Coherent Cosmology

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QSCP XX (Sept. 2015), Varna, Bulgaria

Summary. Analysis of present day cosmology crisis suggests a return to the steady-state model, but adding a source of the cosmic microwave background: the *Grandcosmos*. The *perfect cosmological principle* permits to apply the *holographic principle*, with 1D terms explaining both Grandcosmos and critical condition (flatness), with a general quantization reducing the Plank units by a factor of 10^{61}, while a tachyonic parallel world ($C \approx 10^{61}c$) resolves the vacuum energy dilemma. The time quantization is tied to a general mono-frequency *coherence principle*, so that the Universe would be a computer ruled by a 10^{104} Hz Big Bang/Big Crunch oscillation. This synthesis of the two main cosmological models explains the apparent confirmations of the concordance model, but with radical re-interpretation (inflation and multiverse are unnecessary). This is confirmed by the mono-frequency (non-Doppler) Kotov-Lyuty coherent cosmic oscillation, which enters the *c*-free holographic scheme, showing a symmetry between the Newton and Fermi constants which supports an oriented cosmical sweeping character (parity violation) of the matter-antimatter oscillation (dark matter would vibrate in quadrature). When applied to a hydrogen gravitational molecule model, the coherence principle comes back to a special form of Eddington's formula. Taking into account a trivial matter density 3/10, which resolves the dark energy problem, this corresponds to the Eddington prediction for the hydrogen atom number 136×2^{256}. Special *c*-free holographic relations confirm the scheme, with a proposal for graviton and photon masses, and are summarized in a topological axis rehabilitating the tachyonic bosonic string theory. Physical and biological essential parameters are interconnected, in relation with economic and musical numbers, pointing to a *Diophantine Grand Theory,* rejecting Darwin evolution and favoring universality of Intelligent Life.

Keywords: Quantum Theory, Holographic Principle, Steady-state Cosmology, Coherent Cosmology, Eddington Theory, Dark energy, Antimatter, Dark matter, Combinatorial Physics, Photon mass, String Theory, Cosmo-biology.

1. Introduction: a necessary synthesis between two cosmologies

It is the general opinion that something got wrong in present day standard cosmology. In a recent overall perspective, one reads [1]: *No-one yet knows how the theoretical maladies of cosmology will be solved, if they can be solved, or even if they need to be solved. As more 'conventional' attempts to find solutions have failed to make headway, however, it becomes tempting to try more radical ideas. As evidenced by past 'paradigm shifts' in physics, radical ideas are often necessary for progress, and we, as a community, must be open to their exploration. Certainly, there is no point in being dogmatic about Cold Dark Matter (CDM) when there is consensus that it cannot be the full picture. Still, it should be a principled radicalism that we insist upon. Smashing the foundations of the standard cosmological model is all well and good, but the end result cannot be considered successful unless it is a truly predictive theory – one that not only fits the bulk of current and future data, but explains it as a non-trivial consequence of its deeper structure. Simply introducing additional unconstrained degrees of freedom to fit-out deviations will not do. An alternative theory should ideally strengthen the connections between cosmology and the rest of physics too, as CDM has done só ably; theories with special constructions that disconnect the causes of cosmological phenomena from their possible consequences elsewhere look feeble. But even if evolution, rather than revolution, is needed to fix up CDM, there may still be something to recommend a more radical stance – perhaps a shake-up of our perspective, rather than our theory, is what has been needed all along?*

In particular, consider the 'flatness problem', i.e. why the horizon radius R and the equivalent mass of Universe M are tied by the simple relation $M = Rc^2/2G$. This problem is currently resolved by an ad-hoc inflation step, but this introduces new theoretical difficulties [2]. Also, a main problem is the special value of the cosmological constant, corresponding to the dark energy density, which is 0.685(17), according to the recent Planck mission [3][4]. Now, this is compatible with the trivial value 7/10, one obtains in applying the well-known gravitational potential energy of an homogeneous sphere $(3/5)GM^2/R$, which, by eliminating G with the above critical condition is $(3/10)Mc^2$, letting the density 7/10 apart. This seems to indicate that cosmology would be simpler that it is ordinary believed.

Another intriguing point concerns the Hubble constant. While the recent direct measurement by supernovae 1a [5] leads to the value 73.8(2) km s^{-1} Mpc^{-1}, the Planck mission result [3][4] is 67.8(9) km s^{-1} Mpc^{-1}. These values are discordant but their mean value is very close to the value tied to the so-called universe age 13.81(5) Gyr. Such a direct correspondence is found in *the single time-invariant parameter steady-state cosmology* [6][7], while present-day standard cosmology optimizes 6 time-dependent free parameters.

It is recalled that *the forgotten steady-state cosmology have correctly foreseen the acceleration of galaxy recession and the critical character (flatness).*

Moreover, the main argument which have led to his abandon, the discovery of the Cosmic Microwave Background (CMB), was in fact not pertinent. Indeed, the steady-state is *the only cosmology which have predicted correctly its temperature,* from only the Helium density [8]. This density was correctly estimated at the epoch, from Oort estimation 10^{-30} g cm^{-3} of real matter density, and from the energy associated to each Helium atom formation, one obtains 3 K in a single line of calculus. By contrast, complicated calculation from the Primordial Big Bang model, with transition from cold to hot Big Bang model, led to temperatures between 5 K and 19 K, as described in a review article [9], where one can read a source of error '*It might be noted that the large overestimate of Hubble's constant at that time, with the use of a close to realistic present matter density ...'*

More generally, it is clear that a so quasi-perfect thermal distribution is better explained in a steady-state than in an explosive one. So the Ockham razor is clearly favorable to the steady-state cosmology.

But, contrary to the Primordial Big Bang model, the steady-state model was highly refutable, which is a necessary criteria for a scientific theory. So opponents to this theory (but not only from scientific grounds) found many ways for its refutation, which appeared later to be disputable arguments [10]. It is true that the founders of steady-state cosmology embarked in the search for a thermalizing agent, such as metallic or carbon whiskers [8], which were not convincing enough. This was a main cause of rejection of steady-sate cosmology, but this objection also is not pertinent, because a 'Grandcosmos' may play this thermalizing role, as explained below. So, the observations of the CMB, which seem to confirm the standard model, could be merely a misinterpretation of Grandcosmos properties. It is significant that opponents concentrated effort to such a detail: this means they have no stronger arguments. The irony is that standard cosmology introduces now a multiverse [11], which is unscientific in character, because its is unobservable, contrary to the Grandcosmos, manifested by CMB.

The more delicate point in the steady-state cosmology is that, as a consequence of its basic assumption, the Perfect Cosmological Principle, new matter must appear to compensate for the galaxy recession. This has been called a violation of energy conservation, but it is not really so, since *in an invariant horizon the energy must remains invariant*. It is true that this new matter rate production is no-directly measurable (about one neutron by century in a cathedral volume), but it implies a coherence of the whole universe, implying a tachyonic physics [12] tied to quantum non-locality, and, in the extreme, a discrete and deterministic physics [13] Moreover, this new matter apparition could be related to strange observations of Halton Arp [14], as discussed in the conclusion.

Another dramatic observation is the non-Doppler oscillation [15], with period 9600.6 s observed by Valery Kotov and Victor Lyuty since decades, in several quasars, which is directly related to gravitational and Fermi constant G and G_F, as recalled below. This is the sure sign that new tachyonic physics is on stage.

So, the steady-state cosmology, a hightly refutable model, not only has not been

refuted, but has also been very predictive.

But there is an apparent terrible objection against the steady-state model: for an observer A a given galaxy can exceed the celerity c when she passes across the horizon of A, while for an another observer, this is not the case, since the horizons of observers A and B are not the same. But this is easily resolved by supposing that special relativity is ruled out at cosmological level. Indeed, by summing the galactic kinetic energy $(dm)v^2/2$ in the R-radius sphere, one obtains the non-relativistic result $(3/10)Mc^2$. Now the classical gravitational potential energy of an homogeneous sphere is $-(3/5)GM^2/R$. *Equalizing to zero the sum of these energies,* the famous *free lunch* hypothesis, this corresponds to the critical condition $R/2 = GM/c^2$.

This rejection of Special Relativity could be surprising, but in fact, as explained above, general relativity is not really necessary in cosmology. Indeed standard model itself gets in final a flat space with an apparent absolute time, tied to the so-called Universe age. *The two Relativities would be only local phenomena*. Indeed, physicists have now a special reference frame: the cosmic microwave background (associated to the Grandcosmos) and absolute velocity have a signification: the speed of the sun is about 369(1) km/s. An absolute clock is also known, the above cosmic coherent oscillation, as shown below.

Now, what is the meaning of the traditional expression 'expansive Universe' ?. If one defines the Universe as the totality of everything, it is a contradiction, since one cannot answer the question 'in what the Universe is expanding ?' But with a separation between Universe and Grandcosmos, the situation is clearer. However, since the radius horizon is time-invariant, this means the term 'expansion ' must be replaced by 'galactic recession'. Indeed, by admitting that a repulsive force between two galaxies of mass m_1 and m_2 is proportional to their mutual distance l, its simplest expression is $\sqrt{(m_1m_2)}l/T$, where $T = R/c$ is the single free parameter in the steady-state model. This force corresponds to an exponential recession, and exceeds the gravitational force for a distance superior to $(\sqrt{(m_1m_2)}GT^2)^{1/3}$, which is of order 10^6 light year, i.e. the dimension of a galaxy group. *The non-reconnaissance of this simple argument led to historical misconception: Lemaître and Hubble have taken into account galaxies which belong to the Local group, and so the values of the corresponding so-called 'Hubble constant' was underestimated by an order of magnitude. By the way, the diagram presented by Hubble was anything but a straight line, and was supported by a single one galaxy studied by Humason, the ex-mule driver of the Hubble observatory (Mount Wilson)* [8].

It remains to explain the considerable apparent success of the standard Primordial Big Bang theory, called 'the ··CDM concordance model', with a cold dark matter (CDM) and a repulsive 'dark energy' tied to a constant ···. The aim of this paper is to show that the two cosmologies are mutually compatible, if one reinterprets the Big Bang phenomena as a very rapid Big-Bang/Big Crunch phenomena. This model [16] was first proposed in 2011, and is thoroughly detailed here.

