A Bio-Info-Digital Universe Model - version 2.0 (BIDUM 2.0)

based on a series of Planck-like informational constants and using the hypothetical gravitonic qubit as the basic unit of the (bio)physical information

(Open development interval: 2008 – 2016 - ?) (Preprint [1])

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Important note: The latest (free) version of my BIDUM (possibly newer than this paper) can be downloaded from: http://dragoii.com/bidum_full.pdf and http://dragoii.com/bidum_abbrev.pdf
(the list of abbreviations used in my BIDUM)

1st Motto: "[God:] Universe is nothing but a big copying machine, reproducing your thoughts [pure information] in physical form [energy/matter], that will be your experience [in classical linear time]"[4]

2nd Motto: „[God:] Space is time… demonstrated. In truth there is no such thing as space—pure, <<empty>> space, with nothing in it. Everything is something.[…] Invisible <<energy>> is the <<space>> which holds <<matter together>>. Once—using your linear time as a model—all the matter in the universe was condensed into a tiny speck. You cannot imagine the denseness of this—but that is because you think that matter as it now exists is dense. […] At one point the entire universe actually was <<solid>>. There was virtually no space between the particles of matter. All the matter had the <<space>> taken out of it—and with the enormous <<space>> gone, that matter filled an area smaller than the head of a pin. […] [Man:] Is the universe now expanding? [God:] At a rate of speed you cannot imagine! [Man:] Will it expand forever? [God:] No. There will come a time when the energies driving the expansion will dissipate, and the energies holding things together will take over—pulling everything “back together” again. [Man:] You mean the universe will contract? [God:] Yes. Everything will, quite literally, “fall into place”! […] [Man:] That means that we will no longer exist! [God:] Not in physical form. But you will always exist. You are that which Is. [Man:] What will happen after the universe “collapses”? [God:] The whole process will start over again! There will be another so-called Big Bang, and another universe will be born. It will expand and contract. And then it will do the same thing all over again. And again. And again. Forever and ever. World without end. This is the breathing in and breathing out of God. (Neale Donald Walsch, Conversations with God, 2nd volume, Chapter 6[5])

Abstract

A growing trend in physics is to define the physical world as being made up of information [1]. An important direct relationship between information and entropy is demonstrated by the Maxwell's demon thought experiment [2]: a first important consequence is that it’s impossible to destroy Shannon entropy/information without increasing the Boltzmann entropy of a system [3,4]; another important consequence is that information may be interchangeable with energy [5]. Wheeler’s “it from bit” principle (hypothesis) is also famous [6,7]. In this BIDUM [6] [8], I argue that energy and time are indissolubly connected and can be integrated in a concept of physical information (PI) measurable in qbits (qubits) as an alternative interpretation to the (classical and quantum) angular momentum: energy, matter, spacetime vacuum and their behaviors may be considered proprieties of different PI-quanta and PI should be treated as a central fundamental notion in any type of TOE (Theory of Everything), together with the concept of biological information (BI) [9] in a unified concept of biophysical information (BPI).

Keywords: information, physical information, biological information, Bio-Info-Digital Universe Model, a series of Planck-like informational constants, the hypothetical gravitonic qubit, (bio)physical information.


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Introduction

Edward Teller appears to have been the first who speculate that there may exist a logarithmic relation between the fine structure constant (\(\alpha\)) and the parameter \(G\cdot m_N^2/(\hbar\cdot c)\sim10^{-39}\) of the form \(\alpha\sim\ln[G\cdot m_N^2/(\hbar\cdot c)]\) (equation 4.23) (in fact \(\alpha\sim\ln(3.17\times10^{60})\) and the formula is too insensitive to be of very much use in predicting exact relations)[10, 11]. (\(m_N\) stands for the nucleon [proton/neutron] rest mass)

In this article, I try to demonstrate that Barrow and Tipler overlooked [12] the possibility that Teller’s “speculation” may be much more inspired than the Dirac’s large numbers hypothesis (DLNH) [13] and can represent an important start point of a new Bio-Info-Digital Universe (toy-)Model (BIDUM), a model that can offer important physical explanations and predictions, including: a quantum gravitational coupling constant which simplifies the set of the 26 adimensional constants of the Standard Model (SM) of particle physics, a gravitational Planck-like constant for the hypothetical graviton (\(h_{eg}\)), a quantum G scalar based on this gravitational Planck-like constant (\(G_q\)), a multiple (quantum) G hypothesis (\(mGH\)) based on a quantum G scalar series (\(G_{sq}\)) and a gravitational Planck-like series (\(h_{sq}\)), a unified scalar function (\(F_N[x]\)) for all the (running) coupling constants of the four fundamental fields/forces, an alternative informational definition of the angular momentum as a physical information quantity (\(PI_q\) scalar and \(L\cdot PI_q\) equivalence principle), new methods for measuring the intrinsic physical information quantity (\(PI_q\)) of any quantum or classical object, a set of universal equivalence principles (UEPs) (that contracts the set of SI measure units), an informational matrix global structure of the observable universe, an Info-Dimensional Relativity Principle (IDRP) (which explains why the universe appears as a 3D entity when using the known bosons and fermions to study it), a Generalized Heisenberg’s Uncertain Principle (GHUP) that includes any angular momentum quanta used to measure a target quantum particle, a cutoff physical information quantity (\(PI_q\)) for which the majority of the known quantum particles (QPs) gain rest masses, a meta physical informational “gene” (\(mPI\)-gene) hypothesis in which the universe is considered a universal operating system (uOS) in which each quantum particle (QP) is produced by a specific mPI-gene, a generalized concept of bio-physical force/field and a unified concept of bio-physical observer.
Part I. The main binary-logarithm (variant) of the Teller hypothesis

Returning to the citation from Barrow and Tipler, it is obvious that the natural logarithm variant of the Teller’s hypothesis (TH) is „too insensitive to be of very much use in predicting exact relations”:

\[
a = e^{-1} = h / (k_e^2 / c) \sim 137.036 \implies e^a \sim 3.3 \times 10^{59}, \text{with } h = h / (2\pi)
\]

AND

\[
\ln \left( h / (Gm_N^2 / c) \right) \sim 89.86 \sim (65.58\%) a \implies h / (Gm_N^2 / c) \sim 1.1 \times 10^{39} \sim (3.26 \times 10^{-19}\%) e^a
\]

Even if Teller himself overlooked the possibility of using binary logarithm (bl) (not natural logarithm[nl]) in his hypothesis (1948), it is quite strange that the vast majority of physicists also overlooked this possibility from 1948 until present, with some notable exceptions [Salam, 1970; Sirag, 1980, 1983; Sanchez, Kotov and Bizouard, 2009, 2011, 2012; Kritov, 2013] [14,15]. Despite Barrow’s exclusion of the nl-TH, I want to present a series of much more „sensitive” bl-TH variants in the next table (additional abbreviations used next: \(\hbar\) – the half of reduced Planck constant [= \(\hbar/2 = \hbar/(4\pi)\), the angular momentum of a spin-1/2 fermion like a lepton or a nucleon] or the inferior limit of the product of the angular momentum deviation \(\Delta L\) and the position deviation \(\Delta x\) (from the precise individually predetermined \(L\) and \(x\)) in any set of measurements on similarly prepared systems), so that \(\Delta L \cdot \Delta x \geq \hbar\), as stated by Heisenberg’s Uncertainty Principle [HUP], \(m_c\) – electron rest mass).

<table>
<thead>
<tr>
<th>Table T-I-1. A list of bl-TH variants</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\log_2(h / (Gm_N^2 / c)) \sim 129.6 \sim (94.6%) a \implies h / (Gm_N^2 / c) \sim 1.1 \times 10^{39} \sim (0.6%) 2^a)</td>
</tr>
<tr>
<td>(\log_2(h / (Gm_Nm_e / c)) \sim 140.5 \sim (102.5%) a \implies h / (Gm_Nm_e / c) \sim 1.9 \times 10^{42} \sim (1094%) 2^a)</td>
</tr>
<tr>
<td>(\log_2(h / (Gm_Nm_e / c)) \sim 137.8 \sim (100.6%) a \implies h / (Gm_Nm_e / c) \sim 3.1 \times 10^{41} \sim (174%) 2^a)</td>
</tr>
<tr>
<td>(\log_2(\hbar / (Gm_Nm_e / c)) \sim 136.8 \sim (99.9%) a \implies \hbar / (Gm_Nm_e / c) \sim 1.6 \times 10^{41} \sim (87%) 2^a)</td>
</tr>
</tbody>
</table>

Based on the last (apparent) coincidence from the previous table, I had discovered an unexpected numerical coincidence between the inverse of \(a\) at rest \((a=1/\alpha)\) and the inverse of the gravitational coupling constant \(a_G = a_e^{-1} = h / (Gm_e^2 / c) \sim 1 / (1.75 \times 10^{-45}) \sim 5.71 \times 10^{44}\):

\[
\log_2 \left( \frac{a_G / 2^{3/2}}{a^{3/2}} \right) \sim 137.0303 \sim (99.996\%) a \quad \Leftrightarrow \quad a_G / 2^{3/2} \sim 1.78 \times 10^{11} \sim (99.61\%) 2^a \quad \Rightarrow \quad a_G \sim 2 a^{3/2} 2^a \quad [I-2 (a,b,c)]
\]

I consider this last numerical coincidence the **main bl-TH (mbl-TH)**, as it is the most striking simple and “sensitive” bl-TH variant. In my opinion, mbl-TH deserves a very special attention as it may have great importance in formulating a quantitative description/prediction of the (hypothetical) graviton and the quantum gravity theory. I consider it very small the probability that this “too-simple-and-elegant” numerical coincidence is “just” the result of pure chance. I don’t have any information from the physics literature on a more sensitive theoretical numerical prediction of \(a_G\) using only \(a\) (as an adimensional combination of almost all the fundamental physical constants of quantum mechanics). Next, I shall try to bring more arguments that mbl-TH is NOT a simple coincidence, but very probably a scalar of a potential new law of nature.

Also note that I have chosen to express all the previous adimensional constants/parameters as ratio of two angular momentum: \(h\) (together with its derivatives \(h = h / (2\pi)\) and \(\hbar = h / 2 = h / (4\pi)\)) and a gravitational angular momentum (GAM) of a system of two quantum particles (QPs) at rest \(Gm_Nm_e / c\). As the Planck mass \((m_{Pl})\) is defined by the special propriety that \(h = Gm_{Pl}^2 / c \Rightarrow m_{Pl} = \sqrt{hc / G}\), I shall define the general scalar of the GAM for any two QPs with any two non-0 rest masses as scalar function
\[ hf_G(G,m_1,m_2) = Gm_2 \ell c = GE_1 \ell c^3, \text{ with } E_1 = m_1c^2 \text{ and } E_2 = m_2c^2 \]  

(hf\(_G\) would be the hypothetical gravitational quantum angular momentum \([\text{GQAM}]\) of a hypothetical “gravitational” photon generated by the gravitational energy of a system of two rest masses/energy-quantities, each mass/energy-quantity with a diameter \(d\) much smaller than the distance between the two masses \(\lambda, d << \lambda\) no matter the value of \(\lambda\). As it may be observed, both \(\alpha_G\) and \(\text{mbl-TH}\) imply the \(\text{GQAM}\) of as system composed of two electrons/positrons at rest \(hf_G(G,m_1,m_2) = Gm_2 \ell c\), which is defined independently of the distance between them: the \(\text{GQAM}\) defined by the scalar \(hf_G(G,m_1,m_2) = Gm_2 \ell c\) is a potential candidate for the QAM scalar of the hypothetical graviton as the “gravitational” photon may be a model for this hypothetical graviton in which \(G\) may also be a measure of a hypothetical gravitational Planck-like constant, as I shall try to explain next. An electrostatic angular momentum (\(\text{EAM}\)) may also be defined in analogy with \(hf_G(G,m_1,m_2) = Gm_2 \ell c\), such as \(hf_E(k_e,q_e,q_e) / c\), which is part of the FSC definition, as \(\alpha = hf_E(k_e,q_e,q_e) / \hbar\) and \(a = \alpha^{-1} = \hbar / hf_E(k_e,q_e,q_e)\). \(hf_E\) would be the electrostatic quantum angular momentum \([\text{EQAM}]\) of a hypothetical “weak” photon with QAM with a value equal to \(\hbar \alpha = \hbar / a = \hbar / 137\) generated by the electrostatic energy of a system of two rest charges, each charge with a diameter \(d\) much smaller than the distance between the two masses \(\lambda, d << \lambda\) no matter the value of \(\lambda\).

In the next parts, based on \(\text{mbl-TH}\), I shall propose an universal base-2 power law that is the core of a universal function \(F_2(x)\) which describes the (running) coupling constants of all the four fundamental fields/forces (\(\text{FFs}\)). Concerning this base-2 power law with potential great importance in fundamental physics, some important historical details need to be mentioned.

In 1929, the German physicist R. Fürth was the first who proposed using the number/adimensional constant \(16^{32}(=2^{128})\) in order to connect gravitation to atomic constants \([16]\).

In 1938, Arthur Eddington was the first who proposed that the number of protons in the entire Universe should be exactly equal to: \(N = 136 \times 2^{256} \sim 1.57 \times 10^{99}\) (\(N\) was later called the Eddington’s number \(N_{\text{Edd}}\) \([1, 2, 17]\) and Eddington hypothesized that square root of \(N_{\text{Edd}}\) should be close to Dirac’s Big number (invoked in his large number hypothesis \([\text{DLNH}]\)) such as \(\sqrt{N_{\text{Edd}}} = \sqrt{136 \times 2^{256}} = \sqrt{136} \times 2^{128} \sim 3.97 \times 10^{99}\). Later on, Eddington changed 136 to 137 and insisted that \(\alpha\) has to be precisely \(1/137\), and then his theory seemed to fail at this cornerstone \([17]\). However, Eddington’s statement also implied the number \(2^{128}\) which has been left without proper attention [Kritov, 2013].

In 1980, Saul-Paul Sirag (a theoretical physicist and researcher from San Francisco) proposed a binary logarithmic relation between electromagnetic and gravitational coupling constants and considered that the base-2 power law should have significant role in numerical relations for physics constants. (Sirag, 1980, 1983)

Both exponents \(2^{128}\) and \(2^{256}\) are relatively close to \(a(\sim 137)\) and \(A=2a(\sim 274)\), respectively, which is also indicates a link to the \(\frac{2^c}{2^a}\) factor from \(\text{mbl-TH}\). Although it may seem atypical, the factor \(\frac{2^c}{2^a}\) may have a profound meaning, as it appears in a large series of considered non-coincidences related to the Eddington number, the size, mass, density and age of the observable universe (OU), as I shall try to demonstrate in BIDUM. \(\frac{2^c}{2^a}\) also suggests a strong connection with base-2 logarithms (and the complementary/inverse base-2 exponentials) frequently used in physical/mathematical theories/principles/laws.

In Information Theory (IT), the quantity of information is conventionally and conveniently defined as a base-2 logarithm from the total number of \((\text{nof})\) the possible distinguishable states of a system, which can also be interpreted as the number of \((\text{nof})\) steps needed to locate a target-information in a system with at least 2 distinguishable states (at least one bit of information), using a binary search algorithm (defined as a dichotomic “divide and conquer” recursive and iterative search algorithm commonly found in operations on binary trees or when using binary search).

In Thermodynamics Theory (TT), information is defined as any kind of event that affects or can affect (potentially) the state of a dynamic system that can interpret the information.

Binary logarithms (BLs) are also used in the standard formulation of the mean half lifetime (half-life) of physical particles that have an exponential decay (including radioactive decay studied by nuclear physics).
In my BIDUM, I will also try to demonstrate that the age of the universe has an informational meaning of a logarithmic time, as the observable universe age may be organized as a binary tree, with each “logarithmic epoch” corresponding to a (radius)-doubling step: the present radius of the OU is \( R_{\text{OU}} \sim r_{e\ell p} \cdot 2^n \sim r_{e\ell p} \cdot 2^{137} \) (\( r_e \) is the classical electron radius which is comparable with the proton radius \( r_p \)).

J. D. Bekenstein claimed that a growing trend in physics was to define the physical world as being made up of information [Bekenstein, 2003]. In his Mathematical Universe Hypothesis (MUH), Tegmark suggests a new paradigm, in which virtually everything, from particles and fields, through biological entities and consciousness, to the multiverse itself, could be described by mathematical patterns of information. Another link between energy, entropy and physical information (PI) is demonstrated by the Maxwell’s demons thought experiment: in this experiment, a direct relationship between information and entropy, is demonstrated, with the important consequence that it is impossible to destroy information without increasing the entropy of a system.

Toyabe et al. experimentally showed that information can be converted into work, so that information could be interchangeable with energy; in a study of the logical gates, the theoretical lower bound of thermal energy released by an AND gate is higher than for the NOT gate, because information is destroyed in an AND gate and simply converted in a NOT gate.

An interesting observation is the Titius-Bode (possible apparent) coincidence in which the Sun-orbital rays of most of the planets in our solar system seem to be positioned in a base-2 exponential progression function, with an orbit radius (expressed in astronomical units) \( R(n) \sim 0.4 \text{AU} + 0.3 \cdot 2^n \) [18,19,20,21,22,23]. In my BIDUM I shall try to demonstrate that the universe has a similar way to organize its inner bodies dimensions on a base-2 logarithmic scale and that the Titius-Bode coincidence is related to the ubiquitous logarithmic spiral pattern (based on a generic natural power law equation \( R(a,b,\theta_{\text{variable angle}}(\text{radian})) = a \cdot e^{b \theta} \)) convertible in base-2 exponential equation \( R(a,b,\theta_{\text{variable angle}}(\text{radian})) = a \cdot 2^{b \text{log}_2(e) \theta} \) with different angles, appearing in the majority of observed galaxies [24,25,26] and in other many structures and phenomena found in nature, including biological structures/phenomena, hence are related to both the golden ratio \( \Phi = \left(\sqrt{5} + 1\right)/2 \) emerging from the Fibonacci series (ubiquitous in nature) which also approximates a logarithmic spiral pattern when graphed: for example, the arms of spiral galaxies (as M51 Galaxy), mouse corneal epithelial cells, the phyllotaxis of leaves, the structure of nautilus shells (and many mollusk shells) that exhibit logarithmic spiral growth (but at a variety of angles usually distinctly different from that of the golden spiral); this pattern allows the organism to grow self-similarly, without changing shape and proportions. The Fibonacci series (FS) (in which the 1\(^{\text{st}}\) and 2\(^{\text{nd}}\) terms of the series are \( F_1 = 1, F_2 = 1 \) AND the n-th term of the series is generically defined as \( F_n = F_{n-1} + F_{n-2}, \) with \( n \geq 3 \) and \( F_n / F_{n-1} \to \Phi = \left(\sqrt{5} + 1\right)/2 \)) is very frequent in nature (especially describing the ratios in different biological structures); the n-th term of FS can also be predicted by Binet’s formula which defines it as: \( F_n = \text{INT} \left\{ (\Phi^n - (-\Phi)^n) / \sqrt{5} \right\} \) or \( F_n \sim \text{INT} \left\{ (1 + \sqrt{5})^{n+1} / \sqrt{5} \cdot 2^{-n} \right\} \) (where \( \Phi = (\sqrt{5} + 1)/2 \sim 1.618 \)) is the classical so-called “golden ratio” AND INT is the function that extracts the integer part of a real number.
Part II. The deduction of a quantum gravitational coupling constant and a quantum gravitational constant scalar from the mbl-TH equality

Given its striking quantitative precision, I propose mbl-TH to be formulated as an equality equation in the purpose of defining a new quantum gravitational coupling constant \( \alpha_{\text{Gq}} \) and \( \alpha_{\text{Gq}}^{-1} \) at rest \( \alpha \) alternative to \( \alpha \), as \( \alpha \) is a function of the Newtonian (classical) G, which has NO quantum definition until present and depends on the experimental measurements:

\[
\alpha_{\text{Gq}} = \frac{1}{2a^{3/2}2^a} = \frac{1}{a^{3/2}2^{a+1}} \quad [\text{II-1a}]
\]

\[
a_{\text{Gq}} = \alpha_{\text{Gq}}^{-1} = 2a^{3/2}2^a = a^{3/2}2^{a+1} \approx 5.73 \times 10^{44} \sim (100.39\%)a_G \quad [\text{II-1b}]
\]

Also based on mbl-TH equality and \( \alpha_{\text{Gq}} \) definition, I propose the hypothesis that both \( \alpha \) and \( \alpha_{\text{Gq}} \) have a triple significance: electromagnetic, gravitational and informational, as both can be derived from a single \( (\text{electrogravitational}) \) adimensional constant \( (\text{number}) \) \( N_a = 2^a \sim 1.8 \times 10^{41} \) which I consider (most probably) a very large integer with an alternative informational significance – the maximum number of (nof.) (equally probable) internal states of a specific physical system (PS) at rest. I propose (by hypothesis) that \( a, \alpha, a_{\text{Gq}} \) and \( \alpha_{\text{Gq}} \) to be alternatively redefined (independently to any other physical constant except \( N_a \)) such as \( a = \log_2 (N_a) \), \( \alpha = a^{-1} = 1/\log_2 (N_a) \), \( a_{\text{Gq}} = 2a^{3/2}N_a \) and \( \alpha_{\text{Gq}} = a_{\text{Gq}}^{-1} = 1/(2a^{3/2}N_a) \). In this view, \( a \) is a logarithmic informational constant and \( a_{\text{Gq}} \) is a linearithmic informational constant that both measure the same nof. states \( (N_a) \) of a specific system. \( \alpha(=a^{-1}) \) can be interpreted as a logarithmic probability of a specific state chosen from the \( N_a \) (equal) states of a specific PS. \( \alpha_{\text{Gq}} = a_{\text{Gq}}^{-1} \) can be interpreted as a linearithmic probability of a specific state chosen from the \( N_a \) (equal) states of the same specific PS.

As \( a_{\text{Gq}} \) is considered (by hypothesis) a function of strictly \( N_a \), a hypothetical G quantum scalar \( G_q \) (at rest) can also be deducted from \( N_a \), using the definition of \( a_{\text{Gq}} \). \( G_q \) has a value very close to the standard CODATA-2014 experimental G (in vacuum) \( G \sim 6.67408(31) \times 10^{-11} \text{m}^3 \text{kg}^{-1} \text{s}^{-2} \) with a relative standard uncertainty \( u_G = 47 \text{ppm} \) [27] and may stand not only for distances \( \lambda > 1 \text{ cm} \) (the approximate limit scale of the experimental measurement of G until present) but may also be valid for much smaller distances \( (\lambda \ll 1 \text{ cm}) \), with \( \lambda \geq D_N \) (the approximate diameter of the low energy [quasi-spherical] nucleon [proton/neutron], at which scale the strong nuclear force/field (SNF), the weak nuclear force/field (WNF) and a possible additional strong gravity force/field (SGF) may all manifest).

\[
\hbar \left( G_q m_e^2 / c \right) = a_{\text{Gq}} = 2a^{3/2}N_a \Rightarrow \quad [\text{II-2a}]
\]

\[
G_q = \frac{\hbar c / m_e^2}{2a^{3/2}N_a} \quad [\text{II-2b}]
\]

\[
G_q \approx 6.648 \times 10^{-11} \text{m}^3 \text{kg}^{-1} \text{s}^{-2} \sim (99.6\%)G \quad [\text{II-2c}]
\]
Part III. The „contraction” of the three adimensional constants of the Standard Model $\alpha, \alpha_G$ and $\beta_n$ and a unified scale function for all the four fundamental fields with various predictions on the mass and size of the observable universe.

