A Bio-Info-Digital Universe Model (BIDUM version 1.1) based on a series of Planck-like informational constants and using the hypothetical gravitonic qubit as the basic unit of the (bio)physical information

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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 cannot not 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 version 1.1[6,7,8] **[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**) in a *unified concept of bio-physical information* (**BPI**) [**9**].

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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[1] Online preprints (DOI: 10.13140/RG.2.1.2747.9927) that can be downloaded from the following URLs: [1] univermed-cdgm.academia.edu/AndreiLucianDragoi; [2] vixra.org/author/andrei_lucian_dragoi; [3] gsjournal.net/Science-Journals-Papers/Author/1713/Andrei-Lucian,%20Dragoi; [4] researchgate.net/profile/Andrei_Lucian_Dragoi2

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[4] Walsch N.D. (2000). „Conversations with God: An Uncommon Dialogue (Book 3)" (book). Chapter 1. (URL: nytimes.com/books/first/w/walsch-god3.html) (the passages marked between „[ ]" are my own explanatory and anticipative insertions)

[5] Walsch N.D. (1999). „Conversations with God: An Uncommon Dialogue (Book 2)" (book). Chpater 6. (URL: [1] nytimes.com/books/first/w/walsch-god3.html; [2]universe-people.com/english/svetelna_knihovna/htm/en/en_kniha_conversations_with_god_2.htm)

[6] This BIDUM was also inspired by a large number hypothesis published by Teller and overlooked by the great majority of physicists (including Tipler, Barrow, Dirac and Einstein) but also Teller himself (this hypothesis was explained in BIDUM version 1.0 [published online in March 2015] and is also mentioned in the Addendum of this BIDUM version 1.1)

[7] ORDA registration number for BIDUMv1.1: **2471/24.03.2016** (URL: orda.ro/cautare_cerere.aspx?mid=1&rid=1&cerere=2471)

[8] Drăgoi A.L. (2015). "A Bio-Info-Digital Universe Model (BIDUM version 1.0) inspired by a Teller's large number hypothesis overlooked by the great majority of physicists (including Tipler, Barrow, Dirac and Einstein) but also Teller himself". BIDUMv1.0 is now considered obsolete by the author (as just a sketch with a low scientific level) and was withdrawn from the online mediums in March 2016, as replaced by BIDUMv1.1 (which also includes all the essential and significant hypothesis of BIDUMv1.0). ORDA registration number for BIDUMv1.0: **2546/26.03.2015** (URL: orda.ro/cautare_cerere.aspx?mid=1&rid=1&cerere=2546)

Part 1. A physical information (PI) quantity scalar proposal

The gauge/non-gauge "functional" dichotomy. From the standpoints of digital physics the most important classification of the elementary quantum particles (EQPs) should be considered the *gauge/non-gauge (relative) "functional" dichotomy (which is fundamentally based on the fermionic/bosonic dichotomy of QPs [**FBD**] and on the Pauli Exclusion Principle of the Fermions [**PEPF**])*. The gauge EQPs (**GPs**) are mainly energetic "messages" (carriers of energetic-quanta) and the non-gauge EQPs (**NGPs**) can be regarded mainly as processors of energetic-quanta that can receive GPs (energetic-quanta "messages") and then emit others (GPs) as (processed) "replies". It's obviously a relative classification as all the EQPs can function as both messages (when the macro-objects interchange NGPs playing the role energetic carriers) and message-processors (when 2 or more GPs may interact with each other): however, the fact that GPs are all bosons (that can all occupy the same quantum state in the same time and space) is surely not a coincidence, as GPs mainly tend to carry "messages" and not to process other GPs as "messages". As all GPs are bosons, I shall rename them more specifically as gauge-bosons (**GBs**) in the rest of this essay. It's clear that GBs are much more "adapted" than NGPs to carry multiple parallel simultaneous messages (one message per each GB) on the same channel, as they can all literally "fill" that channel by their potential to occupy the same quantum state simultaneously.

The PI quantity scalar hypothesis (H-I). Although it's not possible for PI-quantity (**PIq** or **I**) to be exactly defined/measured, in the normal observable physical world (in which the arrow of the physical classical linear time is oriented from a lower entropy to a higher entropy), when a NGP is not isolated from any other NGP/GB, it is clear that: **(1)** the (input[**in**]/output[**out**]) **PIq** transferred/extracted to/from a NGP is directly proportional (**dp**) to the time interval of measurement (**$\Delta t = t_2 - t_1$**) (as a larger time interval means a higher probability of [more] virtual and real GBs reception/emission, as each GB participates with its own intrinsic PIq to the PIq input/output to/from a NGP); **[2] PIq** is also **dp** to the energy of each emitted/received GB (**E_{GB}**) (the more energy per each GB, the more chances to change the subquantum and/or quantum state of an emitter/receiver NGP). Based on these 2 simple observational assumptions we can establish a plausible hypothetical scalar for the GB/NGP intrinsic PIq, based on a (hypothetical) simplified constant of direct proportionality $K_{PI}=1$ [9,10,11]

$$\boxed{K_{PI} = 1 (by\,hypothesis\,H-I)} \Rightarrow \boxed{I_{GB(in/out)} = K_{PI} \cdot (E_{GB(in/out)} \cdot \Delta t) = E_{GB(in/out)} \cdot \Delta t} \quad \textbf{(E-I-1.1,1.2)}$$

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[9] In this view, the intrinsic/input/output PIq of a QP may be also considered **dp** to **(3)** the area of the emission/reception surface-interface of a QP (the larger this interface area, the higher the probability to emit/receive information in a specific interval of time): as the most GBs (the gluon, the photon and the hypothetical graviton) are wavicles with no defined (internal) rays (and implicitly no defined surfaces of interface [which most NGPs have] as wavelengths are not equivalent to [internal] rays), this PIq scalar (as defined in **hypothesis H-I**) is the most generic and may apply to both GBs and NGPs classes. Additionally, the Planck constant (**h**) is measured in Joule·second (J·s) units, a fact which suggests that **h** is an (intrinsic) PIq constant that has the potential to be analogously applied to the hypothetical graviton as a specific Planck-like gravitational PIqua (**h_{eg}**), as explained later on in this paper. Additionally, PIq is obviously dp to the rest and/or kinetic mass of any input QPs. As not all QPs have rest mass, BUT all known real QPs have intrinsic energy (which makes them detectable to our measurement tools), it is more convenient to define PIq as dp to energy (and implicitly to any form of mass). Additionally, the energy scalar already contains a space dimension (as energy is the product between a force and a straight/curved distance) which makes PIq an unitary measure of force (implicitly mass), space and time alltogether.

[10] Hypothesis H-I has also another two strong arguments: (**1**) it was not possible to experimentally create/prove a gravitational shield for any physical system (**PS**) so that any apparently isolated PS is in fact bound gravitationally to the rest of the universe: a very important consequence of this fact is that any NGP or GB receives gravitational energy/information permanently (no matter if quantized or not) even if isolated by any other-non-gravity shield in a theoretical perfect vacuum (which is however utopic, as even this perfect vacuum is permeated by gravity); **(2)** any experimental measurement of energy/force/location variation (as a mark of movement/dynamics) is indissolubly related to a frame of (classical linear) time ($\Delta t = t2 - t1$) (in which the measurement was carried out) so that energy and time may be integrated/associated in a PIq scalar, which may be considered a superior more general entity (as PIq is the product of energy and time, with the same measure unit as the quantum angular momentum). As any NGP permanently receives/emits gravitational energy input/output, it is very probable that this gravitational input/output generates different subquantum energetic/momentum [micro] states (but still undistinguishable by our tools of measurement, hidden under the "mask" of the same quantum state) and has the potential to modify the probability of any (apparent) stochastic quantum process (such as particle decays, which may be in fact, at least partially, determined in a specific moment by gravitational pressure that acts even in maximal isolation concerning the other three non-gravity physical types of fundamental forces [**FFs**]).

[11] This PIq scalar definition has strong analogy with biological and digital systems, such as: to modify/delete biological/digital information, a specific energy (quantized to an inferior specific limit) and a (specific) sufficient/minimal amount of time are both needed.

The hypothetical graviton and its potential subtle subquantum action. GBs may be considered not only energetic quanta (*e-quanta [**Equa or Eq**]*) and (kinetic and/or rest) mass quanta (*m-quanta[**Mqua or Mq**]*), but also *PI-quanta (**PIqua**)* (as GBs are quantum PI carriers) that, when emitted/received by a NGP, have the potential to change the (detectable and/or undetectable) subquantum and/or quantum (informational[momentum]/energetic) states of that emitter/receiver NGP. As the individual (hypothetical) gravitons have probably very subtle subquantum manifestation (that are almost/practically impossible to be measured and distinguished individually even in the distant future of technology), *the theoretical number of all the distinguishable states* ($\mathbf{N_S}$) of an NGP[12] is a the product between $\mathbf{N_Q}$ (all the possibly *distinguishable* quantum energetic/momentum [macro]states of that NGP) and $\mathbf{N_{SQ}}$ (all the possibly *distinguishable* sub-quantum energetic/momentum [micro]states of that QP). The *total intrinsic PI quantity* of a NGP [$\mathbf{PI(N_S)}$] can be generally defined as the binary-logarithmic measure of $\mathbf{N_s}$ of that NGP (as the binary logarithm is generally used in the definition of any type of information quantity as firstly proposed by Shannon **[4]**).

$$\boxed{N_S = N_Q \times N_{SQ}} \Rightarrow \boxed{I(N_S) = \log_2(N_S) = \log_2(N_Q \times N_{SQ}) = \log_2(N_Q) + \log_2(N_{SQ})} \qquad \textbf{(E-I-2.1, 2.2)}$$

The PIq scalar is also "hidden" in the photon's energy scalar. As frequency (υ) is the inverse of the time interval (Δt) taken by a full cycle of a periodical physical process (including the full oscillation of a wave-like EQP), *υ=c/λ=1/Δt, the energy of a single photon scalar* $E_{ph}(\lambda)$ can be expressed as a function of this time interval (Δt):

$$\nu = c/\lambda = 1/\Delta t \Rightarrow \begin{bmatrix} E_{ph}(\nu) = h\nu \;\Leftrightarrow\; E_{ph}(\Delta t) = h/\Delta t \Leftrightarrow \\ \Leftrightarrow \; \boxed{h = E_{ph}(\Delta t)\cdot \Delta t \equiv PIq} \end{bmatrix} \qquad \textbf{(E-I-3.1, 3.2, 3.3, 3.4)}$$

The PIqua emission/reception process. As a generalization, all the GBs[13] can be considered PIqua (location-and-momentum [PI] packs: LMIPs or shortly **IPs** [informational packs]). All the NGPs can be considered (*generally parallel)PI-processors* (each with a specific *intrinsic PIq*) that permanently interchange IPs with each other (they emit/receive IPs *not continuously, but in a pulsated mode* describable as 0/1 time series possibly similar to the *Cantor set* **[10]**).

The qbit and the physical-bit (pit) as measure-units for PIq. The PIq (as previously defined in equations **E-I-2.2**, but also in **E-I-1.2**) can be theoretically measured in *qbits* (as any kind of sub/quantum information quantity, as only 1 bit can be extracted from the state of 1 qbit of PI) and *supports addition and subtraction as standard algebraic operations*. The *total PIq* (I_T) of an NGP is obviously related to a (classical linear) time interval ($\Delta t = t_2 - t_1$) of measurement (in a specific reference frame) and can be defined as a function of an *intrinsic (internal) PIq* (I_{int}) (as measured in Δt interval or previously), an *input (received) PIq* (I_{in}) and an *output (emitted) PIq* (I_{out}) of that NGP such as:

$$\boxed{I_T(\Delta t) = I_{int}(\Delta t) + I_{in}(\Delta t) - I_{out}(\Delta t)} \qquad \textbf{(E-I-4)}$$

As it cannot be exactly known how many qbits of intrinsic PIq are contained in any GB(IP)/NGP, a special *(physical) qbit (p-bit or shortly pit) can be defined to measure PIq*, as an integer multiple of the qbit (but with a [still] unknown/uncertain factor of multiplication):

$$\boxed{I_{[pit]} = E_{[J]}\cdot t_{[s]}} \Leftrightarrow \boxed{E_{[J]} = I_{[pit]}/t_{[s]}} \qquad \textbf{(E-I-5.1, 5.2)}$$

$$\boxed{pit = J\cdot s = k_{pit}\left(states\ per\ pit\right) = \log_2\left(k_{pit}\right) qbits} \qquad \textbf{(E-I-5.3)}$$

with $\mathbf{k_{pit}}$**=?states per pit (an adimensional integer constant with an uncertain value)**

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[12] As all the NGP interact by gravity, no matter if gravity is a quantized fundamental force (mediated by the hypothetical spin-2 graviton, as predicted by the quantum field theory [**QFT**]) or the curvature of the spacetime (as predicted by the General Relativity [**GR**]) or both (as explained by BIDUMv1.1)

[13] the (spin-1) gluon, the (spin-1) W^+/ W^-/Z bosons, the (spin-1) photon and the hypothetical (spin-2) graviton

The Planck constant as a PIq constant. The PIq conservation law. As it can be observed from equations **E-I-5.1, E-5.2** and **E-5.3**, the pit is equivalent (only by scalar value, and not necessarily by meaning) to the measure-unit of the (quantum) action and the angular momentum (Js=J·s), and that's why *the Planck constant (**h**) (which is standardly measured in Js) may be considered the electromagnetic (**EM**) PIqua of the **EM** force/ field (**EMF**) which is an essential PIqua of our universe (measurable in pits=Js)*. However, the (quantum) angular momentum conservation law becomes the ***PIq conservation law (PICL)*** of this BIDUM, with the energy-mass equivalence and conservation principles becoming just special cases of this (general) **PICL**. In the E_{ph} scalar, the relation between the PIq and energy is also obvious:

$$h \sim 6.626\times10^{-34}\, pits\,(=6.626\times10^{-34}\, Js)\,;\ \boxed{E_{ph}(\Delta t)_{[J]} = h_{[pit]} / \Delta t_{[s]}} \quad \textbf{(E-I-6.1, 6.2)}$$

The PIq-derived scalar definition of energy. As it can be observed in equations **E-I-5.2** and **E-I-6.2**, this BIDUM offers *a new (informational) hypothetical definition for energy as the PIq transfer speed (pits transferred in [unit of] a time interval [s])*:

$$\boxed{E_{[J]} = \frac{I_{[pit]}}{t_{[s]}} \Leftrightarrow J = \frac{pit}{s} = \frac{k_{pit}(states)}{s} = \frac{\log_2\left(k_{pit}\right)\cdot qbit}{s}} \quad \textbf{(E-I-7)}$$

In this view, *energy and matter are NOT fundamental as PI is, but they are just the result of measuring (in various ways) the PIq interchanged between the observer (including his measuring tools) and the physical system observed, but also the PIq transferred between the subcomponents of that system, both types of measurement being undertaken in a specific chosen time interval ($\Delta t=t_2-t_1$)*. What is perceived physically as the "energy/matter of an observed system" (and/or through measuring tools which are the observer's body extensions) is the result of the capacity of the observed system (including the spacetime [vacuum] it occupies) to transfer a specific PIq to the observer or the capacity of the observed subcomponents (of that system) to interchange a specific nof. IPs per unit of (subjective and/or objective) (classical linear) time interval time. In conclusion, *energy and matter are generated by PIqua flows of different types (as explained later on)*.

PICL is more general than the energy-mass equivalence principle. ***H-I*** *is a general principle that can also be applied to Einstein's mass-energy equivalence principle, as any energy and/or mass measurement must be related to a finite time interval* ($\Delta t=t_2-t_1$, a time frame than can tend to 0 or to infinity, but cannot effectively reach these limits). In this informational view, Einstein's equivalence principle becomes just a particular case (the case in which $\Delta t \rightarrow\infty$, when matter turns to stable radiation composed of different GBs with potential infinite mean half-lives) of the more general and profound PCL. The other extreme particular case ($\Delta t \rightarrow 0$) of hypothesis **H-I** is when $\Delta t = tP=[\hbar G/c^5]^{1/2}$ (the Planck time) as the (hypothesized) minimum possible duration of a quantum process. The PIq will be abbreviated as **I** (from "**information**") (for the simplicity of notations in the next sets of equations).

$$\boxed{I = E\cdot t} \quad \textbf{(E-I-8)}$$

$$E = mc^2 \Leftrightarrow E\cdot t = (mc^2)\cdot t \Leftrightarrow \boxed{I = (mc^2)\cdot t} \text{ or } \boxed{I_E = I_{mc^2}} \quad \textbf{(E-I-9.1, 9.2, 9.3, 9.4)}$$

The most general scalar form of PICL. The most general form of the PCL (as expressed in equation **E-I-4**) may be also applied to the info-energy-matter conservation principle (as expressed in equation **E-I-9.4**) as any QP probably emits and/or receives undetectable (hypothetical) gravitons independently to any possible additional EM radiation (and gravitons are hypothesized to generally have the same speed **c**[14] than the additional optional real/virtual photons) when it transforms into energy (which is generally and mostly EM plus

[14] c is the speed of light in vacuum [hard to detect] gravitational radiation). As gravitation cannot be shielded, it is inevitable that any form of matter emits and receives gravitons in the time interval in which it converts to energy, so that EEP scalar is not an exact mathematical equality but just a very accurate approximate equality (as the hypothetical practically undetectable gravitons may also be closed strings that may escape the 5th dimension as the Super String Theories [**SSTs**] and M-theory [**MT**] predict). In the next equations, $N_{gr(in)(out/esc)}$ is the nof. hypothetical input/output (including escaped) hypothetical gravitons in the Δt interval and E_{gr} is the average energy of these gravitons.

$$\boxed{I_T(t) = I_{int}(t) + I_{in}(t) - I_{out}(t)} \Rightarrow \boxed{I_E(t) = E \cdot t + I_{E(in)}(t) - I_{E(out)}(t)} \; and \tag{E-I-9.5}$$

$$\boxed{I_{mc^2}(t) = (mc^2 \cdot t) + I_{mc^2(in)}(t) - I_{mc^2(out)}(t)} \; and \tag{E-I-9.6}$$

$$\boxed{E \cdot t + I_{E(in)}(t) - I_{E(out)}(t) = (mc^2 \cdot t) + I_{mc^2(in)}(t) - I_{mc^2(out)}(t)} \tag{E-I-9.7}$$

$$\left.\begin{array}{l} E(\Delta t) = E + \left(N_{gr(in)(\Delta t)} - N_{gr(out/esc)(\Delta t)}\right) \cdot E_{gr} \\ mc^2(\Delta t) = mc^2 + \left(N_{gr(in)(\Delta t)} - N_{gr(out/esc)(\Delta t)}\right) \cdot E_{gr} \\ \left(N_{gr(in)(\Delta t)} - N_{gr(out)(\Delta t)}\right) \cdot E_{gr} << E \end{array}\right\} \Rightarrow \boxed{E(\Delta t) = mc^2(\Delta t)} \; AND \; \boxed{E \sim mc^2} \tag{E-I-9.8}$$

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Part 2. The informational quanta for the 4 known fundamental forces

All the classical mass/charge-related non-PIq scalars can be derived from the PIq scalar (hypothesis H-II, which is a direct consequence of H-I). We can also generalize that *all the classical non-PI physical (scalar) invariants (such as the Newtonian universal gravitational constant[**G**], the Coulomb constant [**K$_e$**], the masses/charges of the EQPs and the forces they exert etc.) that appear in the quantitative formulations of the physical laws are essentially scalar functions of different PIqua (that generate them; Planck constant [**h**] as the measure of the EM PIqua for example) and this fact may explain the products and ratios of these classical scalar invariants (energies/masses/charges) as "masking" additions and/or subtractions of PIqs measured as defined in equation E-**I-1.1** (as any product/division of two real numbers may be transformed in addition/subtraction of two exponential factors [generated logarithmically] with the same exponential base*).

$$\boxed{I(N_S)=\log_2(N_S)} \Leftrightarrow \boxed{I(N_{S1})+I(N_{S2})=\log_2(N_{S1})+\log_2(N_{S2})=\log_2(N_{S1}\cdot N_{S2})} \qquad \textbf{(E-II-1.1, 1.2)}$$

$$\boxed{2^{PI(N_{S1})+PI(N_{S2})}=2^{\log_2(N_{S1}\cdot N_{S2})}=N_{S1}\cdot N_{S2}} \equiv \boxed{E_1\cdot E_2} \equiv \boxed{m_1\cdot m_2} \equiv \boxed{q_1\cdot q_2} \text{ (logical equivalences)} \qquad \textbf{(E-II-2)}$$