Section 2 is a reappraisal of cosmology foundations, leading to the same conclusion that above: a tachyonic part of Universe must be envisaged, confirmed by dramatically *c*-free symmetric relations.

Section 3 recalls basic definitions, including proposals for horizon radius *R*. and period of oscillation tcc. This shows a dramatix symmetry between Newton and Fermi constants, interpreting the parity violation.

Section 4 is devoted to an overall coherence analysis of the Universe, showing that the critical condition is merely an application of standard holography principle, suppressing any need for inflation, which is replaced by very rapid Big Bang/Big Crunch oscillation. This is tied with quantization of length-time and under-quantization of mass, by a factor of 4×10^{60}, a factor which is related to the vacuum energy. The later is known to be about 10^{122} larger than visible energy, described as the largest discrepancy of physical physics.

Section 5 presents the Black Atom model, showing tight connexion between micro and macro-physics, leading to dramatic properties of the electric coefficient $a \approx 137.0359991$.

Section 6 is devoted to Holographic two-step interaction, leading to a proposal for photon and graviton masses, with a gravitational speed exceeding *c* by the ratio 2.46×10^{36}.

Section 7 presents the approach of cosmology from the view-point od a quantum system, with a model of a *gravitational* Hydrogen Molecule, in relation with the dark matter problem.

Section 8 is devoted to the Combinatorial Hierarchy, definitely proving that physical parameters has nothing to do with chance.

Section 9 shows special holographic relations, merging in a topological axis (section 10), connected with the tachyonic bosonic string theory, so rehabilitating the later, which was precisely discarded because of its tachyonic character.

Section 11 introduces the beginning of Cosmo-biology.

Section 12 presents the Harmonic Principle, showing that the fundamental laws are arithmetical.

A conclusion (section 13) resumes the general principles to be used in the search for the future Diophantian Grand Theory. A guide to this is given in an Appendix, connecting the Coherent Cosmology with the SO(32) superstring and the BEH scalar boson with the generalized (by Eddington and others) Dirac electron equation.

2. A reappraisal of cosmology foundations: the Coherence Principle

According to the 'Poincaré Principle', the laws of physics must be invariant [17]: this was the premonition of the Perfect Cosmological Principle, extending space homogeneity to time regularity, the very basis for the steady-state cosmology. Now there are two kinds of laws: local or global. The first ones are of differential type,

so sensible to boundary or initial conditions, and thus cannot be applied successfully to Cosmology, since the observable Universe is unique, as Poincaré also remarked, because free parameters would be involved [17]. The second type of laws is of conservation nature, so without free parameters. For example, the energy conservation in a closed system is not really understood (the classical association with an homogeneous time is no really explanation). But if one introduces a Coherence Principle, stating that *a closed system is vibrating with an invariant frequency f* (for instance a vibration matter-antimatter [16][18]), then the meaning of energy conservation is that energy is associated with frequency, a more basic concept. Now, an invariant frequency is the essential requirement to practice holography. This technique is, by far, the more efficient way to deal with information, and corresponds to global conservation laws. Note that the very concept of a 'physical law' implies that there is an hidden calculus. This is in contradiction with the usual statistical interpretation of quantum physics, but will be confirmed by the following 'coherence analysis' (section 3).

Interestingly enough, independently of the present Coherence Principle, and the *arithmetic* Holic Principle of the author [18], theoretical physicists introduced a reduced 'Holographic Principle' [19], limited to the consideration of a single holographic unit: the Planck area. We have shown [20][21], and will resume this below, that other lengths, in particular the main particle and cosmic wavelengths, enter such holographic conservation relations.

But the essential point for applying holography have been overlooked: holography needs complete coherence of all the waves, meaning a single frequency is at work, and this is not possible if the Universe is limited by c celerity, far too slow to assure any coherence in the Universe.

Moreover, the so-called wave-particle dualism was never really explained. In fact matter *propagates by wave and is absorbed by quanta* (the usual sentence 'matter is both quantum and wavy' is imprecise and misleading). So, the simplest explanation is that rapid precursors analyses the situation before deciding where the quantum effect will arise [21] [22]. So no-locality is essential in wavy mechanics. But, since physics allows only measurable quantities, even a tachyonic celerity cannot be infinite, so *one cannot understand quantum physics without involving speed limited tachyonic cosmology*. So one main goal of Coherent Cosmology is to compute this tachyonic celerity C. Of course, the usual presentation of Universe as 'an ensemble of particle in statistical c-limited interaction' is reductionist non-sense.

3. The fundamental formula: evidence for tachyonic sweeping

In each of the following definitions, c is eliminated [23] [24]. Here $a \equiv \hbar c/q_e^2 \approx 137.0359991$ and $\lambda\!\!\!^{-}_e \equiv \hbar/m_e c \equiv ct_e$. Moreover, a_G and a_w are the gravitational and electro-weak analogs of a in the famous article of Carr and Rees [11]. However,

these authors choose rather the gravitational force between two protons, while we consider the force between a proton and an Hydrogen Atom, which is free from electrostatic force and will be justified below by involving a gravitational Hydrogen molecule (Section 7), with $r_H^{(0)}$ the bare Bohr radius, $a \approx 1378.0359991$ and $\lambda\!\!\!^{-}_e = \hbar/m_e c = ct_e$:

$$r_H^{(0)} \equiv a\lambda\!\!\!^{-}_e \tag{3.1}$$

$$a_G \equiv \hbar c/Gm_p m_H \tag{3.2}$$

$$R/2 \equiv a_G \lambda\!\!\!^{-}_e \tag{3.3}$$

$$m_P^4 \equiv Mm_e m_p m_H \tag{3.4}$$

$$a_w \equiv \hbar/cG_F m_F^2 \tag{3.5}$$

$$t_{cc} \equiv \sqrt{(a_G a_w)}\, t_e \tag{3.6}$$

The elimination of c is exactly what is expected in a Coherent Universe. Indeed, this speed is clearly too small to connect a so vast Universe. For this reason, in order to explain the homogeneity of CMB, the standard cosmology invokes again an ad-hoc super-rapid inflation. It is of course more logical to invoke *quantum non-locality*. In fact the above c-free electricity-gravitation symmetry has been suggested by the author as soon as 1998, but rejected by the Orsay University, on the basis of an anonymous expertise, but Jean-Claude Pecker took it seriously, and, on his recommendation, a closed draft was deposed at the French Academy of Science in March 1998. Interestingly enough, the associated time R/c, was, apart a 2 factor which is justified below, the so-called 'Univers age', 18 years before its present 0.3% precision determination. This was deduced from c-free dimensional analysis, in the three first minutes of a sabbatical year (September 1997), but using rather the symmetrical product of electron-proton-neutron masses. This means *the simplest mandatory calculation, eliminating the Primordial Big-Bang dilemna and the associated Large Number Problem, was not made during nearly a century, containing more scientists than in all History*. This is simply due to the fact that putting $c = 1$ in formula, (even Eddington did so), any c-free dimensional analysis was excluded. Note that this catastrophic identification of the concepts of Time and Space, was denounced in advance by Poincaré, the true discoverer of Relativity theory himself.

But, in reverse, this 0.3% *correlation means there is something right in the standard cosmology, confirming the need for a combination of the two main cosmologies as will be confirmed below by the dramatic apparition of the neutrino background field (Section 9).*

Since the Fermi constant G_F, the associated Fermi mass $m_F \approx 573007.33(25)m_e$ and the cosmic period t_{cc} are about 100 times better defined than G, this correspond to a value G' we adopt in all the following, 2 sigma higher from the tabulated value [5] $G \approx 6.6738(8)$ $kg^{-1}m^3s^{-2}$, which is a compromise between discordant measurements:

$$G' \approx 6.675455 \ kg^{-1}m^3s^{-2} \tag{3.7}$$

The corresponding value for R is

$$R \equiv 2\hbar^2/G'm_em_pm_H \equiv 2G_Ft_{cc}^2/m_e\lambda\!\!\!^{-}_e{}^4 \approx 13.8123 \text{ Gly} \tag{3.8}$$

corresponding respectively to a c-free definition and a $\hbar$-free one. Note that the first expression corresponds to a special case of Eddington's formula $R/2\sigma = \sqrt{N}$, with the identification $\sigma \equiv \lambda\!\!\!^{-}_H$, and $N \equiv M/m'_e$, with $m'_e \equiv m_em_p/(m_p + m_e)$, the classical reduced electron mass. This would mean that *the electron is the basic stuff in the Universe*. Combined with the critical condition, this corresponds to the following symmetric multiple relation, resolving the Large Number 'Problem', and making very precise (limited by uncertainty 2×10^{-4} on W) the known fact [11] that a_G is of order W^8, where W and Z are the masses of the weak bosons by respect to the electron:

$$R/2\lambda\!\!\!^{-}_H \equiv \sqrt{(M/m'_e)} \equiv \hbar c/Gm_em_p \approx (WZ)^4/2 \approx \sqrt{(10\pi_{Pt})} \times 2^{137} \tag{3.9}$$

where appears neatly the famous Ptolemaeus approximation $\pi_{Pt} \approx 2 + 137/120 = 377/120$.

Moreover, the above definitions implies the dramatic relation:

$$\sqrt{(G'G_F)} \equiv (\lambda\!\!\!^{-}_e{}^2/t_{cc})\ \hbar/\sqrt{(m_pm_H)} \tag{3.10}$$

showing two terms which are *both area speeds*, characteristic of the second Kepler law. This is significant of a sweeping construction-deconstruction of the Universe by a single point [18] (called the 'Hol'), corresponding with *zero dimension holography*. Since such a sweep is necessarily oriented, this justify at last the dis-symmetry right-left, which is called 'violation parity' in particle physics and appears also in biology.

Note that the common assertion that quantum physics is limited to the micro-physics is false since the Pauli exclusion principle enters the calculation of a star radius, via the concept of degeneracy energy. Also, considering that all atoms are identical, a natural question is the limit of a star radius when its number of atoms goes to unity, This *leads to the above redshift radius R*, a fact nobody has realized during nearly a century. The following calculation of a star radius is given by

P.C.W. Davies [26].