Given the new definition of $\alpha = a^{-1} = 1 / \log_2 \left( N_a \right)$, the (electrostatic/electromagnetic) Coulomb constant ($k_e$) may be considered a scalar function (f) that indirectly measures (and “hides”) both the Planck constant ($\hbar$) and $a$, $k_e = f(h)$ can be expressed using $a = \log_2 \left( N_a \right)$ which is defined independently of $\hbar$. The energy quanta of a photon with a frequency $\nu$ is notated as $E_{ph}(\nu)$ and is the product of the quantum angular momentum (QAM) of the photon (measured by the Planck constant $h$) and its frequency $\nu$.

$$[\text{III-1(a,b)}]$$

$$k_e = f(h) = k_c \cdot h,$$
with $k_c = \frac{c / q_c^2}{2\pi a}$

$$E_{ph}(\nu) = h\nu$$

$$[\text{III-1c}]$$

Analogously to $k_e = f(h) = k_c \cdot h$, $G_q$ may also indirectly measure (and “hide”) a hypothetical (electro)gravitational force/field (EGF) QAM (measured by a Plank-like constant noted as $h_{eg}$) of a hypothetical electrograviton (eg) which is defined as a graviton generating a scalar (exactly) analogous to $k_e$. $G_q = f \left( h_{eg} \right)$ can be redefined considering $a = \log_2 \left( N_a \right)$ and $a_G = 2a^{3/2}N_a$, which are both defined independently of $h$. To calculate $h_{eg}$, I propose a constant $k_G$ defined in exact analogy to $k_c = \frac{c / q_c^2}{2\pi a}$, so that

$$k_G = \frac{c / m_e^2}{2\pi a}$$

and $G_q = f \left( h_{eg} \right) = k_G \cdot h_{eg}$: it results $h_{eg} = G_q / k_G \sim 1.58 \times 10^{-76} \text{Js}$, with $G_q$ previously defined as $G_q = \frac{\hbar c / m_e^2}{2a^{3/2}N_a}$. The energy quanta of an eg with a frequency $\nu$ is notated as $E_{eg}(\nu)$ and is defined analogously to $E_{ph}(\nu)$ (as the eg is a hypothetical spin-2 graviton with a QAM measured by a Planck-like constant $h_{eg}$, that also moves with speed equal or very close to c, like the photon).

$$[\text{III-2(a,b,c)}]$$

$$G_q = f \left( h_{eg} \right) = k_G \cdot h_{eg}, \text{ with } k_G = \frac{c / m_e^2}{2\pi a} \text{ and } G_q = \frac{\hbar c / m_e^2}{2a^{3/2}N_a} = \frac{\hbar c / m_e^2}{4\pi a^{3/2}N_a} \Rightarrow$$

$$\Rightarrow h_{eg} = \frac{G_q}{k_G} = \frac{h}{2a^{1/2}N_a} = \frac{h}{a_G / a}$$

$$h_{eg} \sim 1.58 \times 10^{-76} \text{Js}$$

$$E_{eg}(\nu) = h_{eg}\nu$$

$$[\text{III-2d}]$$

$$[\text{III-2e}]$$

$$[\text{III-2f}]$$

The $h / h_{eg}$ ratio can be named the electrogravitational constant $(K_{eg})$ as it relates the QAM of the electromagnetic force/field (EMF) gauge boson mediator (the photon) with the QAM of a hypothetical EGF spin-2 gauge boson mediator (the eg).

$$K_{eg} = h / h_{eg} = a_G / a = 2a^{1/2}N_a = \left( K_e / G_q \right) \left( q_e / m_e \right)^2$$

$$h_{eg} = h / K_{eg} \iff h = K_{eg} \cdot h_{eg}$$

$$[\text{III-2f}]$$

$$[\text{III-2g,h}]$$
Expressing the Newtonian gravitational force scalar function \( F_g(G_m, m, \lambda) = G m / \lambda^2 \) as a function of \( G_q \) \[ F_g(G_q, m, m, \lambda) = G_q m / \lambda^2 \], one may obtain multiple equivalent equations that maintain the inverse square law (ISL) up to atomic scale, with \( \lambda \geq D_N \). The emission and absorption of (real/virtual) \( G \) on a spherical surface (with area defined as \( A_s(R) = 4\pi R^2 \)) is anticipated by the factor \( 4\pi \lambda^2 = A_s(\lambda) \) that appears in the denominator of the equations below.

\[
\begin{align*}
F_g(G_q, m, m, \lambda) &= G_q \frac{m \cdot m}{\lambda^2} = \frac{hc / m}{a^{3/2}} \cdot \frac{1}{N_a} \cdot \frac{m \cdot m}{4\pi \lambda^2} = \frac{\Gamma}{N_a} \cdot \frac{m \cdot m}{A_s(\lambda)} \\
\text{with} \quad \Gamma^G = \frac{hc / m}{a^{3/2}} \sim 1.5 \times 10^{32} \text{m}^3 \text{kg}^{-1} \text{s}^{-2} \quad \text{and} \quad \Gamma / G \sim 2.2 \times 10^{42}
\end{align*}
\]

\( ^* \Gamma \) is a plausible strong-gravity constant [28] with a value close to that determined by Perng in 1978 [29] of \( \sim 2.78 \times 10^{32} \text{m}^3 \text{kg}^{-1} \text{s}^{-2} \).

\[
\begin{align*}
F_g(G_q, m, m, \lambda) &= \frac{hc}{a^{3/2}N_a} \cdot \frac{(m \cdot m)}{(m \cdot m)} \cdot \frac{A_s(\lambda)}{A_s(\lambda)} = \frac{hc}{a^{3/2}N_a} \cdot \frac{\beta \beta}{A_s(\lambda)}
\end{align*}
\]

From the last equations, EGF can be seen as a form of hugely diminished SGF, as the hypothetical strong gravity constant (SGC) scalar is divided by the factor (1\(^{st}\) rank adimensional constant) \( N_a \). Obviously, this is not the first attempt to link \( \alpha \) with a hypothetical SGC (generally noted as \( \Gamma \) ) [30].

As the super string theory (SST) and the M-theory (MT) both propose the existence of at least two additional spatial micro-dimensions with compact topology (into which the hypothetical gravitons may leak), in order to unify the Standard Model (SM) with General Relativity (GR), it’s an experimental priority for the ISL of the EGF to be verified at micronic and atomic scales (short range gravity tests [31,32,33,34]): as gravity is the key problem of the millennium, measuring \( G \) with higher accuracy at microscopic (including atomic) scales is obviously (also) a priority [35,36,37].

It’s important to remark that \( k_G \) (as defined together with the scalar \( G_q = f(h_{eg}) = k_G \cdot h_{eg} \)) was also used by Perng in 1978 for calculating the hypothetical SGC (noted as \( \Gamma_{Perng} \)) [28,29]:

\[
\begin{align*}
\Gamma_{perrg} &= k_G \cdot h = \frac{hc / m}{a^{2/2}} = \frac{hc / m}{a} \sim 2.78 \times 10^{32} \text{m}^3 \text{kg}^{-1} \text{s}^{-2} \quad \text{and} \quad \Gamma_{perrg} / G \sim 4.2 \times 10^{42} \\
k_G &= \Gamma_{perrg} / h = \frac{c / m}{a^{2/2}}
\end{align*}
\]

\( \text{Checkpoint-conclusion.} \) I consider \( N_a \) a 1\(^{st}\) rank parameter of the OU with a fixed value at rest and possibly variable value at different energies/relativistic speeds of the electron (charges)/proton/neutron (1\(^{st}\) rank conditions). \( h, c, q_e, m_e, k_e, G_q \) are considered 2\(^{nd}\) rank (derived) parameters that can take any dimensional values but with two simultaneous 2\(^{nd}\) rank conditions \( h / (k_e q_e^2 / c) = \log_2 (N_a) = a \) AND \( h / (G_q m_e^2 / c) = 2 \cdot \left[ \log_2 (N_a) \right]^{3/2} N_a = 2a^{3/2}N_a \) which both are equivalent to the ratio equality \( K_{eg} = (K_e / G_q)(q_e / m_e)^2 = 2a^{1/2}N_a \), which also implies the conservation of the two adimensional constants \( a = \log_2 (N_a) \) and \( a_{Gq} = 2a^{3/2}N_a \).
\(\beta_p\) and \(\beta_n\) are 2nd rank parameters demonstrated by the Quantum chromodynamics theory (QCD) as primarily determined by the QCD (energy magnitude) scale \(\Lambda_{\text{QCD}} = 210(\pm 40)\text{MeV}\) of the SNF at which the three quarks of the nucleon confine. The proton rest mass \(m_p\) and the neutron rest mass \(m_n\) may be considered 3rd rank (derived) parameters that can take any dimensional values but with two simultaneous 3rd rank conditions: \(m_p / m_e = \beta_p\) and \(m_n / m_e = \beta_n\) which both are equivalent to the ratio equality \(m_n / m_p = \beta_p / \beta_n\).

The 1st rank parameters and 2nd rank parameters classification OU physical constants ALSO conjectures that OU will (exactly) preserve all its observed proprieties as long its 1st rank parameters, 1st rank conditions, 2nd and 3rd rank conditions are all satisfied simultaneously. This conjecture is also expressed with inspiration by J.D. Barrow: “[An] important lesson we learn from the way that pure numbers like a define the world is what it really means for worlds to be different. The pure number we call the fine structure constant [FSC] and denote by \(\alpha\) is a combination of the electron charge, \(e\), the speed of light, \(c\), and Planck’s constant, \(h\). At first we might be tempted to think that a world in which the speed of light was slower would be a different world. But this would be a mistake. If \(c\), \(h\), and \(e\) were all changed so that the values they have in metric (or any other) units were different when we looked them up in our tables of physical constants, the value of \(\alpha\) remained the same, this new world would be observationally indistinguishable from our world. The only thing that counts in the definition of worlds are the values of the dimensionless constants of Nature. If all masses were doubled in value [including the Planck mass \(m_p\)] you cannot tell because all the pure numbers defined by the ratios of any pair of masses are unchanged.” [38].

There are many speculations concerning the 1st rank parameters and their (apparently) value (at rest) “selection” [39]. I have also discovered a simple and elegant function that links \(\beta_n\) to \(a\) with such a precision (\(
ablaaxx\)) that makes me consider this equation not a pure/simple coincidence, but (with very high probability) to be also the consequence of a more profound still undiscovered law of nature. The existence of this equation suggests the speculation that \(\beta_n\) (and probably \(\beta_p\)) may also depend on \(N_a\). When \(x\) takes the value of \(a\) at rest, then the equation has single real positive solution very close to \(\beta_n\) at rest (as found using the Lambert W function). Interestingly, \(\beta_n^2\) (which appears in the next equation) is a ratio of two gravitational angular momentum (GAM) \(\beta_n^2 = h f_G(G_q, m_n, m_n) / h f_G(G_q, m_e, m_e)\) as \(a^2 = [h / (k q_c^2 / c)]^2\) is also the exponential of the ratio of two momentum. The next equation also explains the fact that \(\beta_n\) and \(a^{3/2}\) have relatively close values: this fact also helped me deriving the mbl-TH from the bl-TH series.

\[
y^2 \cdot \log_2(y) = x^2 \cdot \log_2(x) \Leftrightarrow y^2 \cdot \ln(y) = x^2 \cdot \ln(x) \quad [\text{III-5(a,b)}]
\]

\[
\beta_n^2 \cdot \log_2(\beta_n) \sim a^2 \cdot \log_2(a) \Rightarrow \beta_n^2 \cdot \ln(\beta_n) \sim a^2 \cdot \ln(a) \quad [\text{III-5(c,d)}]
\]

\[
\frac{\beta_n^2 \cdot \log_2(\beta_n)}{a^2 \cdot \log_2(a)} = \frac{\beta_n^2 \cdot \ln(\beta_n)}{a^2 \cdot \ln(a)} \sim 99.99922\%, \text{with } a = \log_2(N_a) \quad [\text{III-5(e,f)}]
\]

\[
\frac{\beta_p^2 \cdot \log_2(\beta_p)}{a^2 \cdot \log_2(a)} = \frac{\beta_p^2 \cdot \ln(\beta_p)}{a^2 \cdot \ln(a)} \sim 99.71\%, \text{with } a = \log_2(N_a) \quad [\text{III-5(g,h)}]
\]

According to the renormalization group equation (RGE) of Quantum ElectroDynamics (QED) (experimentally tested), the value of \(\alpha\) grows direct-proportionally (dp) and logarithmically with the energy magnitude scale (and inverse-proportionally [ip] and logarithmically to the length scale [l] of the measurement), approaching to the SNF strength at (very) high energy scales and at (very) small length scale of measurement (for example, at the scale of the Z boson [ \(~90\ \text{GeV}\), \(\sim 1/127\)]): the Grand Unified Theories (GUTs) rely on this fact. However, the true scaling behaviour of FSC at large energies is not known, as the perturbation theory (which uses the perturbative beta function) cannot be applied at strong coupling, because the
p perturbative beta function doesn’t generate accurate results at strong coupling \([40]\). In my BIDUM, \(\alpha\) varies ip
with \(a = \log_2(N_a)\): a linear variation of \(N_a\) generates a logarithmical variation of \(a\) and an ip-logarithmical variation of the \(\alpha\) respectively. Cororobating these 2 facts, one may conclude that \(N_a\) is ip to the energy magnitude scale and also has the significance of the ratio of two energy scales or two momentum scales (including two GAM) (which may also be compatibile to the predicted informational significance of \(N_a\)).

\[
\alpha_f(x) \sim \frac{\alpha}{1 - \frac{2\alpha}{3\pi} \ln(x)}, \text{with } x = E / \Lambda_{QED};
\]

\(E = \text{the energy (–magnitude scale) at which } \alpha \text{ is tested};\)

\(\Lambda_{QED} = \text{the QED energy (–magnitude scale)}\)

\[
\left[ \frac{\alpha_f(x)}{1 - \frac{2\alpha}{3\pi} \ln(x)} \right] \sim \frac{1}{\log_2 \left( \frac{N_a}{N_a(x)} \right)} \sim \frac{1}{2 \log_2 \left( \frac{N_a}{N_a(x)} \right)} \cdot \ln(x) \equiv
\]

\[
2 \log_2 \left( \frac{N_a(x)}{N_a} \right) \sim \frac{2}{3\pi} \cdot \ln(x) \equiv
\]

\[
\ln \left( \frac{N_a(x)}{N_a} \right) / \ln(2) \sim \ln \left( \frac{N_a}{N_a} \right) / \ln(2) - \ln \left( \frac{2}{x^{1/3}} \right) \equiv
\]

\[
\ln \left( \frac{N_a(x)}{N_a} \right) \sim \ln \left( \frac{N_a}{x^{1/3}} \right) \equiv
\]

\[
\ln \left( \frac{N_a(x)}{N_a} \right) \sim \ln \left( \frac{N_a}{x^{1/3}} \right) \equiv
\]

\[
\left. \frac{N_a(x)}{N_a} \right|_{\ln(4)} \sim \left. \frac{N_a}{x^{1/3}} \right|_{\ln(4)} \sim x^{-\ln(4)/3\pi} \sim 2^{\ln(4)/3\pi} \sim 2^{\ln(4)/3\pi} \sim 2^{\ln(4)/3\pi}
\]

\(N_a(x) \sim N_a \cdot x^{-\ln(4)/3\pi} \equiv \left. \frac{N_a(x)}{N_a} \right|_{\ln(4)} \sim \left. \frac{N_a}{x^{1/3}} \right|_{\ln(4)} \sim x^{-\ln(4)/3\pi} \sim 2^{\ln(4)/3\pi} \sim 2^{\ln(4)/3\pi}
\]

\(a_s \sim 1 = 1 / \log_2 \left( \frac{N_a}{N_a(x)} \right) \sim 1\). As seen next, \(N_{as}\) has the significance of a ratio of two energy-scales or the ratio of two momentum-scales (including two GAM) and may be in fact the same \(N_a\) (extremely) pushed from the rest value \((\sim 10^{41})\) to a value close to 2 (as \(N_{as}\) at rest is), at very high energy scales.

\[
\alpha_{fs}(x) \sim -\frac{2\pi}{\beta_0 \cdot \ln(x)}, \text{with } x = E / \Lambda_{QCD};
\]

\(E = \text{the energy (–magnitude scale) at which } \alpha_s \text{ is tested};\)

\(\Lambda_{QCD} = 210(\pm 40) \text{ MeV}; \beta_0 = -11 + 2n / 3 = -7 \text{ (with } n = \text{number of quark flavors} = 6)\)

\[
\frac{210(\pm 40)}{\text{MeV}} \text{, with } \beta_0 = -11 + \frac{2n}{3} = -7 \text{ (with } n = \text{number of quark flavors} = 6)\]
\[
\alpha_{FS}(x) = \frac{1}{\log_2(N_{ar(x)})} \sim \frac{-2\pi}{\beta_0 \cdot \ln(x)} \]

\[
\Leftrightarrow \ln\left(\frac{N_{ar(x)}}{N_{ar(2)}}\right) \sim (-\beta_0 / (2\pi)) \cdot \ln(x) \Leftrightarrow
\]

\[
\Leftrightarrow \ln\left(\frac{N_{ar(x)}}{N_{ar(2)}}\right) \sim \left[-\beta_0 \ln(2) / (2\pi)\right] \cdot \ln(x) \Leftrightarrow
\]

\[
\Leftrightarrow \ln\left(\frac{N_{ar(x)}}{N_{ar(2)}}\right) \sim \ln\left[x^{(-\beta_0)\ln(2)/(2\pi)}\right] \Leftrightarrow
\]

\[
\Leftrightarrow N_{ar(x)} \sim x^{(-\beta_0)\ln(2)/(2\pi)} \sim 2^{(0.7722)\log_{E}(x)} \sim 2^{\log_2(x^{0.7722})}
\]

\[
\text{and } \alpha_{FS}(x) = \frac{1}{\log_2(N_{ar(x)})}
\]

In conclusion, I propose a unifying function of scaling for all the four fundamental fields/forces (FFs) (running) coupling constants (of both QED and QCD, but also for a hypothetical quantum gravity), \( F_N(x_{E_2=0}) \):

\[
N_a \sim 2^a \quad \text{for } (E_2 = 0 \text{ (at rest)} \Leftrightarrow x = 0)
\]

\[
\begin{align*}
N_{a(x)} & \sim N_a \cdot x^{(-\ln(4))/3\pi} \sim N_a \cdot 2^{\log_2(x^{0.1471})} \quad \text{for } (E_1 = \Lambda_{QED} \\
\text{and } E_2 \geq E_1) \Leftrightarrow x_{E_2=0} \leq 1
\end{align*}
\]

\[
\text{AND } \alpha_f(x) = \frac{1}{\log_2(N_{a(x)})} \sim \frac{\alpha}{1 - \frac{2\alpha}{3\pi} \cdot \ln(x)}
\]

\[
N_{ar(x)} \sim x^{(-\beta_0)\ln(2)/(2\pi)} \sim 2^{\log_2(x^{0.7722})} \quad \text{for } (E_1 = \Lambda_{QCD} \\
\text{and } E_2 \geq E_1) \Leftrightarrow x_{E_2=0} \leq 1
\]

\[
\text{AND } \alpha_{FS}(x) = \frac{1}{\log_2(N_{ar(x)})} \sim \frac{-2\pi}{\beta_0 \cdot \ln(x)}
\]
As $N_a$ determines both $\alpha$ and $\alpha_G$ at rest, it is expected that $N_a$ can predict (by approximation) both atomic quantities and global macroscopic quantities (at rest / low energies).

The length function $L_a(x) = N_a \cdot x$ applied to the classical electron radius $r_e = q_e^2 / (m_e c^2) \approx 2.8 \times 10^{-15} m$, $L_a(r_e) = N_a \cdot r_e \approx 5 \times 10^{-26} m$ has a value which is relatively close to the (experimentally) estimated OU radius $R_{OU} \approx 4.4 \times 10^{26} m$. The same with the $L_a(x)$ function applied to the proton radius $r_p \approx 0.87 \times 10^{-15} m$ $L_a(r_p) = N_a \cdot r_p \approx 1.5 \times 10^{-26} m$. More interestingly, $L_a(r_p)$ also predicts with approximation the Hubble constant $H_0 \approx 67.6 \left[\left(\frac{km}{s}\right)/Mpc\right] \approx 1 / \left(4.56 \times 10^{17} s\right)$, as $c / L_a(r_p) \approx 60.54 \left[\left(\frac{km}{s}\right)/Mpc\right]$.

\[
L_a(r_e) / R_{OU} \approx 1.14 \quad \text{and} \quad L_a(r_p) / R_{OU} \approx 0.35
\]  

\[
\log_2(R_{OU} / r_e) \approx 136.85 \approx (99.86\%)a \quad \text{and} \quad \log_2(R_{OU} / r_p) \approx 138.57 \approx (101.12\%)a
\]

\[
c / L_a(r_p) \approx 60.54 \left[\left(\frac{km}{s}\right)/Mpc\right] \Rightarrow \left[c / L_a(r_p)\right] / H_0 \approx 89.55\%
\]

Interestingly, the mass function $M_a(m_H) = N_a^2 \cdot m_H \approx 5.34 \times 10^{55} kg \text{ (with } m_H = m_p + m_e)$ has a value which is relatively close to the (experimentally) estimated total rest mass of the OU $M_{OU} = \rho_{OU} \cdot V_{OU} \approx 3.55 \times 10^{52} kg$ based on recent estimations of the OU density $\left(\rho_{OU} \approx 9.9 \times 10^{-30} g/cm^3 \approx \left[\rho_c = 3H_0 / (8\pi G) \approx 10^{-26} kg/m^3\right]\right)$ and OU radius $R_{OU} \approx 4.4 \times 10^{26} m$. The product $N_a^2 \cdot m_H \approx 4.56 \times 10^{54} kg$ is even closer to $M_{OU}$. This two facts are equivalent to both $N_a^2$ and $N_a^2 / a^{1/2}$ being close to the ratio $N_H = M_{OU} / m_H \approx 2.12 \times 10^{81}$ (with $m_H = m_p + m_e$)

\[
M_a(m_H) / M_{OU} \approx 15 \quad \Rightarrow \quad N_a^2 / N_H \approx 15
\]

\[
(N_a^2 / a^{1/2}) \cdot m_H / M_{OU} \approx 1.28 \quad \Rightarrow \quad (N_a^2 / a^{1/2}) / N_H \approx 1.28
\]

More interestingly, the function $a^{3/2} N_a^{1/2} \approx 6.78 \times 10^{23}$ is very close to the numerical value of the Avogadro constant $N_a \approx 6.023 \times 10^{23} \text{ (molecules / mole)}$ so that $\left(a^{3/2} N_a^{1/2}\right) / \left(N_a \cdot \text{mole / nof molecules}\right) \approx 112.58\%$

**Checkpoint-conclusion.** In essence, the (TH-derived) mbl-TH can offer an elegant alternative interpretation to DLNH, by offering a unified function $F_{\text{mbl}}(x)$ for all the four coupling constants of the four fundamental fields/forces (FFs). Although just a toy-model, BIDUM can be considered a “patch”, an update for the Standard Model of particle physics (including QED and QCD) that proposes a contraction of the three adimensional physical constants $\alpha$, $\alpha_G$ (redefined as $\alpha_{Gp}$, also implying a new quantum G scalar $G_q$) and $\beta_n$ into one new unifying number (constant at rest) $N_a$. BIDUM also proposes two (1$^{\text{st}}$ and 2$^{\text{nd}}$ rank) set of rules that impose conditions to the 1$^{\text{st}}$ rank parameters and to the 2$^{\text{nd}}$ rank parameters respectively: given these arguments, BIDUM version 2.0 has the potential to create a path for a new class of models beyond the SM, generally called BIDUMs.
Part IV. A $h_{eg}$ series and a $G_q$ series prediction for any nucleus based on the average nuclear binding energy per nucleon

I also propose an alternative plausible explanation to the apparent paradox of the divergent variation of experimental $G$ values, „despite” constant improvements of the measurement systems [42,43]: CODATA-1999 decided to officially increase the relative standard uncertainty of $G \left( u_G \right)$ from 128 ppm to 1500 ppm; CODATA-2010 (re-) established that $u_G = 120 ppm$. The experimental $G$ values differ from one another by a $G$-value deviation $d_G$ as much as $d_G \sim 450 ppm$, even though most of them have $d_G \sim 40 ppm$, that is why CODATA-2014 established that $u_G = 47 ppm$. Some reputable research teams still report $d_G \sim 240 ppm$ in the last decade [44]

