $C$  is the above tachyonic speed and  $E_v$  the vacuum quantum energy  $(4\pi/3)R^3 c^7/\hbar G^2$ , so resolving *the central enigma in present-day physics: why the vacuum quantum energy is about the  $10^{120}$  times the Universe one*. From the critical relation  $R = 2GM/c^2$  and the classical gravitational energy of a homogeneous ball  $E = 3GM^2/5R$ , one obtains  $E = (3/10)Mc^2$ . So this trivial gravitational factor 10/3 corresponds to the misleading 'black energy' of the standard cosmology which needs complete re-interpretation. The fact that *Eddington predicted correctly the effective mass  $3M/10$  (but in term of Hydrogen atoms instead of neutrons) is probably the most remarkable prediction of all Time*.

Eliminating  $\lambda_{CMB}^3$ , this corresponds to:

$$p_G^2 = P^2/2^{127} = p^7/H^5 d_e^2$$

The central quantum electrodynamics constant  $d_e$  confirms its central role in cosmology. The corresponding value for the Kotov time is:  $t_K = t_e \sqrt{(a_G a_w)} = 9600.591445 \text{ s}$ .

## II. Fine-tuning with intermediate Mathematical Constants

### II.I. The Arithmetical Monster Prime 137

The pertinence of our above simple polynomial relations are not admitted by the standard community, arguing that since proton is composite, its mass cannot enter simple relations. The same argument is presented for the theoretical dependence of the electric constant  $a$  with other constants  $g$  and  $g'$ , or with the energy level. These are reductionist arguments, meaningless in cosmology.

The Eddington's proposal for  $a$  was the whole number 137, which intrigued some physicists for a century, but apparently nobody signaled it has a fundamental property: it appears as a Monster Prime in the series of the maximal primes appearing in the numerator of the harmonic series: 3,11,5,137,7,11, showing a symmetry between the 11 supergravity dimensions and the 4 of space-time. Now:

$$137 = 11^2 + 4^2$$

Since Riemann series are tied to the prime number distribution, it is strange that mathematicians have not point out the primes appearing in the Harmonic series, since it is the single pole. It seems

that the basic precept '*all occurs in the pole*' was forgotten in this case. As ancient Egyptian used only fractions of type  $1/n$ , they were certainly aware of this particular harmonic series  $s_5 = 137/60$ . Indeed in appears the Ptolemaic approximation for  $\pi$ :  $377/120 = 2 + s_5/2$ .

Recall that the electrical constant  $a$  characterizes the force  $\hbar c/a l^2$  between two  $l$  - distant elementary charges, appearing central in Atomic Physics and in many fine-tuning relations [1]. It is misleading that physicists focused on only one property, the appearance of its fifth power in the Hydrogen hyper-fine spectra, and call its inverse the 'fine-structure constant'. It is strange also that Eddington's Theory was rejected as soon as  $a$  appeared to be different from 137. Indeed, the following shows that 137 plays a central role in fine-tuning analysis. In particular, one obtains a value  $a \approx 137.035999119$  compatible with measurement  $a \approx 137.035999139(31)$  in:

$$\ln 137 / \ln(a/137) \approx (2 + 135/d_e)^2$$

meaning the ratio  $a/137$  acts as a musical ratio.

### II.II. The Wyler's approach [15]

Armand Wyler's singularized a value  $a_w$  approaching  $a$  to 608 ppb and confirmed the pertinence of the Lenz approximation which plays a central role above:  $p_w = 6\pi^5$  approaching  $p$  to 18.824 ppm. A confirmation of a symmetry between  $a$  and 137 is the relation involving  $H$ , the Hydrogen electron mass ratio, precise to 83 ppb:

$$a/137 \approx (6\pi^5 H)^{1/2}/p$$

Note that the rejection of Wyler's work, due to a non-perfect formula for the  $p$  and  $a$  values, is a new manifestation of the general ignorance of the Hierarchy Principle.