A ball of gas of radius R will remain in equilibrium if its self-gravity is supported by the combined effort of its internal thermal pressure and its electron degeneracy pressure. This will be the case if the gravitational energy by particle is comparable to the sum of the thermal energy and the degeneracy energy. For hydrogen gas this implies

$$k\boldsymbol{T} + \mathrm{N}^{2/3}\hbar^2/m_e R^2 \sim GMm_p/R \tag{3.11}$$

with $\mathrm{N} = M/m_p$. At low density (large R), the term is small, so the temperature is inversely proportional to R. This is the case when the star first forms from a slowly contracting cloud of gas. Eventually, however, as the radius shrinks, the degeneracy term becomes important, and the temperature reaches a maximum when

$$Gm_p^2\mathrm{N}/R \sim \mathrm{N}^{2/3}\hbar^2/\mathrm{m}_e R^2 \tag{3.12}$$

is greatest. This occurs for

$$R \sim 2\hbar^2/Gm_p^2 m_e \mathrm{N}^{1/3} \tag{3.13}$$

which is, for N going to unity, the redshift radius (2.1.1), apart a hydrogen/proton mass ratio. *So the redshift radius was present, since decades, in the astrophysical textbooks.*

It is recalled that the Eddington's prediction [25] for the number of equivalent Hydrogen mass in the Universe is 136×2^{256}, a prediction which was largely mocked, but which is consistent with the official concordance value $T = 13.80(5)$ Gly, taking account of the above 3/10 relative density for matter, this writes:

$$M_{mat}/m_H = (3/10)Tc^3/2Gm_H \approx 2^{256} \times 136.2(5) \tag{3.14}$$

probably the most remarkable scientific prediction in History. *So, the dark matter would be in fact ordinary matter, but as these two kinds of matter are not photon-interacting, this would mean they are vibrating in quadrature.* So the solutions of the Dark matter and antimatter problems are directly connected, see Section 7.

4. Coherence Analysis: The Computing Cosmos

4.1. The General Coherence Condition

Several authors have advanced the hypothesis that the laws of physics result from a calculation process [27]. In fact, the existence of conservation laws favors directly such an hypothesis. This "Computing Cosmos" (CC) is sustained by the dramatic properties of cellular automates [28]. Moreover, Gerard 't Hooft has

shown that quantum field theory can be adapted to deal with a deterministic cellular automaton [29]. This suggests that behind the so-called 'indeterminacy' of quantum physics, a deterministic process is at work.

This induces the following 'coherence analysis', where numerical coefficients are omitted first for simplicity. Consider the critical Universe of radius horizon R. Filling the sphere interior with observers of virtual mass m, (recall that the vacuum is not really empty) this forms a volume referential, far more realistic than the ordinary academic three-axis frame. We define a 'coherence domain' associated to the mass m by $ƛ_m \equiv \hbar/cm$. The total mass is limited by the critical condition $M = Rc^2/2G$, so the number N_{obs} of observers is limited to the value $Rƛ_m/2l_{Pl}^2$. Note that this critical condition applies for a black hole, and is considered as a limitation for preventing a collapse. The formula is the same for the Universe, but, for the latter, *the galaxy recession prevents such a collapse*. Calling d the mean distance between observers, the number of observers is

$$N_{obs} \sim (R/d)^3 \tag{4.1}$$

so:

$$(Rl_{Pl})^2 \sim ƛ_m d^3 \tag{4.2}$$

This General Condition will be applied in the following four ways.

4.2. The Global Coherence condition: **the Large Number problem resolved**

With the global coherence condition $ƛ_m \sim R$, one gets $N_{obs} \sim (R/l_{Pl})^2$, and:

$$d \sim (Rl_{Pl}^2)^{1/3} \sim 10^{-15}\ \text{m} \sim r_e \tag{4.3}$$

a result also obtained by Y. Ng [30], but where considering, with the c - limitation, the Universe as a 'greatly parallel computer'. By contrast we interpret the tachyonic Universe as coherent and sequential. The obtained value 10^{-15} m has no signification in the standard R-variable scheme, but of course, it is close to both the nuclear scale and the classic radius of electron r_e. This is the origin of the Large Number Hint, considered as a 'problem' by a majority who believe in the variability of R, and introduced an ad-hoc application of a so-called Anthropic Principle'. Note that the radius r_e^3/l_P^2 corresponds agaoin to an elimination of c between r_e and l_P. Moreover it writes in function of the Nambu mass $m_N = am_e$, which plays a central role in particle physics [31]. So we introduces the following radius

$$R' = 2\hbar^2/\text{G}m_N^3 \tag{4.4}$$

the factor 2 coming from the fact that the associated mass is then very simple: m_P^4/m_N^3. This radius R' is slightly larger than R, by the ratio

$$R'/R = m_e m_p m_H/m_N^3 \approx 1.31084 \tag{4.5}$$

the simplest interpretation being that R' is the holographic equivalent of the Grandcosmos behind, as confirmed in the following. As this factor is close to 4/3, this leads to the following half-sphere holographic conservation of the Bekenstein-Hawking Universe entropy:

$$\pi(R/l_{Pl})^2 \approx (2\pi/3)\,(R/r_e)^3 \tag{4.6}$$

this holography defines also a wavelength $\lambda\!\!\!^{-}_{hol}$ associated to the Bohr radius r_H:

$$\pi(\lambda\!\!\!^{-}_e/\lambda\!\!\!^{-}_{hol})^2 = (4\pi/3)\,(r_H/\lambda\!\!\!^{-}_e)^3 \tag{4.7}$$

corresponding to a mass $m_{hol} \approx 1853.8\ m_e$, which is encountered in the DNA, see Section 11.

4.3. The One-observer condition: Critical Condition, General quantization and Universe vastness

With $N_{obs} \sim 1$, or the condition $d \sim R$, one gets

$$\lambda\!\!\!^{-}_m = \lambda\!\!\!^{-}_M = \hbar/cM = 2l_P^2/R \sim 10^{-95}\ \text{m} \tag{4.8}$$

this is the Universe wavelength, of central importance, since it enters the following *holographic form of the critical condition* $R = 2GM/c^2$:

$$\pi(R/l_P)^2 = 2\pi R/\lambda\!\!\!^{-}_M \tag{4.9}$$

The standard limitation of length to the Planck unit is toppled, as well as the standard limitation of the standard 'Holographic Principle', which considers only the area l_P^2.

Introducing the General Quantification Principle: any particle of mass $m = M/N_m$ is a sub-multiple of the total mass M, so the associated wavelength $\lambda\!\!\!^{-}_m$ is a whole multiple N_m of $\lambda\!\!\!^{-}_M$, this permits to extend the above holographic conservation in the following manner:

$$\pi(R/l_P)^2 = 2\pi R/\lambda\!\!\!^{-}_M = 2\pi N_m R/\lambda\!\!\!^{-}_m \tag{4.10}$$

this collection of circles generates the approximation of a sphere. But, for this approach to be acceptable, N_m must be large numbers. So *the considerable vastness of the Universe receives a justification*, far better than the standard one, which states that the initial conditions for the Primordial Big Bang were adjusted to 10^{-60} or so.

Note that the characteristic mass $m_0 = \hbar/Rc \approx 2.69\ 10^{-69}$ kg is not a quantum, but a sub-quantum $m_0 = M/N_0$ of the total mass M, with $N_0 = (R/l_P)^2/2$. *This shows an*

interpretation of the above standard Bekeinstein-Hawking entropy, apart a factor $\prec\!2$.

4.4. The Standard Coherence condition: Grandcosmos and vacuum energy

In standard physics, the limit of a spatial dimension is the Planck length. With the condition $d \sim l_{Pl}$, one gets:

$$\lambda\!\!\!^{-}_{m} \sim R^2/l_{Pl} \sim 10^{87}\ \mathrm{m} \sim R_{GC} \tag{4.11}$$

This defines a length of order the Grandcosmos radius, defined by the following way. Applying the monochromatic holographic principle to the above sphere of radius R', with l_{Pl} as the monochrome unit:

$$\pi(R'/l_P)^2 = 2\pi R_{GC}/l_P \tag{4.12}$$

this defines a radius $R_{GC} = 2R'^2/l_P \approx 6.94\ 10^{60}\ R$.

Admitting the Grandcosmos is closed itself by a critical condition with a super-speed C, the uniformity of equivalent material density with the Universe means $C/c = R_{GC}/R$. So a mass m is associated with two energies, the, standard one mc^2 and the tachyonic one mC^2, with a ratio $(C/c)^2 \sim 10^{122}$. This resolves the central problem of present-day theoretical physics the vacuum energy, which shows itself in the Casimir effect [32], and have been checked [33]. The pertinence of this Grandcosmos is assured by *the dramatic value of its volum*e, with unit length the Bohr radius:

$$(4\pi/3)(R_{GC}/r_H)^3 \approx a^a/\pi \tag{4.13}$$

The simplest hypothesis is that the Grandcosmos is the source of the cosmic microwave background (CMB). Indeed, R' is directly tied to the Wien CMB wavelength, in a dramatic manner:

$$(4\pi/3)(R'/l_{Wien})^2 \approx e^a \tag{4.14}$$

This casts a *serious doubt on the general belief that a thermal field loses information.*

4.5. The field Coherence condition: CMB and Biology

With the field coherence condition $\lambda\!\!\!^{-}_{m} \sim d$, one gets:

$$\lambda\!\!\!^{-}_{m} \sim d \sim (Rl_{Pl})^{1/2} \sim 10^{-4}\ \mathrm{m} \tag{4.15}$$

of order the Cosmic Microwave Background (CMB) wavelength, but with a significant departure which will be interpreted below, in the section 11, in liaison

with an identification of some cosmic parameters with biological ones. This means:

$$N_{obs} \sim (R/l_{Pl})^{3/2} \sim (\lambda\!\!\!^{-}_m/l_{Pl})^3 \tag{4.16}$$

Showing another generalization of the standard Holographic Principle, since the volume of the redshift sphere is involved, with unit the linear Planck length.