The average nuclear binding energy per nucleon ($E_{BN}$) from any (quasi/)stable nucleus of any isotope is an intranuclear energetic „pressure” that can modify the QAM quanta (measured by $h_{eg}$) of the gravitational field generated by each of those nucleons. I hypothesize that $h_{eg}$ may vary with a simple grade-I function that generates a $h_{eg} \left( E_{BN} \right)$ series for any (quasi/)stable isotope nucleus. As $G_q = f \left( h_{eg} \right) = k_G \cdot h_{eg}$, the variability of the experimental $G$ values may be explained by $h_{eg} \left( E_{BN} \right)$, that is why I propose a quantum $G$ series $G_s \left( E_{BN} \right) = f \left( h_{eg} \right) = k_G \cdot h_{eg} \left( E_{BN} \right)$ which implies that each chemical isotope may have its own quantum $G$ „imprint” $G_s \left( E_{BN(isotopeX)} \right)$.

\[
\begin{align*}
\text{i} & : \ h_{eg} \left( E_{BN} \right) = h_{eg} \left( 1 + \frac{E_{BN}}{m_{e}c^2} \right), \text{with a formal definition } m_N = \frac{m_p + m_n}{2} \\
\text{iv} & : \ G_s \left( E_{BN} \right) = k_G \cdot h_{eg} \left( E_{BN} \right)
\end{align*}
\]

I also consider that experimental $G$ (as measured between two atoms/isotopes $[a_1 \text{ and } a_2]$) is an indirect measure of the combined QAM quanta of two superposing EGF fields generated mainly by the two nuclei of the two isotopes, each characterized by its own field QAM quanta $h_{eg} \left( E_{BN(1)} \right)$ and $h_{eg} \left( E_{BN(2)} \right)$ and (implicitly) by its own quantum $G$ scalar $G_s \left( E_{BN(1)} \right)$ and $G_s \left( E_{BN(2)} \right)$. Measuring $G$ is in fact measuring the resulting $G_s \left( E_{BN(1,2)} \right)$ scalar that can be defined as a simple geometric mean of $G_s \left( E_{BN(1)} \right)$ and $G_s \left( E_{BN(2)} \right)$.

\[
G_s \left( E_{BN(1,2)} \right) = \sqrt{G_s \left( E_{BN(1)} \right) \cdot G_s \left( E_{BN(2)} \right)} \equiv (\text{experimental})G
\]

$G_s \left( E_{BN} \right)$ can approximate Sun’s and Earth’s specific (average) $G_s$ value based on their chemical composition. The Sun is predominantly composed from hydrogen (H) gas (>70% of the Sun’s mass, predominantly represented by the protium $^1H$ isotope) [45] and $^1H$ has a specific $G_s \left( E_{BN(1)} \right) = G_s \left( 0\text{MeV} \right) = G_q \sim (99.6\%)G$: that is why I estimate the Sun’s specific average $G_s \left( \text{Sun} \right) \sim G_q \sim (99.6\%)G$. The main chemical element in the composition of the Earth (litosphere and crust) is the oxygen (O) (>30% of litosphere and crust masses, predominantly represented [99.762%] by the isotope $^{16}O$)[46] and O is a chemical element with a specific $G_s \left( E_{BN(16O)} \right) = G_s \left( 7.98\text{MeV} \right) \sim (100.46\%)G$. It is very possible that:
(1) (prediction) If experiments on G will be conducted into space, the G values will tend to be smaller (due to the influence of the Sun’s specific EGF quantified by $h_{eg}(\mathcal{E}_{BN(\uparrow H)}) = h_{eg}$ and $G_{q}(\mathcal{E}_{BN(\uparrow H)})$) and due the massive flow of eg's emitted towards the Earth with specific $h_{eg}(\mathcal{E}_{BN(\uparrow H)}) = h_{eg}$.

(2) (retrodiction) When the experiments are conducted deep in the Earth’s layers (usually in deep mines) they tend to generate a larger experimental G values corresponding to $G_{q}(\mathcal{E}_{BN(\uparrow^{*} O)}) \sim (100.46\%) G$: this second statement is an already confirmed retrodiction, as the experiments on G conducted at depths generated systematically high(er) values of G. [47,48]

(3) As the „mix” of EGF fields of the Sun, Earth and other astronomical physical systems (PSs) also depend on the reciprocal spatial orientation of these PSs, I also predict that the experimental values of G can additionally depend on: (a) the Earth’s altitude and latitude at which the experiment takes place; (b) Sun, the momentary distance/configuration between Earth and other stars; (c) the chemical composition of that specific Earth region in which the experiment takes place. In 2002, Mikhail Gershoytn and his colleagues have successfully demonstrated experimentally that the G of the $F_{g}$ vector (established between two test bodies) varies with their orientation in space, relative to a system of distant stars [49]. At the present, experimental measurements of G have the potential to better differentiate between different (combined) chemical structures G „imprints” and between different Sun-Earth-stars configurations G „imprints”.

This multiple-G hypothesis (mGH) is verifiable both retrospectively (by analyzing the negative/positive altitude/latitude, the Sun/Stas-Earth configuration, the chemical composition of that region and of all the materials[50] used in past 200 years G determination experiments) and in the future by using the same experimental device at different altitudes/latitudes [51,52,53] and in different regions and using metal spheres of different atoms or single various atoms and then analyze the systematic differences [54] between the experimental G as function of all these physical and chemical variables: Gundlach’s and Merkowitz’s method [55] and atom interferometry using cold atoms [56,57] are two very useful new tools in this direction.

As it can be seen in the next figure, the theoretical series $G_{q}(\mathcal{E}_{BN})$ tends to approximate all the G value experimental measurements in the past over 200 years [58,59,60,61,62] (for simplicity and clarity, the error limits for each determined value of G where not represented in the next graph): $G_{\text{exp(chron.)}}$ represents the chronological order of the G value results (correlated with the rising accuracy of the experimental devices used to determine G); $G_{\text{exp(ascend.)}}$ represents the experimental G values in a non-chronological but ascending order, which generates a graph quite similar to the $G_{q}(\mathcal{E}_{BN})$ graph curve from the same figure. However, all the experimental G values obtained on Earth are „contaminated” by the EGF field of the Sun and the eg's received from it, which are all characterized by $h_{eg}(\mathcal{E}_{BN(\uparrow H)}) = h_{eg}$ and $G_{q}(\mathcal{E}_{BN(\uparrow H)}) \sim (99.6\%) G$: that is why I have also plotted the graph of the derived series $\left[G_{q}(\mathcal{E}_{BN(\uparrow H)})/G\right] \times G_{q}(\mathcal{E}_{BN})$.
Both $h_{se}(E_{BN})$ and $G_{s_q}(E_{BN}) = f\left(h_{se}\right) = k_G \cdot h_{se}(E_{BN})$ offer an important potential correlation between QFT and GR: the larger the element $x$ $h_{se}(E_{BN(x)})$, the larger the curvature of spacetime, so that the $h_{se}(E_{BN})$ may become a stress-energy-momentum tensor at the quantum level. I propose that $G$ should be replaced with $G_{s_q}(E_{BN})$ in the Einstein (gravitational) field equations (EFE) of the general relativity (GR): the new emergent quantum EFE may bring GR and QFT closer.

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G_{s_q}(E_{BN})}{c^4} T_{\mu\nu}$$

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi \left[k_G \cdot h_{se}(E_{BN})\right]}{c^4} T_{\mu\nu}$$

$$\therefore G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{4h_{se}(E_{BN})}{a \left(m_e c^2\right)^2} T_{\mu\nu}$$
**Check-point conclusion.** The so-called "systematic error" suspected in G measurement may actually be a "systematic" quantum gravity...fact. Not only that mGH proposes an potential significant quantum update for EFE, but mGH is also an important prediction that has the potential to change the paradigm in quantum gravity theory demonstration/verification, as an indirect elegant proof of the existence of the graviton (modelled as "eg") and the validity of the quantum gravity theory: this right "under our nose" quantum gravity (indirect) proof hidden/masked by the experimental G value relatively high variability can open a new unexpected gate to a TOE that can unify GR with QFT.
Part V. An alternative informational definition of both quantum and angular momentum and its most important consequences (including the global PI quantities of the observable universe)

A growing trend in physics is to define the physical world as being made up of information [63]. An important direct relationship between information and entropy is demonstrated by the Maxwell's demon thought experiment [64]: a first important consequence is that it’s impossible to destroy Shannon entropy/information without increasing the Boltzmann entropy of a system [65,66]; another important consequence is that information may be interchangeable with energy [67]. Wheeler’s “it from bit” principle (hypothesis) is also famous [68,69].

Similarly to $\alpha$ and $\alpha_G$ $N_a$-based alternative definitions, I also propose an alternative informational definition (independent and unifying) of the angular momentum (L) in the case of both classical/quantum physical systems (PSs): $L$ is alternatively defined as the maximum number of (nof) potential (past, present and future) distinguishable (at least theoretically, if not always practically) internal states $N_s (\Delta t)$ of a PS at rest, measured in a specific classical time frame $\Delta t = t_2 - t_1$, with each potential state defined by a specific probability $p_S (t_2 - t_1)$, with “i” being the index of the “i-th” state of the that PS, indexed in the $\Delta t$ measurement frame. It is obvious that $N_s (\Delta t)$ and $p_S (t_2 - t_1)$ don’t contain all the information on the PS, as $\Delta t$ never permits an absolute exact measurement of $N_s (\Delta t)$, and there also may exist additional layers of meta-information of that PS also measurable in bits and/or qbits (for example meta-information on how the PS slides from one specific state to another specific state in different time frames). The angular momentum L is considered equivalent to I quantitatively and qualitatively, $L \equiv I$ and $L = I$.

In the case of a QP, I propose a nof quantum states $N_Q (\Delta t)$ and also a nof (possible) subquantum states $N_{SQ} (\Delta t) \geq 1$ (possibly generated by the interaction with an EGF and by the absorption/emission of eg, none of which can be shielded), so that $N_s (\Delta t) = N_Q (\Delta t) \times N_{SQ} (\Delta t)$. The physical information quantity/quanta (PIq) shall be abbreviated as “I” when used in the equations, for the simplicity of notation. I shall define the intrinsic information of a QP $I_{in}$ as the $N_s$ of a QP as measured in the smallest possible classical time frame/“slice” $\Delta t = t_2 - t_1$ which is the Planck time $t_{pl} = \sqrt{\frac{\hbar G}{c^5}} \sim 5.4 \times 10^{-44}$ s, so that $I_{in} = N_s (t_{pl}) = N_Q (t_{pl}) \times N_{SQ} (t_{pl})$. I shall also define the input information $I_{in} (\Delta t)$ as the nof potential states $I_{in} (\Delta t) = \Delta N_s (\Delta t) \geq 0$ that were added to the $I_{in}$ of a QP in any specific frame of measurement $\Delta t = t_2 - t_1$, so that $I_{in(2)} = I_{in(1)} + I_{in} (\Delta t)$. I shall also define the output information $I_{out} (\Delta t)$ as the nof potential states $\Delta N_s (\Delta t) \geq 0$ that were extracted from the $I_{in}$ of a QP in any specific frame of measurement $\Delta t = t_2 - t_1$, so that $I_{out(2)} = I_{out(1)} - I_{out} (\Delta t)$. As $L \equiv I$ and $L = I$, then we can also define intrinsic, input and output angular momentums: $L_{in} = I_{in} = N_s (t_{pl})$, $L_{in} (\Delta t) = I_{in} (\Delta t)$ and $L_{out} (\Delta t) = I_{out} (\Delta t)$. To realize a quantitative equivalence between the dimensional $L_{[\mathcal{J}_s]} = E_{[\mathcal{J}_s]} \cdot t_{[\mathcal{J}_s]}$ and an the adimensional I (a pure number [nof states $N_s (\Delta t)$] alternatively measurable in bits and/or qbits), L can be measured using the $h_{eg}$ (which quantitatively measures the QAM of a hypothetical electrograviton [eg]) as a unit of measure, as $h_{eg}$ is probably the smallest L quanta ($L_{Q}$) of the OU. $h_{eg}$ will be considered qualitatively and quantitatively equivalent to both: (1) the smallest Lq AND ALSO (2) with the
smallest PIq which is considered the bit/qbit which corresponds to a number of 2 classical/quantum states. As the eg has a very small intrinsic PIq, it can be simplified and considered a superposition of just 2 extreme quantum states (which may become two additional subquantum states of the QP that absorbs that eg).

\[
h_{eg} \equiv 2\left[\text{Sub} \right] \frac{\text{Quantum states}}{\log_2(h_{eg})} = 1\text{qbit}
\]

\[
L / h_{eg} = (E \cdot t) / h_{eg} = I(\Delta t) = N_S(\Delta t) = N_Q(\Delta t) \times N_{SQ}(\Delta t)
\]

The \( h / h_{eg} \) ratio was named \( K_{eg} \) (electrogravitational constant), as it relates the EMF-PIq \( h \) to EGF-PIq \( h_{eg} \). I also propose a constant \( k_{js} \) that helps measuring both \( J \cdot s \) product and \( h \) in nof (gravitonic/eg) states and qbits.

\[
K_{eg} = \frac{h}{h_{eg}} \Leftrightarrow h = 6.626 \times 10^{-34} Js = K_{eg} \cdot 2(\text{states}) \Rightarrow
\]

\[
k_{js} = \frac{2K_{eg}}{h / (Js)} = \frac{2K_{eg}}{6.626 \times 10^{-34}} - 1.26 \times 10^{76} (\text{states} / Js) - 253 (\text{qbits} / Js)
\]

\[
h \sim 6.626 \times 10^{-34} Js \sim 8.4 \times 10^{42} \text{states} \sim 143 \text{qbits}
\]

Both the EMF and EGF scalars imply products of masses (which also imply products of Eqs and products of linear/angular momentums by classical definition). The \( L = I \) and \( L = I \) equivalence principle (the [angular] momentum-information equivalence principle, briefly MIEP) may also explain these products of masses/energies/momentums as a combinational product of two \( N_S \) (\( N_{S1} \) and \( N_{S2} \)) of two or more QPs (groups of QPs). As \( N_S \) may take very large values, PIqs can also be measured using the binary logarithm as:

\[
(k_e)_{q_1 \cdot q_2} = (G_e)m_1 \cdot m_2 = E_1 \cdot E_2 \equiv I = N_{S1} \cdot N_{S2}
\]

\[
\left[\log_2(I) = \log_2(N_S)\right] = \log_2(N_Q \times N_{SQ}) = \log_2(N_Q) + \log_2(N_{SQ})
\]

MIEP offers a new alternative definition for energy as the PIq transfer speed (qbits transferred per [unit of] time interval [s]). In this view, PI becomes a fundamental hybrid concept/entity (both mathematical and physical) and energy-matter become secondary/PI-derived entities which are just the result of measuring (in various ways) the PIq interchanged between the observer (including his measuring tools) and the observed PS, but also the PIq transferred between the subcomponents of that PS, both types of measurement being undertaken in a specific chosen time interval \( \Delta t \). What is perceived physically as the “energy/matter of an observed PS” (and/or through measuring tools which are extensions of the observer’s body) is the result of the capacity of that observed and measured PS (including the spacetime [vacuum] it occupies) to transfer a specific PIq to the observer OR the capacity of the observed subcomponents (of that PS) to interchange a specific PIq per unit of (subjective and/or objective) (classical linear) time interval unit. In conclusion, energy and matter may be generated by PIq flows of different types: in this view, OU may be regarded as a huge software similar to an universal operating system. I argue that energy, force, mass and all their derivatives (together with their SI units of measurement which are essentially based on the kilogram) should be “inversely” redefined from this PIq-
scalar of the angular momentum \( L \). For the simplicity of notation, PIq is denoted as “I”, time is denoted as “t” and linear/circular lengths/distances (denoted as “d”). This new system of measurements is essentially based on the qbit and the classical spacetime measure units (meter[m] and second [s]). The square root of classical physical mass (which often appear in different physical laws, but which is classically counterintuitive) also has an intelligible significance: mass is PIq multiplied with a time interval \( \Delta t \) (in fact multiplied with a number of Planck intervals \( N_{Pl} = \Delta t / t_{Pl} \) over an area, that can support the square root without losing its informational (combinatorial) meaning and becoming a linear PIq distribution (as on a quasi-straight or curved string).

\[
L = I \Rightarrow Js = k_{Js}(\text{states / qbits})
\]

\[
E(\text{energy}) = L / t = I / t \Rightarrow J = k_{Js}(\text{qbits}) / s
\]

\[
P(\text{power}) = L / t^2 = I / t^2 \Rightarrow W = k_{Js}(\text{qbits}) / s^2
\]

\[
F(\text{force}) = L / (d \cdot t) = I / (d \cdot t) \Rightarrow N = k_{Js}(\text{qbits}) / (m \cdot s)
\]

\[
M(\text{mass}) = (L \cdot t) / d^2 = (I \cdot t) / d^2 \Rightarrow kg = k_{Js}(\text{qbits}) \cdot s / m^2
\]

\[
\sqrt{M(\text{mass})} = \sqrt{(L \cdot t) / d^2} = \sqrt{(I \cdot t) / d^2} = \sqrt{(I \cdot t) / d} \Rightarrow kg = \sqrt{k_{Js}}(\text{states}) / m
\]

BIDUM ALSO launches the hypothesis that the so-called “rest mass” of a QP is always the consequence of an intrinsic PIq at rest (implicitly a quantum angular momentum at rest) that splits when observed resulting an energy quanta (Equa) (at rest) with a mean (classical linear lifetime): the “rest mass” quanta (Mqua) can be extracted from the Equa as \( M_{\text{qua (rest)}} = E_{\text{qua (rest)}} / c^2 \). The main argument of this hypothesis is that all (quark-based) hadrons (mainly represented by the proton and the neutron) have their “rest” masses determined mainly by the kinetic energy/angular/momentum of the internal gluons (as quanta of the internal SNF that hold quarks together in hadronic structures). Similarly to the quark-based hadrons/nucleons, it is possible that the so-called “rest mass” classical concept to be just a relative empirical concept for all EQPs, as it is very probable (by this hypothesis) that all the “rest masses” of all EQPs with non-0 rest masses, can be in fact generated by the intrinsic PIq (quantum angular momentum) of a group of hypothetical subjacent subquantum particles (SQPs): by this hypothesis, even the quarks and leptons may “gain” their non-0 “rest masses” from the rotation/vibration/translation of those subjacent sub-particles which all generate a common resultant angular momentum that furthermore generates the impression of a global so-called “rest mass” of that (apparently elementary) QP. By this hypothesis, BIDUM conjectures that all EQPs are in fact Apparently Elementary QPs (AEQPs). This hypothesis is in concordance with SST and M-theory, as it also predicts subquantum entities (that may be ball-like, empty sphere-like, irregular surface-like or string-like).

I also push further the possibility of (at least qualitative) interconversion between classical SI units using a set of universal equivalence principles (UEP) based on the apparent constancy of the values of some universal physical parameters like c, h, G and \( k_{eq} \). As c is an universal physical constant, its constancy can be considered a 1st rank UEP between the distance quanta (d) and time quanta (t) so that \( d \equiv t \) and \( d / t = K_c = c \) (apparently and formally dimensional, but essentially adimensional), so that c actually may “hide” a more profound adimensional constant \( K_c \) which may be any arbitrary number (including 1 or \( \pi \) multiples). This distance-time equivalence also predicts the energy-mass UEP.

\[
d \equiv t \Leftrightarrow t_{Pl} \equiv l_{Pl} (1^\text{st rank UEP}[c])
\]
\[
\begin{align*}
(E = I/t) &\equiv I/d \\
(P = I/t^2) &\equiv [I/(d \cdot t)] \equiv I/d^2 \quad (\equiv E/t \equiv E/d) \\
[F = I/(d \cdot t)] &\equiv I/t^2 \equiv I/d^2 \equiv P(\equiv E/t \equiv E/d) \\
(M = I \cdot t/d^2) &\equiv I/t \equiv I/d \equiv E
\end{align*}
\]

As G and \(k_a q_e^2\) (scalars) are also universal physical constants, their constancy can also be interpreted as a 1\(^{st}\) rank UEP between the PIq and area-quanta (aq) so that PIq≡aq (I≡d\(^2\)≡t\(^2\)≡d∙t) and PIq/aq=K\(_G\)≡K\(_Q\)≡(equivalent) PI**: as it can be observed, this is an alternative formulation of the ‘t Hooft’s holographic principle (subsequently developed by Leonard Susskind)

\[
\begin{align*}
(I = N_S) &\equiv d^2 \Rightarrow \text{equiv}(d \cdot t) \equiv I \equiv d^2 \equiv d \cdot t \equiv t^2 \quad (1^{\text{st}} \text{rank UEP}[G]) \\
(E = I/t) &\equiv I/d \equiv d \equiv t \\
(P = I/t^2) &\equiv d^2 / t^2 \equiv t^2 / d^2 \quad (\equiv 1) \\
[F = I/(d \cdot t)] &\equiv I/t^2 \equiv I/d^2 \equiv 1(\equiv P) \\
(M = I \cdot t/d^2) &\equiv t = d \equiv E
\end{align*}
\]

As the Planck constant (h) is also an universal constant, I have already “translated” its constancy in a 1\(^{st}\) rank UEP between the (quantum/classical) angular momentum (measured in Joule-second) and PIq (measured in states and bits and/or qubits) so that: \(\text{QAM}\equiv\text{PIq}\equiv\text{nof. states} \quad (N_S= N_0 \cdot N_{SQ}) \equiv 1.

\[
\begin{align*}
(I = N_S) &\equiv 1 \quad (1^{\text{st}} \text{rank UEP}[h]) \\
(E = I/t) &\Rightarrow E \equiv 1/t \equiv 1/d \equiv 1/\sqrt{I} \quad \Rightarrow \text{UEP}[G] \quad t \equiv 1/t \equiv 1/d \equiv d \\
(P = I/t^2) &\equiv 1/t^2 \equiv 1/(d \cdot t) \equiv 1/d^2 \equiv 1/I \equiv [E^2 \equiv 1/d^2 \equiv 1/t^2 \equiv 1/(dt) \equiv d^2 \equiv t^2] \\
[F = I/(d \cdot t)] &\equiv 1/(d \cdot t) \equiv 1/t^2 \equiv 1/d^2 \equiv 1/I \equiv [E^2 \equiv 1/d^2 \equiv 1/t^2 \equiv 1/(dt) \equiv d^2 \equiv t^2] \\
(M = I \cdot t/d^2) &\equiv 1/t \equiv 1/d \equiv 1/\sqrt{I} \equiv [E = 1/t \equiv 1/d \equiv d \equiv t]
\end{align*}
\]

As PI is a unitary concept and \(L(=E \cdot t)\)∀I, I consider that E is indissolubly related to the classical linear time (quantized as \(\Delta t = t_2 - t_1\) which may be considered a multiple integer of \(t_{Pl}\)); the practical equivalent of this indissolubility is that you cannot separate experimentally a measured E from its time-frame of measurement \(\Delta t = t_2 - t_1\), other but temporary and artificially, using different inductive algorithms (based on repeated experimental “sampling” of different physical objects and phenomena) to theoretically “stretch” or “contract” this experimental time-frame of measurement and usually extend it to larger/smaller as possible time-
intervals of type $\Delta t_{\text{max}} \gg \Delta t$ and $\Delta t_{\text{min}} \ll \Delta t$, trying to test the invariance of various physical laws on these “stretches”/“contractions”. In this view, Einstein’s mass-energy equivalence principle (MEEP) should be rewritten to include the time frame $\Delta t = t_2 - t_1$, even if MEEP was tested to be valid in time-frames as $\Delta t_{\text{max}} \gg \Delta t$ and $\Delta t_{\text{min}} \ll \Delta t$ and also predicted to be valid for $\Delta t_{\text{max}} \sim \infty$ and $\Delta t_{\text{min}} \sim t_p$. Also in this view, the energy conservation principle (ECP) becomes the consequence of the more profound and general PIq Conservation Principle (PICP). The total intrinsic PIq $I_\tau(\Delta t)$ of a QP is obviously related to a (classical linear) time interval ($\Delta t$) of measurement (in a specific reference frame) and can be defined (and generalized) as a function of an intrinsic (internal) PIq $I_{\text{int}}$ (as also measured in the $\Delta t$ interval or previously, in a $\Delta t_{\text{min}} \rightarrow t_p$), an input (received) PIq $I_{\text{in}}(\Delta t)$ and an output (emitted) PIq $I_{\text{out}}(\Delta t)$: this is the most general equation of PICP (ge-PICP) that can be also applied to the MEEP as any QP probably emits and/or receives undetectable (hypothetical) quanta independently to any possible additional electromagnetic (EM) radiation when it transforms into energy (and quanta are hypothesized to generally have the same speed $c$ as the real/virtual photons).