### II.III. The Holic Principle

In the hypothesis of an Arithmetic cosmos, the ultimate equations must be diophantine. The simplest one is  $T^2 = L^3$ , where  $T$  is a time ratio and  $L$  a length one, resolving, since 2 and 3 are coprime in  $T^2 = L^3 = n^6$ . This is *the degenerate arithmetic form of the spatio-temporal holographic principle*, It is also the 3<sup>rd</sup> Kepler law, but its diophantine form gives  $L = n^2$ , the orbit law in the Hydrogen atom and in our Gravitational Molecule model, where the visible Universe corresponds to the first orbital, suggesting the existence of a Grandcosmos, as the Topological Axis does. It was proposed that the Grandcosmos radius  $R_{GC}$  is given by the simplest monochromatic extension of the above Bekeinstein-Hawking entropy, applied to  $R' = RpH/a^3$ :

$$\pi(R'/l_p)^2 = 2\pi R_{GC}/l_p$$

where  $R'/2$  is the simplest cosmic value of tachyonic physics, the length eliminating  $c$  between the classical electron radius and the Planck length. The pertinence of this Grandcosmos is assured by its volume, with unity the atom radius  $r_H = (aH/p)\lambda_e$ , at 0.44 %:

$$(4\pi/3)(R_{GC}/r_H)^3 \approx a^a/\pi$$

*This confirms that  $a$  is an optimal computation basis.* Note that  $a^a$  is of order  $e^{p/e}$ , while  $x^{1/x}$  is maximal for  $x = e$ . So  $a$  and  $p$  are tied to the operational definition of  $e$ . Moreover  $a^{a/2} \approx 3^{306}$  showing an arithmetic property: the fifth optimal musical Scale (306 = 1836/6 notes) [19].

The holographic Grandcosmos reduction radius  $R'$  shows itself an overwhelming holographic relation with the CMB Wien wavelength  $l_{CMB}$ , to 0.01 %:

$$4\pi(R'/l_{CMB})^2 \approx e^a$$

Since the holographic technique uses coherent radiation, this seems incompatible with the CMB thermal character. But in a totally deterministic cosmos, there is no paradox. This question is connected with the black hole information paradox [20]. An argument in favor of a total conservation of information was tied to a non-evolution cosmology [21], independently of our approach showing that formalisms of Holography and Unitary Matrix Quantum Physics are very similar [3]. Note that  $e^a$  is also compatible with the half volume of the proton, with the Planck length as unity.

So, while General Relativity and Unitary Quantum physics disagree about the nature of Space-Time, specially the non-locality phenomena, they agree for complete determinism, *ruining the Copenhagen statistical interpretation. The hidden variables exist really: the Cosmos !* Heisenberg relations would be only Fourier transform manifestations of Wave Mechanics.

*The Holic Principle* [3] is the natural generalization of the above relation  $T^2 = L^3 = M^5 = F^7 = n^{210}$ , where the smallest co-prime numbers are used, with M a mass ratio and F a field ratio. This applies directly to the observable Universe, to 15 and 0.6 ppm:

$$R/\lambda_e \approx (2R/R)^{210} \approx (a/137)(6\pi^5/p)^2(6/\pi)^{\beta a'}$$

This confirms the arithmetic structure of the world and the pertinence of the Grandcosmos holographic reduced length  $R'$ . Analysis shows that, to 4.5 ppm:

$$210 \ln 2 \approx e^{2\pi} \ln(d_e R'/R)$$

The canonical term  $e^{2\pi}$  appears also in the following.

#### II.IV. Liaisons with the Planck thermal law

With the reduced Wien constant  $\varpi = 5(1-e^{-\varpi}) \approx 4.965114245$  defining the Wien wavelength  $\lambda_{\text{Wien}} = \lambda/\varpi = hc/\varpi k\theta$ ,  $e^{\varpi}$  appears in the Planck thermal law and is close to  $a$ . One observes that  $a \approx e^{\varpi} - 2\pi$ , suggesting  $a$  to be a trigonometric line. Indeed  $\cos a \approx 1/e$ . So, to 65 ppb :

$$a \approx 44\pi - \text{Arccos}(1/e)$$

This formula was largely diffused in the web, but without indication of its origin.