5. The Black Atom model

The *black atom* model [14] considers a hydrogen atom which is immersed inside a black hole of radius R_{ba}, limiting electron circular trajectories. The intermediate space is paved with spheres of radius $r_n = n\lambda\!\!\!^{-}_e$ where $\lambda\!\!\!^{-}_e = \hbar/m_e c$. and n an integer number The corresponding electron speeds are given by $\hbar = m_e r_n v_n$, implying $v_n = c/n$, so the first trajectory (n = 1) is excluded. Equating the corrected Bohr radius $r_H = a\lambda\!\!\!^{-}_e(1+1/p)$, where p is the proton-electron mass ratio, with the mean radius of the spheres, limited by $R_{ba}/\ell\!\!\!^{-}_e$ – each with a probability proportional to n^{-2} – one gets

$$r_H/\lambda\!\!\!^{-}_e = \Sigma(1/n)/\Sigma(1/n^2) \tag{5.1}$$

Therefore, with $z \approx 0.422784335$, the complement to 1 of the Euler constant, this defines the radius

$$R_{ba} = \lambda\!\!\!^{-}_e \exp[(\pi^2/6 - 1)r_H/\lambda\!\!\!^{-}_e + z] \approx 1.4923 \times 10^{26} \text{ m} \approx 15.775 \text{ Glyr} \tag{5.2}$$

which is found to be very close to $2\hbar^2/G(ad_a+2\pi)m_e)^3$, with the abnormal electron magnetic coefficient $d_a \approx 1.001159652$. The term $ad_a + 2\pi$ is very close to the canonic term of the Planck law $e^g \approx 143.3249$, where $g \equiv 5(1-e^{-g})$ is the Wien coefficient, i.e. the ratio between the nominal wavelength hc/k**T** and the Wien length. This proximity with $a + 2\pi$ suggests that a is a trigonometric line, indeed:

$$\cos a \approx 1/e \tag{5.3}$$

to 22 ppm. Now the characteristic property is :

$$(ad_a+2\pi)^3 \approx a^{3/2} m_n^2/m_e m_p \tag{5.4}$$

to 1 ppm, where appears the neutron and proton masses. So, there is a relation between R_{ba}, R' and R, specifying the first (0.25%) approximation $R_{ba} \approx (RR')^{1/2}$, where $R' \equiv 2\hbar^2/Gm_N^3$ is the above ``Cosmic Nambu radius''. This "black atom relation" can be approximated by

$$a/\ln(2a_G) \approx (\pi^2/6 - 1)^{-1} \tag{5.5}$$

This makes precise th following rough relation

$$a \sim \ln(a_G) \tag{5.6}$$

justified by basic theoretical considerations, see Carr and Rees [11].

6. Holographic two-step interaction

Even the electromagnetic interaction is not really understood [34]. Consider for simplicity two identical system of mass m in their basic state. They are each characterized by a stationary wave, which may be seen as the sum of a diverging wave and a converging one: $s + s^*$, with $s = \exp(if2\pi(t-r/c))$, where f is the proper frequency $mc^2/\hbar$. The second system is characterized by the analogous wave $r + r^*$. Supposing that the vacuum is *not* empty, an hologram is formed: $(s + s^*)(r + r^*)$, which includes the *resonant* terms $sr^* + s^*r$. So, the simple presence of two systems create such an inhomogeneity in all the Universe. Now if the first system has an excess of energy, this means it is receiving an excess signal of the form s^*. By diffraction on the above hologram it gives rise to $s^*(sr^* + s^*r)$, with resonant term r^*. So convergent waves are of primordial importance, instead of current diverging ones. But the process is symmetrical, so this leads to a oscillation. This is known a the particle exchange (implying a boson with mass m_B) associated with any interaction. But it is assumed here that the boson has a tachyonic speed C_B. Now, the resonance condition is that the wavelengths are identical (in analogy with the Gabor condition [35]). So, for the electron:

$$\lambda\!\!\!^{-}_e = \hbar/m_e c = \hbar/m_B C_B \tag{6.1}$$

Now, the involved ratio is supposed to be R/r_H, so:

$$R/r_H = C_B/c = m_e/m_B \approx 2.46 \times 10^{36} \tag{6.2}$$

This could define the gravitational speed, and defines a gravitation mass:

$$m_{gr} = m_e r_H/R = a m_0 \approx 3.689 \times 10^{-67} \text{ kg} \tag{6.3}$$

where $m_0 = \hbar/Rc \approx 2.69\ 10^{-69}$ kg is the above characteristic mass.
By extending the argument to electroweak interaction, with characteristic mass. $m_w = a_w m_e$:

$$R/r_H = C_B/c = m_w/m_B \approx 2.46 \times 10^{36} \tag{6.4}$$

this defines a photon mass:

$$m_{ph} = m_w r_H/R = a m_0 \approx\approx 1.211 \times 10^{-55} \text{ kg} \tag{6.5}$$

The following Marchal proposition [36] for the photon mass, which is associated to the cosmic oscillation, tied to the above non-Doppler Coherent period $t_{cc} \approx 9600.61$ s, is very close to the above value:

$$m'_{ph} = \hbar/c^2 t_{cc} \approx 1.222 \times 10^{-55} \text{ kg} \tag{6.6}$$

showing a departure of only 0.903 %. Note that the present-day [5] selected maximal value for the maximal photon mass, which have not varied since 2004 [34] is 1.8×10^{-54} kg .

7. The Universe as a quantum system

7.1. The Basic Hydrogen Spectra

Three years before Niels Bohr, see [4], Arthur Haas have equalized three forms of energy, the kinetic, the potential and the quantum forms, in a 2D circular model of an electron orbiting around a proton with the speed v_e on a circle of radius *r*. In fact, from the virial theorem, twice the kinetic energy must be considered, and the quantum form *nhf* uses the frequency of the electron rotation, so writes $nhv_e/2\pi r = n\hbar v_e/r$, so, neglecting at first the equivalent mass problem in this two-body system:

$$m_e v_e^2 = \hbar c/ar = n\hbar v_e/r_n \tag{7.1}$$

Where $a \approx 137.036$ is directly involved in the electric force between two elementary charges $(q/r)^2 = \hbar c/ar^2$ meaning $a = \hbar c/q^2$ (its inverse is called 'structure-fine constant', a non-central concept. The official electrical charge unit (Coulomb) is completely misleading: indeed, as any electric force is a whole multiple of this unitary force, a choice of a specific unit for an electric charge is not necessary, *so an electric charge is directly related to a whole quantum number*. The so-called 'electric permittivity of vacuum' is also completely misleading. The above relations contain the Bohr quantum relation $n\hbar = r_n m_e v_e$, and give:

$$v_{en} = c/an \tag{7.2}$$

$$r_n^{(0)} = n^2 a\hbar/cm_e \equiv n^2 a\lambda\!\!\!^{-}_e \tag{7.3}$$

Note that Haas used the true kinetic energy, so obtained in fact twice the correct value for r_n, in particular for the bare Bohr radius $r_1 = r_H^{(0)} = a\lambda\!\!\!^{-}_e$. Note that with the mass correction, the real Bohr radius is $r_H = r_H^{(0)} \times (1 + m_e/m_p) \approx r_H^{(0)} \times (H/p)$, with *p* and *H* the electron and Hydrogen masses, by respect to the electron one.

7.2. The *Gravitational* Hydrogen Molecule

Now, consider a Hydrogen-proton couple, orbiting by gravitation on a circle of *invariant radius R*, where an electron is also circulating with speed v_e. The

gravitational absolute potential energy is $Gm_Hm_p/2R$, but can be written in the same form as above by introducing the 'gravitational interaction constant' $a_G = \hbar c/\mathrm{G}m_H\mathrm{m}_p$. In this three-body system, the Coherence Principle gives, for n = 1:

$$\mathrm{v}_e = c/2a_G \tag{7.4}$$

$$R = 2a_G\lambda\!\!\!^{-}_{\mathrm{e}} = 2\hbar^2/Gm_em_{\mathrm{H}}m_{\mathrm{p}} \approx 13.812 \text{ Glyr} \tag{7.5}$$

which is compatible with the 0.3 % precise so-called 'Universe age' 13.81(5) Gigayears in standard cosmology [5]. As explained in Section 2, this formula is, in the simplest model, that of a star radius for its number of Hydrogen atoms going to 1, so this length exists for decades in astrophysical textbooks.

By adding the standard critical condition, or, equivalently, the Schwarzschild radius formula of a black hole horizon $R = 2GM/c^2$, this can be written, using the reduced mass $m_e' = m_em_p/(m_p+m_e)$:

$$R/2\lambda\!\!\!^{-}_H = \sqrt{(M/m_e')} = \hbar c/Gm_em_{\mathrm{p}} \tag{7.6}$$

which is the Eddington's statistical formula [6]: $R/2\lambda\!\!\!^{-} = \sqrt{(M/m)}$, with the identification $\lambda\!\!\!^{-} = \lambda\!\!\!^{-}_{\mathrm{H}} \equiv \hbar/m_{\mathrm{H}}c$ and $m = m_e'$. This is the response to Carr and Rees, which in their famous paper [7] state that current physics cannot explain the Large Number Correlation. Note that Eddington had not recognized this very symmetric identification because, at his epoch, the Hubble radius was underestimated by an order of magnitude. Let us recall the basic Eddington's argument: in a black hole of radius R, the position of a particle is uncertain by the length $R/2$. If one considers N particles, this is reduced by the statistical factor $\sqrt{N}$, giving a reduced length $R/2\sqrt{N}$, a length Eddington associated with the nuclear force range. The above equation shows it is rather the reduced Hydrogen wavelength. But the surprise comes from N, the *equivalent number* of electrons, as if everything in Universe would be made of electrons, or if there is only one electron whose sweep defines all the rest.

Note that, in function of the Planck mass $m_P = (\hbar c/G)^{1/2}$ the above relations leads to:

$$M\, m_e\, m_H\, m_p = m_P^4 \tag{7.7}$$

which shows a dramatic 'Machian' character.

7.3. The Quantum Universe and *Real* Matter

The above section was limited to the case $\mathrm{n} = m_eR\mathrm{v}_e/\hbar = 1$, but seems to product the real radius of Universe: this suggests the existence of an external Grandcosmos, see below. Now, the leading large number which appears in the above Eddington statistical formula (4.1) is M/m_e, as remarked above, the *equivalent* number of electrons in the Universe, as if a single electron was describing the whole Universe.