\[
I(\Delta t) = (mc^2) \cdot \Delta t \quad \Leftrightarrow \quad (E \cdot \Delta t) = (mc^2) \cdot \Delta t \quad (\Rightarrow E = mc^2) \text{ or } I_E = I_{mc^2} \tag{V-7a}
\]

\[
I_\tau(\Delta t) = I_{\text{int}} + I_{\text{in}}(\Delta t) - I_{\text{out}}(\Delta t) \quad \Rightarrow \quad I_{(E)}(\Delta t) = I_{\text{int}(mc^2)} + I_{E(in)}(\Delta t) - I_{E(out)}(\Delta t) \tag{V-7b,c} \text{ (ge-PICP)}
\]

\[
E_{\text{in}} \cdot \Delta t + I_{E \text{(in)}}(\Delta t) - I_{E \text{(out)}}(\Delta t) = (mc^2 \cdot \Delta t) + I_{mc^2 \text{(in)}}(\Delta t) - I_{mc^2 \text{(out)}}(\Delta t) \tag{V-7e}
\]

As the (hypothetical) quanta cannot be shielded, it is inevitable that any form of matter emits and receives huge numbers of quanta in the time interval in which it converts to energy (and vice versa), so that MEEP scalar is not an exact mathematical equality but just a very accurate approximate equality, as hypothetical quanta have very small (practically undetectable) average energy quanta. As the hypothetical quanta are considered closed strings that may escape in a possible additional 5th dimension with compact topology (as the Super String Theories [SSTs] and M-theory [MT] predict), in the next equations I will rewrite the MEEP as particular case of PICP. $N_{eg \text{ (in)}}(\Delta t)$ and $N_{eg \text{ (out/esc)}}(\Delta t)$ are the nof (hypothetical) input/output (including escaped) quanta in the $\Delta t$ interval and $E_{eg(E)}$ and $E_{eg(mc^2)}$ is the average energies of these quanta before and after conversion respectively.

\[
E(\Delta t) = E + \left( N_{eg \text{ (in)}}(\Delta t) - N_{eg \text{ (out/esc)}}(\Delta t) \right) \cdot E_{eg(E)} \quad mc^2(\Delta t) = mc^2 + \left( N_{eg \text{ (in)}}(\Delta t) - N_{eg \text{ (out/esc)}}(\Delta t) \right) \cdot E_{eg(mc^2)}
\]

\[
\left( N_{eg \text{ (in)}}(\Delta t) - N_{eg \text{ (out)}}(\Delta t) \right) \cdot E_{eg} \ll E \quad \Rightarrow \quad \begin{cases} E(\Delta t) \sim mc^2(\Delta t) \\ E \sim mc^2 \tag{V-8} \end{cases}
\]

A general function that approximates the intrinsic PIq $I_{\text{int}(QP)}$ for any QP can be deduced by applying ge-PICP for $[\Delta t = t_{QP}]$, where $t_{QP}$ is the mean lifetime of that QP, the maximum $\Delta t$ — quanta in which that QP be studied once and repeatedly studied (experimentally) in $\Delta t_{\text{max}} = N_{\text{max}} \cdot t_{QP}$. The rest mass $m_{QP}$, and the rest energy $E_{QP} = m_{QP}c^2$ of the (non-0 rest mass) QPs both are (relative) constant in $\Delta t = t_{QP}$, implying that $[L_{QP} \cdot (t_{QP}) = E_{QP} \cdot t_{QP} = (m_{QP}c^2) \cdot t_{QP}] = I_{QP} \cdot (t_{QP})$ is also a (relative) constant. The QAM $h_{QP}$ of the 0 rest mass) QPs (like the photon, the eg and the gluon which are all gauge bosons [GBs]) is also (relative) constant in
$\Delta t = t_{QPr}$. The (relative) constancy of \( I_{QPr} = (m_{QPr} c^2) \cdot t_{QPr} \) (for the non-0 rest mass QP) and \( h_{QPr} \) (for the 0 rest mass QPs) imply that \( I_{in}(t_{QPr}) - I_{out}(t_{QPr}) \sim 0 \) in \( \Delta t = t_{QPr} \). As \( t_{QPr} \) is an average (a mean lifetime measured using units of classical linear time) \( I_{QPr}(t_{QPr}) \) is also an average (a mean intrinsic PIq).

\[
\begin{align*}
[I_{in}(t_{QPr}) - I_{out}(t_{QPr})] &= I_{int(QPr)} + [I_{in}(t_{QPr}) - I_{out}(t_{QPr})] \\
\Rightarrow I_{int(QPr)} &\sim I_{QPr}(t_{QPr}) \sim (m_{QPr} c^2) \cdot t_{QPr}
\end{align*}
\]  

[V-9]

Based on the \( I_{int(QPr)} \sim (m_{QPr} c^2) \cdot t_{QPr} \), I propose a function \( hf_{QPr}(m_{QPr}, t_{QPr}) = (m_{QPr} c^2) \cdot t_{QPr} \) that can estimate the (average) intrinsic PIq of all QPs, based on their rest-masses/energies/QAMs and their (experimentally estimated) mean lifetimes: \( I_{int(QPr)} \sim hf_{QPr}(m_{QPr}, t_{QPr}) \). In the next tables, I have listed and explained the intrinsic PIqs of the main QPs (the gauge bosons at first and then the main stable fermions) which are evaluated using the function \( hf_{QPr}(m_{QPr}, t_{QPr}) \).

<table>
<thead>
<tr>
<th>Table T-V-1. The intrinsic PIqs of all the gauge bosons (GBs), which are the field QAM-quanta of all the four fundamental forces of the OU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The QAM/PI-quanta of EGF, which is the intrinsic PIq of an eg (h_\text{eg})</strong></td>
</tr>
<tr>
<td><strong>The QAM/PI-quanta of EMF, which is the intrinsic PIq of a photon (h_{ph}=h)</strong></td>
</tr>
<tr>
<td><strong>The Weak Nuclear Field/Force (WNF) specific QAM/PI-quanta at rest (h_w and h_z)</strong></td>
</tr>
<tr>
<td>*as W-boson is considered a “heavy” photon, it carries almost 6 times more PIq (at rest) than a photon</td>
</tr>
<tr>
<td>The intrinsic PIq at rest of a single Z boson (h_z) is also a function of its rest mass ( (m_z \sim 91.1876 \pm 0.0021 \text{ GeV/c}^2 [70,71]) ) and its half-life ( (t_z \sim 3 \times 10^{-25} \text{ s}) ) (the same references as for the W/W’ boson)</td>
</tr>
<tr>
<td>*as Z-boson is also considered a “heavy” photon, it carries almost 7 times more PIq (at rest) than a photon</td>
</tr>
<tr>
<td><strong>The strong nuclear field/force (SNF) specific PI-quanta at rest (h_s)</strong></td>
</tr>
<tr>
<td>*when compared to the photons and the W/Z-bosons, the gluons may be considered “(very) light” (special) photons, as a gluon carries ~137 times less intrinsic PIq (at rest) than a photon</td>
</tr>
</tbody>
</table>

For the SNF, the intrinsic PIq of a single gluon (h_s) cannot be measured directly using the PIq scalar definition (such as the W and Z bosons which have non-0 rest masses), but can be measured indirectly (inversely) based on the known SNF coupling constant \( (a_s) \) which has a value close to 1 (practically ~137 times larger than \( a=1/a \) at rest)
Table T-V.2. The intrinsic PI quanta of the main (known) stable fermions of the OU

<table>
<thead>
<tr>
<th>The intrinsic PIq at rest of a single proton (h_p) as a function of its rest mass (m_p ~ 0.938GeV/c^2 [72]) and its mean lifetime (with an experimental lower bound t_p &gt; 10^31 years [73,74])</th>
<th>h_p &gt; \left[ (m_p c^2) \cdot t_p \right] &gt; 4.7 \times 10^{28} Js \sim 6 \times 10^{40} states \sim 348qbits, with \ h_p / h_{ph} &gt; 7.2 \times 10^{51} and \ h_p / h_{eg} &gt; 3 \times 10^{104}</th>
</tr>
</thead>
<tbody>
<tr>
<td>The intrinsic PIq at rest of a single up quark (h_{qu}) (which is the most stable of all types of quarks, with a mean lifetime probably comparable to that of the proton) as a function of its rest mass (m_{qu} ~ 2.3MeV/c^2 [75]) and its mean lifetime (with an experimental lower bound t_{qu} &gt; 10^10 years)</td>
<td>h_{qu} &gt; \left[ (m_{qu} c^2) \cdot t_{qu} \right] &gt; 1.2 \times 10^{26} Js \sim 1.5 \times 10^{40} states \sim 339qbits, with \ h_{qu} / h_{ph} &gt; 1.8 \times 10^{59} and \ h_{qu} / h_{eg} &gt; 7.3 \times 10^{101}</td>
</tr>
<tr>
<td>The intrinsic PIq at rest of a single electron (h_e) as a function of its rest mass (m_e ~ 0.511MeV/c^2 [76]) and its mean lifetime (with an experimental lower bound t_e ~ 10^10 years)</td>
<td>h_e &gt; \left[ (m_e c^2) \cdot t_e \right] &gt; 1.2 \times 10^{21} Js \sim 1.5 \times 10^{47} states \sim 323qbits, with \ h_e / h_{ph} &gt; 1.8 \times 10^{54} and \ h_e / h_{eg} &gt; 7.5 \times 10^{96}</td>
</tr>
</tbody>
</table>

Table T-V.3. The prediction of the superior limit of the possible non-0 rest masses of the main GBs based on the estimation of their intrinsic PIq

<table>
<thead>
<tr>
<th>If hypothesized that the photon has a minimal half-life (t_{ph}) comparable to that of the proton (t_p) with an inferior limit of this mean lifetime (t_{ph} &gt; [t_p ~ 10^{31} years]), then a superior limit for a possible non-0 rest mass of the photon (m_{ph}) can be calculated using the PIq scalar, such as:</th>
<th>h_{ph} = \left( (m_{ph} c^2) \cdot t_{ph} \right) \Rightarrow h_{ph} &gt; \left( m_{ph} c^2 \cdot t_p \right)</th>
</tr>
</thead>
<tbody>
<tr>
<td>If hypothesized that the eg has a minimal half-life (t_{eg}) comparable to that of the proton (t_p) with an inferior limit of this mean lifetime (t_{eg} &gt; [t_p ~ 10^{31} years]), then a superior limit for a possible non-0 rest mass of the (hypothetic) eg (m_{eg}) can be calculated from h_{eg} using the PIq scalar, such as:</td>
<td>h_{eg} = \left( (m_{eg} c^2) \cdot t_{eg} \right) \Rightarrow h_{eg} &gt; \left( m_{eg} c^2 \cdot t_p \right)</td>
</tr>
<tr>
<td>If hypothesized that the gluon has a minimal half-life (t_{gl}) comparable to that of the proton (t_p) with an inferior limit of this mean lifetime (t_{gl} &gt; [t_p ~ 10^{31} years]), then a superior limit for a possible non-0 rest mass of the gluon (m_{gl}) can be calculated from h_{gl} using the PIq scalar, such as:</td>
<td>h_{gl} = \left( (m_{gl} c^2) \cdot t_{gl} \right) \Rightarrow h_{gl} &gt; \left( m_{gl} c^2 \cdot t_p \right)</td>
</tr>
</tbody>
</table>

The superior limits for the possible non-0 rest masses for the gluon, the photon and the hypothetical graviton (defined as the hypothetical eg) are much smaller than the ones estimated in the current literature.[78]

Further limitations of the maximum nof. real/virtual eg/ph photons that an isolated (resting) proton (and electron respectively) can emit per unit of time can be calculated using the hypothesis that this frequency (f) of emission has a superior bound that depends on the (real) radius of the proton (t_p) such as f_p \ll f_{r} and the real radius of the electron (which was experimentally tested in QED to have a superior bound equal to the Compton wavelength of a large mass, on the order of 10^6 GeV such as r_e \sim \left[ (\alpha h c) / \left( 10^6 GeV \right) \sim 1.44 \times 10^{-24} m \right]$: with both radiius compared to the minimum wavelength (\lambda_{min}) of the real/virtual eg/photon that can be emitted by the (resting) proton/electron. A resting proton (it is supposed to) can emit only real/virtual eg/phs with the same or lower frequencies than its global frequency (which is \textbf{ip to the inverse of the circumference of the proton} \ v_{maxp}=c/\lambda_{min}. with \lambda_{min} comparable to 2\pi r_p): analogously, an electron can emit
only real/virtual eg/photons with the same or lower frequencies than its global frequency (which is ip to the real circumference of the point-like electron: \( v_{\text{max}} = c / (2 \pi r_{\text{re}}) \)). The (real/virtual) eg/photons may be emitted from inside an emitter QP (if previously absorbed by that QP [proton/electron]) or, in the case of the eg, from the surrounding/adjacent quantum vacuum (QV) (that can be “squeezed” by the energy-mass of that emitter-QP). Supposing the proton/electron would emit ONLY one single (real/virtual) eg/photons at a time at their maximum frequencies \( (v_{\text{max}}) \) (in different directions decided by the electron spin that sweeps the 3D space and the 4D spacetime) the time needed to completely dissipate their total (rest) (intrinsic) PIq into (real/virtual) eg/photons would be much more larger that the age of the present OU \( (A_{\text{OU}} = 13.7 \cdot 10^9 \text{ years}) \): in conclusion, protons and electrons may permanently emit (real/virtual) eg/photons (pulsated emission) with no sign of observable “tiring” at standard time intervals we can measure, as the proton and electron have intrinsic PIq \((h_p \) and \( h_e \) respectively) much larger than the intrinsic PIq of an eg \((h_{\text{eg}})\).

**Table T-V-4.** Protons and electrons permanently emit (real/virtual) eg/photons (pulsated emission) with a superior frequency of limit given in this table below. It may took more that \( 10^5 \) \( A_{\text{OU}} \) (age of the present observed universe) for a proton/electron respectively to completely “vanish” by this pulsed emission of (real/virtual) eg/photons (considering the extreme that they just emit eg/photons and not receive any and that they lose intrinsic PIq when emitting a real/virtual eg/photon)

\[
F_{\text{re}} < \left[ \frac{h \alpha c}{(10^6 \text{GeV})} \approx 1.44 \times 10^{-4} \text{m} \right]
\]

\[
v_{\text{pl}} = 1 / t_{\text{pl}} \approx 1.86 \cdot 10^{43} \text{ Hz (Planck frequency)}
\]

\[
v_{\text{max}} = c / (2 \pi r_{\text{re}}) \approx 3.3 \times 10^{31} \text{ Hz} \ll v_{\text{pl}}
\]

\[
v_{\text{max}} = \frac{c}{2 \pi r_{\text{re}}} \approx 1.23 \times 10^{54} \text{ Hz} \ll v_{\text{pl}}
\]

**Checkpoint conclusion.** BIDUM is different from other informational universe models/descriptions [79,80,81,82] as it offers an indirect theoretical way to measure (approximately estimate) the followings: (1) the intrinsic (essentially) subquantum PIq of any known QP; (2) all the intrinsic PIqs for the four GBs associated to the four FFs (including \( h_{\text{eg}} \), the intrinsic PIq for a hypothetical electrograviton that is proposed as a model for the hypothetical graviton [a spin-2 boson]); (3) a new definition of energy (as PIq transfer speed), physical power, force and mass; (4) four important universal equivalence principles (UEPs) between the main SI physical measures.

All sources of energy can be (essentially) considered sources of PI (as energy is essentially PI): however PIq is not perfectly interchangeable (but a time-dependent quasi-interchangeable) with physical energy and (physical) matter: a physical system has an intrinsic energy \( (E_{\text{c}}) \) because its subcomponents interchange a specific PIq \((I_s)\) per unit of time \((s)\), so that \( I_s = E_{\text{c}} \). Although apparently descriptive, this BIDUM can also offer some important (predictive) reformulations and generalizations of classical and modern notions/concepts of physics. This BIDUM tries to impose the PI concept (together with its powerful tool, the PIq scalar defined by \( h_{\text{QF}} \left( m_{\text{QF}}, t_{\text{QF}} \right) \)) as a sine-qua-non (central/fundamental) component of any “mature” TOE to be discovered/proposed in the future. See **Table T-V-5.**

**Table T-V-5.** Important consequences of the scalar function \( h_{\text{QF}} \left( m_{\text{QF}}, t_{\text{QF}} \right) \) of BIDUM

- The Planck constant \((h_{\text{ph}})\) is also the (central) PIq-unit in the (natural) Planck Units System (PUS) a system which can be generalized for any other Planck-like (PIq) constant \((h_{\text{ph}}, h_{\text{WZ}}\) and \( h_{\text{eg}}\)) and called Planck-Like Units System (PLUS[\( h_{\text{ph}} \)]), such as PUS is the private case PLUS[\( h_{\text{ph}} \)].
- **PLUS(h), with** \( h_{\text{e}} \in \{ h_{\text{eg}}, h_{\text{ph}} = (h), h_{\text{WZ}}, h_{\text{pl}} \} \),
- with \( \text{PUS} = \text{PLUS} (h_{\text{ph}}) \)
- AND
- \( h_{\text{ph}}(h), v_{\text{ph}}(h) = c, m_{\text{ph}}(h) = \sqrt{h_c / G} \)
- \( t_{\text{ph}}(h) = \sqrt{h_c / c^3}, l_{\text{ph}}(h) = \sqrt{h_c G / c^2} \) and \( \text{AS}_{\text{ph}}(h) = \left[ l_{\text{ph}}(h) \right]^2 \).
The coupling (α) constants (at rest) for the three non-EGF FFs can be generalized as a PIq-function (in analogy to FSC definition, but expressed as ratio of two different PIqs), as GCC is not a function of the \( k q c \), but is conventionally expressed as a function of \( \alpha_q \) and h only.

\[
q_q(h_i) = \sqrt{4\pi^2 \hbar c} = q_i \sqrt{\alpha}
\]

\[
\alpha_q(h_i) = \left[ \frac{k q c}{c} \right]_h
\]

with \( h_i \in \{h_q, h_{ph} (=h), h_{W/Z} \} \)

\[
\alpha_c = \left[ \frac{G m_e^2}{c} \right]_h \quad \text{and} \quad \alpha_q = \left[ \frac{G q c}{c} \right]_h
\]

The Bekenstein bound (BB) [83,84,85] (defined as the maximum amount of information [I] [measurable in qbits or in the equivalent bits extracted from those qbits] contained in all the quantum states \( N_Q \) of a sphere that has a finite radius R and contains a finite energy E, when/if assumed that the perfect vacuum carries NO [additional] PIq) can be reformulated as a two PIqs ratio using an additional adimensional constant \( k_{BB} = (2\pi)^2/\ln(2) \).

\[
I \leq \frac{2\pi E R}{\hbar c \ln(2)} \Leftrightarrow \left( \frac{(2\pi)^2}{\ln(2)} \right) \frac{E R}{c h} \Leftrightarrow \left( \frac{k_{BB} \cdot (E, \Delta t_{c,R}, h_i)}{h_{ph}} \right) = \left( \frac{(2\pi)^2 \log_2(N_Q)}{h_{ph}} \right), I_{(E, \Delta t_{c,R}, h_i)} = \ln(N_Q)
\]

Analogously to PLUS(h) generalization, BB can also be generalized for any PIqua of the four FFs, including \( h_q \) which counts the total number of quantum and subquantum [micro]states \( N_S = N_Q \times N_{SQ} \) (as the emission/reception of eg can generate all the possible subquantum energetic/momentum [micro] states [N_{SQ}] that can be “hidden” in a single quantum state of a QP).

The Planck constant \( h \) has also another important significance, as it can be considered a fundamental cutoff for which any QP with intrinsic PIq > h will have a non-0 rest mass (as in the case of W/Z bosons, the leptons, the quarks, the nucleons etc.) and all the QPs with intrinsic PIq ≤ h will have 0-rest mass (the photons, the gluons, and the hypothetical eg). By this h-cutoff, EMF (with its specific h PIqua) is profusely related in fact to the triad of indissolubly related concepts: rest mass, classical linear time and gravity. If the intrinsic PIq of all QPs are pre-considered finite, an important consequence is that all QPs will finally decay (by definite lifetimes).

The Heisenberg’s Uncertainty Principle [HUP] can be generalized as GHUP(h) for any GB (gluon, W/Z boson, photon and eg) that can be used (at least theoretically) as measurement tool in QM. \( \Delta L \) is the angular momentum deviation and \( \Delta x \) is the position deviation (deviations from the precise individually predetermined \( L \) and \( x \)) in any set of measurements on similarly prepared systems.

\[
GHUP(h) : \Delta L \cdot \Delta x \geq h_i / (4\pi), \quad \text{with} \quad HUP \text{ equivalent to} \quad GHUP(h)
\]

The function \( \alpha_f(h_i) = \left[ \frac{k q c}{c} \right]_h \) has obviously larger values when \( h_x \) takes smaller values, because \( \alpha_f \) is ip to \( h_x \). This function also contains a new (inductive) hypothetical rule proposed by BIDUM: the smaller the \( h_x \) of a FF, the larger the coupling constant of that FF (implicitly the larger the strength of that FF). BIDUM proposes the hypothesis that this rule may be applied to ANY FF including any other potential unknown FFs additional to the four known FFs: as eg are GBs with ~40 orders of magnitude lighter than gluons \( (h_q / h_q \sim 3 \times 10^{-6}) \), eg may “secretly” mediate (from scales close to Planck scale to scales close to the nucleonic diameter \( D_N \)) very strong gravitational forces that may be called Strong Gravity/Gravitational Force (SG or SGF)

\[\text{[7]} \ln(2) \text{ comes from measuring } N_0 \text{ using binary logarithm such as } \log_2(N_0) = \ln(N_0) / \ln(2) = I / \ln(2); (2\pi)^2 R \text{ may also be interpreted as the maximum curved wavelength of a photon that is imaginarily "curled" as a solenoid-like circumference of a torus with both rays equal such as } R_{maj} = R_{min} = R, \text{ with } C_1 = 2\pi R, C_2 = 2\pi C_1 = (2\pi)^2 R = A_{torus}/R, \text{ as } A_{torus} = (2\pi)^2 R_{maj} R_{min} = (2\pi)^2 R^2\]
and Very Strong Gravity / Gravitational Forces (VSG or VSGF), each of them defined by a Strong Gravity Constant (SGC) and a Very Strong Gravity Constant (VSGC) and SGC having more than 39 orders of magnitude larger than G, as explained in Part 6.4 of this paper. In this view, \( GCC = \alpha_i = \left[ \frac{GM}{c^4} \right] \hbar \sim 1.7518 \times 10^{-45} \) may have and alternative in \( \alpha_q = \alpha_f(\hbar_q) = [kq^2/c] / \hbar_q \sim 4.838 \times 10^{-9} \gg [\alpha_i \sim 1] \). BIDUM considers very probable that the Newtonian Gravitational Force/Field (NGF) to be just a residual force/field generated/mediated by those egs that manage to escape from the Planck scale and nucleonic scales outside of the hadrons and dissipate in the whole OU: in other words, it is very probable that NGF to be a residue of the SGF, as SGF may also be a residue of VSGF.