Another important Planck Law's number is the Riemann series  $\xi(3) \approx 1.20205691$ , or 'Apéry constant', with *no analytic expression*, but which gives the photon density  $16\pi\xi(3)/\lambda^3$ , where  $\lambda = hc/k\theta$ . The computer indicates, to 1.6 ppm:

$$\sqrt{a} \approx (16\xi(3))^3/\varpi^4$$

With our precise above value  $\theta_{\text{CMB}}$ , the number of photons in the visible Universe is  $n_{\text{ph}} = (4\pi/3)(k_B\theta_{\text{CMB}}R/hc)^3 \approx 3.8400458 \times 10^{87}$ , while the equivalent neutron number is  $n_n = (10/3) \times 136 \times 2^{256} \approx 5.2492414 \times 10^{79}$ . With the ratio  $R_{\text{GC}}/R = C/c = P^3 pH/a^6 \approx 6.9454957 \times 10^{60}$ , the number of photons and equivalent neutrons in the Grandcosmos are respectively  $N_{\text{ph}} = n_{\text{ph}}(C/c)^3 \approx \exp(621.949984)$  and  $N_n = n_n(C/c)^3 \approx \exp(603.841903)$ . One observe that the mean obeys:

$$\sqrt{(N_{\text{ph}} N_n)} \approx (n/6\pi^5) e^{n/3}$$

precise to 6 ppm on a number with 267 decimal digits.

The number of photons in the visible universe is to 0.1 %:

$$n_{\text{ph}} \approx (R'/R)^{1/2} O_M O_B$$

where  $O_B$  is the cardinal order of the Baby Monster. Moreover  $2\ln n_{ph} \approx e^6 \approx e^{2\pi} a^2 / (4\pi)^4$ . Analysis shows that, to 120 and 1 ppb:

$$a \approx (137^2 + 1/\pi^2)^{1/2} \approx 4\pi\beta e^{(3-\pi)/2} (137^2 - 1/\pi^2)^{1/4}$$

so, while the first expression gives an excellent known approximation, the precise value of  $a$  is dependent of the difference  $\pi - 3$ . *This formula is remarkable since  $4\pi$  is the canonic form for  $a^{1/2}$ .*

An approximation of the weak mixing angle 0.231 [7] appears in (144 and 166 ppm):

$$p/O_1 \approx \ln(O_M/O_B) / \ln(O_M O_B) \approx \ln O_M / e^{2\pi}$$

where  $O_1 = 7920$  is the cardinal order of the smallest sporadic Mathieu group. This suggests that all the 26 sporadic groups play a role in the physical parameters. Indeed the product of the 20 cardinal orders of the happy family connected to the Monster shows:

$$(R/R') \Pi_{\text{happy}} \approx a^a$$

while the product of the six pariah groups enters, to 0.02 % and 0.2 %:

$$\Pi_{\text{pariah}}/O_B \approx (\tau/p)R/\lambda_e$$

$$\Pi_{\text{paria}}^{1/20} \approx F/a$$

this is the above characteristic ratio of the redshift periodicity. The 20<sup>th</sup> root of  $O_M$  is close to 496, the dimension of the gauge group of type 1 string theory. Note that the mass ratio scalar Englert-Brout-Higgs Boson/electron is close to  $s \approx 196^2$  corresponding to 125.7 GeV, while the experimental value is 125.09(24) GeV. One notes, to 0.05 %, the relation between three coupling constants:

$$a_w^{1/2}/af \approx 496.$$

where  $f$  is the strong coupling constant, whose fine tuning indicates the optimal value:

$$f \equiv a_w/2\pi(pH)^{3/2} \approx 8.434502892$$

while the CODATA value [10] is badly defined  $f_{\text{CODATA}} \approx 1/0.1181(11)$ . In cosmology, the appearance of  $s$  is direct, to 0.01 % and -0.08 %:

$$(R/\lambda_e)^{1/5} \approx 2\pi^2 a^3 \approx \mu s$$

So, cosmology confirms Particle Physics, especially its latest development, the Englert-Brout-Higgs boson.