This would justify the principle of identity between electrons. This idea of an Universe described by the sweep of a single electron was advanced by Feynman [8], based on the possibility for the sweep to go backwards in time by transforming in positron. Wheeler argued 'in that case there would be the same quantity of matter and antimatter'. So, Feynman abandoned this idea. But the objection of Wheeler was not valid, since it suffices that ordinary matter is in fact a matter-antimatter oscillation [2]. So we suppose now that the single equivalent electron is associated with a large celerity V_e which obeys the Holographic Coherence Principle [9] applied to the Poincaré energy Mc^2:

$$m_e V_e^2 = Mc^2 \tag{7.8}$$

The question is 'what is the corresponding quantum number $n = m_e R V_e/\hbar$?' This writes, taking account of the Eddington statistical relation (3.3):

$$(n\hbar/m_e R)^2 = c^2 M/m_e = (\hbar c^2/G m_e m_p)^2 \tag{7.9}$$

which shows a symmetry $(m, -m)$, so expressing *the double solution matter-antimatter*:

$$n\hbar/m_e R = \pm \hbar c^2/G m_e m_p \tag{7.10}$$

Limiting to positive values, this leads to

$$n = Rc^2/Gm_H = 2M/m_H \tag{7.11}$$

which is the overall number of 'particles' electrons + protons in the sphere of radius R, which is a natural quantum number, widely used by Eddington [6]. This is a validation of the Coherence Principle justifying (4.1), for which an equipartition of the energy $m_e V_e^2$ among the M/m_H electrons leads to an elementary kinetic term:

$$m_e v_e^2 = m_H c^2 \tag{7.12}$$

this implying:

$$v_e = c\sqrt{(m_H/m_e)} \tag{7.13}$$

But this is not permitted by Relativity to *real* electrons. As the liberation celerity is c at the periphery of a black hole, one would have rather $v_e \approx c$, i.e. a replacement of (4.1) by:

$$m_H V_e^{(r)2} \approx Mc^2, \tag{7.14}$$

showing the way the above model must be adjusted. So, consider a reduced number of real Hydrogen atoms, with density $D^{(r)}_H$, the corresponding quantum number is $n^{(r)} = 2D^{(r)}_H M/m_H = m_e RV_e/\hbar$, corresponding to $V_e = 2D^{(r)}_H M\hbar/Rm_e m_H$ and the kinetic term becomes:

$$m_e V_e^2 = D^{(r)}{}_H^2 Mc^2 \tag{7.15}$$

In order to satisfy the above condition $m_H V_e^2 \approx Mc^2$, this implies

$$D^{(r)}_H \approx \sqrt{(m_e/m_H)} \approx 0.0233 \tag{7.16}$$

So the apparently strange fact that the Universe is only scarcely occupied by ordinary matter comes from the rather large ratio of the proton-electron ratio.
Note that the above density is about half the standard 'baryonic' density value [5], but confirms the steady-state cosmology (SSC) [10], [11], and the author 's Coherent Quantum Cosmology [12]. Indeed, the SSC model have predicted a thermal background, resulting from a thermalization of stellar radiation. Taking for the Helium mass density the standard value 0.252, this means a total Helium mass of $0.252 \times 0.0233 \times M \approx 5.172 \times 10^{50}$ kg, or 7.726×10^{76} Helium atoms. For each Helium atom, the released energy is $(4m_H - m_{He})c^2 \approx 4.283 \times 10^{-12}$ Joule. Thus, the total energy is 3.309×10^{65} J, corresponding to an energy density, in the volume of the R-sphere : 3.541×10^{-14} J m^{-3}. By equalizing this with a black body energy density $(\pi^2/15)(kT)^4/(\hbar c)^3$, this leads to $\mathbf{T} \approx 2.616$ K, which is sufficiently close to the CMB measured temperature 2.7255 K to confirm the above real matter density.
Now, taking $n_m = \Box_m M/m_e$, this defines a reduced energy in Eq(7.1), by respect to Mc^2:

$$(n_m\hbar/R)^2/m_e = (D_m/2)^2 Mc^2 \quad => \quad D_m' = (D_m/2)^2 \approx 0.0225 \tag{7.17}$$

which differs from the above value $D^{(r)}_H \approx \sqrt{(m_e/m_H)} \approx 0.0233$ for *real* matter density by 3.7 %.

8. The Combinatorial Hierarchy

The question arises: is there a direct relation between these 3 interaction constants, a, a_w, a_G ? An interesting point here is the remarkable 0.56% property of a_G:

$$a_G \approx 2^{127} - 1 \tag{8.4}$$

which is a Mersenne prime number, with a very special property, indeed $127 = 2^7 -$

1, then $7 = 2^3 - 1$, and finally $3 = 2^2 - 1$ are also prime Mersenne numbers. Now their sum is 3 + 7 + 127 = 137, which is the entire value of *a*, the whole number 137 justified by Eddington. Note that his Fundamental Theory was rejected as soon as *a* appeared to be slightly distinct from 137. Such a rejection is of course not justified, according to the Approach Principle, distinguishing Physics from applied mathematics.

The above series is known as the 'Combinatorial Hierarchy', which ends at the 127th power [37]. Now, 137 and *a* are clearly related by:

$$(137^2 + \pi^2)^{1/2} \approx 137.0360157 \qquad (8.5)$$

a 0.12 ppm approximation for *a*. Now π appears also in the Lenz-Wyler approximation for the proton-electron mass ratio $p \approx 6\pi^5$. Eliminating π between these two relations leads to the discovery of

$$(137^2 + (1834/6)^{2/5})^{1/2} \approx 137.035999097586 \qquad (8.6)$$

which is compatible with the measured value 137.035999074(44).

Note in this respect the remarkable 23 ppm Ptolémée approximation for π, which is encountered above:

$$\pi \approx 377/120 = 2 + 137/120 \qquad (8.7)$$

while the harmonic series of order 5 is involved:

$$1+1/2+1/3+1/4+1/5 = 137/60 \qquad (8.8)$$

Here are the first harmonic numbers:

$1+1/2 = 3/2$

$1+1/2 +1/3 = 11/6$

$1+1/2 +1/3 +1/4 = 5^2/12$

$1+1/2 +1/3 +1/4 + 1/5 = 137/60$

$1+1/2 +1/3 +1/4 + 1/5 + 1/6 = 7^2/20$

$1+1/2 + 1/3 +1/4 + 1/5 + 1/6 + 1/7 = 3^2 \times 11^2/420$

showing an astounding property. If one let apart the 3, the maximal prime numbers in this series shows a periodicity on 11:

$$11: 5; 137; 7; 11 \qquad (8.10)$$

with the 7^{th} harmonic number being 11 = 7 + 4, which is precisely the decomposition of the supergravity dimension number between 7 hidden dimensions and the 4 of ordinary space-time. Moreover, the numbers 4, 11, and 137, all being the maximal number of parts in a n-cutting process: n(n+1)/2 + 1 (for n = 3, 4, 16 respectively) are connected by:

$$11^2 + 4^2 = 137 \tag{8.11}$$

confirming the Eddington's definition: 137 = 136 + 1 (136 was his first prediction for the electric parameter). Moreover, 4 = 3 + 1 is the canonic relativity partition of dimensions into space and time, while 11 = 10 + 1 is the connexion between 11, the supergravity dimension and 10 the superstring one.

As ancian egyptians used only unitary fractions $1/n$, they were probably aware of the special character of 137 (as shown above the harmonic series of order 6 and 7 produce respectively maximal prime numbers 7 and 11). Indeed, it seems that the Hypostyle Room, located between the second and third pillars of the Amon Temple in Karnak represents numbers characteristic of the above Combinatorial Hierarchy and harmonic series. On each side, there is a square of seven by seven columns, (the square of 7 is present in the 6^{th} term of the above series), separated as 4×7 and 3× 7 groups by a transverse axis (called the royal one), which makes a group of 28 columns (the second perfect number) and a group of 21, which, with another group of 12 columns, makes 33, while 137 is the 33^{th} prime number (the square of 33 is also present in the 7^{th} term of the above series). So the total on each side is, by adding the 6 (the first perfect number) central columns: 28 + 33 + 6 = 67, so the total number is 134 = 7 + 127, which added with the pillar number 3 makes 137. What is also fascinating is that the two extremal huge central columns are partially immersed in the wall, as if the architect was representing 11.7, the square root of 137. This architecture is so special that there is little doubt it represents the Combinatorial Hierarchy and the above harmonic series. Moreover, the pharaoh was accustomed to pray at the intersection of the two axes, the divine one and the royal one, as if *the egypytians have devined that the following term involves a vast Universe.* Of course, egyptians could not know by themselves the law giving the order of a prime P, which is $P/\ln P$, so they probably ignored the fact that 137/ln137 is close to 28. So this number have been represented only because it is a perfect number. Also the difference between these numbers 33 and 28 is 5, which was sacred, and corresponds to the number of the free huge columns on each side. So their total is the famous tetractys 10 = 3 + 7, the precursor of 137 in the Combinatorial Hierarchy, Indeed, the sum 3 + 7 + 127 is the natural prolongation of the famous tetractys 1 + 2 + 3 + 4 = 10 = 3 + 7. Recall that Pythagoras lived 13 years in Egypt, so it is possible that this was the origin for his fascination for the tetractys:

$$3 + 7 = 10 \tag{8.12}$$

while the completed tetractis is

$$3 + 7 + 127 = 137 \tag{8.13}$$

The electrical parameter a is connected with 137, not only by the above relation to π, but also by internal relation:

$$a \approx (a/137)^{a^2} \tag{8.14}$$

or , equivalently, the relativistic factor in the first Hydrogen orbit, is, to 0.15 ppm:

$$\beta^2 = 1/(1-1/a^2) \approx lna/ln137 \tag{8.15}$$

Now, a direct relation is found involving the three large numbers directly implying the electron: a, a_w, and $P = m_P/m_e$:

$$P^{10} \approx a_w^{\,7} (\sqrt{a})^{134} \tag{8.16}$$

precise to 50 ppm. One recognizes the characteristic numbers of the CH in exponents. Now, separating 10 = 3 + 7, and 134 = 7+127, one gets:

$$P^3 (P/\sqrt{a}a_w)^7 \approx (\sqrt{a})^{134} \tag{8.17}$$

where the neutron-electron mass ratio n appears,

$$P/a_w\sqrt{a} \approx n^3 \tag{8.18}$$

precise to 90 ppm. This is a dramatic relation, undetected by standard analysis, but encountered already by a systematic elimination of c involving the cosmic Oscillation period.