In the view of **H-II**, (electrostatic/EM) Coulomb constant (**K$_e$**) may be considered an indirect measure scalar function of the photon/EM PIqua (**h$_{ph}$[=h]**). This scalar function can be expressed using the inverse of the (EM) Fine Structure Constant (**FSC**), α= 1/FSC (considering α=1/FSC a pre-designed adimensional constant, with another definition which is theoretically independent of h, as explained in later in this BIDUMv1.1)

$$\boxed{K_e=f(h)=k_C\cdot h}, with \ \boxed{k_C=\frac{c}{q_e^{\,2}(2\pi\alpha)}} \ and \ \boxed{\alpha=\frac{1}{FSC}=\frac{\hbar c}{K_e q_e^{\,2}}(\sim 137.036)} \text{[15]} \qquad \textbf{(E-II-3.1, 3.2, 3.3)}$$

Analogously, the Newtonian universal gravitational constant (**G**) may be considered an indirect measure scalar function of a hypothetical (electro)gravitational (**EGF**) Plank-like PIqua (**h$_{eg}$**) of a hypothetical electrograviton (**eg**) having a scalar exactly analogous to K$_e$ (this scalar analogy being the reason for calling this hypothetical graviton an "electrograviton"), considering $\cancel{\alpha}_G=1/\alpha_G$ a pre-designed adimensional constant, with another definition which is theoretically independent of h (as explained later in this BIDUMv1.1):

$$\boxed{G=f\left(h_{eg}\right)=k_G\cdot h_{eg}}, with \ \boxed{k_G=\frac{c}{m_e^{\,2}(2\pi\alpha)}}, \qquad \textbf{(E-II-4.1, 4.2)}$$

$$\boxed{h_{eg}=\frac{h}{K_{eg}}=\left(\sim 1.58\times 10^{-76}\ pit\right)}, with \ \boxed{K_{eg}=\cancel{\alpha}_G/\alpha\left(\sim 4.182\times 10^{42}\right)} \ and \ \text{[16]} \qquad \textbf{(E-II-4.3, 4.4)}$$

$$\boxed{\cancel{\alpha}_G=\frac{1}{\alpha_G}=\frac{\hbar c}{G m_e^{\,2}}\left(\sim 2.85\times 10^{44}\right)} \qquad \textbf{(E-II-4.5)}$$

The equation **E-II-4.1** is also a potential candidate for the hypothetical quantum ("big") G scalar which is probably a function of an gravitational Planck-like PIqua constant (h$_{eg}$). The energy scalar of a single eg with a frequency υ [**E$_{eg}$(υ)**] can be expressed in analogy with **[E$_{ph}$(υ)=hυ]=[E$_{ph}$(Δt)=h/Δt]** such as: **E$_{eg}$(υ)=h$_{eg}$υ= E$_{eg}$(Δt)=h$_{eg}$/Δt.** K$_{eg}$ (as defined in equation **E-II-4.4**) is an electrogravitational (**EG**) constant, named as such because it interconnects the two (EM and EG) PIqua (h and h$_{eg}$). k$_C$ (as defined in equation **E-II-3.2**) and k$_G$ (as defined in equation **E-II-4.2**) are 2 analogous (secondary) constants defined to simplify the expressions of K$_e$=k$_C$·h and G= k$_G$·h as functions of h and h$_{eg}$ respectively. $\cancel{\alpha}_G$ is the inverse of the reduced gravitational coupling constant (**GCC**=α_G), which is considered a pre-designed adimensional constant, with another definition which is theoretically independent of h (as explained later in BIDUMv1.1)

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[15] $\hbar=h/(2\pi)$ is the reduced Planck constant; K$_e$ is the classical Coulomb (electrostatic) constant; q$_e$ is the elementary (electric) charge; c is speed of light in vacuum

[16] m$_e$ is the rest mass of the electron; c is speed of light in vacuum

The logical equivalence between the Planck-like EGF PIqua (h_{eg}) and the qbit (hypothesis H-III). Even if k_{pit} (as defined in equation **E-I-5.3**) has an uncertain numerical value, there is a method that can roughly estimate its value based on a plausible that *the eg may carry at least 1 qbit of subquantum EG PI, as the eg is a "wavicle" with (at least) two extreme space-dependent quantum states (x-polarized and y polarized egs) and (at least) two time-dependent quantum states (a phase and an anti-phase state that can amplify or attenuate another receiver-eg that can also be in one of these two extreme quantum states when related to the incidental eg): that's why h_{eg} (also measured in pits=Js) can be(logically) associated with one qbit (logical equivalence of minimal PIqs)*. As the h_{eg} scalar can be (theoretically) measured in both pits and qbits, an approximation of k_{pit} and an estimation of h (measured in qbits, not just in pits) can be obtained (it's obvious from the next equations that pit is a huge multiple of the qbit and that a single h-based photon may theoretically carry a huge amount of EG-PIq: **prediction P-III-1**):

$$\boxed{h_{eg} \equiv 2(ExtremeSubQuantumStates) \Leftrightarrow \log_2[h_{eg}] = 1qbit} \text{ (logical equivalence)} \quad \textbf{(E-III-1)}$$

$$\boxed{h_{eg} \sim 1.6\times10^{-76}\, pits = 2(states) = 1qbit} \Rightarrow \quad \textbf{(E-III -2.1,}$$

$$\boxed{k_{pit} = \frac{2(states)}{1.6\times10^{-76}\, pits} \sim 1.25\times10^{76}(states\ per\ pit) \sim 253(qbits\ per\ pit)} \quad \textbf{2.2)}$$

$$\boxed{h_{ph} = h = K_{eg}\cdot h_{eg} = K_{eg}\cdot 2(states)\left[\sim 8.4\times10^{42}\, states \sim 143qbits\right]} \quad \textbf{(E-III-3)}$$

The rest energy/mass definition is indissolubly related to movement definition and that's why it is also (indissolubly) related to classical linear time definition (including the mean lifetime or the half-life of a QP. The generic PIq scalar (as expressed in equation **E-I-8**) can also be applied in the practical (mean) estimation of the intrinsic PIqua (at rest) [$\mathbf{I_{int(rest)}}$] of the other GBs, but also the $\mathbf{I_{int(rest)}}$ of the NGPs based on their resting energy/mass and their specific mean lifetimes (also measured as half-lives) (**hypothesis H-IV**). See **Table T-IV-1** and **Table T-IV-2.**

$$\boxed{I_{\text{int}(rest)(mean)} = E_{rest}\cdot\Delta t_{mean\_lifetime} = \left(m_{rest}\cdot c^2\right)\cdot\Delta t_{mean\_lifetime}} \quad \textbf{(E-IV-1)}$$

Table T-IV-1. The intrinsic PIqua of all the GBs (generating all the four FFs) of our universe	
The (hypothetical) electrogravitational field/force (EGF) PIqua (h_{eg})	$h_{eg} \sim 1.6\times10^{-76}\, pits \sim \left[k_{pit}\cdot\left(1.6\times10^{-76}\right)states\right] = 1qbit, with \boxed{k_{pit} \sim 253qbits/pit}$
The electromagnetic field/force (EMF) PIqua (h_{ph}=h)	$h_{ph} = h \sim 6.626\times10^{-34}\, pits \sim 8.4\times10^{42}\, states \sim 143qbits$
The weak nuclear field/force (WNF) specific PIqua at rest (h_W and h_Z)	
The intrinsic PIq at rest of a single W^+/W^- boson (**h_W**) is a function of its rest mass (**$m_W \sim 80.385\pm0.015 GeV/c^2$ [11,12]**) and its half-life (**$t_W \sim 3\cdot10^{-25}s$**)	$h_W = (m_W c^2)\cdot t_W\left[\sim 3.86\times10^{-33}\, pits \sim 4.8\times10^{43}\, states \sim 145qbits\right]$, $with \boxed{h_W / h_{ph} \sim 5.8*}$ *****as W-boson is considered a "heavy" photon, it carries almost 6 times more PIq (at rest) than a photon
The intrinsic PIq at rest of a single Z boson (**h_Z**) is also a function of its rest mass (**$m_Z \sim 91.1876\pm0.0021 GeV/c$[11,12]**) and its half-life (**$t_Z \sim 3\cdot10^{-25}s$**)	$h_Z = (m_Z c^2)\cdot t_Z\left[\sim 4.38\times10^{-33}\, pits \sim 5.6\times10^{43}\, states \sim 145qbits\right]$, $with \boxed{h_Z / h_{ph} \sim 6.6*}$ *as Z-boson is also considered a "heavy" photon, it carries almost 7 times more PIq (at rest) than a photon
The strong nuclear field/force (SNF) specific PIqua at rest (h_{gl})	
For the **SNF**, the intrinsic PIq of a single gluon (**h_{gl}**) 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* (**α_S**) which has a value close to 1 (practically ~137 times larger than FSC at rest)	$h_{gl} = \left(\alpha_S\cdot FSC\right)\cdot h_{ph} \sim FSC\cdot h_{ph}\left[\sim 4.8\times10^{-36}\, pits \sim 6\times10^{40}\, states \sim 135qbits\right]$ $with \boxed{h_{gl}/h_{ph} \sim FSC \sim 1/137*}\ and\ \boxed{h_{gl}/h_{eg} \sim 3\times10^{40}}$ *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

Table T-IV-2. **The intrinsic PIqua of the main (known) NGP of our universe**	
The intrinsic PIq at rest of a single proton (**h_p**) is as a function of its rest mass (**$m_p \sim 0.938GeV/c^2$ [13]**) and its mean lifetime (with an experimental lower bound **$t_p > 10^{31}$ years [14,15]**)	$h_p > \left[(m_p c^2)\cdot t_p \sim 4.7\times 10^{28}\, pits \sim 6\times 10^{104}\, states \sim 348 qbits \right]$, $with\ \boxed{h_p / h_{ph} > 7.2\times 10^{61}}\ and\ \boxed{h_p / h_{eg} > 3\times 10^{104}}$
The intrinsic PIq at rest of a single electron (**h_e**) is a function of its rest mass (**$m_e \sim 0.511MeV/c^2$ [16]**) and its mean lifetime (with an experimental lower bound **$t_e > 6.6 \cdot 10^{28}$ years [17]**). Electrons can be considered "hyper" photons, with $h_e > 10^{54}h$ (this h_e gives them a non-0 rest mass and some common photon-electron proprieties)	$h_e > \left[(m_e c^2)\cdot t_e \sim 1.2\times 10^{21}\, pits \sim 1.5\times 10^{97}\, states \sim 323 qbits \right]$, $with\ \boxed{h_e / h_{ph} > 1.8\times 10^{54}}\ and\ \boxed{h_e / h_{eg} > 7.5\times 10^{96}}$

Checkpoint conclusion. This BIDUM is different from other informational universe models/descriptions **[18,19,20,21]** as it offers an indirect theoretical way to measure the followings: **(1)** the intrinsic (essentially) subquantum PIq of any known QP; **(2)** all the PIqua of the four known **FFs** (including the h_{eg} PIqua 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). 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_x) because its subcomponents interchange a specific PIq (I_x) per unit of time (s), so that $I_x/s=E_x$. 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 hypothesis **H-I**) as a sine-qua-non (central/fundamental) component of any "mature" TOE to be discovered/proposed in the future. See **Table T-IV-3.**

<table>
<tr><th colspan="3"><u>Table T-IV-3</u>. Important consequences of the PIq scalar and the four PIqua of the four FFs</th></tr>
<tr><td rowspan="5">As this BIDUM treats the four FF PIqua [$h_{(ph)}$, h_{eg} , $h_{W/Z}$ and h_{gl}] as central and more important that the energy/mass quanta, 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 (as defined by E-I-1.1 and denoted as "I") using also time intervals (denoted as "t") and linear/circular lengths/distances (denoted as "d")</td><td>I(=E·t)</td><td>(pit=J·s)≡qbit</td></tr>
<tr><td>E=I/t</td><td>(J=pit/s)≡qbit/s</td></tr>
<tr><td>$P=I/t^2$</td><td>($W=pit/s^2$)≡$qbit/s^2$</td></tr>
<tr><td>F=I/(d·t)</td><td>[N=pit/(m·s)]≡qbit/(m·s)</td></tr>
<tr><td>$M=(I\cdot t)/d^2$</td><td>($kg=pit\cdot s /m^2$)≡$qbit\cdot s /m^2$</td></tr>
<tr><td>The Planck constant (h_{ph}=h) is also the (central) PIqua unit in the (natural) Planck Units System (PUS) a system which can be generalized for any other Planck-like (PIqua) constant (h_{gl}, $h_{W/Z}$ and h_{eg}) and called Planck-Like Units System (PLUS[h_x], such as PSU is the private case PLUS[h_{ph}]).</td><td colspan="2">$PLUS(h_x), with \boxed{h_x \in \left\{ h_{eg}, h_{ph}(=h), h_{W/Z}, h_{gl} \right\}},$ $with\, PUS = PLUS(h_{ph})$</td></tr>
<tr><td>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 $K_e q_e^2$, but is conventionally expressed as a function of Gm_e^2/c and h only.</td><td colspan="2">$\alpha_f(\hbar_x) = \left[K_e q_e^{\ 2} / c \right] / \hbar_x, with \boxed{\hbar_x \in \left\{ \hbar_{gl}, \hbar_{ph}(=\hbar), \hbar_{W/Z} \right\}}$ $\alpha_G = \left[G m_e^{\ 2} / c \right] / \hbar$</td></tr>
<tr><td>The Bekenstein bound (BB) [22,23,24] (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 ray 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 $k_{BB}=(2\pi)^2/\ln(2)$[17]</td><td colspan="2">$I \le \frac{2\pi ER}{\hbar c \ln(2)} \Leftrightarrow I \le \frac{\frac{(2\pi)^2}{\ln(2)} E \frac{R}{c}}{h_{ph}} \Leftrightarrow I \le \frac{k_{BB}\cdot (E\cdot \Delta t_{R,c})}{h_{ph}} \Leftrightarrow$ $\Leftrightarrow \boxed{I \le \left[\frac{k_{BB}\cdot I_{(E,\Delta t_{R,c})}}{h_{ph}} = \frac{(2\pi)^2 \cdot \log_2 (N_Q)}{h_{ph}} \right]}, I_{(E,\Delta t_{R,c})} = \ln(N_Q)$</td></tr>
<tr><td>Analogously to PLUS(h_x) generalization, BB can be also generalized for any PIqua of the four FFs, including h_{eg} which counts the total number of quantum and subquantum [micro]states $N_s=N_Q \times N_{SQ}$ (as the emission/reception of egs may generate all the possible subquantum energetic/momentum [micro]states [N_{SQ}] that can be "hidden" in a single quantum state of a QP).</td><td colspan="2">$\boxed{I(E,\Delta t_{c,R}, h_x) \le \frac{k_{BB}\cdot I_{(E,\Delta t_{c,R})}}{h_x}},$ $with \boxed{h_x \in \left\{ h_{eg}, h_{ph}(=h), h_{W/Z}, h_{gl} \right\}}$</td></tr>
<tr><td>h can be considered a fundamental cutoff for which any QP with intrinsic PIqua > 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 PIqua ≤ h will have 0-rest mass (the photons, the gluons, and the hypothetical egs). By this h-cutoff, EMF (with its specific h PIqua) is profoundly related in fact to the triad of indissolubly related concepts: rest mass, classical linear time and gravity. If the intrinsic PIqua of all QP are pre-considered finite, an important consequence is that all QPs will finally decay (by finite lifetimes).</td><td colspan="2">$\boxed{m_x \cdot t_x \le \frac{h}{c^2}}\ for\ photons, gluons\ and\ egs$ $\boxed{m_x \cdot t_x > \frac{h}{c^2}}\ for\ W/Z\ bosons, Higgs\ boson,$ $neutrinos, leptons\ and\ quarks$</td></tr>
</table>

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[17] ln(2) comes from measuring N_Q using binary logarithm such as **$\log_2(N_Q)=\ln(N_Q)/\ln(2)=I/\ln(2)$**; $(2\pi)^2R$ 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 $R_{maj}=R_{min}=R$, with **$C_1=2\pi R$, $C_2=2\pi C_1=(2\pi)^2R=A_{torus}/R$, as $A_{torus}=(2\pi)^2R_{maj}R_{min}=(2\pi)^2R^2$**

Part 3. The global PI quanta of the white universe and its relation with the four known fundamental forces

The PIq scalar is a powerful theoretical tool that can also be applied at global scales (H-V). The PIq scalar can be used to calculate the main global PIqs of the (directly observable) "white" (finite) part of the universe (**WU**[18]). See **Tables T-V-1A/1B.**

Table T-V-1A. The main global PIqs of the WU (part A)	
The (apparently[19]) at rest energy of the WU (**E_{arWU}**) can be estimated using the recent measurements of the total (apparent rest) mass of WU (**M_{arWU}**) **[25]**	$\boxed{M_{arWU} \sim 1.45\times10^{53}kg} \Rightarrow \boxed{E_{arWU} = M_{arWU}c^2 \sim 1.3\times10^{70}J}$
Based on **M_{arWU}** one may calculate an (Eddington's-number-like) hypothetical (maximum) number of proton-electron pairs (**pep**) (noted as **N_P**) that may (theoretically) compose/generate integrally **M_{arWU}** (including neutrons, as they can be considered compact forms of peps[20]).Each pep may be considered a spacetime atom (**STA**) as it includes not only matter and energy (the energetically charged pep) but also the spacetime the rest and dynamic pep may occupy (the BIDUM definition of pep/STA).	$\boxed{m_{pep} = m_p + m_e} \Rightarrow$ $\Rightarrow \boxed{N_P \sim M_{arWU} / m_{pep} \sim 8.7\times10^{79}(peps)}$
By considering a (hypothetical) mean lifetime of the (apparently rest) WU (**t_{arWU}**) larger than the lower bound of the mean lifetime of the proton (t_p) **[14,15]** (**t_{arWU}** > t_p no matter if WU is cyclic or not), one can estimate the (apparently at rest) intrinsic PIq of the WU (as a hypothetical inequality) based on **E_{arWU}**	$t_{arWU} > \left[t_p > 10^{31}\,years\right] \Rightarrow$ $\left[I_{arWU} = E_{arWU}\cdot t_{arWU}\right] > \left[\sim 614qbits\right]$
The (global expansion/inflation) apparent kinetic energy of WU (**E_{akWU}**) (which is mainly due to gravity as EM radiation only had a significant contribution to the global inflation only when the WU was [very] young) is estimated at ~3/10(0.3) of the (apparent) rest energy of the WU (**E_{arWU}**) **[26]** and indicates an average overall speed of **v_{aWU}~$(E_{arWU}/M_{arWU})^{1/2}$~0.5c**	$E_{akWU} = 0.3E_{arWU} \sim 3.9\times10^{69}J$ $v_{aWU} \sim \sqrt{E_{arWU}/M_{arWU}} \sim 1.6\times10^8 m/s \sim 0.5c$
If the mean lifetime of the apparent (kinetic) WU (**t_{akWU}**) is (hypothetically) considered equal to the mean lifetime of the (apparent rest) WU (t_{akWU}) (no matter if WU is cyclic or not), one can estimate the apparent kinetic (global) PIq of WU (I_{akWU}) using the PIq scalar (presented in equation **E-I-8**)	$\boxed{t_{akWU} = t_{arWU} = t_{WU}} > \left[t_p > 10^{31}\,years\right] \Rightarrow$ $\Rightarrow I_{akWU} = \left[E_{akWU}\cdot t_{WU}\right] > \left[\sim 612qbits\right]$
The total (global) energy of WU (**E_{tWU}**) can be estimated as the sum of the (apparent) resting energy of the WU (**E_{arWU}**) and the (apparent) kinetic energy of the WU (**E_{akWU}**). The total (global) PIq of the WU (**I_{tWU}**) can be estimated as the sum of the (apparent) resting and kinetic PIqs of the WU (I_{arWU} and I_{akWU}).	$\boxed{E_{tWU} = E_{arWU} + E_{akWU}} \Rightarrow \left[I_{tWU} = E_{tWU}\cdot t_{WU}\right]$ $\Rightarrow \boxed{\left[I_{tWU} = I_{arWU} + I_{akWU}\right] > \left[\sim 614qbits\right]}$
I have called the rest and kinetic mass/energy/PIq of the WU (just) "apparent" ($[M/E/I]_{arWU}$ and $[E/I]_{akWU}$) because it is proven that the sum of the rest masses of the three protonic (up/down) quarks **m_{pq}(=2m_{qu}+m_{qd})** is only ~1.002% of the total proton (nucleon) rest mass and ϕ=**m_{pq}**/m_{pep}~1.001%. In conclusion, the real (global) rest PIq of the WU (**I_{rWU}**) is in fact only the real (global) rest PIqs of all the up/down quarks and electrons from the WU (**I_{qeWU}**) (which is only ϕ~1.001% of **I_{arWU}**) AND (1-ϕ)~98.999% of I_{arWU} is in fact (also) kinetic/dynamic PIq generated by the kinetic energy of the all the gluons of the WU (**I_{glWU}**) (as gluons may also be considered white/WU radiation) [21].In this context, the real kinetic (global) PIq of the WU (**I_{kWU}**) is in fact I_{kWU}(= I_{tWU} - I_{rWU}) ~ 99.23% of I_{tWU}, which is significantly larger than I_{akWU} (~23.1% of I_{tWU}).	$\boxed{m_{pq}/m_p \sim 1.002\%} \Rightarrow \boxed{\Phi = m_{pq}/m_{pep} \sim 1.001\%}$ $\boxed{I_{qeWU} = N_P\left[\left(m_{pq}c^2\cdot t_{WU}\right) + h_e\right]}$ $\left(I_{rWU} = I_{qeWU}\right) \sim (0.77\%)I_{tWU} > \left[\sim 607qbits\right]$ $\boxed{I_{glWU} = I_{arWU} - I_{rWU} = (1-\Phi)\cdot I_{arWU} \Leftrightarrow \Leftrightarrow I_{glWU} \sim (76.153\%)I_{tWU} > \left[\sim 614qbits\right]}$ $\boxed{I_{kWU} = I_{tWU} - I_{rWU} \sim (99.23\%)I_{tWU} \sim 614qbits}$