### III. Fine-tuning with basic mathematical constants

Since some dimensionless physical parameters are very precisely measured, it is natural to look relations with mathematical constants, such as  $\pi$ ,  $e$  and  $\gamma \approx 0.577215665$ , the Euler-Mascheroni constant, which all appear in the single-electron cosmology [3]. Note that the canonical ratio  $R'/R$  and  $R$  shows:

$$R'/R \approx e^{2/e^2}$$

to 14 ppm.

### III.I The electroweak constant mathematical fine tuning

The Particle standard model achieved a unification between electromagnetism and weak nuclear force. So we look for a relation involving  $a$ , 137,  $a_w$  and the mathematical constants. One immediately gets:

$$a_w \approx (2\gamma 137a/\pi)^3$$

Now, by introducing the characteristic length  $l_{eF} = (G_F/m_e c^2)^{1/3}$ , this electroweak constant appears as a cube  $a_w \approx (\lambda_e/l_{eF})^3$ , so:

$$\lambda_e/l_{eF} \approx 2\gamma 137a/\pi$$

Admitting the above relation, this defines  $F = a_w^{1/2} = E_F/m_e c^2 \approx 573007.3652$ , inside its  $2.5 \cdot 10^{-7}$  indetermination. The a-priori probability of this correlation is estimated, by looking for the number of solutions obtained by extending the indetermination range by a factor  $10^6$ , keeping a maximal exponent to 3, to be about  $2 \times 10^{-5}$ . Another fine-tuning ties the muon, proton and Hydrogen masses:  $E_F/m_e c^2 \approx m_\mu^2 \sqrt{(m_p m_H)/a m_e^3}$ . This corresponds to a muon mass relative to electron  $\mu = 206.7682869$ , inside its  $2 \times 10^{-8}$  measurement range.

Now the Koide relation [22], where  $\mu$  and  $\tau$  are the Muon and Tau masses relative to Electron:

$$(1 + \mu + \tau)/2 = (1 + \sqrt{\mu} + \sqrt{\tau})^2/3$$

has a mathematical justification in term of circulating matrix. It predicted correctly the tau/electron mass ratio at an epoch where its measurement was false to 3 sigmas. With the above  $\mu$  value, it gives  $\tau \approx 3477.441701$ . *This Koide relation, quite discarded by the communality, is another sign of the serious incompleteness of present Particle Physics standard model.*

### III.II. The Intermediate Bosons mathematical fine tuning

It was noted [1] that is  $a_G$  is of order  $W^8$ , where  $W$  is the mass ratio boson  $W$ / Electron. One observes the more symmetrical relation involving the other (neutral) weak boson  $Z$ :

$$R/(\lambda_p \lambda_H) \approx (WZ)^4$$

This is clearly tied with the above Cartan-Bott periodicity [14]. Now the computer indicates, with  $n \approx 1838.68366089(17)$  the neutron/electron mass ratio:

$$W \approx \gamma a 137^2 / 3\pi d_e$$

$$Z \approx a p^2 \pi^4 / 137 d_e n$$

This corresponds to the above  $G$  value in the ppb range.

### III.III. The Direct Gravitational Constant mathematical fine-tuning

Computer analysis shows the following symmetrical expression for the deviation between  $2^{127}$  and  $a_G$ ,

$$(2^{127}/a_G)^{1/2} \approx a_w^{1/2} (a/\pi)^4 (\gamma/4n)^3$$

this is compatible with the above  $G$  value in the ppb range: comparing with the above relation  $(2^{127}/a_G)^{1/2} \approx d_e (H/p)^3$  and eliminating  $2^{127}$  this leads to:

$$(aa_w^{1/2}/\pi d_e)^{1/3} \approx 4\pi n'/\gamma a$$

where  $n' = nH/p$ , as seen above, is the principal value of the neutron mass by respect to the electron effective mass in the Hydrogen atom.