**The prediction of a connection between SGF and the proton size muon-based measurement anomaly.** BIDUM also predicts that the anomaly (of minus \( \sim 3.4\% \)) in the measurement of the proton charge radius using a muon (resulting an \( r_{p(m)} \sim 0.84\text{fm} \)) versus an electron (resulting an \( r_{p(e)} \sim 0.87\text{fm} \)) [86] may be explained by the SGF (with strength defined by a SGC>>G) that may appear (as a strong attraction force) at atomic and/or nucleonic scales and deform the proton charge (by expanding its radius) in the case of the muon (which is \( \sim 207 \) time heavier than the electron and which also may generate a SGF defined by a SGC>>G). Based on this speculation, BIDUM proposes that the real proton charge radius to be defined as that determined by using the electron (that doesn’t deform that radius significantly by a SGF), which is \( r_p \sim r_{p(e)} \sim 0.87\text{fm} \).

***

In analogy to \( hf_Q = (m_Q, t_Q) = (m_Q, c^2) \cdot t_Q \), I also propose a function \( If_M = (M, t_M) = (Mc^2) \cdot t_M \) that evaluates (by approximation) the average the intrinsic PIq of any classical rest-mass \( M \), with \( t_M \) being defined as the average (classical linear) time interval between the moment of formation of that specific \( M \) and the moment of explosion (disintegration) / implosion (to a possible quasi-singularity) of that \( M \) (\( t_M \) is the analog of the mean lifetime of a QP).

Interestingly, if both differential excess masses \( \Delta M = \left( N_a^2 \cdot m_h - M_{OU} \right) / 14M_{OU} \) and \( \Delta M = \left( [N_a^2 / a^{1/2}] \cdot m_h - M_{OU} \right) / 0.28M_{OU} \) (with \( m_h = m_p + m_e \)) would lay (be “hidden” and only gravitationally coupled with the rest of the OU) in the interior of the OU radius (in \( V_{OU} \)), then they would generate two densities that are larger than the critical density \( \rho_c \), so that the scaling factor at rest \( N_a \) predicts a close universe with \( \Omega_f = \rho_s / \rho_c \) having a value between \( \Omega_f = [N_a^2 / a^{1/2}] \cdot m_h / V_{OU} \sim 1.48 \) and \( \Omega_f = [N_a^2 \cdot m_h / V_{OU}] \sim 17.31 \) that may finally show a decelerated inflation up to a size limit and then deflate and collapse in a so-called Big-Crunch (possibly followed by another inflation-deflation cycle): this scenario would imply a finite (gravitational) angular momentum of OU based on a finite universal time cycle \( t_c \).

**The Bekenstein bound (BB)** conjectures that a finite quantity of space cannot compress other but a finite amount of information (and implicitly a finite amount of energy): there are strong arguments for this conjecture to be true, in order to have GR consistent to the laws of thermodynamics (Bekenstein argues that If a PS would have an intrinsic entropy/information larger than BB, it may become possible for that PS to violate the

---

[8] SGF is also predicted by the non-mainstream Strong Gravity Hypothesis [SGH], which was promoted in 1960s by several theorists (including Abdus Salam) as an alternative to Quantum Chromodynamics (QCD), which was in an early stage of development in those 1960s. However, SGH may have a chance in the mainstream if the future experiments will prove that the classical Newtonian G is larger at submilimetric scales (as predicted by the brane cosmology which considers gravitons as closed strings that may escape the 5th dimension of spacetime and generate a “diluted” gravitational force). Additionally, SST considers a close connection between gauge forces and spacetime geometry and recognizes important duality between gravity-like and QCD-like theories, most notably the AdS/QCD correspondence.
second law of thermodynamics by spontaneously lowering its intrinsic entropy/information and turn into a black hole). Quantum mechanics (QM) also predicts that QPs cannot occupy a space smaller than their wavelengths.

**The asymptotic freedom of gravity (hypothesis).** The loop QGT also suggests that singularities (infinite amount of energy/mass in a finite amount of space) may not exist as there is probably a minimum distance beyond which the force of gravity no longer continues to increase as the distance between the masses becomes shorter (similarly to the SNF which is characterized by asymptotic freedom as mentioned previously): this may be a valuable fact that may help in the study of AdS-QFT correspondence. The eggs may be regarded as "sticky" (1D-) strings (the larger the QAM of an eg associated with the EGF of a QP, the "sticky" that eg is) that glue together all matter and radiation generating a quantum foam similar to a 4D spider web which appears as a 4D vacuum: in this view, gravity is essentially the “viscosity” of an eg-based spacetime and also explains inertia and the inertial mass. An eg-string may be resist to elongation (and this resistance generates the universal force of attracting called gravity) but also may oppose to compression if two object were brought very close together, at distances close to Planck distance scale defined by \( l_{pl} = \sqrt{\hbar G/c^3} \approx 1.616 \times 10^{-35}\, \text{m} \), when the eggs can be compacted/"curled" beyond a point to which they may oppose to contraction and generate repulsion: analogously, the gluons can also be regarded as strings which have this repulsive/attractive character which depends on some cut-off lengths of elongation and contraction. The “spring-like” character of gluons can explain the Pauli exclusion principle inside the nucleus (but also outside) where SNF becomes repulsive at separations between nucleons < 0.7 fm (measured between their centers), depending upon spin alignment, which keeps the nucleons at a certain average separation, even if they are of different types (this repulsion arises from the Pauli exclusion force for identical nucleons): a Pauli exclusion force also occurs between quarks of the same type within two different adjacent nucleons (a proton and a neutron). Because the same “spring-like” character as gluons have, it is also very probable that eggs also generate an intranucleonic quantum gravity that may show an asymptotic freedom similar to the SNF: however, the gravitational repulsive may appear at much smaller scales for EGF, as eggs are strings with a much lower intrinsic Plq (quantum angular momentum) that can theoretically permit a compression at scales close the Planck linear scales. An eg with a wavelength compressed to \( \lambda_{eg} \approx (l_{pl} \approx 1.616 \times 10^{-35}\, \text{m}) \) will have a much smaller intrinsic energy quanta than a gluon with a wavelength compressed to \( \lambda_{gl} \approx (r_p \approx 0.85\, \text{fm}) \), such as \( E_{gl}(\lambda_{gl})/E_{eq}(\lambda_{eg}) \sim (h_{gl}c/\lambda_{gl})/(h_{eg}c/\lambda_{eg}) \sim 5.77 \times 10^{20} \) and \( E_{ph}(\lambda_{gl})/E_{eq}(\lambda_{eg}) \sim (hc/\lambda_{gl})/(h_{eg}c/\lambda_{eg}) \sim 7.9 \times 10^{22} \). The spin/torsion of a string-like eg or gluon (along its longitudinal axis) can also contribute to the spontaneous effect of attraction or repulsion of those string-like eggs/gluons.

Given all these previous arguments, it is supposed that a pre-Big Bang singularity cannot compress an infinite mass in a finite volume: that is why I hypothesize that the mass, energy and momentum of OU are all finite quantities if they are all generated from that pre-Big Bang singularity. An infinite inflation (classical linear) time \( t_f \) would lead to an infinite value of \( \text{Inf}_M(M_{OU}, t_f) = (M_{OU}c^2) \cdot t_f \) which wouldn’t be compatible with a Bing Bang model consistent with BB (implicitly with both GR and thermodynamics simultaneously), QM and loop QGT: that is why I propose a finite \( \text{Inf}_M(M_{OU}, t_c) = (M_{OU}c^2) \cdot t_c \) based on the (supposed) finite parameters: \( c \), \( M_{OU} \) and \( t_c \).

The inflating OU could be regarded as being made of two halves (as defined by any arbitrary axis) that repel each other, so that the GAM of OU may be defined as \( h_{fg}(G, M_{OU}/2, M_{OU}/2) = G(M_{OU}/2)^2 / c \).
\[ \sim 7 \times 10^{89} Js . \] Considering that \[ {I_f}_M (M_{OU}, t_c) = (M_{OU} c^2) \cdot t_c \] is a GAM, I propose that

\[ {I_f}_M (M_{OU}, t_c) - h f (G, M_{OU} / 2, M_{OU} / 2) \Leftrightarrow (M_{OU} c^2) \cdot t_c = G \left( \frac{M_{OU}}{2} \right)^2 / c \]

so that \( t_c \) can be extracted as

\[ t_c = h f \left( G, \frac{M_{OU}}{2}, \frac{M_{OU}}{2} \right) / \left( M_{OU} c^2 \right) \Leftrightarrow t_c \sim \left[ \frac{G \left( \frac{M_{OU}}{2} \right)^2 / c}{(M_{OU} c^2)^2} \right] - \left( \frac{G M_{OU}}{4} / c^3 \right) \]

\( \sim 69.7 \text{ billion years} \). Coincidence or not, the ratio between \( t_c \) and the age of the OU \( (t_{OU} \sim 13.8 \text{ billion years}) \) is greater than 1, such as \( t_c / t_{OU} \sim 5.05 \).

Based on all the previous arguments, I launch the hypothesis that OU is a closed universe with a corrected mass between

\[ M_{OU(c1)} = \left( \frac{N_a^2 / a^{1/2}}{a^{1/2}} \right) \cdot m_H \sim 1.28M_{OU} \approx 4.6 \times 10^{54} \text{ kg} \]

and

\[ M_{OU(c2)} = N_a^2 \cdot m_H - 15M_{OU} \approx 5.4 \times 10^{55} \text{ kg} \]

with a corrected density between \( \rho_{OU(c1)} = M_{OU(c1)} / V_{OU} \approx 1.48 \rho_c \) and \( \rho_{OU(c2)} = M_{OU(c2)} / V_{OU} \approx 17.3 \rho_c \), with a corrected finite intrinsic global PIq between

\[ {I_f}_M (M_{OU(c1)}, t_{c(1)}) = (M_{OU(c1)} c^2) \cdot t_{c(1)} \] and

\[ {I_f}_M (M_{OU(c2)}, t_{c(2)}) = (M_{OU(c2)} c^2) \cdot t_{c(2)} \]

that can be approximated by the corrected GAM which is between

\[ h f (G, M_{OU(c1)} / 2, M_{OU(c1)} / 2) \sim 1.16 \times 10^{90} Js \] and

\[ h f (G, M_{OU(c2)} / 2, M_{OU(c2)} / 2) \sim 1.6 \times 10^{92} Js \]

respectively, so that \( t_c \) is between \( t_{c(1)} \sim 89.5 \text{ billion years} \)

\( t_{c(2)} \sim 1047.8 \text{ billion years} \)

AND the ratio \( t_c / t_{OU} \) is between \( t_{c(1)} / t_{OU} \sim 6.5 \) and \( t_{c(2)} / t_{OU} \sim 75.9 \). Based on this simple hypothesis, one can surely affirm that OU is obviously young, with a ratio \( t_{OU} / t_c \) between \( 1.3% \) and \( 15.4% \). For the simplicity of the next equations, let us consider the following geometric means: the predicted (mean) total mass of the OU

\[ M_{IOU} = \sqrt{M_{OU(c1)} \cdot M_{OU(c2)}} \sim 4.4M_{OU} \approx 1.56 \times 10^{55} \text{ kg} \]

the predicted (mean) density of the OU

\[ \rho_{IOU} = \sqrt{\rho_{OU(c1)} \cdot \rho_{OU(c2)}} \sim 4.39 \rho_{OU} \sim 5.06 \rho_c \]

and the predicted (mean) (global) intrinsic PIq of OU

\[ I_{IOU} = \sqrt{I_{IOU(1)} \cdot I_{IOU(2)}} = \sqrt{\left[ (M_{OU(c1)} c^2) \cdot t_{c(1)} \right] \cdot \left[ (M_{OU(c2)} c^2) \cdot t_{c(2)} \right]} \]

with

\[ I_{IOU} \sim 1.36 \times 10^{91} Js \sim 1.7 \times 10^{167} \text{ states} \sim 556 \text{ qubits} \]

and a predicted (mean) cycle duration of

\[ t_{IOU} = \sqrt{t_{c(1)} \cdot t_{c(2)}} \sim 22.19t_{OU} \sim 306 \text{ billion years} \]

with \( t_{IOU} / t_{OU} \sim 4.51% \). BIDUM goes beyond the SM and standard present cosmology data, and predicts that the rest mass/energy of the WU

\[ M_{WU} \sim 1.45 \times 10^{53} \text{ kg} \]

represents only \( \sim 0.64% \) of the total \( M_{IOU} \), which implies that DU to represent more than 99% of the OU:

\[ (M_{IOU} / M_{WU}) = (E_{IOU} / E_{WU}) \sim (I_{IOU} / I_{WU}) \sim 99.36% \]

(considering that \( t_{WU} = t_{IOU} \))

***

As a ratio of two momentum (implicitly two PIqs), the inverse \( a = 1 / \alpha \) is may be considered a (meta)PIq that can be used as a relative informational measure-unit for large PIq as \( I_{IOU} \) (the alpha-PIq-unit or the alpha-unit [a-unit]). There are some arguments that the conscious part of the human mind (CP-HM) may use the a-unit when reconstructing space-time and energy-matter from the perceived PIqs, as \( \alpha \) is the main propriety/constant of the electron-photon system, a system which is mainly used by the visual system of the bio-
observer (BO) to analyze/decompose and imagine/reconstruct/recompose the environment/any target of interest from the environment.

It is very convenient to express binary logarithms of the large PIqs ratios (the global PIq to each of the four FFs PIqua) using a-units. A very interesting (probably non-) coincidence emerges when comparing the global $I_{\text{OU}}$ to the four PIqs of the four FFs ($h_{\text{eg}}$, $h_{\text{ph}}$, $h_{\text{WZ}}$, $h_{\text{gl}}$) using not only simple ratios, but also binary logarithms of those ratios and their reciprocal base-2 exponentials expressed in a-unit and 2a-units (called A-units, with $A=2a$), such as:

$$\frac{I_{\text{OU}}}{h_{\text{eg}}} \approx 8.56 \times 10^6$$

$$\frac{I_{\text{OU}}}{h_{\text{ph}}} \approx 2.05 \times 10^4$$

$$\frac{I_{\text{OU}}}{h_{\text{WZ}}} \approx 3.29 \times 10^3$$

$$\frac{I_{\text{OU}}}{h_{\text{gl}}} \approx 2.8 \times 10^2$$

The relative closeness of the (fractional) a-dimensions d-sets ($d_{\text{eg}}$, $d_{\text{ph}}$, $d_{\text{WZ}}$, $d_{\text{gl}}$) from the previous equations to the positive integers 4(a)D and 3(a)D respectively is probably a non-coincidence generated by a more profound law of nature, and may explain why our OU appears to our senses/perception/intuition (together with their extensions: our measurement tools) as a 3D space with an additional dimension (time) attached to it. However, the fact that $d_{\text{eg}(p)} \approx 4.05D$ is slightly larger than 4(D) may suggest at least one additional 5th dimension (a hyper-time) as SSTs and M-theory also predict. In other words, the relative scale of $h$ (when compared to $I_{\text{OU}}$) may generate the illusion of a 3D space and the relative scale of $h_{\text{eg}}$ (when compared to the same $I_{\text{OU}}$) may generate the illusion of a 4D spacetime: gravity seems to generate this illusion and this fact may also partially explain the striking power of prediction that GR has, as it is based on a 4D spacetime model of the OU. I also propose a generalized function of any PIqua associated with any dD frame as $hf(d) = I_{\text{OU}} / N_a^d$, with $d$ being an integer or fractional real not abstract/informational a-dimensions of any frame with dD dimensions. Interestingly, when interpreted in A-dimensions, the global $I_{\text{OU}}$ (which measures the intrinsic PIq of the predicted OU) appears as a $\approx 2(A)D$ hologram where all the non-eg GBs move in $\approx 1.5(A)D$ as dusts/swarms of 1(A)D-strings AND eggs being the only QPs that can escape the 2D brane/"OU display" and an escape that may create the illusion of a 3rd spatial dimension to our senses and to their extensions (our measuring tools). BIDUM sustains this holographic principle (first proposed by Gerard't Hooft and then given a precise interpretation in SST by Leonard Susskind [87]), as the global PIq ($I_{\text{OU}}$) need only a collection of multilayered 2(A)D matrices (2D-branes or 2D-bs) to organize as similarly to an universal operating system (UOS) and generate all reality as an apparent moving 3D (multilayered) image on a hypothetical OU-2(A)D display.

The a-unit and its multiple A-unit [=2a-unit] both appear as an “attractor” of all the large ratios of the OU: mass (energy), radius and density ratios between the main parameters of OU and the main parameters of the main QPs of the WU. The (considered non-)coincidences presented in the next table were also remarked (but not interpreted and measured in a-units) by other authors (like Recami E., 1994, 1995, 1997-2001 [111]) who considered them indirect arguments for the possibility of considering all fermions as micro-universes or micro-black-holes similar to our cosmos in a specific sense specified by those authors.

| Table T-V-6. The mass (energy), radius and density ratios between the main parameters of OU and the main parameters of the main QPs of the WU (expressed in a-units or A-units) |
|---|---|
| The ratio between the rest mass $M_{\text{aOU}}$ and the rest masses of the proton and the electron | $\log_2 \left( \frac{M_{\text{aOU}}}{m_p} \right) \sim (99.35\%) A$ |
| | $\log_2 \left( \frac{M_{\text{aOU}}}{m_e} \right) \sim (103.31\%) A$ |
The ratio between \( R_{\text{OU}} \) and the classical radius of the electron
\( (r_e \sim 2.8 \times 10^{-15} \text{m}) \)
\[
\log_2 \left( \frac{R_{\text{OU}}}{r_e} \right) \sim 136.85 \sim (99.86\%)a
\]
The ratio between \( R_{\text{OU}} \) and the radius of the proton/neutron
\( (r_p \sim r_n \sim 0.88 \times 10^{-15} \text{m}) \)
\[
\log_2 \left( \frac{R_{\text{OU}}}{r_p} \right) \sim 138.53 \sim (101.12\%)a
\]
The ratio between \( R_{\text{OU}} \) and the Bohr radius of the hydrogen atom with its electron in the lowest energetic level
\( (r_B \sim 5.3 \times 10^{-11} \text{m}) \)
\[
\log_2 \left( \frac{R_{\text{OU}}}{r_B} \right) \sim 122.65 \sim (89.5\%)a
\]
The ratio between the approximate mass density of the proton \( \rho_p \) and the mass density of the predicted (simplified) closed cyclic OU \( \rho_{\text{OU}} \)
\[
\log_2 \left( \frac{\rho_p}{\rho_{\text{OU}}} \right) \sim (104.64\%)a,
\text{with } \rho_p = m_p / V_p \sim 6.3887 \times 10^7 \text{kg} / \text{m}^3
\]

A prediction on the radius of the hypothetical cyclic OU at the end of the last phase of (decelerated) inflation. \( \log_2 (R_{\text{OU}} / l_{Pl}) \sim (148.93\%)a \) is a notable exception that may be the base of a new prediction of BIDUM: the function \( R_{\text{OU}} = N_a^2 \cdot l_{Pl} \sim 1.17 \times 10^{33} R_{\text{OU}} \) may actually predict the maximum real ray of a finite universe at the end of the inflation (in the point of maximum expansion) so that \( \log_2 (R_{\text{OU}} / l_{Pl}) \sim 2a \sim A \) (and also follow the rule of both a-unit and A-unit as attractors). This prediction may be compatible with another (similar) prediction made by SST that estimate the real radius of the present universe to be at least 1000 times larger than \( R_{\text{OU}} \).

BIDUM predicts that the universe is a huge software similar to an universal operating system (UOS) composed of informational cells (ICs) that can be modeled using a 2D grid/matrix (as OU has \( \sim 2(A)D \) gravitational dimensions), in which he\( g (=2 \) quantum states of an eg=1 qbit) is the smallest Plq that can flow between two different (not necessarily adjacent) ICs. BIDUM adopts a model similar to a cellular automaton/automata (CA) \([88,89,90]\) to resolve the major problem of SST that is: a 1D string (with 0 internal volume) cannot generate space(time) without already containing an internal/intrinsic space (and that contradicts the definition of strings, generating a paradox). BIDUM proposes a 2D Multilayered Matrix Universe Model (MMUM) in which there is a basic 2D layer - a “0-layer” (indexed with i=0) containing basic raw input/output data (for simplicity, we may impose that all ICs of this layer can take just 2 values: 0 and 1) and a large (but finite) nof additional i-layers (i>0 and maximum i is finite) each containing software (line codes, which are essentially meta-information/meta-PI or information about/on information) that manipulates the ICs from the 0-layer: all the QPs and quantum fields (QFs) can be regarded as software installed on the entire 0-layer (which may explain the principle of non-locality of QPs in QM and the wave-particle duality, which can be both derived from the Heisenberg’s Uncertainty Principle \([\text{HUP}] \)). Between an i-layer and a 0-layer, there also can exist at least one intermediate j-layer (0<j<i) containing a finite nof copies of the i-layer software, each copy being localized in a separate IC of the j-layer and also acting on the 0-layer, but also sending information to the i-layer: in this manner, BIDUM simulates each i-layer (which contains only one software/one original copy of a QF/QP software) analogously to a biological DNA/RNA gene (which I may call a meta-PI gene[mPl] of index i): for each i-layer there may exist a j-layer (with j<i) which contains a finite nof copies of the i-layer gene, copies which act on the same basic 0-layer. The prototype of each individual life form (LF) can be also considered na i-layer software (with i values much larger than the indexes of the layers occupied by QP/QF originals/copies) which also has its own distinct j-layers containing all the identical/quasi-identical copies of that prototype LF. In conclusion, MMUM is essentially a hierarchic graph of CAs, each CAs corresponding to an i-layer, with all i layers organized in two columns that lay on the same 0-layer: a \( i_1, i_2, ..., n \) pile of i-layers which contains one software copy per each i-layer (as mPl genes that encode the intrinsic Plq of any QP, QF and LF) AND a \( j_1, j_2, ..., n \) pile of j-layers which contains an arbitrary finite nof software copies per each j-layer (as copies/replica of the corresponding mPl genes).

BIDUM predicts that there are no absolute Euclidean dimensions of spacetime because spacetime is NOT absolute NOR Euclidean, but an emergent illusory phenomenon generated by PQua flows from one IC to all the other ICs (of the same i-layer or j-layer), generating the fours FFs and their spacetime “scene”. The spatial dimensions of OU are in fact just a-dimensions, which are illusory (both objective and subjective) relative abstract dimensions: this dimensionality perception is generated by the ratios between the global intrinsic PQua of the OU (I_{OU}) and the four PQua of the four FFs.

In this way, BIDUM proposes the resolution of the apparent paradox that strings cannot generate spacetime without implying spacetime in their inner structure (one of the greatest fundamental problems of SSTs): BIDUM considers strings to be abstract string-like PI flows that have NO spacetime, but only generate
spacetime “sensation” by their flows between different ICs/mPI-genes: these PI-flows also interact with the senses and the mind of a bio-observer (BO) generating the perceptual impression /illusion of space and time. In this way, BIDUM proposes an a-dimensional explanation for the hierarchy problem as the EGF PI-flow appears to generate the 4th a-dimensional frame/illusion of the global Plqua (I_{OU}) (and not vice versa how GR predicts [that gravity is generated by the curvature of the 4D spacetime]) and the other non-EGFs appear to generate the ~3D a-dimensional frame: as \( \log_2(N_a) = a \approx 137 \) is more than 2 orders of magnitude larger than 1 and that explains the huge ratio of non-EGF to EGF strengths of about \( N_a \sim 10^{40} \) (40 orders of magnitude).

Although the spatial/temporal dimensions are redefined in BIDUM as a-dimensions (spatial or temporal), I have chosen the common abbreviation “D” for the concept “a-(abstract-PI)-dimension” for simplicity, instead of (a)D.

Strings (and their specific interactions/operations) can be regarded as PI flow-circuits between swarms of ICs (each with an intrinsic PIq qualitative and/or quantitative gradient to the ICs that are adjacent to them, in the same i-layer). The illusions of (vacuum)space-time and matter-energy may both be generated by those PI-flows between those ICs.