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[18] the White (part of the) Universe (**WU)** is conventionally defined as all the (finite) matter and (finite) energy/radiation that can be measured directly with the recent specific tools (obviously, WU is defined considering the dark/matter-energy hypothesis, as complementary to this "dark" (part of the) universe [**DU**]

[19] the standard estimation of the WU rest mass (**M_{arWU}**) is just "apparently" a rest mass, as it is generated by the sum of the rest masses of all the nucleons of all the atoms, which are quark-based and have ~99% of their masses determined by the kinetic energy of the gluons: in conclusion, **M_{arWU} is in fact a kinetic mass generated by the sum of the kinetic energies of all the gluons of the WU**

[20] each pep is in fact a tetrad of four EQPs: 3 up/down quarks and an electron [the lightest lepton] interconnected by all the four FFs; additionally, it is obvious that the protons outnumber the neutrons by far, as the stars [which have the hydrogen atoms as the major constituents] are the main contributors to **M_{arWU}**

[21] the sum of the rest masses/PIqs of all the gluons and photons in the WU is theoretically 0 AND the kinetic energies/PIqs of all the electrons and all the up/down quarks in the WU are also negligible when compared to I_{tWU} and that is why they are not considered here

<u>Table T-V-1B</u>. The main global PIqs of the WU (part B)	
I_{kWU} and can be analyzed as the sum between: (**1**) I_{glWU}; (**2**) the sum of the kinetic PIqs of all the hypothetical egs from the WU (**I_{egWU}**); (**3**) the sum of the (kinetic) PIqs of all the photons from the WU (**I_{phWU}**);(**4**) the (hybrid) sum between rest and kinetic PIqs of all the W/Z ever emitted/received in the WU (**I_{wzWU}**). Based on I_{glWU} and h_{gl}, the total nof. real gluons in the WU (N_{glWU}) can also be estimated.	$\boxed{I_{kWU} = \left[I_{glWU} + I_{phWU} + I_{egWU}\right]} \pm I_{wzWU}$ $I_{glWU} \sim (76.8\%) I_{kWU}$ $N_{glWU} = I_{glWU} / h_{gl} > \left[\sim 8.42 \times 10^{143}\, gluons\, in\, the WU\right]$
I_{egWU} is in fact ~ I_{akWU}, as I_{akWU} is mainly due to gravity in the majority of the epochs that followed the [hypothetical] Big Bang and gravity is mediated by [hypothetical] egs although generated by the baryonic mass [which mass is generated by the kinetic mass of all the gluons from the WU]). Based on I_{egWU} and h_{eg}, the total nof. real (hypothetical) egs in the WU (N_{egWU}) can also be estimated.	$\boxed{I_{egWU} \sim I_{akWU} \sim (23.1\%) I_{kWU} \sim (23.3\%) I_{tWU}}$ $I_{egWU} > \left[\sim 612 qbits\right]$ $N_{egWU} = I_{egWU} / h_{eg} > \left[\sim 7.8 \times 10^{183}\, egs\, in\, the WU\right]$
The total nof. real photons in the WU (N_{phWU}) can be approximated from the baryons-to-photons ratio in the present WU, which is constrained relatively tightly as η ~ (5.7 - 6.7) x 10^{-10} baryons/photon given the primordial abundance of ^{7}Li inferred from the latest observations **[27].** Based on N_{phWU} and h_{ph}(=h), **I_{phWU}** can also be estimated.	$N_{phWU} = \left(\eta^{-1} N_P\right) \sim 1.4 \times 10^{89}\, photons\, in\, the WU$ $\boxed{I_{phWU} \sim N_{phWU} \cdot h_{ph} \sim (1.8 \times 10^{-53}) I_{kWU} \sim (1.79 \times 10^{-53}) I_{tWU}}$ $I_{phWU} > \left[\sim 439 qbits\right]$
I_{wzWU} is a special case that cannot be determined exactly, because it depends on the frequency of the beta-decay (number of beta-decays per nucleon and per unit of time) in the WU, which is not known exactly, as it depends on the unknown frequency of the beta-radioactive isotopes in the WU. However, even if the W/Z bosons have an intrinsic PIq with about one order of magnitude larger than the photon ($h_{W/Z}$~7·h_{ph}), it's obvious that beta-decay frequency is many orders of magnitudes smaller than the photon emission frequency (so that the nof. W/Z bosons [N_{wzWU}] in the WU is much lower than the nof. of photons in the same WU) and that is why **I_{kwzWU}** is very probably much (with many orders of magnitude) smaller than **I_{phWU}**	$\boxed{I_{wzWU} \sim^{?} \left(I_{tWU} - I_{qeWU}\right) - \left(I_{glWU} + I_{phWU} + I_{egWU}\right)}$ $\boxed{N_{wzWU} << N_{phWU} <<^{?} 1.4 \times 10^{89}\, WZ\, bosons\, in\, the WU}$ $\boxed{I_{wzWU} << I_{phWU} <<^{?} 439 qbits}$

The real (not virtual) WU may be represented as a phase space using a 3D graph with: (**1**) NGPs-nodes (mainly the protonic [real] up/down quarks triad and the electron which emit and receive real GBs generating the four FFs) and (**2**) GBs-flows internodes organized in four (real) web-like layers (one layer per each FF). See **Table T-V-2.**

<u>Table T-V-2</u>. The four layers of (webs of) internodes corresponding to the four FFs	
The nof. up/down quark-nodes (N_q) is 3 times the nof. peps (N_P). The nof. electron-nodes (N_e) is equal to N_P. The total nof. nodes is the sum between N_q and N_e	$\boxed{N_q = 3N_P \sim 2.86 \times 10^{80} (up / down\, quarks)}$ $\boxed{N_e = N_P \sim 8.7 \times 10^{79} (electrons)}$ $\boxed{N_{qe} = N_q + N_e = 4N_P \sim 3.5 \times 10^{80} (NGP - nodes)}$
The basic EGF (real) web has a nof. NI_{EGF} internodes (populated by real egs interconnecting all the N_{qe} nodes by each-to-all type of connection so that NI_{EGF}=N_{qe}^2). Using I_{egWU} and NI_{EGF}, one can also calculate a flow of a maximum nof. real egs interchanged per EGF-internode and per unit of time (second) of t_{WU} (F_{egWU}). (this is an apparent asymptotic maximum nof. egs, as many egs may be emitted in empty space without being ever received in the t_{WU} interval: on the other hand N_{egWU} is defined by an inequality to a minimum as I_{tWU} is also defined by a inequality to a minimum, and that why the minimum/maximum is aspect uncertain)	$\boxed{NI_{EGF} \sim N_{qe}^{\ 2} \sim 1.2 \times 10^{161} (EGF - internodes)}$ $\boxed{F_{egWU} = \left(N_{egWU} / NI_{EGF}\right) / t_{WU}(s) >^{?} (\sim 2.1 \times 10^{-16})^{*}}$ (* the maximum/minimum(?) nof. [hypothetical] real egs interchanged per EGF-internode and per second in the t_{WU} interval)
The superimposed layer of EMF (formed by a web of NI_{EMF} internodes populated by real photons interconnecting all the N_{qe} nodes by each-to-all type of connection so that NI_{EMF}=N_{qe}^2). Using I_{phWU} and NI_{EMF}, one can also calculate a flow of a maximum nof. real photons interchanged	$\boxed{NI_{EMF} \sim N_{qe}^{\ 2} \sim 1.2 \times 10^{161} (EMF - internodes)}$

per EMF-internode and per unit of time (second) of t_{WU} (F_{phWU}). (this is an apparent asymptotic maximum nof. photons, as many photons may be emitted in empty space without being ever received in the t_{WU} interval: on the other hand N_{phWU} is defined by an inequality to a minimum as I_{tWU} is also defined by a inequality to a minimum, and that's why the minimum/maximum aspect is uncertain)	$\boxed{F_{phWU}=\left(N_{phWU}/NI_{EMF}\right)/t_{WU}(s)>^{?}\left(\sim 3.8\times 10^{-111}\right)*}$ (* the maximum/minimum(?) nof. real photons interchanged per EMF-internode and per second in the t_{WU} interval)
The superimposed layer of EWF (formed by a web of WNF internodes populated by real and virtual W/Z bosons interconnecting theoretically all the N_{qe} nodes [as electrons have 3 common FFs with quarks in which they engage: EWF, EMF and EGF] by each-to-all type of connection so that $NI_{WNF}=N_{qe}^2$). Using I_{wzWU} and $NI_{WNF,}$ one can also calculate a flow of a maximum nof. real W/Z bosons interchanged per WNF-internode and per unit of time (second) of t_{WU} (F_{wzWU}). (this is an apparent asymptotic maximum nof. W/Z bosons, as many W/Z bosons may be emitted in empty space without some of their daughter-particles (generated by the decay of the W/Z bosons) being ever received in the t_{WU} interval: on the other hand N_{wzWU}(<<N_{phWU}) is defined by an inequality to a maximum as I_{tWU} is also defined by a inequality to a minimum, and that's why the minimum/maximum aspect is uncertain)	$\boxed{NI_{WNF}\sim N_{qe}^{2}\sim 1.2\times 10^{161}(WNF-internodes)}$ $\boxed{F_{wzWU}=\left(N_{wzWU}/NI_{WNF}\right)/t_{WU}(s)<<^{?}\left(\sim 3.8\times 10^{-111}\right)*}$ (* the maximum/minimum(?) nof. real W/Z bosons interchanged per WNF-internode and per second in the t_{WU} interval)
The superimposed layer of SNF (formed by a web of SNF-internodes populated by real gluons interconnecting only the N_q nodes in groups of three represented by the up/down quark triads [as not the electrons, but only the quarks couple with the SNF and most of WU is organized in stars composed mostly by simple hydrogen and ^{4}He atoms] so that NI_{SNF}~N_q). Using I_{glWU} and $NI_{SNF,}$ one can also calculate a flow of a maximum nof. real gluons interchanged per SNF-internode and per unit of time (second) of t_{WU} (F_{glWU}). (this is an apparent asymptotic maximum nof. gluons, as some gluons may be emitted in empty space without being ever received in the t_{WU} interval: on the other hand N_{glWU} is defined by an inequality to a minimum as I_{tWU} is also defined by a inequality to a minimum, and that's why the minimum/maximum aspect is uncertain)	$\boxed{NI_{SNF}\sim N_{q}\sim 2.86\times 10^{80}(SNF\ internodes)}$ $\boxed{\left(N_{glWU}/NI_{SNF}\right)/t_{WU}(s)>^{?}\left(\sim 1\times 10^{25}\right)*}$ (* the maximum/minimum(?) nof. real gluons interchanged per SNF-internode and per second in the t_{WU} interval)
Interestingly, the ratio between the flow of real gluons (per SNF-internode and per unit of time) (F_{glWU}) and the flow of real (hypothetical) egs (per EGF-internode and per unit of time) (F_{egWU}) predicts quite accurately the ratio between the electrostatic force of attraction between a protons and an electron located at a distance d>>proton diameter>>electron diameter and the gravitational force of attraction between the same protons and electron in the same pep (**prediction P-V**). The F_{glWU}/ F_{egWU} ratio is a function of three other ratios: I_{glWU}/I_{egWU}, h_{gl}/h_{eg} and NI_{SNF}/NI_{EGF}.	$\boxed{F_{glWU}/F_{egWU}\sim 5\times 10^{40}}$ *and* $\boxed{\left(K_eQ_e^{2}\right)/\left(Gm_pm_e\right)\sim 2.3\times 10^{39}}$ $I_{glWU}/I_{egWU}\sim 3.3$ $h_{gl}/h_{eg}\sim 5.7\times 10^{44}$ $NI_{SNF}/NI_{EGF}\sim 3/(4N_{qe})\sim 2.1\times 10^{-81}$

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Part 4. The PI-gene hypothesis

The PI-gene hypothesis. On the qualitative (not just quantitative) aspect of PI, it's very plausible that I_{tWU} 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), mPI(1) describes and even may process blocks of mPI(0) (as it mai contain algorithms similar to a subroutine), mPI(2) may integrate all mPI(1) in super-subroutines and so on. However, this BIDUM predicts that the maximum n (n_{max}) may be a finite natural number (as based on a global possible finite I_{tWU}), 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**) **[28]** and may explain why all the 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 fundamental particle. As it can be observed, this BIDUM describes I_{tWU} 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*[,29]: 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" ($N_e=N_P$) 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 PIqua $i_e=h_e=E_e\cdot t_{e(1/2)}=(m_ec^2)\cdot t_{e(1/2)}$., but they may differ by their 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: analogous to an explosion process in which the amount of energy released in that explosion isn't necessary higher than the standard energetic processes, but it is released in a much smaller time interval [at much higher speeds] which indicates a much higher PIq, as PIq is the energy-transfer speed).

The EQP-microchip/microprocessor hypothesis. Each EQP may be a quantum microchip (with both a software/code and a hardware, a form of micro/sub-universe of the WU 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**[30,31,32]**, 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 splitted in two sub-PIqua (a software PIqua [**sPIq**] and a hardware-PIqua [**hPIq]** similar to a gene being splitted in introns and exons which is also a genetic PI-dichotomy, 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 PIqua four-steps replication-dichotomization-materialization-particulation hypothesis. The process of materialization of a PIqua 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 mPI-gene into a PIqua, in which the intrinsic PIq contained in that mPI-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 PIqua dichotomization in which the primary ("mother") PIqua splits in two secondary ("daughter") PIqua (sPIq and hPIq) (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 hPIq (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 PIqua) 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_{tWU} may be considered a "hard-disk" (a read-only-memory [ROM]: a phase space **[33]** 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-quanta (limited superiorly by the Planck frequency υ_P). The speed of light in vacuum (c) helps defining the Planck (maximum possible) frequency ($\upsilon_P=c/l_P$) of local retrieval of a specific PIqua from the global PIqua (I_{tWU}).

The materialization (wave function collapse) and the classical linear time may be mind-constructs. The process of materialization of a specific PIqua (i-quanta) 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 mPI-gene/PIqua 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**[34]** 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 the linear classical time as a mind construct) is that the conscious part of human consciousness (**CP-HC**) 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 unconscious part of human consciousness (**UCP-HC**), 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 CP-HC but also the products of human creativity (which is mainly controlled by UCP-HC). The same i-quanta can decompose in a spectrum of all the possible variants of Equa(E_q) and 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_q,$t_{1/2}$) possible combination (see next points): that's why the question "Does the Universe Exist if We're Not Looking?"**[6]** (the participatory universe hypothesis) may be legitimate**[35,36]** as the most recent experiments**[37]** confirm (legitimate in the energetic sense, not in the PI sense, as the PIqua 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-quanta in different global Equa depending and indissolubly related to a specific (classical linear) time interval ($\Delta t=t_2-t_1$) of measurement (i-quanta collapse into a spectrum of different [E_q,$t_{1/2}$] combinations): this may to explain the wave function collapse. The act of measuring a targeted global i-quanta of a physical system may also be considered a way (applied by the CP-HC) of analyzing a possibly (fully spatial) 4D entity by splitting it in a global (spatial) 3D Equa and a frame of classical linear time quanta (t-quanta Δt): this process may be considered a conventional method of measuring the 4^{th} 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 **[6]**. See **Table T-VI**-I for the aspect description of the different types of PIqua materialization.

Table T-VI-1. The description of the aspects and different types of PIqua materialization	
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 WU may create).	$if\ (I = E_q \cdot t) = constant \Rightarrow \begin{cases} if\ E_q \to \infty \Rightarrow t \to 0 \\ OR\left(if\ E_q \to 0 \Rightarrow t \to \infty\right) \end{cases}$
The pre-Big-Bang global PI hypothesis (H-VI-6). The initial (pre-Big Bang) global i-quanta (I_{tWU}) can be considered the quantum superposition of all the possible (E_{tWU},t_{WU}) combinations: that is why, in a hypothetical cyclic WU, each cycle of (global) i-quanta (I_{tWU}) universal inflation-deflation can bring another very different (E_{tWU}, t_{WU}) combination.	
The vacuum as a PI-source hypothesis (H-VI-7). 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 virtual GBs that produce the four FFs (as the Quantum Field Theory [**QFT**] predicts). Vacuum also "cooperates" with the observer to co-generate the presence of a QP in a specific spatial location when that QP is observed/measured by the HC (and its tools), in a specific (classical) linear time interval.	

Virtual QP is un-materialized PIqua and real QP is materialized PIqua (hypothesis). In BIDUM virtual QPs (that generate/ mediate the four FFs) are considered pure un-materialized PIqua and real QPs are considered materialized PIqua existing as (Eq,$t_{1/2}$) 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 PICL 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 QP 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 **PICL**. 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 probably emit virtual egs and virtual egs (in pulsated modes) without changing their EM/EG energetic-level (the virtual photons and egs 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 sustains the sub-hypothesis that the virtual QPs (un-materialized PIqua) 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 Phenomena (**QEP**) (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 **[38,39]**). 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 (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 (**oSS**) 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”**[40]**.

Synchronicity versus causality (causality which may be an illusion generated by a mind construct: the classical linear time) hypothesis. It is very possible that all QPs to be in fact (3+1)D entities in which the 4^{th} dimension to contain the software (associated with a PIqua) and the 3D space to contain the $(E_q,t_{1/2})$ pair): this 4^{th} dimension may be populated with different types of faster-than-light travelling QPs (including the hypothetical gravitons, that are predicted by SSTs to escape the 3^{rd} and 4^{th} dimensions) which are essentially PIqua that may travel in the 4^{th} dimension interconnecting different QPs at very long distances (by **QEP**): in this way *synchronicity (generated by the hidden phenomena of the 4^{th} 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 (generally a GB) is absorbed by another QP, the integration process may be very complex and similar to a software patching in which the received GB is integrated more like a subroutine in the software of the receiver QP. Similarly, when an EQP (generally a GB) is emitted by another QP, 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).

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Part 5. 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 (**BLF**), 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 PIqua from/to the entire (external) WU 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])**[41]** (**definition D-BO**). Dawkins' meme theory (in which a meme is essentially a biological/physical information 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 SP; SP can be considered an extended BOB [**eBOB**]; all our biosphere (**BS**)/planet can be considered an extended phenotype, as Dawkins R. first defined it **[42]**): 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 pe considered a pure un-materialized mPI-subsystem of a BO that can manipulate BOB. BOB can be considered a materialized mPI-subsystem that can also send PIqua 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 **[43,44,45]** is an additional strong argument that BOs are essentially informational entities (PI-processor) that manage their lifetimes by a form of BI conservation law (**BICL**) analogous to the **PICL**, 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). In the active part of their life-cycle (t_{lc}), 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) **[46,47,48,49,50,51]**, 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.