9. Special Holographic Conservations

The following holographic expression, of type the area of a 4D-sphere $2\pi^2r^3$, involves very precisely the CMB wavelength $\lambda_{CMB} = hc/k\mathbf{T}_{\rm CMB}$, giving a temperature compatible with the measured one $\mathbf{T}_{\rm CMB} \approx 2.7255(6)$ K:

$$2^{127} \approx 2\pi^2(\lambda_{CMB}/\lambda\!\!\!^{-}_{\rm e}) \times (\lambda_{CMB}/\lambda\!\!\!^{-}_{\rm H})^2 \quad => \quad \mathbf{T}_{\rm CMB} \approx 2.7258204 \text{ K} \tag{9.1}$$

this is confirmed by the following formula involving the Fermi wavelength:

$$F^5 \equiv (\lambda\!\!\!^{-}_e/\lambda\!\!\!^{-}_F)^5 \approx 6\,(\lambda\!\!\!^{-}_{CMB}/\lambda\!\!\!^{-}_e)^3 \quad \Rightarrow \boldsymbol{T}_{CMB} \approx 2.725820(1)\ \mathrm{K} \qquad (9.2)$$

Admitting Eq. 9.3, this would permit to precise $G_F \approx 1.435850902 \times 10^{-62}$ Joule.m^3, corresponding to the following Fermi-electron mass ratio, while the present day measured value is $F = 573007.33(14)$:

$$F \approx 573007.325 \qquad (9.3)$$

It is this value we use in the following, and the corresponding CMB wavelength:

$$\lambda\!\!\!^{-}_{CMB} \approx 0.84007165 \quad \mathrm{mm} \qquad (9.4)$$

Now, the above formula $R = 2\hbar^2/Gm_em_pm_H$ may be written in terms of a 1D-2D holographic conservation:

$$2\pi R/\lambda\!\!\!^{-}_e \equiv 4\pi\lambda\!\!\!^{-}_H\lambda\!\!\!^{-}_p/l_P^2 \qquad (9.5)$$

while the connexion with $l_{cc} = ct_{cc}$ permits to add a 4D term implying both the Fermi wavelength and the CCO one. Moreover, another 4D term involves neatly both the CMB and neutrino wavelengths (CNB), through their characteristic ratio $11/4 \equiv (T_{CMB}/T_{CNB})^3$ being the cube of their temperature ratio:

$$2\pi R/\lambda\!\!\!^{-}_e \equiv 4\pi\lambda\!\!\!^{-}_H\lambda\!\!\!^{-}_p/l_P^2 \equiv 4\pi((\lambda\!\!\!^{-}_F l_{cc})^{1/2}/\lambda\!\!\!^{-}_e)^4 \approx 4\pi(\lambda\!\!\!^{-}_{CMB}/\lambda\!\!\!^{-}_e)^4 \times (11/4)^2\, p6\pi^5/H^2 \qquad (9.6)$$

precise to 0.1 ppm. This calls for a 3D holographic term, which dramatically gives the CMB nominal wavelength alone in function of the Hydrogen molecule one (which was the starting point):

$$2\pi R/\lambda\!\!\!^{-}_e \equiv 4\pi\lambda\!\!\!^{-}_H\lambda\!\!\!^{-}_p/l_P^2 \approx (4\pi/3)(\lambda\!\!\!^{-}_{CMB}/\lambda\!\!\!^{-}_{H2})^3 \qquad (9.7)$$

Note that this corresponds, one more time, to an elementary c-free calculation: *starting from the constants G, ħ, and the characteristic energy kT_{CMB}, one gets a length close to the Hydrogen wavelength, with a geometric factor 8/3 appearing, inducing directly the above holographic relation*.
Moreover, the c-free length defined from $\hbar$, G and the Universe mass density gives a length very close to $\lambda\!\!\!^{-}_e{}^2/l_P$, corresponding to:

$$a_G\{m_e\} \equiv \hbar c/Gm_e^2 \approx R/\lambda\!\!\!^{-}_F \qquad (9.8)$$

Looking for a 5D term leads to the discovery of the dramatic relation:

$$R/\lambda\!\!\!^{-}_e \approx (2\pi^2 a^3)^5(H/6\pi^5) \qquad (9.10)$$

where $2\pi^2 a^3$ is the area of the 4-sphere of radius a, which is also the product of the perimeter by the area of a disk of radius a, which is *a characteristic of 4D space*. The dramatic correcting factor, involving the Hydrogen-electron mass ratio H and the Lenz-Wyler approximation $6\pi^5$ for the proton-electron mass ratio confirms the above specified value G', to 0.3 ppm, and a factor π is eliminated:

$$6R/\lambda\!\!\!^{-}_e \approx (2\pi a^3)^5 H \approx \exp(2^{26/4}) \tag{9.11}$$

showing the appearance of the tachyo-bosonic dimension 26, with 1.6 ppm precision (see the following section 10).

According to the Holic principle the 210D term (where $2\times3\times5\times7 = 210$) could be pertinent. Indeed with the central constant $k = 2R/R' = 2a^3/pH$, *with a deviation of 15 ppm on k, which must be an important mathematical constant:*

$$R/\lambda\!\!\!^{-}_e \approx (k)^{2\times3\times5\times7} \tag{9.12}$$

Another geometric dramatic property is:

$$\pi R R_{Ed}/\lambda\!\!\!^{-}_e{}^2 \approx \pi^{12\times13} \tag{9.13}$$

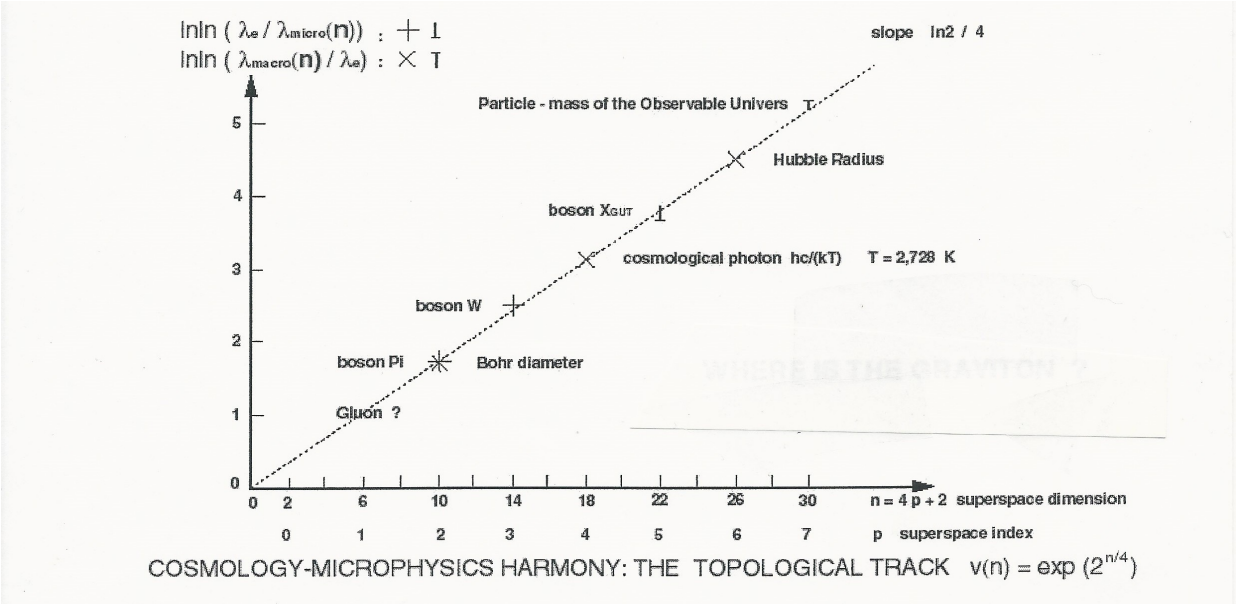
precise to 4.5 ppm. As $(R/\lambda\!\!\!^{-}e)^2 \approx 2^{256}$, this means a relation beween powers of 2 and π. In fact 137 appears in:

$$2^{1/155} \approx \pi^{1/256} \approx (2\pi)^{1/3\times137} \approx (2p)^{1/p} \tag{9.14}$$

in the last relation 137 is replaced by 137.0365, a good approximation for a. This example shows how the considerations of cosmic quantities help to connect the physical parameters.

10. The Topological Axis

It is difficult to represent the large numbers of macro and micro-physics on a single graph, even with normal logarithmic scale. But double logarithmic representation leads to the following regularity, which resume the main above holographic conservations. The surprise is that *the numeration of the large numbers appears to be the special dimension series of string theory:*



Topological Axis : double logarithm of large numbers appearing in micro and macro-physics. The numerotation shows the string theory special series.

By alternating micro and macro-physical numbers, the holographic relations show the series:

$$\lambda\!\!\!^{-}_e/\mathrm{d} \sim (R/\lambda\!\!\!^{-}_e)^2 \sim (\lambda\!\!\!^{-}_e/l_X)^4 \sim (\ell\!\!\!^{-}/\lambda\!\!\!^{-}_e)^8 \sim (\lambda\!\!\!^{-}_e/l_W)^{16} \sim (l_{at}/\lambda\!\!\!^{-}_e)^{32} \sim (\lambda\!\!\!^{-}_e/l_{Gl})^{64} \sim (t\!\!\!^{-}_{string}/\lambda\!\!\!^{-}_e)^{128} \sim 2^{256}$$

The two first relations are well-known (Weyl, Eddington, Dirac). The third one, implying the CMB is noted by Davies [26]. The forth, implying the intermediary boson is signaled by Carr and Rees [11]. Note that the gauge bosons W and X have odd p-numbers. Extrapolating to p = 1, this predict a mass for the Gluon, about 10 m_e. For p = 7, the 'topon', whose mass is that of the Universe, would be a gauge boson, probably tied to the force that repel galaxies. The point n = 26, the characteristic dimension of bosonic string theory, relies with the Hubble radius, by: $\exp(2^{26/4}) \approx 6R/\lambda\!\!\!^{-}_e$ (0.066%). The point n = 10, characteristic of superstring theory shows a remarkable micro-macro-physical symmetry. Extending this symmetry to the point n = 30, this predicts a Grandcosmos, correcting the general asymmetry of the scheme. Note that the bosonic string theory was unduly rejected for its tachyonic character, and is thus here rehabilitated.