**Figure F-V-1. The five fundamental interactions of the type-I 1D strings regarded as PI flow-circuits**

The ratio between \( h_{eg} \) and the other non-EGF Plqua (\( h_{gl}, h_{ph} \) and \( h_{WZ} \)) is so small (40 orders of magnitude smaller that 1) such as the sum of all the OU eg's tend to behave like a “liquid” spacetime in contrast to all the other QPs that behave as if “immersed” and as if they may bend the so-called (eg/egic)spacetime (which is probably formed by a quantum sea/ocean/foam of free “sub-eg” strings and eg's) bringing more close GR and QFT, as it may also explain the thermodynamics of the black-holes.

Essentially, BIDUM sustains the Simulation Hypothesis (SH) [91] by which OU (including WU) and all the BO are parts of simulated reality based on Plq gradients measurable in a-units (also measured in qbits): BIDUM also rebrings into attention the soul theory promoted by the majority of the faiths and religions in the world (products of the human intuition/revelation in which BO mind [BOM] and BO body[BOB] are considered simulated realities of the so-called “soul”/”spirit” [BO’S” or “BOS”]). BIDUM co-sustains (as most of religions do) that PO and BO are only software: energy, matter, spacetime, BOM and BOB are all subroutines of this main software (analogous to a universal operating system [UOS])

The fact that the universe is essentially (with high probability) pure software (organized as an UOS and containing both mPI-genes and mBI-genes corresponding to the Plqua of the BOs) governed by the laws of mathematics (essentially the theory of information) is a fact that may also explain why mathematics offers such a good support in expressing the laws of physics which often use additions, extractions, products and exponentials (together with logarithms): "At this point an enigma presents itself, [an enigma] which in all ages has agitated inquiring minds. How can it be that mathematics, being after all a product of human thought which is independent of experience, is so admirably appropriate to the objects of reality?" (Albert Einstein, 1921 [92])
In the absence of a mature theory to explain the existence and functioning of the human consciousness (HC), all the TOE-models produced by this HC may be flaws generated by incomplete self-knowledge.

As it can be observed from the previous equations, \( \Omega_f (\rho_{iou}) = \rho_{iou} / \rho_c \approx 5.06 \) is almost one order of magnitude higher than 1, which corresponds to a universe that will start to deflate and collapse (a Big-Crunch) in the distant future defined by \( t_{iou} = \sqrt{t_{e(1)} \cdot t_{e(2)}} \approx 22.19 t_{iou} \approx 306 \text{ billion years} \), which is similar to a Phoenix universe [93,94]: the Barrow’s Singular inflation theory [95] and Turok’s Cyclic Model of the Universe (M-Theory Model of a Big Crunch/Big Bang Transition) [96,97] also sustain this possibility. The most recent measurements of top quark mass will surely bring more answers on whether our universe resides in a stable or metastable region of the electroweak theory (EWT) of the Standard Model (SM) [98].

OU (as measured indirectly by FSC and GCCr) can be simulated by a 4D hyper spherical phase space (4D-HSPS), modeled by a 4D-graph. This 4D-HSPS can be represented as a 4D ball-graph in which the up/down quark-nodes are close to each other in triads (quark triangulation) super-organized in clusters/swarms (as most of WU is composed of hydrogen atoms clustered in stars) and the internodes (the four FFs and their specific Plqua) are organized in four layers, one per each FF, each internode with a specific Plqua (hgl, hph, hw and hqg) attached to it (that may be represented in different colors). Gravity is the basic layer of internodes: as this layer has \( \sim 4D \) (~2[A]D), it is clear that it interconnects all the nodes from the \( \sim 4D \) “dust” of nodes that can be uniformly (but sparse) distributed in the 4D-HSPS. However, there is a high probability that this graph has a (quasi-)fractal character, as the nodes and internodes may be (relatively) uniformly distributed in the 4D-HSPS: the 3-non-EGF FFs webs surely have a (quasi) fractal ~3D (quasi)uniform global distribution. The 4th dimension can be physical dimension but ALSO pure informational/abstract dimension in which the ~3D/ ~4D configurations of the four FFs are recorded/pre-designed. The SNF-EWF-EMF webs (of internodes) interconnects ~3D swarms of quarks from the global 4D-HSPS. The EGF webs (of internodes) interconnects the ~4 swarm of quarks from the same global 4D-HSPS.

In the interior of a quark triad/triangulation (QT), all the four types of FF internodes superpose to each other such as the 2nd layer is the EMF which has a theoretical infinite distance of action but which doesn’t escape the 4th dimension (as the photons are considered open strings that remain in the ~3rd dimension of our 4D brane/world/OU). The EWF and SNF internodes are superposed to the EGF and EMF webs, but their action is restrained in the interior of the QT. It is very probable that the egs interchanged in a QT to have a much larger intrinsic PI (a larger hcg probably of the same order as hph) which implies a very large G (named Strong Gravity Constant [SGC abbreviated as \( \Gamma \)]).

Based on the function \( hf(d) = I_{iou} / N_a^d \) associated with any dD frame, I also propose a quantum G function \( Gf_q(d) = k_G \cdot hf(d) \) associated with any dD frame. If the OU phase space is considered a 4D hypersphere, then \( N_a (=2^a) \) (the exponential a-unit measure) may be considered the nof. fermionic-nodes per each diameter of this 4D hypersphere: if this OU phase space is considered a 4D hypercube, then \( N_a \) may be considered the nof. fermionic-nodes per each lateral edge of this 4D hypercube. Based on \( \Gamma = [Gf_q(d) = k_G \cdot hf(d) = k_G \cdot I_{iou} / N_a^d] \), the function \( df(\Gamma) \) that approximates the (fractional) nof. dimensions corresponding to a specific value of the \( \Gamma \) scalar (as predicted and calculated by different authors) is a simple logarithmic function with base \( N_a \) (it’s obvious, however, that this function generates just an approximation of the real \( df(\Gamma) \), as it is deducted [for simplicity of equations] from cubic volumes, not spherical volumes).

\[
hf(d) = \frac{I_{iou}}{N_a^d} \quad \Rightarrow \quad Gf_q(d) = \Gamma = k_G \cdot hf(d) = k_G \cdot \frac{I_{iou}}{N_a^d}
\]

with \( k_G = \frac{c / m_e^2}{2 \pi a} = \frac{c^5 / (m_e c^2)^2}{2 \pi a} \)  

[11(a,b,c)]
\[ df(\Gamma) = \log_{N_c} \left( \frac{I_{\text{OUT}}}{\Gamma / k} \right). \]

\[ V-11d \]

<table>
<thead>
<tr>
<th>Table T-V-7. The value of function ( G_f(d) ) for different (fractional) no. a-dimensions ( d )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( G_f \left( \Gamma_{\text{Seshavatharam--Avogadro}^{-2.89^*}} \right) \approx 2.42 \times 10^{-17} m^3 kg^{-1} s^{-2} )</td>
</tr>
<tr>
<td>( G_f \left( d_{\text{perg}}^{-3.01^*} \right) \sim \Gamma_{\text{perg}} = \frac{\hbar c}{m_e^2} \approx 2.78 \times 10^{32} m^3 kg^{-1} s^{-2} \sim 4.2 \times 10^{42} G ) (*this frame predicts ( \Gamma ) as calculated by Perg[28,29]) : Perg’s ( \Gamma ) scalar is similar to the Fedosin’s ( \Gamma ) scalar (see the last lines of this table)</td>
</tr>
<tr>
<td>( G_f \left( d_{\text{Seshavatharam}}^{-3.02^*} \right) \sim \Gamma_{\text{Seshavatharam}} \approx 6.94 \times 10^{-13} m^3 kg^{-1} s^{-2} \sim 1.04 \times 10^{42} G ) (*this frame predicts ( \Gamma ) as calculated by Seshavatharam and Lakshminarayana [28,103])</td>
</tr>
<tr>
<td>( G_f \left( d_{\text{Fisenko}}^{-3.03^*} \right) \sim \Gamma_{\text{Fisenko}} \approx 5.1 \times 10^{31} m^3 kg^{-1} s^{-2} \sim 7.6 \times 10^{41} G ) (*this frame predicts ( \Gamma ) as calculated by Fisenko et al.[28,104,105,106] who found a spectrum of steady states of the electron in proper gravitational field (0.511 MeV …0.681 MeV) on the base of this value of ( \Gamma ))</td>
</tr>
<tr>
<td>( G_f \left( d_{\text{Recami}}^{-3.06^*} \right) \sim \Gamma_{\text{Recami}} \approx 3.2 \times 10^{-30} m^3 kg^{-1} s^{-2} \sim 4.8 \times 10^{40} G ) (*this frame predicts ( \Gamma ) as calculated by Recami [28,107,108,109,110,111])</td>
</tr>
<tr>
<td>( G_f \left( d_{\text{Fedosin}}^{-3.09^*} \right) \sim \Gamma_{\text{Fedosin}} = \frac{\hbar c}{m_p m_e} \approx 1.514 \times 10^{29} m^3 kg^{-1} s^{-2} \sim 2.3 \times 10^{30} G ) (*this frame predicts ( \Gamma ) as calculated by Fedosin in 1999 on the basis of equality between the Coulomb electric force and gravitational force in the hydrogen atom on the Bohr radius [28,112,113,114,115]; Fedosin’s ( \Gamma ) scalar is very similar to Perg’s ( \Gamma ) scalar (see the first lines of this table)</td>
</tr>
<tr>
<td>( G_f \left( d_{\text{Tennakone}}^{-3.1^*} \right) \sim \Gamma_{\text{Tennakone}} \approx 3.9 \times 10^{28} m^3 kg^{-1} s^{-2} \sim 5.8 \times 10^{35} G ) (*this frame predicts ( \Gamma ) as calculated by Tennakone [28,116])</td>
</tr>
<tr>
<td>( G_f \left( d_{\text{Stone}}^{-3.112^*} \right) \sim \Gamma_{\text{Stone}} \approx 2.4 \times 10^{28} m^3 kg^{-1} s^{-2} \sim 3.6 \times 10^{38} G ) (*this frame predicts ( \Gamma ) as calculated by Stone[28,117])</td>
</tr>
<tr>
<td>( G_f \left( d_{\text{Oldershaw}}^{-3.113^*} \right) \sim \Gamma_{\text{Oldershaw}} \approx 2.18 \times 10^{28} m^3 kg^{-1} s^{-2} \sim 3.3 \times 10^{38} G ) (*this frame predicts ( \Gamma ) as calculated by Oldershaw[28,118])</td>
</tr>
<tr>
<td>( G_f \left( d_{\text{Mongan}}^{-3.12^*} \right) \sim \Gamma_{\text{Mongan}} \approx 1.1 \times 10^{28} m^3 kg^{-1} s^{-2} \sim 1.6 \times 10^{38} G ) (*this frame predicts ( \Gamma ) as calculated by Mongan[28,119])</td>
</tr>
<tr>
<td>( G_f \left( d_{\text{Sivaram}}^{-3.125^*} \right) \sim \Gamma_{\text{Sivaram}} \approx 6.7 \times 10^{27} m^3 kg^{-1} s^{-2} \sim 1.004 \times 10^{38} G ) (*this frame predicts ( \Gamma ) as calculated by Sivaram and Sinha[28,120] based on the analogy[28,121] between hadrons and Kerr-Newman black holes; this value of ( \Gamma ) is also accepted by Raut and Usha[28,122]; ( \Gamma_{\text{Sivaram}} ) also allowed estimating the strong spin-torsion interaction between spinning protons[28,123])</td>
</tr>
<tr>
<td>( G_f \left( d_{\text{Dufour}}^{-3.18^*} \right) \sim \Gamma_{\text{Dufour}} \approx 2.06 \times 10^{25} m^3 kg^{-1} s^{-2} \sim 3.09 \times 10^{35} G ) (*this frame predicts ( \Gamma ) as calculated by Dufour[28,124])</td>
</tr>
</tbody>
</table>

As all the four FFs have dimensional frames with a fractal dimension \( d \sim 3 \), BIDUM associates each elementary QP node in the graph (quark/lepton/neutrino) with a 3D-brane which may be considered a 3D (point-like) ball-branes (3D-bb) (and not 0D as adimensional points are) with a specific radius and a 2D spherical surface. ITMU distinguishes 3 major types of 3D-bbs: quark 3D-bbs (q3D-bbs, one per each type of quark, from which up/down Q3D-bbs are the most stable and implicitly most frequently present in the WU), lepton 3D-bbs (L3D-bbs, one per each type of lepton, from which the electron is the most stable and implicitly most frequently present in WU) and neutrino 3D-bbs (N3D-bbs, one per each type of neutrino, from which the
electron neutrino is the most stable and implicitly most frequently present in the WU). The 4 GBs can be considered cylindrical surfaces (that may oscillate between cylindrical [wave] and spherical [particle] geometrical extreme states, generating the wavicle character of all the fermions [that permanently emit egs from their surfaces] and all GBs, as conjectured by de Broglie’s hypothesis and explained by HUP) that have the capacity to interconnect the Q3D-bbs in the 4 different specific frames defined by the dimensional set (d_{eg}, d_{ph}, d_{WZ} and d_{g}). The fermion-boson dichotomy may be explained by the topological differences between a 3Dbb (which has a fermion-like character, as two or more identical 3Dbbs cannot all occupy the same quantum state at the same time, as they are balls, not empty) and a 2Dbb (which has a boson-like character, as more than 2 empty identical spherical/cylindrical 2Dbbs can occupy the same quantum state at the same time by superposing/incorporating one another as spherical/cylindrical sheets); this can explain why the majority of bosons (egs, photons and gluons) do not have a rest mass, AND also can explain how the high energetic bosons can generate a particle-antiparticle pair (PAPP) by splitting of the spherical/cylindrical 2Dbb in (symmetrical) two fermion halves (3Dbs as 3D micro-“balls”). The 4D-HSPS may be considered a swarm of Q/L3N3D-bs interconnected by 2D cylindrical/spherical branes (the GBs) and 1D strings (which both may be considered 2D/1D grids of ICs. This may explain why the universe has a 3D appearance (as these elementary Q/L3N3D-bs are), as each of these 3D nodes (the elementary QPs that are 3D-bb) emits GBs on a spherical surface and interchange PI (location-momentum packs) continuously (as in the case of fields) or in pulses (in the case of emission/absorption processes) that creates PI gradients between different 3D-bbs. These 3D-bs may have an multilayered internal structure (multiple concentric 2D-branes as spherical surfaces [2D-sb] superposed one to another, from the center to the peripheral region of those 3D-bs).

Using the generalized scalar \(G_f (d) = k_G \cdot hf (d)\), we can estimate as the minimal magnitude of the cohesion force between 2 adjacent concentric 2D-sb of the same 3D-bb, a force mediated by the eg (which may exert huge gravitational forces at very small scales, as anticipated in this article): this hypothetical (but very probable to exist) may be called Very Strong (Quantum) Gravity (VSG) (analogous to Strong Gravity [SG] defined by the predicted SGC series [\(\Gamma\)]).

The maximal magnitude of VSG may be defined by \(G_f (2) \sim 1.8 \times 10^{74} \text{m}^3 \text{kg}^{-1} \text{s}^{-2} \sim 2.7 \times 10^{84} G\). The huge magnitude of the minimal-to-maximal interval of VSG may explain why the so-called elementary QPs appear as point-like unsplittable QPs in all the experiments conducted until now in the LHC. If we recursively consider that the 2D-bs are also formed by strings (1D-branes[1D-bs]) attached together, then we can estimate the cohesion force between those strings (1D-branes) in the interval \(G_f (2) \sim 2.7 \times 10^{84} G\) and \(G_f (1) \sim 3.2 \times 10^{145} \text{m}^3 \text{kg}^{-1} \text{s}^{-2} \sim 4.8 \times 10^{125} G\). If we recursively consider that the 1D-bs (strings) are also swarms of adimensional points (0D-branes[0D-bs]) attached together, then we can estimate the cohesion force between those points (0D-branes) in the interval \(G_f (1) \sim 1.9 \times 10^{43} G\) and \(G_f (0) \sim 5.7 \times 10^{56} \text{m}^3 \text{kg}^{-1} \text{s}^{-2} \sim 8.5 \times 10^{66} G\).

Each possibly controlled by the multilayer informational matrix (MIM) (as defined by MMUM, as the UOS-OU) (with defined PI-gradients between adjacent points, PI-gradients that makes them distinguishable one from another on that strings: only the points that have a PI-gradient with its adjacent points truly exist [a condition of existence based on non-uniform PI-distribution: a principle of absolute non-homogeneity/differentiation of the same nPI-gene “clone”-points of the OU (similar to clone cells role/function specialization/differentiation)]. In this view, a string can be considered a swarm of points corresponding to a swarm of ICs (each possibly controlled by the MIM) that can be analyzed with the tools of the swarm theory: the PI-gradient between the points of a swarm string of adimensional points creates the spacetime-energy-matter (string-based) illusion, as BIDUM considers spacetime and energy-matter as emergent from the intrinsic PI of each different adimensional point).

The function \(hf (d) = I_{\text{net}} / N_a d\) can be used to calculate the specific PIqua of any frame with one or more additional dimensions (which are predicted by SST and MT). When considering d=5 the minimal nof dimensions of OU required by SST, it may result the PIqua of a string (that may be building block of all QPs associated to frames with d<5, including the eg): \(h_{str} = hf (5) \sim 7.45 \times 10^{-116} Js\), \(h_{eg} / h_{str} \sim 2.1 \times 10^9\) and \(G_f (5) \sim 4.8 \times 10^{-40} G\). Interestingly, there are two scalars that also suggest a (minimal) 5D universe:
Analogously, one can also calculate the Plqua associated to any frame with $d>5$ nof dimensions, up to $d=11$ and $d=12$ (as predicted by SST and MT). In any of the $(d\geq5)$-frames, $h_{sr}(d) = \frac{I_{OU}}{N_{a}^{d}}$ can be associated with one qbit (2 string states) and the intrinsic Plqs of all other QPs associated with $(d<5)$-frames can be recalculated as multiples of $h_{sr}(d \geq 5)$. SST also predicts that time is in fact a spatial $4^{th}$ dimension with a compact topology: an argument in this direction is the simple observation that the more compact (well-packed) a QP is, the more durable it is (having a larger mean lifetime), as if when a QP “shrinks” spatially (by also lowering its mass) a part of its mass escapes in this $4^{th}$ dimension generating the appearance of stability in (classical linear) time of that QP, a stability that is standardly measured by the mean lifetime $t_{op}$.

By combing $h_{sr}(E_{BN}) = \frac{I_{OU}}{N_{a}^{d}}$ one can calculate a generalized Plq function $h_{fs}(d,E_{BN}) = \left[1 + E_{BN}/(m_{c}c^{2})\right]^{-1} \frac{I_{OU}}{N_{a}^{d}}$ and a generalized (combined) G-function $G_{fs}(E_{BN},d) = k_{G} \cdot h_{fs}(d,E_{BN}) = k_{G} \cdot \left[1 + E_{BN}/(m_{c}c^{2})\right]^{-1} \frac{I_{OU}}{N_{a}^{d}}$.

The Info-Dimensional Relativity Principle (IDRP) of BIDUM. In conclusion, BIDUM launches the hypothesis that the real nof dimension of our OU is relative and depends on the Plqua-“key” $(h_{r})$ we use to study OU (using our mind, sense and tool-extensions), a “key” that defines the relative nof dimensions of the studied frame such as $d_{x} = \log_{N_{a}}\left(\frac{I_{OU}}{h_{x}}\right)$: when using $h_{sr}$, OU appears $\sim$5D because $\log_{N_{a}}\left(\frac{I_{OU}}{h_{sr}}\right) \sim 5(D)$; when using the eg, OU appears $\sim$4D because $\log_{N_{a}}\left(\frac{I_{OU}}{h_{eg}}\right) \sim 4(D)$ and when using $h_{ph}(=h)$, $h_{wz}$ and $h_{gl}$, the same OU appears as $\sim$3D because $\log_{N_{a}}\left(\frac{I_{OU}}{h_{ph}}\right) \sim \log_{N_{a}}\left(\frac{I_{OU}}{h_{wz}}\right) \sim \log_{N_{a}}\left(\frac{I_{OU}}{h_{gl}}\right) \sim 3(D)$. IDRP can offer an escape from a potential tautology, as when we measure different parameters of QP, we use algorithms based on the a priori assumption that space has 3 dimension (d=3) (which is essentially an illusion created by the ratio between $h$ and $I_{OU}$). In the view of IDRP, any QP may be both elementary or composite, depending on the frame of reading the global Plqua $I_{OU}$: in a 5D frame, the string appears as the only composite informational/physical entity (and all the other known QPs[including the eg] are composed of these 5D-frame associated strings); a $>5D$ frame, even the strings may appear as composite. IDRP suggests a fractal universe which permits potential infinite zooming, at potential infinite detail. In conclusion, the measurements in a/A-units indicate that $N_{a}$ is a scaling factor that also connects the macro/global Plqua (such as $I_{OU}$) with the micro Plqua (the four Planck-like constants of the four FFs).

If we consider a black hole (BH) born very close to the Big-Bang moment, defined by unknown rest mass $M_{BH(s)}$, with a mean lifetime equal to a full inflation-deflation OU cycle $2t_{OU}$ and an intrinsic Plq $I_{BH}$ condensed on its 2D spherical surface (so that the frame of Plq-reading corresponds to $d=2$ and $I_{BH} = \frac{I_{OU}}{N_{a}^{2}}$) AND $\left[M_{BH(s)} \cdot \frac{I_{BH}}{c^{2}} = \left(\frac{I_{OU}}{N_{a}^{2}}\right) \cdot \left(2t_{OU}\right)\right]$ then it results an $M_{BH(s)} \sim 2.4 \times 10^{-28}$ kg. As it can be remarked, $M_{BH(s)} \sim 2.4 \times 10^{-28}$ kg is unexpectedly close to a nucleon mass, such as $M_{BH(s)} \sim \left(14.6\%\right) m_{N}$. From this informational point of view, BIDUM considers that nucleons are essentially micro black-holes that can be modeled by the Kerr–Newman metric tensor [Recami E., 1994, 1995, 1997-2001] [Oldershaw R.L., 2006], and that may explain the AdS-QFT correspondence. In fact, A=2a (the 2[a]D frame or the 1[A]D frame) is an attractor all the rest masses of the main QP when expressed in a/A-units, which indicates that all QPs are essentially quantum BHs:

$\log_{2}\left(\frac{I_{OU}}{m_{n}}\right) \sim 1.99a \sim 0.99a$, $\log_{2}\left(\frac{I_{OU}}{m_{e}}\right) \sim 2.06a \sim 1.03a$, $\log_{2}\left(M_{BH(s)} / m_{ph}\right) \sim 2.05a \sim 1.025a$, $\log_{2}\left(M_{BH(s)} / m_{gl}\right) \sim 2.04a \sim 1.02a$. Additionally, at the Planck mass/energy scale and in the case of an “almost eternal proton and electron” (with a mean lifetime $t_{p} \geq 10^{31}$ years and $t_{e} > 6.6 \times 10^{38}$ years), it is possible for the Plq to be even more compressed so that it is condensed not on a 2D...
surface, but in a 1.5(a)D fractal “dust” or in a 0.75(A)D swarm of points (each corresponding to an ICs):

\[ \log_2 \left( \frac{M_{IOU}}{m_p} \right) \sim 1.52(a)D \sim 0.76(A)D, \quad \log_2 \left( \frac{R_{IOU}}{l_{pl}} \right) \sim 1.49a \sim 0.74A, \quad \log_2 \left( \frac{I_{IOU}}{h_p} \right) \sim 1.51a \sim 0.75A, \]

\[ \log_2 \left( \frac{I_{IOU}}{h_e} \right) \sim 1.7a \sim 0.85A. \]
Part VI. The PI-gene hypothesis

The PI-gene hypothesis. As explained previously, on the qualitative (not just quantitative) aspect of PI, it’s very plausible that \( I_{OU} \) to be organized in multiple meta-layers as not all the qbits store the same type of PI (as the global PIqua is an informational map of energy-matter structures and functions/dynamics that can also be considered a universal operating system [UOS] analogous to those used in IT/computers); there are blocks of meta-PI (mPI) (also measured in qbits) that describe algorithms applied on other blocks of PI (of inferior grade) (“information about information” is meta-information). mPI may describe groups of possible states and their successions/parallel associations. mPI may also contain algorithms/code lines that process basic input/output PI. mPI may be indexed as n-grade mPI (mPI(n)): mPI(0) is basic input/output PI (basic input/output qbits of data) which corresponds to the 0-layer of MIM, mPI(1) describes and even may process blocks of mPI(0) (as it may contain algorithms similar to a subroutine), mPI(2) may integrate all mPI(1) in super-subroutines and so on. However, BIDUM predicts that the maximum n (n_{max}) may be a finite natural number (as based on a global possible finite \( I_{OU} \)), and mPI(n_{max}) is the analogous to a universal operating system (UOS), a macro-PI-“skeleton” in which all the other mPI(n<n_{max}) are embedded/coordinated. As it can be seen, all types of mPI(n) are mathematical bodies/entities containing number or a combination of numbers and algorithms (composed of logical and other mathematical operations[ops]), which makes this BIDUM very similar to Tegmark’s Mathematical Universe Hypothesis (MUH) [125] and may explain why all the elementary QPs (EQPs) of the same type have the same (probably perfectly identical) properties when tested in the same conditions: this apparent tautology (as one may argue that some QPs are defined as the same type of particle just because they show identical properties in identical experimental conditions) may be explained by the fact that, in this BIDUM, all the particles of the same type correspond and are generated to/by the same type of mPI with the same index (n), which functions like a “PI-gene” that is used to produce multiple copies of the same EQP. As it can be observed, this BIDUM describes \( I_{WU} \) as an informational entity similar to the DNA/RNA of the living cells (which are essentially phase-spaces of information organized hierarchically waiting to be accessed whenever is necessary for survival and adaption to the environment). Using this PI-gene hypothesis, this BIDUM explains an re-brings in attention Wheeler’s one-electron-universe intuition[126]: in terms of PI, it is very plausible the universe to have only one PI-gene for the electron (mPI[n_{e}]) from which a nof. energetic-materialized “copies” (\( N_{e}=N_{Eda} \)) were produced after the Big Bang (similar to RNA translation processes in which the succession of codons from RNA is translated into specific proteins). Electrons may also be produced spontaneously from the vacuum as proton-positron pairs (the Casimir effect). All the electrons have the same intrinsic PIqua \( \text{i}_{e}=\hbar c E_{\text{Eda}}(m_{c}c^{2})^{-1}t_{e} \), but they may differ by their intrinsic Equa (also depending on their speed which is also a function of their orbital energetic level in a pep in the case of the electrons bound in atoms). It’s also clear that all the photons have exactly the same intrinsic PIq (measured by \( h_{ph}=h \)) as all the photons may be copies of the same mPI-photon-gene (differing just by the energy, which is the speed of transferring that PIqua[\( h_{ph}=h \)], determined by the different frequencies of the photons.