BI and PI can both can both be digitized and measured in bits/qbits (H-VII-1). 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 PIqs 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): that's why I have chosen the "digital" label for the BIDUM class (as digits can be used to describe all the WU, including the BO). BO can be regarded as composed of software-BI (**sBI**) (with its own intrinsic BIq [**BI_s**]) and hardware-BI (**hBI**: sub cellular and supra cellular structures, all based on DNA, RNA, proteins etc.) also containing its own intrinsic BIq (**BI_h**): the total intrinisic BIq of a BO (**BI_t=BI_s+BI_h**) tends to self-conserve, self-replicate and adapt (by evolution and/or involution of its intrinsic BI_t) with a (generally) finite life-cycle (**lc**) (measured also [but not only] by t_{lc}), but potentially infinite nof. iterations of that **lc** (each **lc** measured also [but not only] by t_{lc}). 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($n>n_x$)-genes and PIqua are produced by low index mPI($n<n_x$)-genes. As the index

n takes progressively higher positive integer values, one cannot tell exactly the value of n_x: however, there probably exists a transition open interval (n_x,n_y) in which mPI(n_x<n<n_y) genes generates PI/BIqua that have transient proprieties between non-life forms and life-forms (viruses are probably produced by this kind of transient index mPI-genes)

The BO-materialization process hypothesis based on the BO-PO structural analogy (H-VII-2). QPs have a dual (but monad-like unitary) wave-particle (wavicle character) with both an intrinsic rest PIqua (rPIqua) and an intrinsic kinetic PIqua (kPIqua): BOs also have a dual (but monad-like unitary) character as being composed of both software (s-BI or BI_s, which may be considered a kind of intelligent "wave function" of that BO) and hardware (h-BI or BI_h, which may be considered the non-wave/particle function of that BO). This similarity may be explained by the hypothesis that BIqua may have the same four steps materialization process that a PIqua 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 the human mind/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 BOB-Equa-subcomponents, each with its specific mean lifetime (classical linear time measured as t_{lc}, which is controlled by sBIqua) but also a global $\mathbf{t_{lc}}$ for all the subcomponents of a BOB; (4) the "particulation" process in which that specific **Equa** (produced from that PIqua) 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 (H-VII-3). The PI concept (along with its scalar) has also 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 the BOB has additional layers of PIqua flows between its subcomponent QPs (as all QP that compose a BOB have just four layers of PIFINs, a 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) I_{tWU} 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 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 very 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 FPF that act in a BO can also be considered (basic) BIFs, as all the four PIqua 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 t_{WU} as described by the **Fine-tuned universe theories** (**FTUTs**) including the **Anthropic (Cosmological) Principle** (**ACP**) [**52**,**53**].

BO representation as a BPIF graph. Analogously to I_{tWU}, the BO can also be simulated as (>)4D 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 (H-VII-4). 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 5^{th}, the 6^{th} 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 BOBs. This (hypothetical) microscopic **SQG** has the potential to change the "warm-wet and noisy" paradigm (possible prejudice) **[54]** 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 BOB understanding.

The consciousness-intelligence equivalence hypothesis (H-VII-5). This BIDUM generalizes the definition of consciousness as synonymous to cosmic intrinsic intelligence (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 **[55,56],** in which HC is considered to derive from a "proto-conscious" quantum structure of reality. All the eleven FPF will be named BPI forces/fields (**BPIFs**): four **FPFs** and seven **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 BOB). 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 **BS** that is extended at a scale of $\sim10^7$ 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 BI 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 $\sim10^{13}$m (~the equatorial diameter of our Solar System) in the distant future.

All the eleven BPIFs started from the Big-Bang, NOT only the FPFs (H-VII-6). As BOBs very probably wouldn't have formed and survived without stars (as the stars are the main SNF-sources that generate EMF PIqua/Equa used by the BOs and large stars are also the only source of large atoms heavier that the iron atom, which are vital microelements for the BOBs), 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 WU 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 WU in all the past subinterval of the t_{WU} (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 (H-VII-7). It is generally considered that BOBs non-0 probability of existence strongly depends on some narrow intervals of FSC(~1/137) and beta constants values ($\beta_p=m_e/m_p\sim1/1836$ and $\beta_n=m_e/m_n\sim1/1838$) **[52]** 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** and the **PEPF** (which also both play crucial roles in the existence of the BOs and their subcomponent chemical structures) **[52]**. 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 eleven BPIFs (together with the FSC, beta-constants, the **FBD**, the **PEPF** and the **PICL)** to be encoded in the pre-Big Bang vacuum which was and is a source of PI (**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 WU 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 BIqua), 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 BIqua 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 PI-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 (H-VIII). The intrinsic BIq of a dead BOB (I_{BOB}) can be defined in a similar/analogous way to the PIq scalar (as defined by H-I), using the total relativistic energy stored in a BOB (E_{BOB}) (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 [t_d]) 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 DNA may last] as this later decompositions are mainly dominated by the four FPFs not the other seven BIFs, except when a BOB is degraded/digested by other alive BOs), such as:

$$\boxed{I_{BOB} = E_{BOB} \cdot t_d = \left(M_{BOB}c^2\right) \cdot t_d} \qquad \textbf{E-VIII-1}$$

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

$$\boxed{I_{BO} = I_{BOB} + I_{BOM}} \qquad \textbf{E-VIII-2}$$

The impact of the I_{BOM} to the I_{BOB} is to increase the time of survival of that BOB, generating a life-cycle time interval (t_{lc}) generally larger (except for the occasional suicides of BOs) than the time of decomposition of a dead BOB (t_d) such as:

$$\boxed{t_{lc} = I_{BO} / \left(M_{BOB}c^2\right) = t_d + I_{BOM} / E_{BOB}} \qquad \textbf{E-VIII-3}$$

Even if BOM induces the programmed death of its own BOB (as apoptosis or suicide), t_{lc} will always be larger than t_d, as I_{BOM}, E_{BOB} (and implicitly their ratio) are always positive by definition (which implies that a life-cycle of a BOB also includes t_d additionally to its well defined born-to-death life span [t_{ls}]), so that:

$$\boxed{\left[t_{ls} = \left(I_{BOM} / E_{BOB}\right)\right] > 0} \Rightarrow \boxed{\left(t_{lc} = t_d + t_{ls}\right) > t_d} \qquad \textbf{E-VIII-4.1, 4.2}$$

The three maim 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_x)-gene and uses all its subcomponents (that are copies of mPI($n<n_x$) 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 WU environment (the so-called anabolism macro-process). aBOM mechanisms may use all the eleven BFIFs 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_{ls} 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 WU environment (the so-called catabolism macro-process). cBOM mechanisms may use all the eleven BFIFs 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_{ls} 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_{lc}): 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 PIqua by copying them and internalizing or externalizing them form/to the environmental WU: that is why mBOM mainly controls the central nervous system and the sensorial organs that extracts important (for survival) PIqua from the environmental WU BUT also emits important (for survival) PIqua to the environmental WU (in its EP).

$$\boxed{I_{BOM} = I_{mBOM} + I_{aBOM} + I_{cBOM}} \qquad \textbf{E-VIII-5}$$

BIDUM also offer a global unified explanation for the process of BOB-aging. The process of BO-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 BOM 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 H-IX). In this BIDUM, the act of observing is defined as the capacity of a BI/PI-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-WU, **(2)** analyze those PI/BIqua (by comparing it with its (other) intrinsic BI/PIqua 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/PIqua. 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 – WU 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 t_{WU} and on a finite but sufficiently large nof. planets (spread in the entire WU) as a global WU biosphere, then a significant degree of superposition between the global PIqua ($\mathbf{I_{tWU}}$) and the global BIqua ($\mathbf{B_{tWU}}$) can be considered: the proved fact (by ^{14}C composition studies) that biosphere is $\sim 4 \cdot 10^9$ years old, imposes the idea that our biosphere has a life span of at least $\sim 1/3 t_{WU}$ which is a significant part of the t_{WU} 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 WU, can take decisions and also emit signals to all the WU, the entire WU can be considered the potential EP of our BS.

The holographic character of the intrinsic BIq of a BOB. 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 BIq (each type of cell with its own pattern of gene-expression). Interestingly, each genome (global BIqua copy) is also composed by a nof. M 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 WU 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 **[57]**).

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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Part 6. Addendum of PI-related aspects (explanations and predictions) and (possible apparent) coincedences discovered by the author of this paper

In this part I have chosen to list and comment a couple of physical aspects (implied by the previous parts of this paper) and some numerical (possibly apparent) coincidences and that I have discovered in the last decade that are stated as hypotheses, as they may have further implications in the (BPI-based) understanding of the universe and shall be integrated in the next versions of BIDUM that will be published in the future.

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FSC and the GCC can be interpreted as the ratios of two PIqua, but also as PIqua per se

Using the PIq scalar definition (H-I), FSC can be viewed as the ratio of two PIqs: the electrostatic PIq of a two elementary charges system (proton/positron/electron etc. localized at any distance λ to each other, with λ >>electron-particle diameter ~10^{-15}m) AND the reduced PIqua of a photon ($\hbar$ =h/[2π]]). As FSC<1, FSC can also be interpreted as the probability of that simple two-elementary charges system to emit a real photon:

$$FSC = \frac{K_e q_e^2}{\hbar c} = \frac{K_e q_e^2 / c}{\hbar} = \frac{(K_e q_e^2 / \lambda)\cdot(\lambda / c)}{\hbar} \Leftrightarrow \boxed{FSC = \frac{E_e(q_e, q_e, \lambda)\cdot \Delta t_{\lambda/c}}{\hbar}\left(\sim \frac{1}{137}\right)}$$

Using the PIq scalar definition (H-I), GCC (α_G) can also be viewed as the ratio of two PIqs: the gravitational PIq of two positron/electrons (or both) system (localized at any distance λ to each other, with λ >>electron-particle diameter ~10^{-15}m) AND the reduced PIqua of a photon ($\hbar$ =h/[2π]]). As GCC <<1,GCC can also be interpreted as the probability of that simple two positron/electrons (or both) system to emit a real a real photon using only its EGF-PIq and not its EMF-PIq:

$$\alpha_G = \frac{G m_e^2}{\hbar c} = \frac{G m_e^2 / c}{\hbar} = \frac{(G m_e^2 / \lambda)\cdot(\lambda / c)}{\hbar} \Leftrightarrow \boxed{\alpha_G = \frac{E_g(m_e, m_e, \lambda)\cdot \Delta t_{\lambda/c}}{\hbar}\left(\sim \frac{1}{3.6\times 10^{45}}\right)}$$

As they both are ratios of two PIqs, the inverse of FSC and GCC can also be considered (meta) PIq, as the generic ratio PIq_1/PIq_2 can be considered a measurement of PIq_1 using PIq_2 as a PIq-unit of measurement.

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On a Teller's large number derived-hypothesis overlooked by Tipler and Barrow

„Edward Teller appears to have been the first who speculate that there may exist a logarithmic relation between the fine structure constant (α) and the parameter $G\cdot m_N^2/(h\cdot c)\sim 10^{-39}$ of the form $\alpha\sim\ln[G\cdot m_N^2/(h\cdot c)]$ [equation 4.23] (in fact $\alpha^{-1}=\ln(3.17 \text{ x } 10^{60}$ and the formula is too insensitive to be of very much use in predicting exact relations)“**[58]**. **(**m_N stands for the neutron/nucleon rest mass)

In this BIDUM, I will try to demonstrate that Barrow and Tipler overlooked **[59]** the possibility that Teller's "speculation" may be much more inspired than the *Dirac's large number hypothesis (DLNH)***[60]** and may the basis of a new class of informational (bio-info-digital [BIDUM]) toy-models of the universe (info-universe), a class that can offer important physical explanations and predictions.

The logarithmic relation, $\alpha^{-1} \sim \ln(\alpha_G^{-1})$ (where $\alpha_G = Gm_N^2/\hbar c$ is the conventionally defined form of the GCC) has been long regarded as a requirement for a self-consistent electrodynamics**[59, 61, 62, 63, 64, 65, 66, 67, 68]**. A more recent renormalisation group analysis by Page of supersymmetric GUT suggests that $\alpha^{-1} \sim (5/\pi)\ln(\alpha_G^{-1})$ **[69]**

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":

$$\boxed{\alpha = \frac{1}{FSC} = \frac{\hbar c}{K_e q_e^2} = \left(\frac{\sqrt{\hbar c}}{k_e q_e}\right)^2 \sim 137.036 \Rightarrow e^{\alpha} \sim 3.3\times 10^{59}}\ \text{and (see next line)}$$

$$\ln\left(\frac{hc}{Gm_n^2}\right) \sim 89.9 \sim (65.6\%)\alpha \Rightarrow \frac{hc}{Gm_n^2} \sim 1.1\times 10^{39} \sim (3.2\times 10^{-23}\%)e^{\alpha}$$

Even if Teller himself overlooked the possibility of using *binary logarithm (BL)* (not natural logarithm [NL]**)** in his hypothesis mentioned in the abstract, it is quite strange that the vast majority of physicists also overlooked this possibility from 1948 until present. Despite Barrow's superficial analysis and exclusion of the NL-TH, here is a a much more „sensitive" BL-TH variant**[22]**:

$$\boxed{\log_2\left(\frac{hc}{Gm_n^2}\right) \sim 129.6 \sim (94.6\%)\alpha}\ \text{and (see next line)}$$

$$2^{\alpha} \sim 1.8\times 10^{41} \Rightarrow \frac{hc}{Gm_n^2} \sim 1.1\times 10^{39} \sim (0.6\%)2^{\alpha}$$

Other „striking sensitive" BL-TH variants are presented in the next table (additional abbreviations used next: $\hslash$ – the half of reduced Planck constant [=h/(4π)= $\hbar/2$, the angular momentum of a spin 1/2 fermion like the electron/positron or the angular momentum of the hypothetical *de Broglie half-photon*], m_p – proton rest mass, m_e – electron rest mass)

Table T5-1. Other „striking sensitive" BL-TH variants
$\log_2[hc/(Gm_{p(n)}m_e)] \sim 140.5 \sim (102.5\%)\alpha \Rightarrow hc/(Gm_{p(n)}m_e) \sim 1.9\times 10^{42} \sim (1094\%)2^{\alpha}$
$\log_2[\hbar c/(Gm_{p(n)}m_e)] \sim 137.8 \sim (100.6\%)\alpha \Rightarrow \hbar c/(Gm_{p(n)}m_e) \sim 3.1\times 10^{41} \sim (174\%)2^{\alpha}$
$\log_2[\hslash c/(Gm_{p(n)}m_e)] \sim 136.8 \sim (99.9\%)\alpha \Rightarrow \hslash c/(Gm_{p(n)}m_e) \sim 1.6\times 10^{41} \sim (87\%)2^{\alpha}$

From the previous table I shall keep the main (apparent) coincidence which I consider the most important (as, for example, the description of the ^{1}H isotope of the hydrogen atom which contains just one proton and one electron in its lowest energetic state):

$$\boxed{\log_2[\hslash c/(Gm_p m_e)] \sim 136.8 \sim (99.9\%)\alpha} \Leftrightarrow \boxed{\hslash c/(Gm_p m_e) \sim 1.6\times 10^{41} \sim (87\%)2^{\alpha}}$$

The alpha-beta coincidence. Additionally, there is also a relatively closeness between the adimensional value of the exponential $\alpha^{3/2}$ and the standard beta constants (β_p and β_n) defined next (**observation O-I.5**), which is also a notable (probably a non-) coincidence that I shall discuss later on:

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[22] I have emailed a couple of years ago Mr. Barrow and Mr. Tipler on this BL-TH variant for their book next edition review, but never received any answer on this punctual observation

$$\boxed{\begin{Bmatrix} \alpha^{3/2} \sim 1604 \\ \beta_p = m_p / m_e \sim 1836 \\ \beta_n = m_n / m_e \sim 1839 \end{Bmatrix} \Rightarrow \boxed{\alpha^{3/2} \sim (87\%)\beta_{p/n}} \Leftrightarrow \boxed{\beta_{p/n} \sim \alpha^{3/2} / (87\%)}}$$

I consider that the last 2 equations from above are in fact *non-coincidences* generated by *a more profound (yet) undiscovered law of nature,* as I shall try to explain next. But the proton and neutron are composite particles (quark-based hadrons), that's why I consider that m_p and m_n (generated mainly [~99%] by the kinetic energy of the gluons and just secondary [~1%] by the rest and kinetic masses of the inner up/down quarks) aren't really fundamental, but can theoretically be deducted from the combined properties of the up/down quarks, the gluons and the 3D spatial volume of vacuum they all occupy. However, the electron (and also the positron) is considered ("more") fundamental, as it is a point-like QP with no (experimentally apparent) inner structure, that's why a BL-TH variant implying just the electron/positron rest mass will deserve a special attention: it's also the main reason for which the gravitational coupling constant [α_G] is expressed as a function of m_e, not of m_p or m_n. I have defined 2 types of inverses of α_G (noted $\not{\alpha}_G$ and $\bcancel{\alpha}_G$) to simplify the next logarithmic equations, such as:

$$\not{\alpha}_G = \alpha_G^{-1} = \hbar c / (G m_e^2) \sim 1 / (1.75 \times 10^{-45}) \sim 5.7 \times 10^{44}$$

$$\boxed{\bcancel{\alpha}_G = \bcancel{h} c / (G m_e^2) \sim 2.85 \times 10^{44}}$$

The last chosen BL-TH variant can be rewritten as a function of β_p and m_e, such as:

$$\log_2[\bcancel{h} c / (G \beta_p m_e^2)] \sim 136.8 \sim (99.9\%)\alpha \;\Leftrightarrow\; \bcancel{h} c / (G \beta_p m_e^2) \sim 1.6 \times 10^{41} \sim (87\%)2^{\alpha}$$

Replacing β_p as deduced from the alpha-beta coincidence, with $\alpha^{3/2}$, eliminating the (~87%) factor and separating the adimensional factor $\alpha^{3/2}$ as a denominator in the last equation, one can obtain:

$$\boxed{\log_2\left[\frac{\bcancel{h} c / (G m_e^2)}{\alpha^{3/2}}\right] \sim 137.0304 \sim (99.996\%)\alpha} \Leftrightarrow \boxed{\frac{\bcancel{h} c / (G m_e^2)}{\alpha^{3/2}} \sim 1.78 \times 10^{41} \sim (99.613\%)2^{\alpha}}$$

As previously defined, the $\bcancel{h} c / (G m_e^2)$ factor can be identified and replaced with $\bcancel{\alpha}_G$ in the last equation above, so that one can essentialise:

$$\boxed{\log_2\left(\frac{\bcancel{\alpha}_G}{\alpha^{3/2}}\right) \sim \alpha} \Leftrightarrow \boxed{\bcancel{\alpha}_G \sim \alpha^{3/2} 2^{\alpha}} \Leftrightarrow \boxed{\log_2\left[\frac{\bcancel{h} c / (G m_e^2)}{\alpha^{3/2}}\right] \sim \alpha} \Leftrightarrow \boxed{\bcancel{h} c / (G m_e^2) \sim \alpha^{3/2} 2^{\alpha}}$$

I consider this last coincidence-equation the *main BL-TH (MBL-TH)*, as it is the most striking simple and "sensitive" BL-TH variant. MBL-TH deserves a very special attention (in my opinion) as it may have great importance in formulating a quantitative description/prediction of *gravitons and 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* α_G and a *quantum G scalar for a 2 electron/positron system* (including the Einstein's $8\pi G$ general relativity equation factor) using only α (as an adimensional combination of almost all the physical constants fundamental to quantum mechanics theory).