11. Cosmo-Biological Relations

For explaining a number of correlations between physical parameters, many

invoked an Anthropic Principle, a non-scientific argument opening the way to the Multiverse conandrum. In fact, interestingly enough, tenants of the Anthropic Principle has not seen that some biologic constants are closed to physical ones. For instance, consider the DNA anhydrous nucleotides masses, in Dalton units (1 Da ≈ 1.008 m_H):

A- anhydrid desoxyadenosine monophosphate (anhydrid dAMP) A ≈ 313.21
G- anhydrid desoxyguanosine monophosphate (anhydrid dGMP) G ≈ 329.21
C- anhydrid desoxycytidine monophosphate (anhydrid dCMP) C ≈ 289.18
T- anhydrid desoxythymidine monophosphate (anhydrid dTMP) T ≈ 304.20

These masses enters the following 3×10^{-5} precise relation

$$A + T = G + C - 1 \qquad (11.1)$$

As each bi-codon of the DNA chain is composed of 3 couples from the dual choice AT or GC, this means the bi-codon mass is about an invariant, differing by ±1H, 2H, 3H, with mean value:

$$6(A + T + G + C)/4 \approx p_{hol} \qquad (11.2)$$

precise to 8×10^{-5} where p_{hol} is the mass ratio defined by the holographic relation, deduced above from cosmic consideration:

$$\pi p_{hol}^2 = (4\pi/3)(r_h/\lambda\!\!\!^{-}_e)^3 \qquad (11.3)$$

Now the holographic term p_{hol} is connected with the Fermi mass F: by $p_{hol} \approx \sqrt{(6F)}$, so:

$$(A + T + G + C)/4 \approx p_{hol}/6 \approx F/p_{hol} \qquad (11.4)$$

Since p_{hol} is close to the Hydrogen mass H, this means that the mean nucleotide mass is close to the Fermi one, showing a connexion between Biology and Particle Physics.

From the the proximity of p_{hol} with p one deduces that the cosmic period relies with the DNA bicodon mass, so c-free length from and m_{biodon}, is $2l_{cc} = 2ct_{cc}$:

$$\hbar^2/Gm_{biodon}^3 \approx 2l_{cc} \qquad (11.5)$$

Now, consider the mammal temperature $\mathbf{T}_{mam} \approx 310$ K, and the triple point temperatures of Hydrogen $\mathbf{T}_{H2} \approx 13.83$ K, Oxygen $\mathbf{T}_{O2} \approx 54.33$ K, and water $\mathbf{T}_{H2O} \approx 273.15$ K. They are connected by the 1% precise relations:

$$\mathbf{T}_{H2} \times \mathbf{T}_{O2} \approx \mathbf{T}_{H2O} \times \mathbf{T}_{CMB} \quad (11.6)$$

Moreover, in the relation

$$a/(1+\ln a) \approx e^{\pi} \quad (11.7)$$

the Steinheimer scaling factor [38] appears: $j \equiv 8\pi^2/\ln 2 \approx a - e^{\pi} \approx e^{\pi}\ln(a)$, which enters the canonical form

$$(R/r_H)^{1/2} \approx e^{j/e} \quad (11.8)$$

and one observes:

$$\mathbf{T}_{mam}/\mathbf{T}_{CMB} \approx j \quad (11.9)$$

Moreover, the symmetry between the Universe and Nambu radius is expressed by considering the wavelength associated to the mammal and triple point water temperatures $\lambda_{mam} \equiv hc/k\mathbf{T}_{mam}$, $\lambda_{H2O} \equiv hc/k\mathbf{T}_{H2O}$:

$$(R'l_{Pl})^{1/2} \approx \lambda_{H2O} \quad (11.10)$$

$$(Rl_{Pl})^{1/2} \approx \lambda_{mam} \quad (11.11)$$

precise respectively to 0.1% and 1%. Recall that temperature is noted by Schrödinger [39] as an essential parameter for Life (tied to the mutation rate). Indeed the mammal temperature is the same for the polar bear and the African antilop, which means apparently a large waste of energy [40]. But *it seems here that the Water molecule and the mammal organism are even more important, from a cosmical computer point of view, than the CMB*. This is not a come back to the anthropomorphic Anthropic Principle, but rather its inversion, the Cosmos using human calculators to help in its computational researc: this is the natural answer to the basic question: 'why do we ask questions ?'.

12. The Harmonic Principle

Following the old tradition of Pythagoras, the Harmonic Principle states that there is a connection between canonical large numbers appearing in Music and the physical parameters. In the Jeans classification of best musical scales, obtained by the so-called 'continuous fraction' analysis, there are, following the 12 degrees of occidental music, the numbers of notes 41; 53; 306;...

Note firstly that the occidental music involves the large number correlation : $2^{19} \approx 3^{12}$, which prolongates, by introducing the golden number ϕ:

$$2^{19} \approx 3^{12} \approx \phi^{137/5} \tag{12.1}$$

Many authors have tried, without notable success, to connect the golden number $\phi = (1 + \sqrt{5})/2$ with musical scales. Thus, the ancestral problem of connecting the golden ratio with music is resolved, simply by introducing the number 137. This is not a unique property of occidental scale, since this introduces the large number associated to the old Han Chinese scale $3^{60} \approx \phi^{137}$, which is very close to a large integer, noted already for his very special properties [18]. Moreover, the 5th harmonic ratio 137/60 appears in the relation between ϕ and 3, the optimal integer base (the closest to e):

$$3 \approx \phi^{137/60} = \phi^{1+1/2+1/3+1/4+1/5} \tag{12.2}$$

Note that the number 3 correlates also very precisely with the ratio *F/a*, where *F* is the Fermi/electron mass ratio

$$3 \approx (a/137)^{F/a} \tag{12.3}$$

It is well known that musician experts divide the tone (about the sixth part of the octavos) into 9 commas, 4 forming a minor semi-tone, 5 forming a major semi-tone só leading to a $9 \times 6 = 54$ commas in the octave. But the Hinduist scale, with 53 notes, is more precise, so the perfect number 6 is obtained at the 137th note:

$$2^{1/53} \approx 3^{1/84} \approx 6^{1/137} \tag{12.4}$$

Thus, 137 is really present in advanced occidental music, where a 'comma' is distinguished by violinists. But the presence, in the following scale of the number $306 = 1836/6 \approx \pi^5$ is even more dramatic, when expressed by the associated large number 3^{306}:

$$3^{1836/3} \sim 137^{137} \sim \exp(e(2\pi)^3) \tag{12.5}$$

Recall that a^a appears neatly in the Grandcosmos volume. Now the operational definition of the optimal base *e* is that $e^{1/e}$ is maximal, and 3 is the nearest whole number from *e*. It is known that the calculation base 3 would be far more efficient that the base 2, but there are many technical problems. Now:

$$\exp(e(2\pi)^3) \approx a^a \tag{12.6}$$

In a letter to Christian Goldbach, 17 april 1712, Gottfried Leibnitz writes "Musica est exercitium arithmeticae occultum nescientis se numerare animi" (Music is a secret exercise on numbers). Let us precise this by arguing that the

brain is a multi-base computer, mainly using the bases 2, 3, 5 and 137, which appears in the harmonic series of order 5. The above relation suggests that *a* is even a better base than 137.

Note that physical parameters shows arithmetic properties which are of no direct musical pertinence. For instance consider the above main large number. One observes:

$$R/\lambda\!\!\!^{-}_{e} \approx 2^{128} = 2\text{^}(2\text{^}7) \tag{12.7}$$

$$R'/\lambda\!\!\!^{-}_{e} \approx 27\text{^}27 = (3\text{^}3)\text{^}(3\text{^}3) \tag{12.8}$$

exhibiting 'economic numbers', i.e. large numbers depending only on one or two small numbers. The first one is correct to 0.6%, and connects directly with the last term of the Combinatorial Hierarchy [37]. The second one is even more precise, showing a 0.03 % precision. Thus, the symmetry between the two radius R and R' is confirmed, in connection with the two main whole bases 2 and 3.

The canonic ratio R_{GC}/R shows also such a singularity, to 2% :

$$R_{GC}/R = C/c \approx 3\text{^}(2^7\text{-}1/2) \tag{12.9}$$

all this cannot be due to chance, and call for further analysis.

13. Conclusions

The misconception of a propagative photon led De Broglie to the vain research of a 'double solution', and Einstein to propose that hidden *local* variables exist, which was, *of course*, refuted by experiment. Some consider this is a triumph for Bohr viewpoint, but his assertion 'quantum physics is complete', is itself reductionism nonsence, because it does not include *the cosmos, the obvious source of hidden variables*, in an holistic approach [4].

The separation of the total Universe energy Mc^2 between its 3/10 and 7/10 parts is so clearly demonstrated, but is an unsolvable enigma for current cosmology based on General Relativity, a *local* theory applied to cosmology, a method Poincaré has forbidden, arguing that in a unique Univers, differential equations would imply free parameters.

This study is principally based on a simple idea: conservation of geometric forms of different dimensions, by analogy with the holographic technique. This leads to very precise relations between the canonic physical ratios. As these numbers are not recognized by any mathematical fields, the standard thinking is to attribute them to chance, for instance at the occasion of a primordial Big Bang, and, in order to explain the relations between them, by invoking a multitude of Universes, called the Multiverse. But we have gone further, showing that these

relations are connected with the determination of approximations for $\prec$, and a liaison with the special series of dimensions in string theory, with emphasis to the bosonic special value $n = 26$ and the superstring one $n = 10$. This means the ancestral idea of a unique Univers should be restored, with the existence of a Grand Theory, which must be connected with the Eddington Fundamental Theory, since the latter predicted correctly the number 136×2^{256} of atoms in the material part of the Universe. Note that holographic conservations could not occur in an Universe with variable radius, so the refutation of the Primordial Big Bang cosmology is a necessity. But note also that intriguing common points have been found between the two cosmologies, leading to the hypothesis of a 'Permanent Big Bang', an oscillation matter-antimatter with hight frequency (10^{104} Hz).