The EQP-microchip/microprocessor hypothesis. Each EQP may be considered a quantum microchip (with both a software/code and a hardware, a form of micro/sub-universe of the OU analogously to a software application being a micro/sub-universe in the UOS and/or a microchip being a micro/sub-universe in a global hardware of a computer), a microchip that can receive, process and emit/output PIqua (mPI[0]) as response to external PI stimuli. The intrinsic mPI(0) of a QP can be further copied (analogously to the process by which it was received by that same QP) from one particle to another (by physical interactions mediated by the four FFs). The other part of the intrinsic PIq of that QP (the code, which is mPI(n), with n>0 by definition) may not always be copied directly but can be multiplied using that PI-gene (as the Casimir effect may suggest). This view is different from the Forrester’s analog/digital PI differentiation[127,128,129], as all the global PI is considered digital in this BIDUM (and not a hybrid analogous-digital PI as Forrester suggested). In this view, a PIqua may be split in two sub-PIqua (a software PIqua [sPIq] and a hardware-PIqua [hPIq]) similar to a gene being split in introns and exons which is also a genetic PI-dichotomy (analogous to bosons-fermions dichotomy in which bosons are the equivalent of a software and bosons are the equivalent of a hardware), as introns mainly contain software and play a software-like role and exons code and are further converted into the proteome which plays the role of a hardware in a living organism, a hardware that mainly executes software instructions).
The Plqua four-steps replication-dichotomization-materialization-particulation hypothesis. The process of materialization of a Plqua can be preliminary analyzed as a four steps process (analogous to the transcription-translation double process of a living cell): (1) the replication of the mPlq-gene into a Plqua, in which the intrinsic Plq contained in that mPlq-gene is copied into a replica (possibly stored in the observed/human mind/consciousness) (analogously to an DNA-gene that is copied into a messenger RNA molecule [mRNA]; a process named genetic transcription); (2) the software-hardware Plqua dichotomization in which the primary (“mother”) Plqua splits in two secondary (“daughter”) Plqua (sPlq and hPlq) (analogously to an mRNA gene-copy which is splitted in introns and exons: a process named “genetic splicing”); (3) the energy-time splitting of the hPlq in which that QP can be observed as an Equa in a specific classical time frame (analogous to the RNAm translating into proteins, which are specific composite molecular-Equas with specific mean lifetimes); (4) the “particulation” process in which that specific Equa (produced from that Plqua) also decomposes into a specific particle with a specific rest mass (Mqua) that moves with a specific speed v (analogously to the protein being further prepared and packed for reaching its full expected functionality, often with the help of different other molecules, including the introns): in the cases of the gluon, the photon and the (hypothetical) eg, v=c (as these 3 GBs only have kinetic/relativistic masses and theoretically zero rest-masses); in the case of the W/Z bosons, v<c (as both W/Z bosons have quite large non-0 rest masses [non-0 Mquas] and also have kinetic masses when generated). In this view, I_{O}U may be considered a “hard-disk” (a read-only-memory [ROM]: a phase space [130] which stores all the possibilities of any potential [dynamical] particle and process). The observer plays the role of a random-access-memory (RAM) unit that applies an algorithm that extracts information from the ROM (by a copy-paste process [not a cut-paste process] similar to the living cell DNA/RNA transcription/translation which generates proteins from coding genes) and generate different dynamical particles (Equa) and processes with specific energies/frequencies/t-qua (limited superiorly by the Planck frequency ν_p). The speed of light in vacuum (c) helps defining the Planck (maximum possible) frequency (ν_p=c/l_P) of local retrieval of a specific Plqua from the global Plqua (I_{O}U).

The materialization (wave function collapse) and the classical linear time may be mind-constructs. The process of materialization of a specific Plqua (i-qua) may be considered (apparently) stochastic (but potentially/possibly [at least partially] decided by the volitional and perceptual human consciousness[HC]). The classical linear time produced in the 3rd step of mPlq-gene/Plqua materialization is a potential/possible (at least partially automatic) mind construct that can be measured only as a mean lifetime or as half-life in the case of multiple-particle materializations, as the decay of any particle is an apparently stochastic process which occurs to a particle of a system with a high degree of uncertainty): this is a possible explanation/prediction for/of Heisenberg’s Uncertainty Principle (HUP) as generator[131] of wave-particle (“wavicle”) duality and also an explanation for the “birth” of classical linear time by wave function collapse, as it’s no hazard that (physical) complementarity properties can be defined in respect to the i-quantity definition (position and momentum; energy and duration; spin on different axis; wave and particle; value of a field and its change at a certain position). Another argument (for that linear classical time is a mind construct) is that the conscious part of human consciousness (cHC) operates using a classical linear time (a “step-by-step” and “one-at-a-time” method of approach) oriented on casual successions of events to be stored and processed, in contrast, with the subconscious part of human consciousness (sHC), that operates using a parallel non-linear time (a parallel method of approach) oriented on synchronicity of events to be stored and processed: all the sciences are mainly the products of the cHC but also the products of human creativity (which is mainly controlled by sHC). The same i-qua can decompose in a spectrum of all the possible variants of Equa(E_{i}) and mean lifetimes / half-times(t_{1/2}) with a probably Gaussian (natural) distribution (with a peak around the mean lifetime and the specific Equa of that measured/observed QP) and any external source of PI (including the mind and measurement tools of the observer) can influence the probability of each (E_{i},t_{1/2}) possible combination (see next points): that’s why the question “Does the Universe Exist if We’re Not Looking?”[68] (the participatory universe hypothesis) may be legitimate[132,133] as the most recent experiments[134] confirm (legitimate in the energetic sense, not in the PI sense, as the Plqua may pre-exist in the vacuum long before the moment of a specific observation). It’s very possible that the simple act of measurement of a quantum (physical/informational) system randomly (but partially voluntary-observer determined) splits its global i-qua in different global Equa depending and indissolubly related to a specific (classical linear) time interval (Δt=t_{2}-t_{1}) of measurement (i-qua collapses into a spectrum of different [E_{i},t_{1/2}] combinations): this may to explain the wave function collapse. The act of measuring a targeted global i-qua of a physical system may also be considered a way (applied by the cHC) of analyzing a possibly (fully spatial) 4D entity by splitting it in a global (spatial) 3D Equa and an
artificial/abstract frame of classical linear time quanta (t-quanta Δt): this process may be considered a conventional method of measuring the 4th dimension of space using classical linear time quanta (t-quanta). The materialization process of an i-quanta is also one of the possible realization/implementation of Wheeler’s “it from bit” principle [68]. See Table T-VI-1 for the aspect description of the different types of PIqua materialization.

<table>
<thead>
<tr>
<th>Table T-VI-1. The description of the aspects and different types of PIqua materialization</th>
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<tr>
<td>There may be a very large Equa (E_q) (with a very high degree of localization in a specific spatial position (for example particle-like Equa like W and Z bosons) but with a very short half-life (t). There also may be a very low Equa (that remain undetected by our most sensitive measurement tools, with a very low degree of localization in a specific spatial position: a wave-like Equa like the hypothetical eg) but with a very long half-life (that can create the illusion of space and time, like the sum of all egs from the OU may create).</td>
</tr>
<tr>
<td>if ((I = E_q \cdot t)) = constant (\Rightarrow) if (E_q \rightarrow \infty \Rightarrow t \rightarrow 0) (\lor) if (E_q \rightarrow 0 \Rightarrow t \rightarrow \infty)</td>
</tr>
<tr>
<td>The pre-Big-Bang global PI hypothesis. The initial (pre-Big Bang) global i-quanta (I_gOU) can be considered the quantum superposition of all the possible (E_{OU}, I_{gOU}) combinations: that is why, in a hypothetical cyclic OU, each cycle of (global) i-quanta (I_{gOU}) universal inflation-deflation can bring another very different (E_{OU}, I_{gOU}) combination, but keeping I_{gOU} constant in all the possible universal cycles.</td>
</tr>
<tr>
<td>The vacuum as a PI-source hypothesis. Given the (already) proven Casimir effect, vacuum itself can be considered a primordial source of PI as it constantly generates particle-antiparticle pairs. Vacuum also contributes to the generation of the spacetime “scene” itself and to the generation and propagation of the four quantized FFs (as the Quantum Field Theory [QFT] predicts). Vacuum also “cooperates” with the observer to co-generate the presence of a PI in a specific spatial location when that PI is observed/measured by the chC (and its tools), in a specific (classical) linear time interval.</td>
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</table>

Virtual PI is un-materialized PIqua and real PI is materialized PIqua (hypothesis). In BIDUM virtual QPs (that generate/medicate the four FFs by quantizing these four fundamental fields) are considered pure un-materialized PIqua and real QPs are considered materialized PIqua existing as (\(E_q, t_{1/2}\)) pairs. BIDUM sustains the sub-hypothesis that all QP emit energy (materialized PIqua) by a cut-and-paste process (following the Energy-Conservation Principle [ECP]), BUT emit PIqua by a copy-and-paste process (NOT a cut-and-paste process, BUT also following the PICP in a qualitative NOT quantitative way, as PIq may be infinitely replicated by a copy-and-paste process, which is a fundamental propriety of auto replication possessed by pure un-materialized PIqua) so that QPs may forever exert their specific FFs (on which they couple by emitting/receiving specific virtual GBs of the four FFs) without losing intrinsic PIq and NOT losing their energetic level: only real PI lose energy (and PIq) when changing the energetic level in a pep or in a free unbound state (by accelerating or slowing down). In conclusion, all FFs are essentially copy-and-paste type of PIqua-transfer of virtual QPs, governed by PICP. Real QPs (materialized PIqua) follow only the cut-and-paste type of PIqua/Equa-transfer (governed by the ECP). Additionally, all the electrons that orbit/oscillate inside a pep emit real egs in pulsed modes without changing their EM/EG energetic-level (the virtual photons and egs field quanta interchanges are however important for those electrons to maintain their present energetic orbits), although they may change their subquantum EG energetic-level when emitting real egs, but this EG energetic-level changing remains undetected by our tools which are far from having the sensibility required to detect distinct subquantum EG energetic-levels of the electrons in a pep/hydrogen atom. BIDUM also sustains the sub-hypothesis that the virtual QPs (un-materialized PIqua) (which are the quanta of the four fundamental fields) interchange is instantaneous with practically almost infinite speed AND that real QPs (materialized PIqua) interchange is limited to the maximum speed c (similar to the RAM speed which is far superior to a ROM speed). This hypothesis may explain the Quantum Entanglement (QE) phenomenon (denoted as Einstein-Podolsky-Rosen paradox [EPRP], as Einstein and other author of that time didn’t regard matter and energy as essentially information/PI [135,136]). This hypothesis is also sustained by a recent study on Coulomb force that suggested a Coulomb field carried rigidly by the electron beam as if the virtual photons/EM field (that generate the Coulomb force) propagate instantaneously, no matter the distance: “Newton, Laplace and Eddington later also pointed out that, if gravity (hypothetically mediated by virtual egs) propagated with finite velocity (c or higher), the motion of the planets in our Solar System (SS) around the sun would become unstable due to a torque originating from time lag of the gravitational interactions. Such an odd behavior can be found also in
EMF, when one computes the propagation of the electric fields generated by a set of uniformly moving charges. As a matter of fact the Liénard-Weichert retarded potential leads to the same formula as the one obtained assuming that the electric field propagates with infinite velocity”[137].

**Synchronicity versus causality hypothesis (causality which may be an illusion generated by a mind construct: the classical linear time).** It is very possible that all QPs to be in fact (3+1)D entities in which the 4th dimension to contain the software (quantized as a Plqua) and the 3D space to contain the (E_{q,t_{1/2}}) pairs: this 4th dimension may be populated with different types of faster-than-light travelling QPs (including the hypothetical gravitons and tachyons, that are predicted by SSTs to escape the 3rd and 4th dimensions) which are essentially Plqua that may travel in the 4th dimension interconnecting different QPs at very long distances (by QE): in this way synchronicity (generated by the hidden phenomena of the 4th dimension) can be “masked” by the apparent causality of the 3D phenomena, as it is very possible that classical linear time (to which causality is indissolubly related by definition) to be an illusion, a mind (re)construct of the observer (similar to a 4D reality in a 3D space of projection).

**The absorption-emission hypothesis.** When an EQP (boson or fermion) is absorbed by another QP, the integration process may be very complex and similar to a software patching in which the received QP is integrated more like a subroutine in the software of the receiver QP. Similarly, when an EQP is emitted by another non-EQP, the emission process may be very complex and similar to a software splitting in which the emitted GB is exported as an autonomous subroutine (probably using both copy/cut-and-paste processes).

**The informational creationism hypothesis and the realistic sciences versus religions and humanities.** This universe-software (US previously abbreviated as uOS) may be eternal (in the informational sense) but with a possible starting point, as it may had been created by another software (a Creator-software [CS]). It is very possible that this US to be permanently coordinated by its CS. We also, as bio-observers (BO), are subroutines of this US and we are also able to create additional subroutines inside this huge US and to influence its global and local data and code: this makes the BOs a kind of informational channels between the CS and the US. To explain this view, I have created the last part of my BIDUM in which I propose a general new definition of the fundamental force/field, in which the additional layers of communication between the modules of a BO body (at cellular and supra-cellular level) are also considered additional fundamental biophysical forces of the universe that can govern/coordinate the first four (physical) fundamental forces/fields. The realistic sciences analyze the both quantitative and qualitative aspects of this US. The religions and humanities/liberal arts (including the seven arts) analyze the qualitative aspects of US and CS and the connection between our US and its hypothetical CS (considered true by faith, as faith is a method of knowledge of the emotional component of the HC). I have added this hypothesis as an answer to a question from Dina Grutzendler[9] to whom I thank again for her time, patience and attention.

Part VII. The biological forces as additional fundamental (physical) forces of the universe

Life (the explanation of its existence and evolution) must be an essential component of any PI-centered mature TOE, as life forms are essentially PI-processors and selectors/replicators. Another main reason for which a TOE must treat PI as a central part is that a mature TOE should explain and integrate the existence of (biological) life forms (bLFs), which are essentially PI-processors (as EQPs are also considered PI-processors in this BIDUM) and which shall be called bio-observer(s) (BO[s]) in the rest of this paper, as they all search, receive, process and emit Plqua from/to the entire (external) OU environment but also from/in the interior of their bodies. BIDUM defines the BOs as being NOT only humans, but all the living unicellular/multicellular plants and animals, including also viruses, as viruses are codes of life-cycles similar to a software with hardware support (DNA and/or RNA and structural/functional proteins/lipids/ carbohydrates [polysaccharides]) [138] (definition D-BO). Dawkins’ “meme” theory (in which a “meme” is essentially a biological/physical information (BI/PI) quanta with a powerful selection and replication capabilities) also highlights the biological information (BI)-replicative/selective capacity of the BOs.

The self and extended phenotype of a BO and the software/hardware dichotomy of a BO. A BO not only possess a hardware (a body [BOb], also called a self-phenotype [SP]), but also an extended phenotype (EP) (all spacetime in which the effects of a gene existence and transcription/translation [expression] are measurable, inside or outside the SP, including the SP; EP can be considered an extended BOB [eBOb]; all our biosphere (BS)/planet can be considered an extended phenotype, as Dawkins R. first defined it [139]! A BO also possesses a software (sBO) (a collection of algorithms that process the PI received from the SP and the EP), which is synonymous to a mind (BOM): BOM is clearly different from BOB as, for example, the genetic code (which is a part of the extended BOM [eBOm]) is an alphabet which differs from the chemical structure of the DNA, RNA, enzymes and ribosomes that store this alphabet. BOm can be considered a pure un-materialized mPI-subsystem of a BO that can manipulate BOB. BOB can be considered a materialized mPI-gene-subsystem that can also send Plqua to the BOm (to “inform” and even “constrain/manipulate” it) as the BO survival depends on a proper bidirectional PI-flow between BOM and BOB subsystems of the BOs.

BOs as dissipative systems. The fact the BOBs are dissipative systems [140,141,142] is an additional strong argument that BOs are essentially informational entities (PI-processor) that manage their lifetimes by a form of BI conservation Principle (BICP) analogous to the PICP, by which the BOs tend to conserve (by survival and replication) as efficient as possible their global intrinsic (genetic and epigenetic) BI (despite the often rough conditions of their environments), with constant renewal of all the atoms in the BOB with the purpose of keeping their global intrinsic BIq relatively constant/ intact (but progressively losing that intrinsic BI in a quasi-inevitable senescence). BOs also (generally) try to keep relatively constant the intrinsic BIq of all their EPs, not only from their SPs: keeping their micro-environments with a relatively constant intrinsic BIq is essential for the survival of BOs. In the active part of their life-cycle (tLC), BOs change almost all their structural physical particles/atoms (by cells/molecules repairing and/or replacing at least once in a life-cycle) at different rates (depending on the molecule/cell/tissue/organ type) [143,144,145,146,147,148], without significantly changing their global intrinsic BIqs on short and medium term, as the intrinsic BIq of a BO also contains specific error-correcting algorithms that may patch different BI-loses of the intrinsic BIq and implicitly prolong the lifetime of that BOB (measured by tLC).

BI and PI can both can both be digitized and measured in bits/qbits (hypothesis). Biological (bio) is essentially informational (info): that’s why I have chosen the “bio-info” label for this BIDUM. The physical PI and BI can both be digitized and measured in bits/qbits (using Plqs and BIqs measured with base-2 logarithms of the maximum nof. physical/biological energetic/momentum quantum/subquantum [macro/micro] states of a physical/biological system [BIS]): that’s why I have chosen the “digital” label for the BIDUM class (as digits can be used to describe all the OU, including the BO). BO can be regarded as composed of software-BI (sBI) (with its own intrinsic BIq [BIq]) and hardware-BI (hBI: sub cellular and supra cellular structures, all based on DNA, RNA, proteins etc.) also containing its own intrinsic BIq (BIq); the total intrinsic BIq of a BO (BIq = BIq + BIq) tends to self-conserve, self-replicate and adapt (by evolution and/or involution of its intrinsic BIq) with a (generally) finite life-cycle (LC) (measured also [but not only] by tLC), but potentially infinite nof. iterations of that LC (each LC measured also [not only] by tLC). Analogously, QPs and all the non-living physical systems (PS) can also be considered PI-software-hardware entities (physical observers [PO]). In the light of the mPI-gene hypothesis, it’s obvious that the only difference between the BIqua and the PIqua is that BIqua are
produced by high index mPI(n>n_s)-genes and Plqua are produced by low index mPI(n<n_s)-genes (subroutines of the mPI(n>n_s)-genes). As the index n takes progressively higher positive integer values, one cannot tell exactly the value of n_s; however, there probably exists a transition open interval (n_x,n_y) in which mPI(n_x<n<n_y) genes generates Pl/Blqua that have transient proprieties between non-life forms and life-forms (viruses can be considered as produced by this kind of transient index mPI-genes).

The “it from bit and bit from it” principle of BO. In the case of the BO, the Wheeler’s "it from bit" principle becomes the "it from bit and bit from it" principle, as the BOM also permanently remodels its data and algorithms (at least partially) when learning to deal with different dynamic structures (“it”) from the EP of that BO.

The BO-materialization process hypothesis based on the BO-PO structural analogy (hypothesis). QPs have a dual (but monad-like unitary) wave-particle (wavicle character) with both an intrinsic rest Plqua (rPlqua) and an intrinsic kinetic Plqua (kPlqua): BOs also have a dual (but monad-like unitary) character as being composed of both software (sBI qualitatively measured as Bls, which may be considered a kind of intelligent “wave function” of that BO) and hardware (hBI, quantitatively measured as Blh, which may be considered the non-wave/particle function of that BO). This similarity may be explained by the hypothesis that Blqua may have the same four steps materialization process that a Plqua has: (1) the replication of a high-index mPI-gene into a BIqua, in which the intrinsic BIq contained in that mPI-gene is copied into a replica (possibly stored in HC); (2) the software-hardware BIqua dichotomization in which the primary (“mother”) BIqua splits in two secondary (“daughter”) BIqua (sBIq and hBIq); (3) the energy-time splitting of the hBIq producing different BO-Equa-subcomponents, each with its specific mean lifetime (classical linear time measured as tlc, which is controlled by sBI) but also a global te for all the subcomponents of a BOB; (4) the “particulation” process in which that specific Equa (produced from that Plqua) also decomposes into a specific system of particles, each with a specific rest mass (Mqua) that moves with a specific speed v in a specific time interval.