MBL-TH also suggests that FSC has a dual electrogravitational significance (with FSC being a both electromagnetic and gravitational constant). In the next versions of BIDUM, I shall try to bring more arguments that *<u>MBL-TH is very probably a true non-coincidence due to a more profound yet undiscovered law of nature.</u>*

In conclusion, MBL-TH can be formulated as an *equality (which is a new quantum electronic[qe] definition [* $\bcancel{\alpha}_{Gqe}$ *] alternative to the classical* $\bcancel{\alpha}_{G}$ ***)**:*

$$\boxed{\bcancel{\alpha}_{Gqe} = \alpha^{3/2}2^{\alpha}} \Leftrightarrow \boxed{\bcancel{h}c/(G_{qe}m_e^{\,2}) = \alpha^{3/2}2^{\alpha}}$$

As G is the only classical constant (with the highest value of uncertainty when compared with the other quantum constants) in the MBL-TH equation, a hypothetic G quantum electronic (qe) (/positronic) scalar (G_{qe}) (anticipated in the last equation above) can be deducted for an electro-gravitational system of 2 resting electrons/positrons localized in vacuum, at a distance λ > 1cm (the limit scale of G measurement) from each other. However, it can be predicted that this scalar is also valid for much smaller distances (**λ** << 1cm), with λ ≥ **$D_{p/n}$** (the approximate real diameter of the low energy proton/neutron, where SNF, WNF and a possible a strong gravity**[70,71]** force (SGF) may also come into action). The value of G_{qe} scalar is very close to the standard CODATA-2012 G value:

$$\boxed{\begin{gathered}\frac{G_{qe}m_e^{\,2}}{\lambda} = \frac{\frac{\bcancel{h}}{\alpha^{3/2}2^{\alpha}}\cdot c}{\lambda} \Leftrightarrow G_{qe} = \frac{1}{m_e^{\,2}}\cdot\frac{hc}{(4\pi)\alpha^{3/2}2^{\alpha}} \Leftrightarrow G_{qe} = \frac{c}{m_e^{\,2}(2\pi)\alpha}\cdot\frac{h}{2\alpha^{1/2}2^{\alpha}} = f(h_{eg}) = k_G h_{eg}, \\ \text{with}\,\lambda \geq D_{p/n}\;, k_G = \frac{c}{m_e^{\,2}(2\pi)\alpha}\,and\; h_{eg} = \frac{h}{2\alpha^{1/2}2^{\alpha}} = \frac{h}{K_{eg}}\left(with\,K_{eg} = 2\alpha^{1/2}2^{\alpha} = \alpha^{1/2}2^{\alpha+1}\right)\end{gathered}},$$

$$\boxed{G_{qe} \sim 6.648\cdot 10^{-11}m^3kg^{-1}s^{-2} \sim 99.613\%\cdot G_{CODATA\_2012}}$$

$$\boxed{\cancel{\alpha}_{Gqe} = \hbar c/(G_{qe}m_e^{\,2}) \sim 5.71\times 10^{44} \sim (100.4\%)\cancel{\alpha}_{G}}$$

$$\boxed{\bcancel{\alpha}_{Gqe} = \bcancel{h}c/(G_{qe}m_e^{\,2}) \sim 2.87\times 10^{44} \sim (100.4\%)\bcancel{\alpha}_{G}}$$

The G_{qe} scalar expressed in the last equations is very similar to the Coulomb constant (K_e) extracted from the α(=1/FSC) definition:

$$\alpha = \frac{\hbar c}{K_e q_e^{\,2}} \Leftrightarrow \boxed{K_e = \frac{1}{q_e^{\,2}}\cdot\frac{hc}{(2\pi)\alpha} = \frac{c}{q_e^{\,2}(2\pi)\alpha}\cdot h = f(h) = k_C\cdot h}\left(with\,k_C = \frac{c}{q_e^{\,2}(2\pi)\alpha}\right) analogous\,to$$

$$\boxed{G_{qe} = \frac{1}{m_e^{\,2}}\cdot\frac{hc}{(4\pi)\alpha^{3/2}2^{\alpha}} = f(h_{eg}) = k_G h_{eg}}, with\,k_G = \frac{c}{m_e^{\,2}(2\pi)\alpha}\,and\;h_{eg} = \frac{h}{2\alpha^{1/2}2^{\alpha}}$$

As it can be observed from the last analogic equations, the (classical) K_e can be considered an indirect way to measure the quantum constants: q_e, h, c, but also the adimensional FSC(=1/α). Measuring K_e at different distances (λ) is essentially and indirect way to measure photon energy at different wavelengths (**λ**) (with $E_{ph}(\lambda)=hc/\lambda= h\nu$) and especially and indirect way to measure h (the electromagnetic quanta, as the Coulomb force is considered to be generated by interchanging virtual photons):

$$\frac{K_e}{\lambda} = \frac{1}{q_e^{\,2}(2\pi\alpha)}\cdot\frac{hc}{\lambda} = \frac{1}{q_e^{\,2}(2\pi\alpha)}\cdot E_{ph}(\lambda) \Leftrightarrow \boxed{K_e = \frac{c}{q_e^{\,2}(2\pi\alpha)}\cdot h = f(h) = k_C\cdot h}\left(with\,k_C = \frac{c}{q_e^{\,2}(2\pi)\alpha}\right)$$

The G_{qe} scalar can be expressed in perfect analogy with K_e, such as:

$$\frac{G_{qe}m_e^{\,2}}{\lambda} = \frac{\frac{h}{(4\pi)\alpha^{3/2}2^{\alpha}}\cdot c}{\lambda} \Leftrightarrow \frac{G_{qe}}{\lambda} = \frac{1}{m_e^{\,2}(2\pi\alpha)}\cdot\frac{\frac{h}{2\alpha^{1/2}2^{\alpha}}\cdot c}{\lambda} \Leftrightarrow$$

$$\Leftrightarrow \boxed{G_{qe} = \frac{c}{m_e^{\,2}(2\pi\alpha)} \cdot \frac{h}{2\alpha^{1/2}2^{\alpha}} = f(h_{eg}) = k_G h_{eg}}, with\, k_G = \frac{c}{m_e^{\,2}(2\pi)\alpha} \, and \, h_{eg} = \frac{h}{2\alpha^{1/2}2^{\alpha}}$$

Expressing the Newtonian gravitational force (F_g) as a function of G_{qe}, one may obtain multiple equivalent equations that maintain the inverse square law (ISL) up to atomic scale, with $\lambda \geq \mathbf{D_{p/n}}$:

$$\boxed{F_g = G_{qe}\frac{m_1 m_2}{\lambda^2}} = \boxed{\frac{hc}{m_e^{\,2}\alpha^{3/2}}\frac{1}{2^{\alpha}} \cdot \frac{m_1 m_2}{4\pi\lambda^2}} = \boxed{\frac{\Gamma}{2^{\alpha}} \cdot \frac{m_1 m_2}{4\pi\lambda^2}}$$

$$with \boxed{\Gamma^* = \frac{hc}{m_e^{\,2}\alpha^{3/2}} \sim 1.5\times10^{32}\, m^3 kg^{-1} s^{-2}} \, and \, \boxed{\Gamma / G \sim 2.2\times10^{42}}$$

(*Γ is a plausible strong-gravity constant [SGC] [70] with a value close to that determined by Perng in 1978[70,71] of $\sim 2.77\times10^{32}\, m^3 kg^{-1} s^{-2}$**)**

$$\boxed{F_g = hc \cdot \frac{\left(\frac{m_1}{m_e}\right)\left(\frac{m_2}{m_e}\right)}{4\pi\lambda^2}\frac{1}{\alpha^{3/2}2^{\alpha}}} = \boxed{hc \cdot \frac{\beta_1\beta_2}{4\pi\lambda^2}\frac{1}{\alpha^{3/2}2^{\alpha}}}$$

$$\boxed{F_g = \frac{4\pi K_e}{\alpha^{1/2}2^{\alpha}} \cdot \frac{(\beta_1 q_e)(\beta_2 q_e)}{8\pi\lambda^2}} = \boxed{\frac{F_e(\beta_1 q_e, \beta_2 q_e, \lambda)}{2\alpha^{1/2}2^{\alpha}}}$$

$$\boxed{F_g = \frac{\beta_1\beta_2}{2\pi\lambda + 2\pi\lambda} \cdot \frac{E_f(\lambda)}{\alpha^{3/2}2^{\alpha}}, with\, E_f(\lambda) = hc/\lambda}$$

From the last 3 equations F_g can be seen as a form of strong gravity dispersed/divided by the factor 2^{α} (on the significance of this BL-TH factor it shall be discussed later on). This is not the first attempt **[72]** to link FSC with a hypothetical strong gravity constant (**SGC**).

From the second last equation above, F_g can also be seen as a form of modified Coulomb force generated by strong-charges (multiple to q_e by beta-constants $\beta_1 = m_1/m_e$ and $\beta_2 = m_2/m_e$) $F_e(\beta_1 q_e, \beta_2 q_e, \lambda) = K_e \cdot \frac{(\beta_1 q_e)(\beta_2 q_e)}{\lambda^2}$ dispersed/divided by the factor $2\alpha^{1/2}2^{\alpha}$ (on the significance of this BL-TH factor it shall be discussed later on) with *charges and masses being interchangeable using beta-constants* (*as masses can be treated as gravitational charges possibly generated by same mechanism that also generates the electromagnetic charges, as it shall be discussed later on*)

As SST and MT propose the existence of additional spacetime (ST) dimensions (at least 2 additional micro-dimensions with compact topology that may alter ISL by leaking of hypothetical gravitons in those additional ST dimensions) in order to unify the Standard Model (**SM**) with General Relativity (**GR**), it's an experimental priority for the gravitational ISL to be verified at micronic and atomic scales (short range gravity tests**[73,74,75,76]**).

The Gqe definition can also be written as equivalent to $\boxed{FSC^{3/2} \propto G_{qe}}$, which has a strong similarity with a prediction **[77]** of SST:

$$\boxed{G_{qe}=\frac{c}{m_e^{\,2}(2\pi\alpha)}\cdot\frac{h}{2\alpha^{1/2}2^{\alpha}}=\frac{hc}{m_e^{\,2}}\cdot\frac{1}{4\pi\alpha^{3/2}2^{\alpha}}=\frac{hc}{m_e^{\,2}}\cdot\frac{FSC^{3/2}}{4\pi 2^{1/FSC}}}\Leftrightarrow$$

$$\boxed{FSC^{3/2}=\left(\frac{m_e^{\,2}}{hc}4\pi 2^{1/FSC}\right)G_{qe}}\Leftrightarrow\boxed{FSC^{3/2}\propto G_{qe}}$$

It’s important to remark that k_G (as defined in Part 2 of this paper) can also be derived from the hypothetical SGC determined by Perng in 1978 (noted as Γ_{Perng}) **[70,71]:**

$$\boxed{\Gamma_{Perng}=\frac{hc}{m_e^{\,2}(2\pi\alpha)}=\frac{\hbar c}{m_e^{\,2}\alpha}\sim 2.78\times10^{32}m^3kg^{-1}s^{-2}}\ and\ \boxed{\Gamma_{Perng}/G\sim 4.2\times10^{42}}$$

$$\boxed{k_G=\Gamma_{Perng}/h=\frac{c}{m_e^{\,2}(2\pi\alpha)}}$$

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A unified EMF-EGF interpretation of FSC and GCC based on MBL-TH. A possible Eddington-like connection between FSC, GCC and the nof. peps in the WU

As FSC can be viewed as the ratio of two PIqs (both expressed in qbits, which qbit is a (pure) base-2 logarithmic nof. quantum/subquantum [macro/micro] states of a quantum system), FSC is in fact a way of measuring a PIqua using another PIqua as a measure-unit, so that FSC is essentially ALSO a (meta) PIqua (expressed as probability or as an inverse probability, α=1/FSC). All the other α coupling constants generalized as the **$\alpha_f(h_x)$ function** can also pe considered (meta) PIqua. Analogously, GCC is essentially ALSO a PIqua (expressed as probability or as an inverse probability, 1/ α_G). As a consequence, MBL-TH is in fact an important relation between two PIqua: FSC and GCC. The fact that α=1/FSC appears in MBL-TH both as α and 2^{α} strongly suggests that $N_a=2^{\alpha}$ is the nof. states of an EM-PIqua and is more fundamental that α which is the base-2 logarithm (derived) measure of N_a. FSC and GCC may be both considered two different ways to measure the same N_a, such as:

$$\boxed{N_a\sim 1.8\times10^{41}(=2^{\alpha})}\ AND\ \left\{\begin{matrix}\boxed{\alpha=\log_2(N_a)}\\ FSC=1/\log_2(N_a)\end{matrix}\right\}\Rightarrow\left[FSC^{-1}=\log_2(N_a)=\frac{\hbar}{E_e(q_e,q_e,\lambda)\cdot\Delta t_{\lambda/c}}\right]$$

$$\boxed{\cancel{\alpha}_G=\frac{1}{2\cdot GCC}\sim\alpha^{3/2}2^{\alpha}\sim\left[\log_2\left(N_a\right)\right]^{3/2}N_a}\Leftrightarrow\boxed{GCC^{-1}\sim 2\left[\log_2\left(N_a\right)\right]^{3/2}N_a=\frac{\hbar}{E_g(m_e,m_e,\lambda)\cdot\Delta t_{\lambda/c}}}$$

As the definition of GCC is essentially a convention (as there is no discovered and demonstrated quantum scalar for G), it is convenient to redefine GCC as GCCr (GCC redefined) so that GCCr=N_a and the FSC-GCCr equivalence to be more obvious:

$$\left\{\begin{matrix}\boxed{GCC_r^{\,-1}\sim N_a}\\ GCC_r\sim 1/N_a\end{matrix}\right\}\Leftrightarrow\boxed{GCCr\sim 2\left[\log_2\left(N_a\right)\right]^{3/2}/GCC^{-1}=\left(G/K_e\right)\cdot\left(m_e/q_e\right)^2\sqrt{4\alpha}}$$

$$\boxed{FSC^{-1}=\alpha=\log_2(N_a)}$$

The rest mass of the electron (m_e) is the smallest charged rest mass known in the WU, so that the ratio (m_e/q_e) is a minimum mass-to-charge quantity ratio of the nature (inversely, the ratio q_e/m_e is a maximum charge-to-mass quantity ratio of the nature) and so the derived composed EGF/EMF ratio $Gm_e^{\,2}/(K_eq_e^{\,2})$: that is why the inclusion of this ratio in this proposed GCCr may help as an indirect argument for FSC-GCCr common interpretation.

There is another (apparent probably non-)coincidence complementary to MBL-TH that may help understand the significance of the new (large number) constant N_a that unifies FSC and GCC(GCCr): it's the base-2 logarithm measure of the nof. peps in the WU (N_P)

$$\boxed{\log_2(N_P)/2 = \log_2(\sqrt{N_P}) \sim 132.8 \sim (96.9\%)\alpha \sim (96.9\%)\log_2(N_a)} \Leftrightarrow \boxed{N_a^{\,2}/N_P \sim 368}$$

Based on the relative closeness between Na^2 and N_P one can hypothesize that FSC/GCC/GCCr (as measures of N_a) measure in fact the real nof of peps in our universe, that is surely much larger than the N_P from the (visible) WU. Based on this speculative but very appealing hypothesis, one can estimate the real nof. of peps in the universe as a corrected N_P (N_{Pc}):

$$\boxed{N_{Pc} \sim N_a^{\,2} \sim 368 N_P}$$

A part of (N_{Pc}-N_P) difference may explain the DU-hypothesis in which dark energy and dark matter (composing the dark universe [DU]) have a ~19 to 1 (~95% to ~5%) preponderance. The rest of (N_{Pc}-N_P) difference may be explained by the energy and matter that expand beyond the ray of our visible WU with speeds that probably close to the speed of light and possible with a larger acceleration than the acceleration of the WU expansion measured in the present using the Hubble constant.

This hypothesis may explain and predict the small variations of FSC when measured in different hemi-spaces **[78,79]**, as the universe isn't perfectly homogenous and isotropic in the distribution of N_{Pc}. This hypothesis may also explain and predict why FSC doesn't seem to vary in the last 7 billion years when measured longitudinally in time**[80]**, as the real total nof. pep hasn't varied in this time frame.

As N_{pepc} is over 2 orders of magnitude larger than N_{pep}, this hypothesis may also explain/predict why the universe doesn't seem to form larger "clumps" of matter at scales comparable to the ray of the **WU** (R_{WU})**[81]** as the universe its self may be a huge clump of matter with ~368 more matter the (directly and indirectly [by FSC/GCC]) observable universe (**OU**): this sustains the hypothesis that the universe may be still a fractal at those scales despite the recent evidence**[81]** that refute the fractal-universe hypothesis at larger scales.

It is also true that there is a similarity between this hypothesis and Eddington's conjecture **[82]** connecting FSC with N_P (also called the Eddington's number), but this similarity is just a superficial one, as this hypothesis proposes a completely different type of (informational) connection between α(=1/FSC) and N_{Pc} than that proposed by Eddington (which is now considered obsolete). However, the Eddington hypothesis remains partially open as, in the context of a finite universe (finite information/energy/matter) both FSC and N_{Pc} are important in defining that type universe, even they may vary in different historical time frames at different energies.

An important consequence of this speculative hypothesis is that, if FSC and GCC are finite numbers (that estimate the total PIq of the OU), then the total PIq of the OU is ALSO FINITE.

Based on the N_{Pc} value and m_{pep}, new corrected I_{ctOU}, M_{ctOU} and E_{ctOU} can be precisely calculated as:

$$\boxed{I_{ctOU} = N_{Pc}\cdot(h_p + h_e) \sim 283 I_{tWU} \sim 622 qbits}$$

$$\boxed{M_{ctOU} = N_{Pc}\cdot m_{pep} \sim 5.3\times10^{55} kg} \; and \; \boxed{E_{ctOU} = M_{ctOU}\cdot c^2 \sim 4.8\times10^{72} J}$$

$$\boxed{E_{ctOU}/E_{tWU} = M_{ctOU}/M_{tWU} = N_{Pc}/N_P \sim 368.3}$$

The additional mass ($\Delta M=M_{ctOU}-M_{rWU}$) predicted by this hypothesis is very probable organized in 2 sectors:

(1) a part of the same ΔM (called ΔM_{int}~$19M_{arWU}$) may be localized (internally) in our V_{OU}, but cannot be directly observed because it may organized as dark energy (DE) and dark matter (DM) interacting with the white matter/energy (WU) just by WNF and EGF and not by EMF and SNF (as WIMPs, the main candidate for the dark matter composition, do); dark matter may also be composed of quarks bound together by a new and yet-unobserved strong interaction, a dark**[83]** form of QCD or SGF as it will be discussed later on)

(2) the other part of this ΔM (called ΔM_{ext}~M_{ctOU}-(ΔM_{int}+M_{arWU})~$347M_{arWU}$) may be composed by peps external to the present observed volume of the observable universe $V_{OU}=(4\pi/3)R_{OU}^3$ and cannot be directly observed (other but indirectly measured by FSC and GCC), but it may have measurable influence on our V_{OU} (as FSC and GCC may be determined by N_{Pc} and implicitly by ΔM_{ext}), as a the accelerated inflation of the observable **WU** may be partially generated by the ΔM_{ext} sector that may strongly attract the mass left behind in our V_{OU} (a gravitational traction effect that can explain the Hubble law/observation): this ΔM can also lessen the percent of dark energy needed to explain the present acceleration **[84,85**] of the WU.

(3) However, it is much more probable that all the M_{ctOU} to be localized (but mostly hidden) in the interior of the present observed volume of the observable universe $V_{OU}=(4\pi/3)R_{OU}^3$ as all the N_{Pc} can far more easily interconnect to each other using speeds ≤c (determining the values of FSC and GCC): as the (partially empty) space external to the V_{OU} surely expands at speeds higher than c, these faster-than-light speeds can alter (to totally disruption) the capacity of the (possible) energy-matter external to V_{OU} to influence FSC and GCC measured in the interior of the V_{OU} (and supposed that FSC and GCC are the measure of the nof. peps from the interior of the V_{OU}), at least not by using the four known FFs that are supposed to be limited by c.