### III.IV The Atiyah constant

Michaelangelo Atiyah was a precursor in the search for unity of Mathematics and Physics. He recently introduced the following constant, as a simplification term [23]:

$$\Gamma = \gamma a / \pi$$

Indeed this simplifies some of the above relations:

$$\lambda_e / l_{eF} \approx 137 \times 2 \Gamma$$

$$W \approx 137^2 \Gamma / 3 d_e$$

$$(\Gamma a_w^{1/2} / \gamma d_e)^{1/3} \approx 4 n' / \Gamma$$

and the above relation giving  $a_G$  shows a double form, the first one without any numerical factor:

$$(a/\pi)(a_G/2^{127})^{1/2} \approx (nF/137^2 \Gamma^3)^3 \approx (4n/\Gamma)^3 / F$$

Now the exponents represents the number of dimensions. So, this corresponds to a dimensional reduction, by eliminating 137, from 9D and 6D to 3D, which could be associated to Superstring theory, where the equations are coherent only if space has 9 dimensions, and if the 6 supplementary dimensions are fold on very small distances [24]. Note that  $4n/\Gamma$  is close (0.12 %) to the monstrous fifth term 292.6345909 in the fractional development of  $\pi$  which is itself very close to  $n/2\pi$  to  $3.4 \cdot 10^{-6}$ . Since the fractional development of  $\pi$  is always a non-resolved problem, this confirms that present mathematics is incomplete. Note that in his last work [23], Atiyah introduced the Bernoulli function  $x(1 - e^{-x})^{-1}$ , which is the kernel of thermal Planck law, confirming the above connexions between this law and the physical parameters.

## IV. Discussion

One can wonder about the origin of the present blockage in physics [25], and why a large majority of physicists do not consider seriously any refutation of standard cosmology. The misleading review article on the anthropic principle [1] was the basis of the Paul Davies book, with the controversial title 'The Accidental Universe' [26]. In the preface, Davies, forgetting the doubts expressed in this article's conclusion, dare to write: *'The only systematic attempt (outside religion) to explain the extraordinarily contrived appearance of the physical world has developed out of a radical departure from traditional scientific thinking. Called the 'anthropic principle', the idea is to relate basic world features to our own existence as observers. The principle has its origins with great physicists such as Boltzmann, and in recent years has been restated by Brandon Carter, Robert Dicke, Freeman Dyson, Stephen Hawking, Martin Rees and John Wheeler. Some of these scientists go so far as to claim that our existence can be used as a biological selection effect, allowing one to actually explain the otherwise mysterious numerical values of the fundamental physical constants.'*

Of course such a statement opens the door to religious interpretations, in particular the 'intelligent design' sect. The present article clearly prove that the above great physicists were completely wrong. Indeed, the high precision (ppb) of the relations shown in the present article

prove that the traditional scientific thinking is not at all baffled by *the physical parameter values, meaning they are mere mathematical constants*. In the wonderful success of mathematical formalism, it was forgotten that the direct search for relations between measurement results has led Dalton, Balmer, Mendeleiev and Mendel to decisive discoveries, as recalled in the introduction. In this respect, the high precision in the measurement of the Fermi constant, Muon mass, the background temperature and the Kotov cosmic period must be saluted as *decisive achievements*. Now, we have also shown [3] direct connexions between physical and biological parameters which have escaped the above researchers. So, while the 'Anthropic Principle' states that Life implies a favored Cosmos among a Multiverse, the 'Inverse Anthropic Principle' [3] is more logical, stating that *an all-deterministic single Cosmos implies Life*, in contradiction with the Darwin 'accidental life' approach, a generally admitted so-called 'theory' which is contradicted by so many missing links.

The present-day physics community is divided, a minority who believe in a Single Final Theory, and a large majority having abandoned hope and believing seriously in the extreme consequence of the 'Anthropic Principle', the Multiverse conundrum. The present article settles the debate in favor of a single steady-state cosmos.