The biological forces may be also considered fundamental forces of the WU (hypothesis). The PI concept (along with its scalar) also has the potential to generalize/extend the concept of fundamental physical force (FPF) as based on a distinct abstract layers of PI-flow internodes (PIFINs). The main difference between a BOB and an inert micro/macro-object is that BOB has additional layers of Plqua flows (including specific Blqua flows) between its subcomponent QPs (as all QP that compose a BOB have just four layers of PIFINs, one layer for each FF): these additional layers of PIFINs may be named layers of BI-flow internodes (BIFINs). As each of the four physical layers of (previously defined) IOU has an FF associated to it, it is convenient to extend the definition of the FPF as a bijection, so that each type of FPF has its own layer of PI-flows (LPIF) (different from all the other LPIFs) AND LPIF has its own associated FPF. Using this generalized/extended informational definition of a FPF, we can define additional FPF, one per each layer of BI-flow (LBIF). Each of this newly defined FPF may be called a (fundamental) biological intelligent force (BIF) with an indexed from 1(organelle) to 7(social) attached to its name and abbreviation: (BIF1) the biological cellular organelles LBIF (as viruses have only this LBIF as DNA, RNA and their protective chemical envelopes may be considered subcellular organelles); (BIF2) the cellular LBIF (all the unicellular and multicellular organism possess this LBIF); (BIF3) the tissular LBIF (only the multicellular organisms possess this LBIF); (BIF4) the organic LBIF (only some multicellular organisms possess this LBIF); (BIF5) the systemic/apparatus LBIF (only the advanced multicellular organisms possess this LBIF); (BIF6) the systemic/apparatus-based organism LBIF (only the advanced multicellular organisms possess this LBIF, including multicellular plants and animals from worms to humans); (BIF7) the social organisms LBIF (only the relatively advanced multicellular organisms possess this LBIF). However, it is also obvious that PI and BI can also move between different layers (this inter-layer PI/BI-flows are essential for the BO survival). The four FPFs (the four FFs) that act in a BO can also be considered (basic) BIFs, as all the four Plqua of the four FPFs have those (apparently pre-designed, but also possibly randomly selected) specific ratios of their coupling constants that permit BOs to appear and evolve/survive in a specific time subinterval of the tOU as described by the Fine-tuned universe theories (FTUTs) including the Anthropic (Cosmological) Principle (ACP) [149,150].

The Pauli Exclusion Principle of the (two identical fermions) Fermions (PEPF) and the Fermions-bosons dichotomy (FBD) can be unified as one FPF. From the standpoint of BIDUM’s new extended (generalized) definition of FF (as FPF), the PEPF-FBD association (as PEPF doesn’t apply to bosons AND FBD distinguishes fermions from bosons by the integer versus half quantum spin criteria) is essentially a FPF (an informational schema/structure) that interdicts that two fermions occupy the same quantum state simultaneously. The term “simultaneously” ALSO implies the classical linear time definition (as Plq also
implies classical linear time and so the quantum spin): concluding, PI (and PIq), (nof.) (sub)quantum states and classical linear time are indissolubly related and unified in a new definition for PI in BIDUM. BIDUM hypothesizes that PEFP (as a FPF governing PI) may also be profoundly connected with the nof. dimension (3D) that HC observes with its physical senses. PEFP can be considered the “0th” FPF (being defined as a specific informational flow/pattern/level). In my BIDUM, I consider the PEFP-BDM association as the “most fundamental” of all FPFs (including BIFs) and I chose to index PEFP with 0, as FPF(0).

### Table T-P5-1. The index system of the (redefined) fundamental physical forces (FPF) proposed by BIDUM

<table>
<thead>
<tr>
<th>The index (i) of the FPF</th>
<th>The type of FF defined by FPF(i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0, FPF(0)</td>
<td>the PEFP-FBD association (as PEFP doesn’t apply to bosons and BFD distinguishes fermions from bosons by the integer versus half quantum spin criteria)</td>
</tr>
<tr>
<td>1, FPF(1)</td>
<td>EGF</td>
</tr>
<tr>
<td>2, FPF(2)</td>
<td>EMF</td>
</tr>
<tr>
<td>3, FPF(3)</td>
<td>WNF</td>
</tr>
<tr>
<td>4, FPF(4)</td>
<td>SNF</td>
</tr>
<tr>
<td>5, FPF(5)</td>
<td>BIF1 – the biological cellular organelles LBIF</td>
</tr>
<tr>
<td>6, FPF(6)</td>
<td>BIF2 – the cellular LBIF</td>
</tr>
<tr>
<td>7, FPF(7)</td>
<td>BIF2 – the tissular LBIF</td>
</tr>
<tr>
<td>8, FPF(8)</td>
<td>BIF3 – the organic LBIF</td>
</tr>
<tr>
<td>9, FPF(9)</td>
<td>BIF4 – the organic LBIF</td>
</tr>
<tr>
<td>10, FPF(10)</td>
<td>BIF5 – the systemic/apparatus LBIF</td>
</tr>
<tr>
<td>11, FPF(11)</td>
<td>BIF6 - the systemic/apparatus-based organism LBIF</td>
</tr>
<tr>
<td>12, FPF(12)</td>
<td>BIF7 – the social organisms LBIF</td>
</tr>
</tbody>
</table>

**BOs as enzyme-based PI-processors.** BOs are all based on a relatively large pack of (bio)enzymes: each enzyme hugely raises the speed of reactions in a BO by significantly lowering the energetic threshold of all the chemical reactions/processes in a BO (without this speeding up of all the reaction, a BO couldn’t reach/show 7 levels of super-organization, denoted as BIFs1 to 7). The enzyme isn’t an energy source but is essentially a BPI-source that helps in BPI-processing by speeding it up and lowering the potential/possible errors in that BPI-processing. The enzyme uses its 3D structure and some fragments of its molecule (including electrons) as sources of BPI for the specific reaction for which it is created/produced. Enzyme are vital for any BO because they create very high speeds of BPI-transfer (the speed of BPI transfer is redefined as energy in BIDUM) between BOB subcomponents so that these very high speeds may countervail the possible destructive PPI transfers between the BOB and its environment (including other destructive BOs that can attack/infest/infest a target BOB). Enzymes are essentially a form of intelligence super-coordinated by BOs (using flows of BPI from inside and outside that BPI) that make life possible and are intrinsically and definitely related to life phenomenon (LP) and life forms (LFs). In conclusion, (bio)enzymes are essentially (B)PI-microprocessors. The enzymatic essence of BOBs is another strong argument that BOs are essentially informational entities (BPI/PI-processors).

**BO representation as a BPIF graph.** Analogously to I_{LBIF}, the BO can also be simulated as (>4)D graph with nodes and internodes, but with more than one layer of nodes (an additional layer for each additional LBIF structure of that BO different from the quarks-electrons basic web layer of nodes that control the four FFs) and five to eleven nof. layers of BPI flows (BPIF), which implies up to eleven abstract PI-dimensions of space.

**The possible connection between BIFs and the eight additional spatial (compact topology) dimensions predicted by the M-Theory (hypothesis).** Note that most SSTs and the MT also predict a total nof eleven dimensions (three spatial observable dimensions and eight additional spatial dimensions with compact topology). It is very possible (although quite speculative) that each of those eight additional dimensions (predicted by SSTs and MT) to manifest itself in our (observable) 3D space of WU as “masked” in those seven additional BIFs of the BOs.

**The strong quantum gravity possibility.** If quantum gravity theory proposed by MT (in which egs are closed strings that can escape our 4D-brane [spacetime] in additional compact topology dimensions: the 5th, the
6th etc.) will prove to be true, then it is very probable that G to be much larger at microscopic scale (micro / nano / angstrom scales) and it is also very probable that this strong quantum gravity (SQG) manifested at these microscopic scale to play a crucial role in the stability/surviving of the BOs. This (hypothetical) microscopic SQG has the potential to change the “warm-wet and noisy” paradigm (possible prejudice) [151] and make quantum coherence existence much more probable and frequent in all the cells (including the neurons from the brain) with potential huge impact on biology and on BO understanding.

The consciousness-intelligence-software equivalence hypothesis. This BIDUM generalizes the definition of consciousness as synonymous to cosmic intrinsic intelligence/software (that is stored in the cosmic vacuum which was shown to be a source of PI and is probably the source of BI too) and all the FPF (including the BIFs) are considered eleven different forms of manifestation of the cosmic intelligence (consciousness), as the quantity and quality of intelligence can be measured by the nof. levels of super-organization of that micro/macro object (a human may have up to eleven layers of PI/BI flows). BO may be considered super-quantum systems governed by five or more FPFs. This BIDUM also proposes a unification of both PI and BI under the name of bio-physical information (BPI), as both PI and BI are considered fundamental information (generators of FPFs) and can be both measured in qbits, as I shall argue next. This hypothesis of BIDUM pushes further the newly proposed theories of quantum consciousness, like the Hameroff-Penrose “Orch OR (orchestrated objective reduction)” theory [152,153], in which HC is considered to derive from a “proto-conscious” quantum structure of reality. All the twelve FPF will be named BPI forces/fields (BPIFs): five FPFs (the four basic FPFs and the PEPF-FBD association) and seven (superior) BIFs.

BIFs versus FPFs. The seven BIFs are superior to the first four (classical) FFs as they coordinate all four FPFs (that also act in/on EPs) so that to maximize the mean lifetime of those EPs (as this is the main target of all types and levels of biological memory and volition). Apparently, BIFs coordinates only the EGF and EMF in an EP (as WNF and SNF don’t have an important time-transverse role, BUT they have a very important time-longitudinal role as nuclear stability of the atoms that compose an EP is vital for the stability/survival of that SP/EP, as SNF and WNF nodes and internodes are a “quantum skeletal system” of any chemical structure of a BO). The fact that BIFs coordinate EMF and EGF inside a SP/EP efficiently to increase the mean lifetime of that SP/EP (by “fighting” any SNF/WNF “side effects”) is another argument for the informational superiority (as a coordinator) of a BIF.

BIFs can offer an elegant explanation to the hierarchy problem in physics. The seven BIFs/LBIFs fill the huge gap between the EMF and EGF (as EGF has ~40 orders of magnitude less than the EMF) and can offer an unexpected elegant PI-based explanation of the so-called “hierarchy problem” in physics by cancelling the “huge” character of this apparent “gap”, as any BO has the capacity to transform an SNF/WNF/EMF stimulus into a EGF response and vice versa (except that apparently only humans have the capacity to manipulate volitionally the SNF and WNF) and to coordinate the four FPFs that act in a EP simultaneously to BIFs. The “PI-power” that the seven BIFs have on the four FPFs is huge as the seven BIFs have managed to create a biosphere (BS) that is extended at a scale of ~1017 meters (~the equatorial diameter of the Earth), a BS which permanently integrates the information of the four FPF (by converting ant type of PI to any type of BIF and vice versa) in order to keep its stability and survival on the planet. Additionally, our BS has the potential capacity to fill with life forms (LF) (at least) a significant part of our solar system (using human BO as a vector of spreading) which makes BS extendable to scale of ~1013 m (~the equatorial diameter of our Solar System[SS]) in the distant future.

All the eleven BPIFs started from the Big-Bang, NOT only the FPFs (hypothesis). As BOs very probably wouldn’t have formed and survived without stars (as the stars are the main SNF-sources that generate EMF Pluaq/Equa used by the BOs and large stars are also the only source of large atoms heavier than the iron atom, which are vital microelements for the BOs), it is very possible that the BIFs have started their action immediately after the Big-Bang, as all the FPFs probably did. There is an observational argument that sustains this hypothesis: even if the four FPFs seem to increase entropy in the OU generating the arrow of physical time (governed by the second principle of thermodynamics [SPT]), (abiotic and biotic) micro-objects and macro-objects with increasing complexity tend to appear constantly in the OU in all the past subinterval of the t_{OU} (including stars, planetary systems, galaxies, clusters of galaxies, BOs with different levels of complexity etc.)

Evolutionism and creationism may be two facets of the same “seed”-like pre-Big-Bang monad as unified by this BIDUM (hypothesis). It is generally considered that BOs non-0 probability of existence strongly depends on: PEPF-FBD association, some narrow intervals of FSC (~1/137) allowed variations (±4%) and some narrow intervals of beta constants values allowed variations (β_p = m_p/m_e ~1836 and β_n = m_n/m_e ~1838)
and it is also generally admitted that FSC and beta-constants have probably been “decided” (naturally selected) in the first moments after the (hypothetical but very probable) Big-Bang. It was also demonstrated that the stability of all the chemical structures that compose BOBs mainly depend on FSC and these beta-constants, but also on the FBD-PEPF association (which also both play crucial roles in the existence of the BOs and their subcomponent chemical structures) [149]. In order for the first BOs to appear by the 3rd step of “biological natural selection”, proper chemical structures (atoms and molecules) must have been produced long before these first BOs by a 2nd step of “chemical natural selection”: but this 2nd step of “chemical natural selection” strongly depends on the values of FSC and beta-constants that were also “naturally selected” right after the Big-Bang moment and this may be consider the 1st step of “alpha-beta natural selection”. In this way, BIDUM proposes the unification of evolutionism and creationism, as it pushes the three-steps “natural selection” very close to the moment 0 of the Big Bang when FSC and beta-constants were probably “naturally” but not necessarily randomly selected by all the BIFs right after the Big-Bang: it is very probable that all the four classes of GBs) and the mean interval of time in which that BOB will be decomposed by different FBD, the PEPF and the PICP) to be encoded in the pre-Big Bang vacuum which was and is a source of BPI (the BIDUM monad as an alternative to the physical singularity) similar to the (genetic and epigenetic) laws of a seed which are both encoded in the SP/EP, but also are encoded the rest of OU that hosts these SP and EP.

The importance of the FSC in the functioning of the BOBs. As the modifying the energetic level of an electron in a molecule of a BOB may produce a change in configuration of that molecule (a change that may also generate and transmit a BIq), FSC (the probability of a real electron to emit a real photon [Feynman’s interpretation of the FSC]) is a probabilistic measure of the relative stability of a molecule configuration that a BOB can rely on as a BIq generator/transmitter: FSC may be considered a constant of evanescence of the electron configurations (energetic layers) and also a constant of viscosity of the vacuum that governs the stability of the chemical structures (as the kinetic electron-to/from-photon partial interconversions take place in the vacuum, as the photon, the electron and all the other EQPs may be considered vacuum phenomena and also proprieties of the same BPI-based vacuum), such as it establishes an upper limit to the maximum complexity that can be reached by a BOB/SP.

A BI-scalar similar to the PI-scalar hypothesis. The intrinsic BIq of a dead BOB (IBOB) can be defined in a similar/analogue way to the PIq scalar, using the total relativistic energy stored in a BOB (EBOB) (defined as the total theoretical energy that can be released by BOB if turned completely into white radiation mediated by the four classes of GBs) and the mean interval of time in which that BOB will be decomposed by different physical, chemical and biological factors (the time of decomposition [td]) can be conventionally defined as the interval until all its self-cells are dead/inert so that all BOB becomes “dead”, no matter if some molecules of those cells may decompose in much longer time intervals [as for example the DNA, that may last much longer in its molecular integrity] as this later decompositions are mainly dominated by the basic BIFs (FPFs) not the other seven BIFs, except when a BOB is degraded/digested by other alive BOs), such as:

$$I_{BOB} = E_{BOB} \cdot t_d = (M_{BOB}c^2) \cdot t_d$$

[VII-1]

The total intrinsic BIq of a BO(BOB) is the sum between IBOB and the intrinsic BIq of the BOM (IBOM) (that manages the BOB survival), such as:

$$I_{BO} = I_{BOB} + I_{BOM}$$

[VII-2]

The impact of the IBOM to the IBOB is to increase the time of survival of that BOB, generating a life-cycle time interval (tI) generally larger (except for the occasional suicides of BOs) than the time of decomposition of a dead BOB (td) such as:

$$t_I = I_{BO} / (M_{BOB}c^2) = t_d + I_{BOM} / E_{BOB}$$

[VII-3]

Even if BOM induces the programmed death of its own BOB (as apoptosis or suicide), tI will always be larger than td, as IBOM, E_BOB (and implicitly their ratio) are always positive by definition (which implies that a life-cycle of a BOB also includes td additionally to its well defined born-to-death life span [td]), so that:
The three main subcomponents of a BOm. BOm is composed of very complex pyramidal (hierarchical) multi-level algorithms/subroutines that control all the subcomponents of the BOb (and may also control some or all the subcomponents of the EP of that BO). BOm is “designed” to maximize the chances for survival and replication. In this BIDUM, BOm is essentially considered a materialized copy of a mPI(n,)-gene and uses all its subcomponents (that are copies of mPI(n+1)-genes) in the purpose of survival and replication. BOm may be considered to have a master subroutine (mBOm) that coordinates/controls two other non-master classes of subroutines: the anabolic BOm (aBOm) and the catabolic BOm (cBOm). (1) aBOm contains algorithms that can mobilize mechanisms of searching, absorbing and storing PI/E/Mqua from the OU environment (the so-called anabolism macro-process). aBOm mechanisms may use all the eleven BIFs in complex coordinated strategies of reaching the master-purpose pre-decided by the mBOm (and accomplished by the aBOm). aBOm dominates the first main subinterval of the \( t_{ik} \) in which the BO grows it BOB to a maximum maturity and complexity. (2) cBOm contains algorithms that can mobilize mechanisms of searching and eliminating (by digestion and further excretion) PI/E/Mqua from the BOB in and to the OU environment (the so-called catabolism macro-process). cBOm mechanisms may use all the eleven BIFs in complex coordinated strategies of reaching the master-purpose pre-decided by the mBOm (and accomplished by the cBOm). cBOm dominates the second main subinterval of the \( t_{ik} \) in which the BO uses its already reached maturity and complexity to survive, adapt and replicate. It’s obvious that a BO alternates between different higher and lower levels of entropy of its BOB (‘‘higher” and “lower” being defined as relative to an average BOb entropy calculated in relation to all the \( t_{ik} \)): internalizing PI/E/Mqua for survival is an alternate definition for (biological) anabolism and externalizing PI/E/Mqua for survival is an alternate definition for (biological) catabolism. The mBOm has the important capacity to mainly import and export Plqua by copying them and internalizing or externalizing them form/to the environmental OU: that is why mBOm mainly controls the central nervous system and the sensorial organs that extracts important (for survival) PIqua from the environmental OU BUT also emits important (for survival) Plqua to the environmental OU (in its EP).

\[
I_{BOm} = I_{mBOm} + I_{aBOm} + I_{cBOm}
\]

BIDUM also offer a global unified explanation for the process of BOB-aging. The process of BOB-aging is very complex and although it has more than 100 plausible explanations (which are all valid, in part), its main profound double-cause is that: (1) the finite BOB loses qbits (progressively) from its initial total intrinsic BIq (as its error-correcting algorithms cannot be 100% efficient on a long term), (2) the finite BOB also loses qbits (progressively) from its initial total intrinsic BIq because its error-correcting algorithms cannot be 100% efficient on long term AND because the efficiency of BI-transferring (from an old atom excreted from the BOB to a new atom integrated in the BOB for a specific interval) cannot be 100% on a long term. The degree of BOB-aging is also strongly related to the progressive decrease of the average content of water in a BOB (which may be explained by the fact that water has the propriety to conserve a BOB by keeping the BI-transfer efficiency from one atom to another as close to 100% as possible).

QPs can also be considered (non-living) physical observers (PO) (hypothesis). In BIDUM, the act of observing is defined as the capacity of a BI/PlS-system (software and hardware) to: (1) absorb (and not necessarily to search) a specific (pre-programmed) spectrum of PI/BIqua from the EP and non-EP-OU, (2) analyze those PI/BIqua (by comparing it with its (other) intrinsic BI/Plqua stored in its memory or in its EP/non-EP environment) and (3) generate (by an analysis-synthesis algorithm) and answer/react to that analyzed BI/Plqua. BIDUM considers very plausible that QPs are in fact PI-microchips (software stored on a micro-hardware) that have the (pre-programmed) capacity to observe intrinsic/extrinsic PI/BIqua, so that QPs may be also considered [non-living] physical observers [PO]). In this way, BIDUM tries to unify the BO and PO concepts in a new generalized biophysical observer (BPO) concept, analogously to the unified BPI and BPIF concepts.
The superposition between the global PIq and the global BIq – OU may be considered the EP of our biosphere. In BIDUM, software and intelligence are considered synonyms and are considered inherent to both global PIqua and global BIqua. If a complex extended network of BOs will exist in a specific (finite) linear time interval of the tOU and on a finite but sufficiently large nof. planets (spread in the entire OU) as a global OU biosphere, then a significant degree of superposition between the global PIqua (IOU) and the global BIqua (BIOU) can be considered: the proved fact (by ^14C composition studies) that biosphere (BS) is ~4·10⁹ years old, imposes the idea that our biosphere has a life span of at least ~1/3tOU which is a significant part of the tOU interval. It’s obvious that complex and diverse global BI-software needs a suitable BI-hardware, both complex and diverse (like our Earth BS is). As our BS can receive signals even from the margins of the OU, can take decisions and also emit signals to all the OU, the entire OU can be considered the potential EP of our BS.

The holographic character of the intrinsic BIq of a BO. All multicellular BOBs are composed by N>1 nof. cells that contain the same genetic global BIqua (replicated in N copies, one per each cell) but which (slightly) differ in expressing locally that global BI (each type of cell with its own pattern of gene-expression). Interestingly, each genome (global BIqua copy) is also composed by a nof M>0 BIqua, one per each pair of alleles-genes, as all the multicellular BOBs have two allele-genes for each BIqua of that genome (coding the same protein). The local diversity (more than one cell type) integrated in the global unity a BOb (the same [but multifunctional and locally adaptable] genome structure in all the cells) has strong similarities with the mechanism of writing/reading holograms by creating/reading patterns of interference with laser rays. This complex model of interferences has a correspondence even in the gene structure: when a gene produces a protein, it first has to separate its exons from its introns (the splitting process of the mRNA) and then recompose the protein-code by joining all the pre-separated exons into one exonal mRNA which is further translated in a protein by the ribosome. The intron/exon alternation in the structure of a gene is in fact a BI interference pattern, as introns and exons both code genetic BI, but intronal and exonal genetic BI have different roles in a cell.

The probable holographic nature of a PIqua materialization from the vacuum (the Casimir effect as the materialization of the mPI-genes stored holographically as PI-layers of the vacuum). It is very probable that all the EQPs in the OU to be stored as PIqua in the vacuum using the same type of holographic intronal/exonal alternation so that each EQPs materializes itself from its exonal part of its mPI-gene stored as a PI-layer in the entire vacuum: the all-in-one holographic principle may explain the wave-particle duality of all EQPs and the non-0 probability to find an observed EQP in any point of space when trying to measure its momentum (as it was demonstrated that the wave-particle duality is in fact the consequence of the HUP [154]).

Pre-final checkpoint-conclusion of the BIDUM: The BPI unified scalar definition (combined with the BPIF generalization of the FF concept, the mPI-gene hypothesis and the unified BPO) have the potential to integrate biology (as the science about BOs) in any (informational) BIDUM-like TOE.

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A FINAL SYNTHESIS OF BIDUM

In BIDUM I argue that the concept of (physical) information should be the central notion of any mature TOE. I also argue that physics must be translated in informational terms (as I have tried in BIDUM). I think that a truly fundamental theory in physics should consider that even the strings/branes predicted by SST and MT are nothing but circuits/flows of physical information (PI) between swarms of (pure informational) point-like processors (corresponding to software the manipulate ICs) that have a non-0 informational gradient between them (a “(quasi)absolute informational non-homogeneity”). BIDUM is also a way of unifying biological and non-biological physical information (a way of unification between physics and biology) and a way of generalizing the concept of observer (as biological observer and/or non-biological observer). In BIDUM the universe is considered most likely a software and all the contained entities (the quantum particles, the biological forms etc.) are all considered subroutines of this software. In this aspect, BIDUM is similar to MUH and also sustains the Simulation Hypothesis (SH).

As BIDUM proposed a strategy of unification between both major domains of science (physics and biology) using the digital physics view and the digital biology view, BIDUM also proposes a new interdisciplinary/transdisciplinary domain of science which I may call in different ways: Digital BioPhysics (DBP or briefly DigiBioPhysics, as the most preferred of all alternatives) or InfoBioPhysics (IBP) or Digital Physical Biology (DPB or briefly DigiPhysical Biology) or InfoPhysical Biology (IPB).

ACKNOWLEDGEMENTS

I would like to express all my sincere gratitude and appreciation to my family (always so close to me) and to all my mathematics, physics, chemistry, biology and medicine teachers for all their support and fellowship throughout the years, which provided great human models and substantial motivation for the redaction and completion of this paper.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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