Based on ΔM_{int} and V_{OU}, one can calculate the density of all white and dark energy/matter in our OU (ρ_{OU}). A (first) maximum density for (all) the OU($\rho_{max[1]OU}$) can be also calculated if supposing that all M_{ctOU} is localized in a volume of a sphere with a ray (R_{xOU}) at least 10^3 times larger that R_{OU} (V_{tOU}) (as predicted by SSTs). **A (second) maximum density for (all) the OU($\rho_{max[2]OU}$) can be also calculated if supposing that all M_{ctOU} is localized (even if mostly hidden) in the interior of the present V_{OU} (as estimated in the last previous paragraph: the possibility with the highest probability of all).** As it can be observed next, $\rho_{max[1]OU} << \rho_{OU} < 1$ BUT $\rho_{max[2]OU} > 1 > \rho_{OU}$ (with over an order of magnitude larger than 1)

$$\boxed{V_{tOU}=V_{WU}=\left(4\pi/3\right)R_{WU}{}^{3}\sim 3.6\times 10^{80}m^{3}}\Rightarrow\boxed{\rho_{WU}=M_{arWU}/V_{OU}\sim 4\times 10^{-28}\left(kg/m^{3}\right)}$$

$$AND\ \boxed{\rho_{OU}=\left(M_{arWU}+\Delta M_{\mathrm{int}}\right)/V_{OU}\sim 8.5\times 10^{-27}\left(kg/m^{3}\right)\sim 21\rho_{WU}}$$

$$\boxed{R_{xOU}>10^{3}R_{OU}}\Rightarrow\boxed{V_{tOU}>\left(4\pi/3\right)R_{xOU}{}^{3}\sim 3.6\times 10^{89}m^{3}}\Rightarrow\boxed{\rho_{\max[1]OU}<M_{ctOU}/V_{tOU}\sim 1.5\times 10^{-34}\left(kg/m^{3}\right)}$$

$$\boxed{\rho_{\max[1]OU}<\rho_{WU}<<\left[\rho_{OU}\sim 21\rho_{WU}\right]}$$

$$\boxed{\rho_{\max[2]OU}=M_{ctOU}/V_{OU}\sim 1.5\times 10^{-25}\left(kg/m^{3}\right)\sim 368\rho_{WU}\sim 17.5\rho_{OU}}$$

Based on each of the OU densities previously calculated (ρ_{WU}, ρ_{OU}, $\rho_{max[1]OU}$, $\rho_{max[2]OU}$), a value for each density parameter function (Ω_f) (the ratio between a specific density and the Friedmann critical density [ρ_c] which is a function of the Hubble constant [H_0]) can be calculated, such as::

$$\boxed{\rho_c = \frac{3H_0^{\ 2}}{8\pi G} \sim 8.7\times10^{-27}\left(kg/m^3\right)}\ and\ \boxed{\Omega_f(\rho) = \rho/\rho_c} \Rightarrow$$

$$\Rightarrow \left\langle \begin{array}{l} \boxed{\Omega_f\left(\rho_{WU}\right) \sim 0.05} \\ \boxed{\Omega_f\left(\rho_{OU}\right) \sim 0.982} \\ \boxed{\Omega_f\left(\rho_{\max[1]OU}\right) < 1.7\times10^{-8} << \Omega_f\left(\rho_{WU}\right) << \Omega_f\left(\rho_{OU}\right)} \\ \boxed{\boxed{\Omega_f\left(\rho_{\max[2]OU}\right) \sim 13.5}\left(the\ most\ probable\ possibility\right)} \\ M_{arWU}/M_{ctOU} \sim 0.27\% << \left[\dfrac{white\ energy\ \&\ matter}{total\left(including\ dark\right)energy\ \&\ matter} \sim 4.9\%\left(present\ estimation\right)\right] \end{array} \right.$$

$\Omega_f(\rho_{max[1]OU})$ ~$1.7\cdot10^{-8}$ is much lower than 1 which corresponds to a universe that may expand forever (ONLY if SGC will be proved to NOT exist: with NO strong quantum gravity acting neither in the nucleus of atoms or in black-holes). However, BIDUM considers $\Omega_f(\rho_{max[2]OU})$ ~13.5 > 1 as the possibility with the larger probability: this corresponds to a universe that will eventually collapse. BIDUM predicts that at the moment of deflation t_d>>t_{WU} the WU (OU) (t_d>>t_{WU} because the universe still has a positive acceleration which marks that it is still a young universe when compared to a hypothetical maximum inflation-deflation cycle measured in classical linear time units) will start to deflate similar to a Phoenix universe **[23,24]**: singular inflation theory **[25]** and Turok's Cyclic Model of the Universe **[26]** / M-Theory Model of a Big Crunch/Big Bang Transition **[27]** also sustains this possibility. The most recent measurements [**28**] 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**). However, it is sure that, if the universe is expanded by a form of gravitational spring (with a behavior similar to a common metallic spring), then our universe is the younger with the larger the positive acceleration: studies than determine other positive acceleration than the ones before may be translated as the universe is younger or older than thought and not necessarily that the universe will "die faster or slower".

In a check-point conclusion, BIDUM essentially marks the possibility that FSC and GCC may be indirect measures for both dark and white energy/matter (as expressed in nof. real/equivalent peps) AND also predicts that it is most probable that the white energy and matter to have a preponderance of at least 10 times smaller than is estimated today (~0.27% versus present estimation of ~4.9%)

As FSC (and its inverse α=1/FSC) is in fact a (meta)PIqua it can also be used as a relative informational measure-unit for large PIqua (**the alpha-PIq-unit or the alpha-unit [α]**). There are some arguments that BOMs

[23] Lehners, J-L. and Steinhardt P.J. (2008). "Dark Energy and the Return of the Phoenix Universe" (URL: [1] arxiv.org/abs/0812.3388; [2] physics.princeton.edu/~steinh/phoenix5.pdf)
[24] Lehners, J-L. and Steinhardt P. J. (2009). "The Return of the Phoenix Universe" (URL: arxiv.org/abs/0910.0834)
[25] Barrow J. D. and Graham A. H. (2015). "Singular Inflation" (URL: arxiv.org/abs/1501.04090)
[26] Turok N., Paul J. Steinhardt (2001-2002). "A Cyclic Model of the Universe" (URL: arxiv.org/abs/hep-th/0111030v2)
[27] Turok N., Malcolm Perry and Paul J. Steinhardt (2004). "M Theory Model of a Big Crunch/Big Bang Transition". (URL: [1] arxiv.org/abs/hep-th/0408083; [2] physics.princeton.edu/~steinh/BTBB36.pdf)
[28] D0 Collaboration (Liu S. et al.) (2015). "Precise measurement of the top quark mass in dilepton decays using optimized neutrino weighting" , Top2015 (the 8th International Workshop on Top Quark Physics) (September 2015) and The 3rd Annual Large Hadron Collider Physics Conference (August 2015) (URL: arxiv.org/abs/1508.03322)

may use this alpha-PIq-unit when reconstructing space-time and energy-matter from the perceived PIqua, as FSC is the main propriety/constant of the electron-photon system, a system which is mainly used by the visual system of the BO to analyze/decompose and imagine/reconstruct/recompose the environment/any target of interest from the environment.

It is convenient to express binary logarithms of the large PIqs ratios (the global PIq to each of the four FFs PIqua) using alpha-PIq-units (α).

A very interesting (probably non-) coincidence emerges when comparing the global I_{tWU} and I_{ctOU} to the 4 PIqua of the four FFs (h_{eg}, h_{ph}=h, $h_{W(Z)}$, h_{gl}) using not only simple ratios, but also binary logarithms of those ratios and their reciprocal base-2 exponentials expressed in alpha-units, such as:

$$\boxed{I_{tWU}/h_{eg} > 3.4\times10^{184}} \Leftrightarrow \boxed{d_{eg} > \left[\log_2\left(I_{tWU}/h_{eg}\right) \sim 4.473\alpha\right]} \Leftrightarrow \boxed{h_{eg} < I_{tWU}/2^{d_{eg}}}$$

$$\boxed{I_{tWU}/h_{ph} > 8.1\times10^{141}} \Leftrightarrow \boxed{d_{ph} > \left[\log_2(I_{tWU}/h_{ph}) \sim 3.44\alpha\right]} \Leftrightarrow \boxed{h_{ph} < I_{tWU}/2^{d_{ph}}}$$

$$\boxed{I_{tWU}/h_{WZ} > 1.3\times10^{141}} \Leftrightarrow \boxed{d_{WZ} > \left[\log_2\left(I_{tWU}/h_{WZ}\right) \sim 3.421\alpha\right]} \Leftrightarrow \boxed{h_{WZ} < I_{tWU}/2^{d_{WZ}}}$$

$$\boxed{I_{tWU}/h_{gl} > 1.1\times10^{144}} \Leftrightarrow \boxed{d_{gl} > \left[\log_2\left(I_{tWU}/h_{gl}\right) \sim 3.492\alpha\right]} \Leftrightarrow \boxed{h_{gl} < I_{tWU}/2^{d_{gl}}}$$

$$\boxed{I_{ctOU}/h_{eg} > 9.5\times10^{186}} \Leftrightarrow \boxed{d_{eg(c)} > \left[\log_2\left(I_{ctOU}/h_{eg}\right) \sim 4.533\alpha\right]} \Leftrightarrow \boxed{h_{eg} < I_{ctOU}/2^{d_{eg(c)}}}$$

$$\boxed{I_{ctOU}/h_{ph} > 2.3\times10^{144}} \Leftrightarrow \boxed{d_{ph(c)} > \left[\log_2(I_{ctOU}/h_{ph}) \sim 3.499\alpha\right]} \Leftrightarrow \boxed{h_{ph} < I_{ctOU}/2^{d_{ph(c)}}}$$

$$\boxed{I_{ctOU}/h_{WZ} > 3.7\times10^{143}} \Leftrightarrow \boxed{d_{WZ(c)} > \left[\log_2\left(I_{ctOU}/h_{WZ}\right) \sim 3.48\alpha\right]} \Leftrightarrow \boxed{h_{WZ} < I_{ctOU}/2^{d_{WZ(c)}}}$$

$$\boxed{I_{ctOU}/h_{gl} > 3.1\times10^{146}} \Leftrightarrow \boxed{d_{gl(c)} > \left[\log_2\left(I_{ctOU}/h_{gl}\right) \sim 3.551\alpha\right]} \Leftrightarrow \boxed{h_{gl} < I_{ctOU}/2^{d_{gl(c)}}}$$

The relative closeness of the (fractal) alpha-dimensions d-sets (d_{eg}, d_{ph}, d_{WZ}, d_{gl}) and ($d_{eg(c)}$, $d_{ph(c)}$, $d_{WZ(c)}$, $d_{gl(c)}$) from the previous equations to the positive fractional ~4.5(α-D) and ~3.5(α-D) respectively is probably a non-coincidence generated by a more profound law of nature, and may explain why our WU appears to our senses/perception (together with their extensions: our measurement tools) as a 3D space with an additional half-dimension (unidirectional time) attached to it. However, the fact that $d_{eg(p)}$ ~4.5D is larger than 4(D) suggests at least one additional 5th dimension (a hyper-time) as SSTs also predict.

A similar but more striking (probably non-) coincidence emerges when expressing in alpha-units the binary logarithmic ratio between the partial global PIqua related to the present estimated age of WU (t_{pWU}) $I_{pWU}=E_{tWU}\cdot t_{pWU}$ to each of the four PIqua of the four FFs (h_{eg}, h_{ph}=h, $h_{W(Z)}$, h_{gl}), such as:

$$\boxed{I_{pWU} = E_{tWU}\cdot t_{pWU} \sim I_{tWU}/\left(7.2\cdot10^{20}\right) \sim 4.6\times10^{163}\,qbits}$$

$$\boxed{I_{pWU}/h_{eg} \sim 4.6\times10^{163}} \Leftrightarrow \boxed{d_{eg(p)} = \log_2\left(I_{pWU}/h_{eg}\right) \sim 3.967\alpha} \Leftrightarrow \boxed{h_{eg} \sim I_{pWU}/2^{d_{eg(p)}}}$$

$$\boxed{I_{pWU}/h_{ph} \sim 1.1\times10^{121}} \Leftrightarrow \boxed{d_{ph(p)} = \log_2(I_{pWU}/h_{ph}) \sim 2.934\alpha} \Leftrightarrow \boxed{h_{ph} \sim I_{pWU}/2^{d_{ph(p)}}}$$

$$\boxed{I_{pWU}/h_{W(Z)} \sim 1.8\times10^{120}} \Leftrightarrow \boxed{d_{WZ(p)} = \log_2\left(I_{pWU}/h_{W(Z)}\right) \sim 2.915\alpha} \Leftrightarrow \boxed{h_{W(Z)} \sim I_{pWU}/2^{d_{WZ(p)}}}$$

$$\boxed{I_{pWU}/h_{gl} \sim 1.5\times10^{123}} \Leftrightarrow \boxed{d_{gl(p)} = \log_2\left(I_{pWU}/h_{gl}\right) \sim 2.986\alpha} \Leftrightarrow \boxed{h_{gl} \sim I_{pWU}/2^{d_{gl(p)}}}$$

The relative closeness of the (fractal) alpha-dimensions (present) d-set ($d_{eg(p)}$, $d_{ph(p)}$, $d_{WZ(p)}$, $d_{gl(p)}$) from the previous equations to the positive integer ~4(α-D) and 3(α-D) respectively is probably a non-coincidence generated by a more profound law of nature, and may explain why our WU appears to our senses/perception/intuition (together with their extensions: our measurement tools) as a 3D space with an additional 4^{th} dimension (time) attached to it. This may also partially explain the striking power of prediction that GR has, as it is based on a 4D spacetime model of the WU.

FSC and GCCr can also be redefined (double redefined GCC or GCCdr) as derived form N_{Pc} (independently of h_{eg} and h) and can be used to re-express the Ke, G and Gqe quantum scalars, such as:

$$\left\{\begin{array}{l}\boxed{GCCdr^{-1} = N_{Pc} = N_a^{\ 2} = 2^{2\alpha} \sim 3.2\times 10^{82}} \\ GCCdr = N_{Pc}^{\ -1} = N_a^{\ -2} = 2^{-2\alpha} \sim 1/\left(3.2\times 10^{82}\right)\end{array}\right\} \Leftrightarrow \left\{\begin{array}{l}\boxed{GCC_{dr}^{\ -1} = GCCr^{-2} \sim 4\left[\log_2\left(N_a\right)\right]^3 / GCC^{-2}} \Leftrightarrow \\ \Leftrightarrow GCC_{dr}^{\ -1} = \left(G/K_e\right)^2 \cdot \left(m_e/q_e\right)^4 \left(4\alpha\right)\end{array}\right\}$$

$$\boxed{FSCr^{-1} = \log_2(N_{Pc}) = 2\log_2\left(N_a\right) = 2\alpha}\ and\ A = 2\alpha (by\ definition)$$

Another interesting (probably non-) coincidence emerges when comparing the global I_{tWU} and I_{ctOU} to the four PIqua of the four FFs (h_{eg}, h_{ph}=h, $h_{W(Z)}$, h_{gl}) using the binary logarithms of their simple ratios expressed in A-units (double alpha-units), such as:

$$\boxed{d_{eg} > \left[\log_2\left(I_{tWU}/h_{eg}\right) \sim 2.23A\right]} ; \boxed{d_{eg(c)} > \left[\log_2\left(I_{ctOU}/h_{eg}\right) \sim 2.26A\right]}$$

$$\boxed{d_{ph} > \left[\log_2(I_{tWU}/h_{ph}) \sim 1.72A\right]} ; \boxed{d_{ph(c)} > \left[\log_2(I_{ctOU}/h_{ph}) \sim 1.78A\right]}$$

$$\boxed{d_{WZ} > \left[\log_2\left(I_{tWU}/h_{WZ}\right) \sim 1.71A\right]} ; \boxed{d_{WZ(c)} > \left[\log_2\left(I_{ctOU}/h_{WZ}\right) \sim 1.74A\right]}$$

$$\boxed{d_{gl} > \left[\log_2\left(I_{tWU}/h_{gl}\right) \sim 1.78A\right]} ; \boxed{d_{gl(c)} > \left[\log_2\left(I_{ctOU}/h_{gl}\right) \sim 1.77A\right]}$$

When interpreted in A-dimensions, both global I_{tWU} and I_{ctOU} (what BIDUM interprets as OU) appear as a ~2D hologram where all the non-eg GBs move in ~1.75(A)D as dusts/swarms of 1(A)D-string AND egs being the only QP that can escape the 2D brane/display and/or can create the illusion of a 3^{rd} dimension. BIDUM sustains this holographic principle (first proposed by Gerard't Hooft and then given a precise interpretation in SST by Leonard Susskind **[86]**), as the global PIqua (I_{tWU} and I_{ctOU}) need only a collection of multilayered 2(A)D (~2.26D) matrices to organize as an UOS and generate all reality as an apparent moving 3D (multilayer) image on a hypothetical WU/OU-2(A)D display.

BIDUM also presents another series of observations that are also considered non-coincidences generated by a more profound law of nature. This non-coincidences series links the ray of the observable universe (R_{OU}) and N_a with:

- **(1)** the real (maximum) ray of the (supposed point-like) electron $R_{re} \sim Rp/(m_p/m_e)^{1/3} \sim 0.72\cdot 10^{-16}$m (calculated based on the hypothesis that the proton and the electron have similar average energy-matter densities)
- **(2)** the classical ray/diameter of the electron ($R_e \sim 2.8\cdot 10^{-15}$m, D_e=$2R_e \sim 2.8\cdot 10^{-15}$m)
- **(3)** the ray/diameter of the proton/neutron ($R_p \sim R_n \sim 0.88\cdot 10^{-15}$m and D_p=$2R_p \sim D_n$=$2R_n \sim 1.75\cdot 10^{-15}$ m)
- **(4)** the Bohr ray/diameter of the hydrogen atom with its electron in the lowest energetic level ($R_B \sim 5.3\cdot 10^{-11}$m and D_B=$2R_B \sim 1.1\cdot 10^{-10}$ m)

<u>Table T5-2</u>. The BL-TH applied to the ratios between R_{OU} (ray of the OU) and the dimensions of the main atomic/subatomic entities/particles
$\log_2(R_{OU}/R_{re}) \sim 142.1 \sim (103.7\%)\alpha$ $\log_2(R_{OU}/D_{re}) \sim 141.1 \sim (103\%)\alpha$
$\log_2(R_{OU}/R_{e}) \sim 136.85 \sim (99.86\%)\alpha$ $\log_2(R_{OU}/D_{e}) \sim 135.85 \sim (99.1\%)\alpha$
$\log_2(R_{OU}/R_{p}) \sim 138.53 \sim (101.09\%)\alpha$ $\log_2(R_{OU}/D_{p}) \sim 137.53 \sim (100.36\%)\alpha$
$\log_2(R_{OU}/R_{B}) \sim 122.65 \sim (89.5\%)\alpha$ $\log_2(R_{OU}/D_{B}) \sim 121.65 \sim (88.8\%)\alpha$

Another (considered non-)coincidence (that are related to the ones presented in the **Table T5-3)** regards the binary logarithmic ratios between the density of the proton/neutron (ρ_n~[$\rho_{p=}m_p/V_p$]~m_n/V_n, with V_n~V_p=$(4\pi/3)R_p^3$) and the densities of OU (ρ_{OU} and ρ_{maxOU} calculated previously)

<u>Table T-X-2</u>. The BL-TH applied to the ratios between the density of the proton/neutron and the densities of WU and OU
$\log_2(\rho_p/\rho_{OU}) \sim 145.6 \sim (106.3\%)\alpha, with\, \rho_p = m_p/V_p \sim 5.9\times10^{17} kg/m^3$
$\log_2(\rho_p/\rho_{WU}) \sim 150 \sim (109.5\%)\alpha$
$\log_2(\rho_p/\rho_{\max[1]OU}) \sim 171.4 \sim (125\%)\alpha$
$\log_2(\rho_p/\rho_{\max[2]OU}) \sim 141.5 \sim (103.3\%)\alpha$

The (considered non-)coincidences presented in tables **T5-2** and **T5-3** were also remarked by other authors (like Recami E.**[**111**]**) who considered them indirect arguments for the possibility of considering all NGPs as micro-universes and/or hadronic/leptonic micro-black-holes similar to our cosmos in a specific sense specified by those authors. However, these (considered non-)coincidences were never interpreted in the view of MBL-TH, using binary logarithms and α-units. In this category of (considered non-) coincidences (presented in **T5-2** and **T5-3)** there is also the observation first published by Barrow J. that the ratio between the age of the universe (t_{pWU}) and the mean-life of a proton expressed by its lower bound (t_p) is about the same order of magnitude as Eddington's number (the nof. peps directly detectable in the WU)**[59]**

BIDUM predicts that there are no absolute Euclidean dimensions of spacetime because spacetime is NOT absolute NOR Euclidean, but an emergent phenomena of the four PIqua flows from one mPI-gene to another mPI-gene (generating the fours FFs and their spacetime "scene"). The alpha-dimensions of the WU are the only relative (abstract)(dimensions, as (both objectively and subjectively) generated (as dimensionality perception) by the ratios between the global PIqua and the four PIqua of the four FPFs. 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 problems of SSTs): BIDUM considers strings that abstract string-like PI flows that have NO spacetime, but only generate spacetime "sensation" by their flows between different mPI-genes: these PI-flows also interact with BOMs generating the perceptual impression /illusion of space and time. In this way, BIDUM proposes an alpha-dimensional explanation for the hierarchy problem as the EGF PI-flow appears to generate the 4th alpha-dimensional frame/illusion of the global PIqua (I_{tWU}) (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 alpha-dimensional frame: as α~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 2^{α}~10^{40} (40 orders of magnitude). BIDUM predicts five abstract alpha-dimensions generated by the four layers of the FF-internodes: this prediction is also contained in Randall-Sundrum universe models (RS-1 and RS-2) which propose a (4+1)D brane-based universe. **[87,88]. Although the spatial/temporal dimensions are redefined in BIDUM as alpha-dimensions (spatial or temporal), I have chosen the common abbreviation "D" for the concept "alpha-(abstract-PI)-dimension" for simplicity (instead of alpha-D or αD). Note that an α-dimension is the logarithmic form of a GCCr-dimension, as GCCr=N_a and α=$\log_2(N_a)$: α-dimension is the equivalent of a GCCr dimension.**

The ratio between h_{eg} and the other non-EGF PIqua (h_{gl}, h_{ph} and h_{WZ}) is so small (40 orders of magnitude smaller that 1) such as the egs (the EGF-layer of OU/WU-internodes) tend to behave like a "liquid" spacetime in contrast to all the other GBs and NGPs 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 egs) bringing more close GR and QFT, as it may also explain the thermodynamics of the black-holes.