Another type of separation exists: a minority think Physics and Mathematics are unified, while a majority separate the two domains (so separating also Biology). The present article shows that the former are right: physical constants are mathematical constants, so *the present-day mathematics are still in infancy, not realizing that the discovery of sporadic groups is a crucial discovery for physics*. In particular, we have clearly shown that Grandcosmos is a computer which uses optimal physico-mathematical constants as calculation basis and that they are present in DNA characteristics [3]. The present article show definitely the liaisons with  $\pi$ ,  $e$  and  $\gamma$ , and rehabilitate String theories, also foolishly abandoned by a majority [27].

There is also the Determinism separation, a majority believing seriously that 'God plays dices', in contradiction with our Cosmic Computing Principle. The  $c$ -free analysis gives simply and directly the Large time periodicity of an all-deterministic Grandcosmos, as it gives in an elementary calculation the visible Universe horizon radius, in a formula which was present for a century in astrophysics text-books: the limit of a star radius when the number of atoms reduce to unity [3]. This is tied to the application of the exclusion principle that Eddington dared to apply in cosmology. For this reason he was declared 'crakpot' and his theory discarded by a majority. Fortunately, the large theoretical advance of Eddington is now recognized [28][29], but without mention that he had predicted the tau fermion with a right order of mass, 30 years before its surprising discovery, calling it Heavy Mesotron [1].

It seems that the pre-scientific role of chance is a common point between three misleading views in present mainstream thinking. Firstly, in biology, the assimilation of Darwin vague arguments with a scientific theory. Secondly, in quantum physics, the so-called 'incertitude relations', which are only manifestations of the general (Field *and* Matter) wave propagation, through Fourier transform properties. Thirdly, in cosmology, the recourse to the Multiverse conundrum.

In his book, '*The Trouble with Physic*', Lee Smolin [25] argues 'it is not so much a particular theory but a style of doing science that was well suited to the problems we faced but is ill suited to the problems we face now'. It is right that the present style is faulty, but simply because *the basic scientific method has been forgotten*: 'connect directly the experimental results, independently of any a-priori theory. We have answered the five main Smolin problems : 1. Unification Gravitation-Quantum Physics, by rehabilitating the forgotten Eddington's statistical theory, 2. The real signification of Quantum Physics, by assuming Physics is based on Arithmetics, 3. The overall unification by showing that cosmology is the basis of all science, 4. The role of dimensionless parameters, by proving that they are optimal basis of computation tied with the Holographic and its arithmetic form, the Holic Principle and 5. The Dark energy proportion 0.7, which is a false problem, since the trivial ratio between the observable universe gravitational and critical energies is 3/10.

## V. Conclusions: Simplicity at work

The application of the *old direct scientific method*, looking for fine tuning between physical parameters leads to a return to the Perfect Cosmological Principle implying a Steady-state Cosmos.

*The simplest method of looking for simple monomial expressions* involving mathematical constants leads to ppb correlations, meaning Cosmos Unicity. As Atiyah writes [23]: '*Nobody has ever wondered what the Universe would be if  $\pi$  were not equal to 3.14159.... Similarly no one should be worried what the Universe would be if  $a$  were not 137.035999....*' This is a definite refutation of the Multiverse Hypothesis.

The present article confirms also the Topological Axis, which was obtained by the *simplest visualizing method* to represent in a single figure the characteristic lengths in macro and micro-physics, taking the electron wavelength as unity. This rehabilitates the String theory, including the *tachyonic* bosonic version, since the canonical dimension 26 appears to characterizes the observable universe radius  $R$ . This confirms that  $c$  is not a cosmic pertinent speed, as is clearly shown both by logic and quantum non-locality.

Indeed, by excluding  $c$  in the *simplest tool of elementary physics, three-fold dimensional analysis*, this gives immediately  $R/2$ , the cosmic temperature and the cosmic overall periodicity, which connects with the dimension  $n = 30$  in the Topological Axis, suggesting the existence of a Grandcosmos. While it is claimed that String Theory do not connect with experiment [27], the Cartan-Bott periodicity appears, showing the GUT( $n = 30 - 8 = 22$ ), Weak ( $n = 14$ ) and Gluon ( $n = 8$ ) gauge bosons, so confirming the Standard Model of Particle Physics, but with *massive gluon*, which is seriously considered [30]. This means also that *the International System must go back to only three fundamental unities, Mass, Length and Time*. The distinction between Length and Time, as Poincaré, the father of Relativity Theory, himself stated, must be emphasized. Indeed their confusion, by writing  $c = 1$ , impeded during one century the fact that  $R$  is a trivial length, already present in astrophysical text-books.