The main physical parameters are obtained easily by applying basic quantum principles, with, in particular, the resolution of the dark matter problem, an unsolvable dilemma in standard cosmology. *So, while Particle Physics is incomprehensible without invoking cosmology, the latter is also incomprehensible if the Universe is, as ordinary stated, would be merely 'an ensemble of particles in c-limited probabilistic interaction'*. Note that, while a real physicist carefully distinguishes Time from Space, all other research people put $c = 1$ in the formula: they are mathematicians, applied mathematicians, physical mathematicians, and theoretical physicists. For these no real physicist people, the dimensional analysis is considered as numerology, since there is no theoretical basis for it (apart the author's analysis [18]). For this reason, the discoveries of the author has been blocked for publication in main journals since 18 years, including the Cornell electronic archivs, while most results were freely published in the completely free archiv vixra.com.

In fact, the holographic relations seems to reveal more than a simple geometric analogy. Indeed the associated 'Coherence Principle' can be related to the fact that holographic technique use a coherent, i.e. monofrequency radiation. Considering that holography is the designated role of coherent waves, it may be deduced that all waves associated with particles have a mutual coherence. This is the signification of the Coherence Principle: in the Cojherent Cosmology, a single frequency is at work, $f = h/E \approx 10^{104}$ Hz, and can be associated with matter-antimatter oscillation, which suggest to define 'dark matter' as oscillation in quadrature. This connects with some de Broglie considerations about the relation electron-positron, as noted independently by Jean Maruani [41].

The dramatic relation between the Newton and Fermi constants confirms the sweeping aspect of the cosmic 10^{104} Hz desintegration-reintegration giving at last an explanation for the parity violation.

This leads to the idea of a computing Universe, using the mysterious physical parameters as optimal calculation basis. This answers the question 'why do we ask questions ?' Animals and human beings would be peripheral calculators of Cosmos. But, as infinity of events is excluded, this must be periodic, so there is only one cyclic History. Thus, the 'undeterministic' interpretation of quantum mechanics

would be replaced by an hidden deterministic calculation. The famous 'hidden variables' would be in fact the rest of the Cosmos, and, of course, are subject to the quantum non-locality. But strict non-locality is also excluded, because it would involve an infinite velocity. So we have proposed that a super-celerity is at work, about $10^{61}c$.

So, the whole science seems to need a complete reformulation, based on the following principles, which are neither exhaustive nor mutually independent, which come after the very basic one, the ZERO PRINCIPLE: *the Approach Principle: one can learn something without the need to know everything:*

1. General Quantification Principle: the physical laws are arithmetical ones, excluding both infinity and continuum concepts. As Kronecker said 'God invented whole numbers, but humans defined all the other sorts of numbers'. One may add the prediction of an ULTIMATE ARITHMETICS PRINCIPLE : Nature uses an yet unknown optimal *inductive* arithmetics, so justifying the Approach Principle.
2. Perfect Cosmical Principle: The laws of physics are the same everywhere and every time (a spatial generalization of Poincaré's Principle) implying the steady-state cosmology,
3. Cyclic Principle : all the events reproduce themselves with a periodicity multiple of $T = R/c \approx 13.812$ Gyr,
4. Ambivalence Principle: a physical phenomena can be explained by very different models.
5. Coherence Principle: an unique frequency governs each phenomena, including a DNA chain, a biological cell, or a whole organism.
6. Resonance holo-scanning Principle: the universe with energy E is vibrating with a periodicity $t = h/E = 2t_P^2/T$. The period of the vibration matter-antimatter of each particle is a whole multiple of t.
7. Tachyonic Principle: there is an invisible tachyonic world, with speed $C = cR_{GC}/R_U \approx 6.94\times10^{60}\ c$, associated with the quantum vacuum.
8. Generaised Holographic Principle: Holographic conservations (in fact dimensional transferts) are the fundamental laws.
9. Grandcosmos Principle: an external thermostat is the source of the CMB and CNB, with radius $R_{GC} = R'^2/2l_{Pl}$.
10. Computing Principle: the numerical constants are computation basis in a calculating Cosmos.
11. Harmonic Principle: numerical physical constants are connected with musical numbers.
12. Immergence Principle, or Inverted Anthropic Principle. Life helps cosmic computation: biological parameters are tied to cosmic ones.

Leaving apart the far-reaching philosophical consequences of *this refutation of the Primordial Big Bang hypothesis, with, in particular, the definitive refutation of any global universal evolution or the non-scientific Multiverse concept,* this study

leads to dramatic observational predictions, *(a*) by selecting *the true cosmic redshifts*, the recession time must be identified with the period T (which is no longer any age), corresponding to the recession constant 70.79 km s^{-1} Mpc^{-1}, *(b)* the far-field galaxies, in average, could present the same features as near field ones, with identical physical characteristics (notice it is already supported by "abnormal" old galaxies, and even groups of galaxies, in the deep field), *(c)* the existence of young galaxies in the near field (in this respect the observations of Halton Arp must be revisited), *(d)* the identical CMB temperature everywhere, *(e)* the Wolf solar cycle $(Tt_{cc}^2)^{1/3}1/3 \approx 11$ yr and the large climatic period, $(T^1t_{cc})^{1/3}1/3 \approx 400000$ yr, might be present in other celestial objects (e.g., a cycle of 11.4 yr has been already detected in the monstrous blazar OJ 287) [42]. *(f)* a mass for gluons, which is not excluded by theory [43] is predicted, about 10 electron mass. (g) a specified value for G is proposed, in the ppm range. (h) the galaxy recession is exponential**,** meaning that the acceleration is itself accelarated.

Acknowledgments. The author is indebted to Valery Kotov, Jean-Claude Pecker, Cynthia Whitney, Christian Marchal, Christian Bizouard, Roland Lefebvre, Grigori Tomski; Christiane Bonnelle and Dominique Weigel for stimulating discussions. He is especially indebted to Jean Maruani for his encouragements and criticisms and for having him invited to QSCP meetings in Taipei and Varna. The present work was presented at the QSCPXX, Varna, 16 September 2015. Thanks also to Denis Gayral for informatics assistance.

Appendix. After the Varna meeting, (September 2015), it was realized in November that the first role of the equivalent number of electron, in the Eddingtonian canonic relation:

$$R/2\lambda\!\!\!^{-}_H = \sqrt{(M/m_e')} = \hbar c/Gm_e m_p \qquad (A.1)$$

would mean that *cosmology would be tied to the properties of a single electron* (m_e' is the electron reduced mass in the Hydrogen atom). Now, the Eddington number $N_{Ed} = 136 \times 2^{256}$, which gives with accuracy the number of Hydrogen atoms in the material part (3/10) of the Universe, shows clearly that cosmology is tied to the Eddington matrix 16 × 16. Indeed 136 is the symmetric term in $16^2 = 256 = 136 + 120$, the natural decomposition of the matrix. This was a generalization of the Dirac matrix 4 × 4 (see [44]). So it is asked if the following number x, defined by

$$N_{Ed} = 136 \times 2^{256} = x^{256^2} \qquad (A.2)$$

could be tied to particle properties. Indeed, one observes :

$$x \approx \sqrt{(6p^5 H)}/p_G \approx (p/p_G)(a/137) \qquad (A.3)$$

where $p_G = \sqrt{(\hbar c/2^{127} G')}/m_e \approx 1831.530734$, confirming the chosen value, in the principal text ot the value G'. Indeed, due to the exponent $256^2 = 2^{16}$, a 10^{-4} variation on G' would means a final deviation of several hundreds. Moreover, this reveals a relation between the above characteristic parameters, confirming a liaison between a and 137. Now comparing p_G with $\sqrt{(pH - a^2)} \approx 1831.53323$, one observes a deviation y of 1348 ppb, corresponding, when elevated to the $256^2 \times 32$ power to the ratio tau/muon, itself close to the topological term $\exp(2^{6/4})$. This means that the power 16^5 of y leads to the characteristic string term $\exp(\sqrt{2})$. So the topological function seems to enter these considerations. Indeed, the correcting factor y, elevated to the power 256^2 is compatible with the rational number:

$$y \,\hat{}\,(256^2) \approx 2 \times 136 / 249 \qquad (A.4)$$

where $249 = 496/2 + 1$, where appears the canonical number 496, the third perfect number, which is associated to the first superstring revolution. Now, as explained in [44], the generalization of Dirac equation leads to a space-time matter of 5 dimensions, so corresponding to the superstring SO(32) group, a 496-dimensional manifold. Now, the scalar boson mass is close to 496^2 times the electron mass, and one observes :

$$496^2 = 134 \times 1836 - 8 \qquad (A.4)$$

A research of maximal correlation defines a value close to 495.84, corresponding to 125.620 Mev. Now, considering the modified separation of $256 = 137 + 119$, one observes that

$$2 \times 119^2/137 \approx 206.73 \qquad (A.5)$$

giving the muon mass ratio to $2\ 10^{-4}$. By extrapolating to the symmetric 25×25 matrix, this defines a number close to $2a$:

$$299^2/326 \approx 2aH/p(H-p)^2 \qquad (A.6)$$

precise to 0.4 ppm. Now introducing 137 in the decomposition: $25^2 = 137 + 488$, one observes this gives the tau mass :

$$2 \times 488^2/137 \approx 3476.55 \qquad (A.7)$$

precise to 2.5 10^{-4}. So, the above principles lead, via cosmology, to a reapraisal of superstring theory. Pursuing the generalisation, one can wonder if the number 6^4 would play a role. Indeed, one observes :

$$32^2 + 2 \times 136 \quad = \quad 6^4 \quad \approx \quad 1834.421 / \sqrt{2} \qquad \text{(A.8)}$$

$$32^2 + 2 \times a \quad \approx \quad 1835.751 / \sqrt{2} \qquad \text{(A.9)}$$

where appears the number $p^2d/n \approx 1836.7515$, where d is the magnetic electron coefficient 1.001159652. This shows a transition from 136 to a, conforting the Eddingon's approach.

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