Essentially, BIDUM sustains the Simulation Hypothesis (SH) [89] by which OU/WU and HC are parts of simulated reality based on PIq gradients measurable in alpha-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 mind [BOM] and body[BOB] are considered simulated realities of the soul [bio-observer soul 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 (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) 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 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 [90])

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.

The (probably apparent non-) coincidence that [$\log_2(R_{OU}/R_e)=\log_2(R_{OU}/R_e)$]~[α=$\log_2(N_a)$~137] with N_a becoming an alpha-measure of the R_{OU} (by R_{OU}/Re ratio), ALSO opens the possibility that all ΔM to be actually "hidden" in the WU(OU) volume. Supposing that all ΔM is (may be) localized in $V_{WU(OU)}$ ("hidden" as dark matter and energy), BIDUM can predict the minimum percent of white energy-matter from the total energy-matter of this hypothetical universe of M_{ctOU} mass, such as:

$$\boxed{\%_{\min}(M_{arWU}) = M_{arWU} / M_{ctOU} = N_P / N_{Pc} = 1/368.2 \sim 0.27\%}$$

A corrected density of the OU (ρ_{cOU}) can be calculated as:

$$\boxed{\rho_{cOU} = M_{ctOU} / V_{WU(OU)} \sim 1.5\times10^{-25}\left(kg/m^3\right) \sim 368\rho_{WU} \sim 17.5\rho_{OU}} \Rightarrow$$

$$\Rightarrow \boxed{\Omega_f\left(\rho_{cOU}\right) \sim (17.2 > 1) \sim 17.5\Omega_f\left(\rho_{OU}\right) \sim 368\Omega_f\left(\rho_{WU}\right)}$$

As it can be observed from the previous equations, Ωf(ρ_{cOU})=17.2 is one order of magnitude higher than 1, which corresponds to a universe that will start to deflate and collapse as a Big-Crunch in the (probably) distant future, which is similar to a Phoenix universe **[91,92]**. The Barrow's Singular inflation theory **[93]** and Turok's Cyclic Model of the Universe (M-Theory Model of a Big Crunch/Big Bang Transition) **[94,95]** 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**) **[96]**. If the global corrected PIqua of the OU (I_{ctOU}) and the global (corrected) mass of the OU (M_{ctOU}) take minimal values, then the cyclic inflate-collapse time interval of the OU expressed in units of classical linear time will the lower bound of the mean lifetime of the proton (also using the hypothesis that [t_{OU}= t_{WU}]>t_p)

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A 5D simulation of the OU and the prediction of all the main SGCs pre-calculated by different authors

OU (as measured indirectly by FSC and GCCr) can also be simulated by a 5D hyper spherical phase space (**5D-HSPS**) similar to the 3D-graph previous simulation of the WU. This 5D-HSPS can be represented as a 5D 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 4FFs and their specific PI-quanta) are organized in 4 layers, one per each FF, each internode with a specific PI-quanta (h_{gl}, h_{ph}, h_W and h_{eg}) attached to it (that may be represented in different colors). Gravity is the basic layer of internodes: as this layer has ~4.5D, it is clear that it doesn't interconnect all the nodes from the 5D-HSPS, but only a ~4.5D dust of nodes that can be uniformly (but sparse) distributed in the 5D-HSPS, but also in the proximity of our 4D spacetime as if our 4D brane is attracting the egs and concentrates them in its vicinity. **[97,98]**. 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 5D-HSPS: the 3-non gravity FFs webs surely have a (quasi) fractal (quasi)uniform global distribution. The 4th and the 5th dimensions can be physical dimensions but ALSO pure informational/abstract dimensions in which the ~3.5D/ ~4.5D configurations of the 4 FFs are recorded/pre-designed. The SNF-EWF-EMF webs (of internodes) interconnects ~3.5D swarms of quarks from the global 5D-HSPS. The EGF webs (of internodes) interconnects ~4.5D swarms of quarks from the same global 5D-HSPS.

In the interior of a quark triad/triangulation (**QT**), all the 4 types of FF internodes superpose to each other such as the second layer is the EMF which has a theoretical infinite distance of action but which doesn't escape the 5th dimension (as the photons are considered open strings that remain in the ~3.5th dimension of our 4D brane). The EWF and SNF internodes are superposed to the EG 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 h_{eg} probably of the same order as h_{ph}) which implies a very large G (named Strong Gravity Constant [SGC abbreviated as Γ]). A quantum G (G_q) can also be generalized as a function of h_{eg} (which also may considered a function of I_{kWU} and the nof. (d) alpha-dimensions of the frame of reading). **If the OU phase space is considered a 5D hypersphere, then N_a (=2^{α}) (the exponential alpha-unit measure) is the nof. NGP-nodes per each diameter of this hypersphere: if this OU phase space is considered a 5D hypercube, then N_a is the no. NGP-nodes per lateral edge of this 5D hypercube.** The (approximate) (fractional) nof. dimensions (d) corresponding to a specific value of Γ scalar (as predicted and calculated by different authors) can be generated using a simple logarithmic function with base N_a (it's obvious, however, that this function generates just an approximation of the real d(Γ), as it is deducted [for simplicity of equations] from cubic volumes as in i(d) function, not spherical volumes).

$$\boxed{G_q(d) = k_G \cdot \frac{I_{tWU}}{N_a{}^d}}, with \ \boxed{k_G = \frac{c}{m_e{}^2(2\pi\alpha)}}$$

$$\boxed{d(\Gamma) = \log_{N_a}\left(\frac{I_{tWU}}{\Gamma / k_G}\right)}$$

Table T-VI-1. The value of function $G_q(d)$ for different (fractional) nof. alpha-dimensions d
$G_q(\Gamma_{Seshavatharam-Avogadro} \sim 3.32^*) \sim 2.42\times10^{37} m^3kg^{-1}s^{-2} \sim \Gamma_{Seshavatharam-Avogadro} = N_A{}^2G \sim 3.6\times10^{47}G$ (*this frame predicts Γ as calculated by Seshavatharam and Lakshminarayana based on Avogadro Number (N_A) **[70,99,100,101,102]**)
$G_q(d_{Perng} \sim 3.44^*) \sim \Gamma_{Perng} = \frac{\hbar c}{m_e{}^2\alpha} \sim 2.78\times10^{32} m^3kg^{-1}s^{-2} \sim 4.2\times10^{42}G$ (*this frame predicts Γ as calculated by Perng**[70,71]**) ; Perng's Γ scalar is similar to the Fedosin's Γ scalar (see the last lines of this table)
$G_q(d_{Seshavatharam} \sim 3.455^*) \sim \Gamma_{Seshavatharam} \sim 6.94\times10^{31} m^3kg^{-1}s^{-2} \sim 1.04\times10^{42}G$ (*this frame predicts Γ as calculated by Seshavatharam and Lakshminarayana **[70,103])**
$G_q(d_{Fisenko} \sim 3.458^*) \sim \Gamma_{Fisenko} \sim 5.1\times10^{31} m^3kg^{-1}s^{-2} \sim 7.6\times10^{41}G$ (*this frame predicts Γ as calculated by Fisenko et al.**[70,104,105,106]** 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 Γ)
$G_q(d_{Recami} \sim 3.487^*) \sim \Gamma_{Recami} \sim 3.2\times10^{30} m^3kg^{-1}s^{-2} \sim 4.8\times10^{40}G$ (*this frame predicts Γ as calculated by Recami **[70,107,108,109,110,111]**)
$G_q(d_{Fedosin} \sim 3.519^*) \sim \Gamma_{Fedosin} = \frac{\hbar c}{m_p m_e \alpha} \sim 1.514\times10^{29} m^3kg^{-1}s^{-2} \sim 2.3\times10^{39}G$ (*this frame predicts Γ 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 **[70,112,113,114,115]**); Fedosin's Γ scalar is very similar to Perng's Γ scalar (see the first lines of this table)
$G_q(d_{Tennakone} \sim 3.533^*) \sim \Gamma_{Tennakone} \sim 3.9\times10^{28} m^3kg^{-1}s^{-2} \sim 5.8\times10^{38}G$ (*this frame predicts Γ as calculated by Tennakone **[70,116]**)
$G_q(d_{Stone} \sim 3.539^*) \sim \Gamma_{Stone} \sim 2.4\times10^{28} m^3kg^{-1}s^{-2} \sim 3.6\times10^{38}G$ (*this frame predicts Γ as calculated by Stone**[70,117]**)
$G_q(d_{Oldershaw} \sim 3.54^*) \sim \Gamma_{Oldershaw} \sim 2.18\times10^{28} m^3kg^{-1}s^{-2} \sim 3.3\times10^{38}G$ (*this frame predicts Γ as calculated by Oldershaw**[70,118]**)
$G_q(d_{Mongan} \sim 3.547^*) \sim \Gamma_{Mongan} \sim 1.1\times10^{28} m^3kg^{-1}s^{-2} \sim 1.6\times10^{38}G$ (*this frame predicts Γ as calculated by Mongan**[70,119]**)
$G_q(d_{Sivaram} \sim 3.552^*) \sim \Gamma_{Sivaram} \sim 6.7\times10^{27} m^3kg^{-1}s^{-2} \sim 1.004\times10^{38}G$ (*this frame predicts Γ as calculated by Sivaram and Sinha**[70,120]** based on the analogy**[70,121]** between hadrons and Kerr-Newman black holes; this value of Γ is also accepted by Raut and Usha**[70,122]**; $\Gamma_{Sivaram}$ also allowed estimating the strong spin-torsion interaction between spinning protons**[70,123])**
$G_q(d_{Dufour} \sim 3.613^*) \sim \Gamma_{Dufour} \sim 2.06\times10^{25} m^3kg^{-1}s^{-2} \sim 3.1\times10^{35}G$ (*this frame predicts Γ as calculated by Dufour**[70,124]**)

As all the four FFs have dimensional frames with a fractal dimension d>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 ray 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 NGPs [that permanently emit egs from their surfaces] and all GBs, as conjectured by de Broglie's hypothesis) 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_{gl}). The 5D-HSPS may be considered a swarm of Q/L/N3D-bbs interconnected by 2D cylindrical/spherical branes (the GBs). This may explain why the universe has a 3D appearance (as these elementary Q/L/N3D-bbs 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) in pulses that creates PI gradients between different 3D-bbs. These 3D-bbs 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-bbs).

Using the generalized G_q scalar we can estimate as $G_q(3)$ the minimal magnitude of the cohesion force between 2 adjacent concentric 2D-sb of the same 3D-bb: 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 [Γ]). The maximal magnitude of VSG may be defined by $G_q(2)$. 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 $G_q(2)$ and $G_q(1)$. If we recursively consider that the 1D-bs (strings) are also swarms of adimensional points (0D-branes[0D-bs]) (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 mPI-gene "clone"-points of the OU (similar to clone cells role/function specialization/differentiation)]; in this view, a string can be considered swarms of points 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 illusion, as ITMU considers spacetime and energy-matter as emergent from the intrinsic PI of each different adimensional point**) attached together, then we can estimate the cohesion force between those points (0D-branes) in the interval $G_q(1)$ and $G_q(0)$.

$$\boxed{G_q(3) \sim 3.9\times10^{50} m^3kg^{-1}s^{-2} \sim 5.9\times10^{60} G}$$

$$\boxed{G_q(2) \sim 6.98\times10^{91} m^3kg^{-1}s^{-2} \sim 1.05\times10^{102} G}$$

$$\boxed{G_q(1) \sim 1.2\times10^{133} m^3kg^{-1}s^{-2} \sim 1.9\times10^{143} G}$$

$$\boxed{G_q(0) \sim 2.2\times10^{174} m^3kg^{-1}s^{-2} \sim 3.3\times10^{184} G}$$

An important remark. Apparently N_P is the real number of QPs in the WU and the difference to $ND^{4.5D}$ is an imaginary number. In fact, these additional particles may be considered real QPs in other parallel 4D-branes equatorial plates of the 5D-HSPS: from this consideration it is also clear that the 4 FFs have not only a transverse action in space, but also a longitudinal action in the 4th and the 5th dimensions (time and hyper-time) connecting QPs with their own "clones" from the other parallel 4D-bs (in other words, the 4 FFs are ways in which each particle connect not only with the other, but also with themselves, alias their replicas from other parallel 4D-plates/branes).

All the GBs except the egs can escape the 3Dbs in the 4th dimension (but not the 5th dimension), creating ~3.5D webs of the 3 non-EG FFs. ITMU considers that egs are close strings than are interchanged by 3D-bbs that can escape both the 4th and the 5th dimensions (as **SST** and M-Theory[**MT**] also predict): however, our 4D-b attracts the egs that escape from it in the 5th dimension and tends to concentrate those egs in its vicinity**[88,97,99]**.

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The law of PIqua-emmision can explain the EMF and EGF classical scalars

The granulated structure of any NGP (as a dust of identical/similar 3D-branes (**3Dbs**) with a fractional nof. alpha-dimensions between 3D and 4D, approximately ~3.5D located in a 4Db), the 3Db character of all EQPs and the quantum field theory (in which all the four FFs are generated by the interchange of virtual GBs) may also explain the inverse square law (the law of inverse proportionality to the square root of distance that characterizes EMF and EGF scalars).

The fact that scalar of the (Newtonian) gravitational force (F_g) is **dp** to the product of masses may be explained by each mass (m_1 and m_2) being a ~3.5D dust composed of n_1 and respectively n_2 elementary 3Dbs AND that each of those subcomponent 3Dbs (from the ~3.5D dust of m_1) communicates (by emission-reception of virtual/real egs) with all the subcomponent 3Dbs of m_2 and vice-versa, such as **F_g is dp to $[(n_1 \cdot n_{2)} \cdot m_{3Db}{}^2]$ product** (with **m_{3Db}** being a minimal hypothetical elementary mass of a standard 3Db that composes both masses). Each mass (supposed point-like when compared to the distance d between those masses) scatters egs in all the 3D directions of space on a surface of a sphere with variable ray(r). For r=d, the first group of n_1 egs (at least 1 eg emitted by each of n_1 3Dbs) will be scattered on a spherical surface of area $A_1= 4\pi d^2$ and the same type of spreading is generating by m_2 with $A_2=A_1=A=4\pi d^2$: the probability for each eg emitted by one mass (or the other) to target a subcomponent 3Db of the other mass is inversely proportional (**inp**) to A_1 and A_2 respectively and so F_g will be **inp** to the sum of the 2 areas ($A_1+A_2=2A=8\pi d^2$) such as $F_g=(8\pi G) \cdot [(n_1 \cdot n_{2)} \cdot m^2]/(8\pi d^2)$. That's why BIDUM considers $8\pi G$ (used to simplify the 8π sub-factor of $8\pi d^2$) a true corrected Newtonian G ($G_c=8\pi G$) offering an alternative additional explanation for the $8\pi G$ factor in the Einstein (gravitational) field equations (**EFE**) that may bring more close **GR** and **Quantum Field Theory** (**QFT).**

As egs may be considered closed strings scattered in both the 4th and the 5th dimension (SST hypothesis and prediction) there is a non-0 probability for each eg to target the other mass even if they are emitted in the opposite direction of the targeted-mass (as they may return from the 4Db/5Db/4th/5th dimensions back in the ~3.5D dust of the emitter-mass from another direction, which makes theoretically possible the targeting of the other mass): that's why, when formulating the F_g scalar, BIDUM considers the sum of 2 integral spherical areas $A_1+A_2=2A$ and not just the sum of 2 hemispheres strictly reciprocally oriented to the other mass). Analogously, as the virtual/real photons don't escape the 4Db of the emitter-mass (as predicted by SST), only the virtual/real photons emitted on the hemisphere oriented to the other charge (with both charges composed of n_1 and n_2 nof. 3Dbs, each with an elementary charge of **q_{3Db}**) will participate in generation of the electromagnetic/Coulomb force (F_e) and that's why the F_e scalar is **inp** to the sum of 2 hemispheric areas ($A_1/2+A_2/2 = (A_1+A_2)/2 =2A/2= 4\pi d^2$) and that's why BIDUM considers $4\pi K_e$ (used to simplify the 4π sub-factor of $4\pi d^2$) a true corrected Coulombian K_e ($K_{ec}=4\pi K_e$):

$$\boxed{G_c = 8\pi G} \; and \; \boxed{F_g = G_c \frac{(n_1 n_2) m_{3D-b}{}^2}{A_1 + A_2} = G_c \frac{(n_1 n_2) m_{3D-b}{}^2}{8\pi d^2}}$$

$$\boxed{K_{ec} = 4\pi Ke} \; and \; \boxed{F_e = K_{ec} \frac{(n_1 n_2) q_{3D-b}{}^2}{(A_1/2)+(A_2/2)} = K_{ec} \frac{(n_1 n_2) q_{3D-b}{}^2}{4\pi d^2}}$$

$$\boxed{G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}} \Leftrightarrow \boxed{G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{G_c}{c^4} T_{\mu\nu}} \quad \textbf{(EFE)}$$

One may also speculate that the 3Dbs (which compose all the known NGPs) may also have an "onion"-like internal (sub)structure, being composed of concentric layers of 2Dbs kept in adhesion by Very Strong Gravity (**VSG**) adhesion forces characterized by strengths between $G_q(3)\sim10^{61}G$ and $G_q(2)\sim10^{102}G$: these VSG forces may explain why the so-called EQP appear as point-like and almost perfectly spherical (as the electron was shown to be**[125]**) apparently elementary particles, as no experiment managed to split these EQPs in subcomponents until the present time. The 2Dbs may also have an "onion"-like internal (sub)structure, being composed of concentric layers of 1Dbs (strings) kept in adhesion by **VSG** adhesion forces characterized by strengths between $Gq(2){\sim}10^{102}G$ and $Gq(1){\sim}10^{143}G$. The 2Dbs may also have an internal (sub)structure, being composed of 0Dbs (PIqua points) kept in adhesion by **VSG** adhesion forces characterized by strengths between $Gq(1){\sim}10^{143}G$ and $Gq(0){\sim}10^{184}G$.

In conclusion, BIDUM also sustains the Preonic Models (PM) of the EQPs (including the Rishonic Model [**RM**]of EQPs) **[126]** that go far beyond the Standard Model (**SM**) with the hypothesis (for which there are a couple of suggestive experimental indications) that leptons, neutrinos, and quarks are composite QPs (built from confined fermionic subparticles called “rishons”) and their structure is described by the quantum group SLq(2) **[127]**. Additionally., BIDUM also predicts the magnitudes of specific N<3 dimensional VSG huge adhesion forces with $G_q(N)$ strengths.