The *simplest model*, the gravitational Hydrogen molecule gives  $R$ , explaining the above 2 factor and justifying the elimination of  $c$ , as in the Bohr model.

The *simplest statistical theory of Eddington* gave another justification to the observable universe radius. Particularly simple is the *Large Eddington number, giving correctly the number of neutrons in the trivial fraction  $3M/10$  of the observable universe*.

The *simplest topological equations*, the equality between dimensionless varieties, circumference, area, 3D volume ... appear to apply in cosmology, which is, for many, the hardest chapter of physics. This modern, negative opinion is in fact contrary to the ancient culture, for which the Cosmos is the first of all science, so must be the simplest. In the original sens of the word 'revolution', it is a return to the source of Science, the '*all is whole number*', of Pythagoras. Even the degenerate form of topological or holographic relations, the *simplest diophantine equations*, the Holic Principle, works.

The discovery of the standard Holographic Principle was on the right track [4], but must be generalized to unities others than the Planck length, even invoking the visible Universe wavelength, which breaks another taboo of current thinking: the Planck wall, by an enormous factor resolving the vacuum energy dilemma.

The *simplest proof of the computation basis character* of the electrical parameter  $a$  is provided by the multiple appearance of the terms  $e^a$  and  $a^a$ , of order  $e^{p/e}$ , while  $e^{1/e}$  is decisive for the operational definition of  $e$ . The fact that  $a^a$  appears also in the fifth Optimal (305 notes) Musical Scale indicates a liaison with Arithmetics.

The *simplest imaginable Symmetry* is shown by the Monster and Baby Monster Groups, and the Moonshine Monster Dimension emerges naturally from consideration of the Unruh-Kotov Length. Analysis shows that all the 26 sporadic groups are implied. This furnishes 26 mathematical parameters, while the number of standard model free-parameters is also close to 26. Now, *the deep significance of a number of dimensions is the number of independent variables*, which is a fundamental invariant, whatever the theory [31]. So, it is normal to introduce the hypothesis that

26 physical parameters are defined by the 26 sporadic cardinal orders. Since Sporadic Groups are associated with octonion algebra [32], this rejoins a prediction of Atiyah's last work, the essential role of octonion algebra in the final theory [23].

Acknowledgements. The authors want to thank the memory of Michaelangelo Atiyah for this message to one of us; '*While I appreciate your physics, I do not wish you cite my non-published work*'. We salute his modesty, but his introduction of the rather unexpected Euler-Mascheroni constant in the fine-tuning research has considerably helped our task of proving the existence of a fundamental theory. This means that, no matter the reception of his last work by other mathematicians, embedded in their absence of simplicity, *his last work will enter History*.

## References

- [1] Carr B.J. and Rees M. J. , “*The anthropic principle and the structure of the physical world*”, Nature 278, 605-612 (1979).
- [2] Eddington A.S., *The Fundamental Theory* (Cambridge, 1946).
- [3] F.M. Sanchez. *Coherent Cosmology* Vixra.org,1601.0011. Springer International Publishing AG 2017. A. Tadjer et al. (eds.), *Quantum Systems in Physics, Chemistry, and Biology*, Progress in Theoretical Chemistry and Physics 30, pp. 375-407. DOI 10.1007/978-3-319-50255-7\_23.
- [4] Bousso R., “*The Holographic Principle*”, Review of Modern Physics, vol 74, p.834 (2002).
- [5] Sanchez F.M., V. A. Kotov and C. Bizouard C. Towards a synthesis of two cosmologies: the steady-state flickering Universe., Journal of Cosmology, vol 17, 7225-7237, (2011).
- [6] Kotov V. A. and Lyuty V. M., “The 160-min. Periodicity in the optical and X-ray observations of extragalactic objects.” Compt. Rend. Acad. Sci. Paris 310, Ser. II, 743-748 (1990).
- [7] Review of Particle Physics. Particle Data Group, Phys. Rev. D98, 030001 (2018).
- [8] Quinn T, Speake C, Parks H, Davis R. 2014 *The BIPM measurements of the Newtonian constant of gravitation*, G. Phil.Trans. R. Soc. A372: 20140032.
- [9] Sanchez F.M., “*Towards the grand unified Holic Theory*”. Current Issues in Cosmology. Ed. J.-C. Pecker and J. Narlikar. Cambridge Univ. Press, 257-260 (2006).
- [10] Kotov V. A. and Sanchez F.M., *Solar 22 years cycle*, Astrophysics and Space Science, Volume 362, Issue 1, article id.6, 6 pp. (2017).
- [11] Tifft, W. G. (2006). “*Redshift periodicities, The Galaxy-Quasar Connection*”. Astrophysics and Space Science. 285 (2):429.
- [12] Arp H., *The origin of Companion Galaxies*. Astrophysical Journal, 496, 661-669 (1998)
- [13] Borchers, Richard, *Monstrous Moonshine and Monstrous Lie Superalgebras*. Invent. Math., 109: 405–444, (1992).
- [14] Cartan-Bott periodicity
- [15] Wyler A., “*L'espace symétrique du groupe des équations de Maxwell*” C. R. Acad. Sc. Paris, t. 269, 743-745 (1969). “*Les groupes des potentiels de Coulomb et de Yukawa*”. C. R. Acad. Sc. Paris, t. 272, 186-188 (1971).
- [16] Bastin T. and Kilmister C.W., *Combinatorial Physics* (World Scientific, 1995).
- [17] Unruh W.G., “*Notes on black-hole evaporation*”, Phys. Rev. D 14, 870 (1976)
- [18] Moonshine
- [19] Jeans J., Science and Music, p. 188 (Dover, 1968).
- [20] Preskill, John. *Do Black Holes Destroy Information?* International Symposium on Black Holes, Membranes, Wormholes, and Superstrings. [arXiv:hep-th/9209058](https://arxiv.org/abs/hep-th/9209058). (1992).
- [21] Nikolic, Hrvoje. “*Resolving the black-hole information paradox by treating time on an equal footing with space*”. Physics Letters B. **678** (2): 218–221. [arXiv:0905.0538](https://arxiv.org/abs/0905.0538). (2009).
- [22] Koide Y., *Fermion-Boson Two-Body Model of Quarks and Leptons and Cabibbo Mixing* Lett. Nuovo Cimento 34, 201 (1982).
- [23] Atiyah M. The fine-structure constant, 4 th Heidelberg Laureate Forum conference (2018). [blog.sciencenet.cn/home.php?mod=attachment&id=256716](http://blog.sciencenet.cn/home.php?mod=attachment&id=256716)

- [24] Polchinski J., *String Theory*, Vol 1, p. 22 (Cambridge University Press, 1998)
- [25] Smolin, L. *The Trouble with Physics*. Houghton-Mifflin, (2006).
- [26] Davies P. *The Accidental Universe*. C.U.P. , 1982
- [27] Woit P. *Not Even Wrong: The Failure of String Theory and the Search for Unity in Physical Law*. Basic books, 2006.
- [28] Durham I.T. 2006, *Sir Arthur Eddington and the Foundations of Modern Physics* [arXiv:quant-ph/0603146v1](https://arxiv.org/abs/quant-ph/0603146v1) p.111.
- [29] Salingaros N., *Some Remarks on the Algebra of Eddington's E Numbers*. *Foundations of Physics*, June 1985, Volume 15, 6, pp 683–691.
- [30] Larin S.A, *Quantum Chromodynamics with massive gluons*. ArXiv:1304.8107, (2013)
- [31] Veigel D. and Veysseyre R. ....
- [32] Atiyah M. private communication (2018)