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Based on the PIq scalar, BIDUM may predict the maximum (possibly) non-0 rest mass for the gluon, the photon and the (hypothetical eg) which are considered to have a theoretical 0-rest masses

If hypothesized that the photon has a minimal half-life ($\mathbf{t_{ph}}$) comparable to that of the proton ($\mathbf{t_p}$) with an inferior limit of this mean lifetime ($\mathbf{t_{ph} > [t_p \sim 10^{31}}$ **years]**), then a superior limit for a possible non-0 rest mass of the photon ($\mathbf{m_{ph}}$) can be calculated using the PIq scalar, such as:

$$\left.\begin{array}{l}\boxed{h_{ph} = (m_{ph}c^2)\cdot t_{ph}}\\ \boxed{t_{ph} > t_p}\end{array}\right\} \Rightarrow \boxed{h_{ph} > (m_{ph}c^2)\cdot t_p} \Leftrightarrow \boxed{m_{ph} < \left[\frac{h_{ph}/t_p}{c^2} \sim 1.31\times10^{-53}(eV/c^2)\right]}$$

If hypothesized that the eg has a minimal half-life ($\mathbf{t_{eg}}$) comparable to that of the proton ($\mathbf{t_p}$) with an inferior limit of this mean lifetime ($\mathbf{t_{eg} > [t_p \sim 10^{31}}$ **years]**), then a superior limit for a possible non-0 rest mass of the (hypothetic) eg ($\mathbf{m_{eg}}$) can be calculated from h_{eg} using the PIq scalar, such as:

$$\left.\begin{array}{l}\boxed{h_{eg} = (m_{eg}c^2)\cdot t_{eg}}\\ \boxed{t_{eg} > t_p}\end{array}\right\} \Rightarrow \boxed{h_{eg} > (m_{eg}c^2)\cdot t_p} \Leftrightarrow \boxed{m_{eg} < \left[\frac{h_{eg}/t_p}{c^2} \sim 3.1\times10^{-96}(eV/c^2)\right]}$$

If hypothesized that the gluon has a minimal half-life ($\mathbf{t_{gl}}$) comparable to that of the proton ($\mathbf{t_p}$) with an inferior limit of this mean lifetime ($\mathbf{t_{gl} > [t_p \sim 10^{31}}$ **years]**), then a superior limit for a possible non-0 rest mass of the gluon ($\mathbf{m_{gl}}$) can be calculated from h_{gl} using the PIq scalar, such as:

$$\left.\begin{array}{l}\boxed{h_{gl} = (m_{gl}c^2)\cdot t_{gl}}\\ \boxed{t_{gl} > t_p}\end{array}\right\} \Rightarrow \boxed{h_{gl} > (m_{gl}c^2)\cdot t_p} \Leftrightarrow \boxed{m_{gl} < \left[\frac{h_{gl}/t_p}{c^2} \sim 1\times10^{-55}(eV/c^2)\right]}$$

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An information-area and energy-mass-distance-time set of equivalences (hypothesis) based on the Planck units extended in the additional 4^{th}/ 5^{th}/N^{th} (compact topology) dimensions of the universe predicted by the SSTs

As BIDUM argues for the existence of (at least) 5 spatial dimensions (as also supported by SSTs and MT), time can be considered a 2D (at least) spatial surface (the 4th and the 5th spatial dimensions, both with compact topologies) also measurable in meters. Vacuum can be abbreviated as $S_{3D}T_{2D}$.(3 spatial dimensions and 2 temporal dimensions with are essentially also spatial dimensions, but with compact topologies).

$$\boxed{S_{3D}T_{2D} \equiv S_{3D}S_{2D(compact)} \equiv S_{5D}}$$

BIDUM considers that the smallest time quanta in our 3D universe (the Planck time [t_P]) also measures (in fact) the smallest linear (space) quanta (the Planck length [l_P]) of the 4^{th} and 5^{th} dimensions, as BIDUM considers (in principle) the same G in all the 5 (spatial) dimensions and using c as an interconversion factor between the second and the meter.

$$\boxed{t_P \equiv l_{P(of\ a\ compact\ 2D\ temporal\ surface)}} \Leftrightarrow \boxed{t_P \equiv c \cdot t_P} \Leftrightarrow \boxed{1s \equiv 3 \cdot 10^8 m_{2d(temporal)}}\ and\ \boxed{c \equiv 1}$$

As previously explained, BIDUM treats I_{tWU}, I_{ctOU}, N_a and the four PIqua [h_{eg}, h_{ph}=h, $h_{W/Zb}$ and h_{gl}] as central and more important that the energy/mass quanta and considers that energy, force and mass and their measure units (together with all their sub-derivatives) can be deducted from the PIq (I) scalar and additional I-derived scalars can also be defined. The abbreviation "t" is used for an interval of time $\Delta t = t_2 - t_1$ (equivalent to distance/length) and the abbreviation "d" is used for distance (for the simplicity of the equations in the next table)

Table T5-4. **PI quantity and its spacetime and space-only derivatives** („t"=time interval; „d"=distance/length; „I"=PI quantity)

PI quantity (PIq or I) (analogous to quantum action/quantum angular momentum, but measurable in pits/qbits/bits)	$I = E \cdot t \left(\equiv E \cdot d\right) \Rightarrow$ $\Rightarrow pit = J \cdot s \left(\equiv J \cdot m\right)$
I-flux (flow) (IF) in time (IFT) (the total I transferred and multiplied over a specific t)	$IFT = I \cdot t = E \cdot t^2 \left(\equiv E \cdot d^2\right) \Rightarrow$ $\Rightarrow pit \cdot s = J \cdot s^2 \left(\equiv J \cdot m^2\right)$
IF in distance (IFD) (the total I transferred and multiplied over a specific d [usually a circumference perpendicular to the IF direction])	$IFD = I \cdot d = E \cdot t \cdot d \left(\equiv E \cdot d^2\right) \Rightarrow$ $\Rightarrow pit \cdot m = (J \cdot s) \cdot m \left(\equiv J \cdot m^2 \equiv J \cdot s^2\right)$
IFD speed (IFDS) (the total I transferred and multiplied over a specific d [usually a circumference perpendicular to the IF direction] per unit of t)	$IFDS = (I \cdot d)/t = [(E \cdot t) \cdot d)/t = E \cdot d \Rightarrow$ $\Rightarrow pit \cdot m/s = (J \cdot s) \cdot m/s = J \cdot m \left(\equiv J \cdot s \equiv I\right)$ (the significance of the scalar products $\boxed{h \cdot c}$, $\boxed{K_e q_1 q_2}$ and $\boxed{Gm_1 m_2}$ as total I emitted/received over a circular front/distance d [centered in the emission/reception center[source] of the circle] per unit of time)
IF in distance and in time (IFDT) (the total I transferred and multiplied over a specific d [usually a circumference perpendicular to the I flow direction] and over a specific time interval)	$IFDT = (I \cdot d) \cdot t = [(E \cdot t) \cdot d] \cdot t = E \cdot d \cdot t^2 \left(\equiv E \cdot d^3\right) \Rightarrow$ $\Rightarrow pit \cdot m \cdot s = [(J \cdot s) \cdot m] \cdot s = J \cdot m \cdot s^2 \left(\equiv J \cdot m^3 \equiv J \cdot s^3\right)$

IF in/over an area (IFA) (the total I transferred and multiplied over a specific area d^2 [usually the area of a circular surface perpendicular to the IF direction])	$IFA = I \cdot d^2 = E \cdot t \cdot d^2 \left(\equiv E \cdot d^3\right) \Rightarrow$ $\Rightarrow pit \cdot m^2 = J \cdot s \cdot m^2 \left(\equiv J \cdot m^3 \equiv J \cdot s^3\right)$
Energy (E) (I transfer[interchange] speed / ITF acceleration) **(I transferred per unit of time t)**	$E = \frac{I}{t}\left(\equiv \frac{I}{d}\right) \Rightarrow \frac{pit}{s} = J(Joule)\left(\equiv \frac{pit}{m}\right)$
(Physical) Power (P) (the variation of I transfer-speed [E] with time; I transfer acceleration)	$P = \frac{E}{t} = \frac{I/t}{t} = \frac{I}{t^2}\left(\equiv \frac{I}{d^2}\right) \Rightarrow$ $\Rightarrow \frac{pit/s}{s} = \frac{pit}{s^2} = W(Watt)\left(\equiv \frac{pit}{m^2}\right)$
Force (F) (the I transfer per unit of d [linear or circular distance usually perpendicular on the direction of IF] and per unit of t)	$F = \frac{E}{d} = \frac{I/t}{d} = \frac{I/d}{t} = \frac{I}{d \cdot t}\left(\equiv \frac{I}{d^2}\right) \Rightarrow$ $\Rightarrow \frac{pit}{m \cdot s} = N(Newton)\left(\equiv \frac{pit}{m^2} \equiv \frac{pit}{s^2} = P\right)$
Square root of F (a 0.5D Cantor-fractal sampled I distributed per unit of 0.5D Cantor-fractal sampled time t and distance d) (0.5D Cantor-fractal pulsated I transfer)	$\sqrt{F} = \frac{E^{1/2}}{d^{1/2}} = \frac{I^{1/2}/t^{1/2}}{d^{1/2}} = \frac{I^{1/2}}{d^{1/2} \cdot t^{1/2}}\left(\equiv \frac{I^{1/2}}{d}\right) \Rightarrow$ $\Rightarrow \frac{pit^{1/2}}{m^{1/2} \cdot s^{1/2}} = N^{1/2}\left(\equiv \frac{pit^{1/2}}{m} \equiv \frac{pit^{1/2}}{s}\right)$

Mass (information flow [LMI transfer flow] per unit of area [an area usually perpendicular to the direction of LMI transfer]). Mass also may have the significance of an informational distribution over a linear/curved distance (informational pressure over a distance)	$M = \frac{F(Force)}{a(acceleration)} = \frac{E/d}{d/t^2} = \frac{\frac{I/t}{d}}{d/t^2} = \frac{I \cdot t}{d^2} = \frac{IFT}{d^2}\left(\equiv \frac{I}{d} \equiv \frac{I}{s} \equiv E\right) \Rightarrow$ $\Rightarrow \frac{N}{m/s^2} = \frac{pit/(m \cdot s)}{m/s^2} = \frac{pit \cdot s^2}{m^2 \cdot s} = \frac{pit \cdot s}{m^2} = kg\left(\equiv \frac{pit}{m} \equiv \frac{pit}{s} \equiv J\right)$ Mass is equivalent to energy in a 4D space-time in which time is considered an indirect logarithmic measure of distance in the 4th spatial dimension. The PI-based mass-energy logical equivalence is also obvious.
The rest mass of the electron can be understood as the informational flow (measured by nof. strings in a minimal full rotation interval of time $\frac{2\pi R_e}{c} \sim 10^{19} t_P$) per unit of circular section area (supposing that the electron is a 4D torus/hyper-sphere in which all the co-phase sub-strings circularly move through a section area, and this informational flow movement generates the rest mass, the spin and the charge of the electron which was demonstrated to be almost perfectly spherical).	
Square root of mass (0.5D Cantor-fractal sampled LMI flow [1 of the 2 LMIP pair of the mass field in a 0.5D Cantor-fractal sampled time interval] distributed per unit of distance/length [a linear/circular distance usually perpendicular to the direction of LMI transfer]) (0.5D Cantor-fractal pulsated LMI flow)	$\sqrt{M} = \sqrt{\frac{IFT}{d^2}} = \frac{IFT^{1/2}}{d} \Rightarrow$ $\Rightarrow \sqrt{kg} = \frac{pit^{1/2} \cdot s^{1/2}}{m}$

Square of mass (informational 2D "super"-flow per unit of 4D hyper volume)	$M^2=\left(\frac{IFT}{d^2}\right)^2=\frac{IFT^2}{d^4}\left(\equiv\frac{IFT^2}{t^4}\right)\Rightarrow$ $\Rightarrow kg^2=\frac{(pit\cdot s)^2}{m^4}=\frac{pit^2\cdot s^2}{m^4}\left(\equiv\frac{pit^2}{m^2}\equiv\frac{pit^2}{s^2}\right)$
The linear/translational momentum (classical) (informational quantity transferred per unit of distance/length [a linear/circular distance usually perpendicular to the direction of LMI transfer])	$p=M\cdot v=\frac{IFT}{d^2}\cdot\frac{d}{t}=\frac{IFT}{d\cdot t}=\frac{IF/t}{d}=\frac{I}{d}\left(\equiv\frac{I}{t}\right)\Rightarrow$ $\Rightarrow kg\cdot\frac{m}{s}=\frac{pit\cdot s}{m^2}\cdot\frac{m}{s}=\frac{pit}{m}\left(\equiv\frac{pit}{s}\right)$
The classical Newtonian G and the classical Coulombian scalar $K_eQ_e^2$ have the significance of an inverse of the informational distribution over and area (informational "pressure" over and area)	$G\equiv K_eQ_e^2=\frac{F\cdot d^2}{M^2}=\frac{d^3/t^2}{M}=\left(\frac{I\cdot t^3}{d^5}\right)^{-1}\left[\equiv\left(\frac{I}{d^2}\right)^{-1}\equiv\left(\frac{I}{t^2}\right)^{-1}\right]\Rightarrow$ $\Rightarrow\frac{m^3}{kg\cdot s^2}=\left(\frac{pit\cdot s^3}{m^5}\right)^{-1}\left[\equiv\left(\frac{pit}{m^2}\right)^{-1}\equiv\left(\frac{pit}{s^2}\right)^{-1}\right]$

Checkpoint conclusion: BIDUM "contracts" energy, force and mass (with their measure-units) in just one scalar (PIq) and its spacetime/spatial-only/time-only derivatives.

As c is an universal constant (verified as constant in all the WU), BIDUM ALSO interprets its constancy as a first rank equivalence principle between the distance quanta (**dqua**) and time-quanta (**tqua**) so that dqua≡tqua (or d≡t) and dqua/tqua=K_c≡c (apparently dimensional but essentially adimensional) so that c actually hides a more profound adimensional constant K_c which may be any arbitrary number (including 1 or π multiples)

As G and $K_eQ_e^2$ (scalars) are also universal constants (verified as constants in all the WU), BIDUM ALSO interprets their constancy as a first rank equivalence principle between the PIqua and area-quanta (**aqua**) so that PIqua≡aqua ($I\equiv d^2\equiv t^2\equiv d\cdot t$) and PIqua/aqua=$K_G$(≡G)≡ K_Q (≡ $K_eQ_e^2$) (apparently dimensional but essentially adimensional) so that G and $K_eQ_e^2$ actually hide the more profound adimensional constants K_G and K_Q which may also be any arbitrary numbers (including 1 or π multiples). The PIqua-aqua equivalence principle may be stated as "PI is essentially (equivalent) area and area is essentially (equivalent) PI": as it can be observed, this is an alternative formulation of the 't Hooft's holographic principle (subsequently developed by Leonard Susskind) **[128,129,130,131]**

As the Planck constant (h) is also an universal constant (verified as constant in all the WU), BIDUM ALSO interprets its constancy as a first rank equivalence principle between the (quantum/classical) angular momentum (measured in Joule·second) and pure information (measured in pure numbers of bits and/or qbits) so that angular momentum(p)≡PIq≡nof. states (N_S) and PIq/N_S=K_I(≡h) (apparently dimensional but essentially adimensional) so that h actually hides the more profound adimensional constants K_I (which was alternatively calculated relative to the eg-qbit as K_{PI} in the first parts of BIDUM) which may also be any arbitrary number (including 1 or π multiples). The p≡PIq(I)≡N_S equivalence principle combined with the PIq scalar, t≡d and $I\equiv d^2\equiv t^2$ principles can generate another secondary equivalence principles: E≡I/t≡I/d≡d≡t (which predicts strings as energy quanta like in the SSTs), $F\equiv I/(t\cdot d)\equiv I/d^2\equiv I/t^2\equiv 1$ (force is considered essentially adimensional in BIDUM), M≡d≡t(≡E) (which predicts strings as mass quanta like in the SSTs AND also predicts the energy-mass equivalence principle or EEP as explained by string-based character of masses and energies)

As there are many rest masses/energies, one per each type of QP, the mass-energy equivalence is considered a second rank equivalence principle of BIDUM, as there is no unique Equa (nor Mqua): h, G, KeQe are unique universal constants and are the basement of the first rank equivalence principles of BIDUM.

All the equivalence principles of BIDUM (previously mentioned in this chapter) are all resumed in the next table.

Table T5-5. **All the information-area and energy-mass-distance-time equivalence principles of BIDUM** („t”=time interval or time quanta; „d”=distance/length quanta; „I”=PI quantity [PIq])	
The distance-(classical linear) time equivalence principle of BIDUM (derived from the interpretation of the constancy of c)	$t \equiv d$
PI quantity (PIq or I) (analogous to quantum action/quantum angular momentum, but measurable in pits/qbits/bits) as equivalent with area of space or time (the holographic principle of BIDUM derived from the interpretation of the constancy of G and Ke)	$I \equiv t \cdot d \equiv t^2 \equiv d^2 (area) \Rightarrow$ $\Rightarrow pit = J \cdot s \left(\equiv J \cdot m\right)\left(\equiv s \cdot m\right)\left(\equiv s^2\right)\left(\equiv m^2\right)$
I-flux (flow) (IF) in time (IFT) (the total I transferred and multiplied over a specific t) as equivalent with a volume of space or time **(the process of generating 3D-volumic mind constructs using classical linear time and 2D PIq matrix areas)**	$IFT = I \cdot t \left(\equiv t^3 \equiv d^3\right) \Rightarrow$ $\Rightarrow pit \cdot s = J \cdot s^2 \left(\equiv s^3 \equiv m^3\right)$
IF in distance (IFD) (the total I transferred and multiplied over a specific d [usually a circumference perpendicular to the IF direction])	$IFD = I \cdot d = I \cdot t \left(\equiv t^3 \equiv d^3\right) \Rightarrow$ $\Rightarrow pit \cdot m = J \cdot s \cdot m \left(\equiv s^3 \equiv m^3\right)$
IFD speed (IFDS) (the total I transferred and multiplied over a specific d [usually a circumference perpendicular to the IF direction] per unit of t) **(essentially equivalent to PIq and space/time/spacetime area)**	$IFDS = (I \cdot d)/t\left[\equiv I \equiv t \cdot d \equiv t^2 \equiv d^2 (area)\right] \Rightarrow$ $\Rightarrow pit \cdot m/s \left(\equiv s \cdot m\right)\left(\equiv s^2\right)\left(\equiv m^2\right)$ (the significance of the scalar products $\boxed{h \cdot c}$, $\boxed{K_e q_1 q_2}$ and $\boxed{G m_1 m_2}$ as total I emitted/received over a circular front/distance d [centered in the emission/reception center[source] of the circle] per unit of time)
IF in distance and in time (IFDT) (the total I transferred and multiplied over a specific d [usually a circumference perpendicular to the I flow direction] and over a specific time interval) **(the process of generating 4D-hypervolumic mind constructs using 2D PIq matrix areas and classical linear time and 1D spatial distances)**	$IFDT = (I \cdot d) \cdot t \left(\equiv I \cdot d^2 \equiv I \cdot t^2 \equiv d^4 \equiv t^4\right) \Rightarrow$ $\Rightarrow pit \cdot m \cdot s \left(\equiv pit \cdot m^2 \equiv pit \cdot s^2 \equiv m^4 \equiv s^4\right)$
IF in/over an area (IFA) (the total I transferred and multiplied over a specific area d^2 [usually the area of a circular surface perpendicular to the IF direction]) **(the process of generating 4D-hypervolumic mind constructs using 2D PIq matrix areas and classical 2D spatial areas)**	$IFA = I \cdot d^2 \left(\equiv I \cdot d^2 \equiv I \cdot t^2 \equiv d^4 \equiv t^4\right) \Rightarrow$ $\Rightarrow pit \cdot m^2 \left(\equiv pit \cdot m^2 \equiv pit \cdot s^2 \equiv m^4 \equiv s^4\right)$
Energy (E) (I transfer[interchange] speed / ITF acceleration) **(I transferred per unit of time t) (energy-distance equivalence principle of BIDUM which may suggest the string**	$E = \frac{I}{t} \left(\equiv \frac{I}{d}\right)\left(\equiv d \equiv t\right) \Rightarrow$ $\Rightarrow \frac{pit}{s} = J(Joule)\left(\equiv m \equiv s\right)$

interpretation of any Equa as in SSTs)	
(Physical) Power (P) (the variation of I transfer-speed [E] with time; I transfer acceleration) **(as it can be observed physical power is adimensional as I is equivalent to a space/time/spacetime area)**	$P=\frac{E}{t}=\frac{I/t}{t}=\frac{I}{t^2}\left(\equiv\frac{I}{d^2}\equiv 1\right)\Rightarrow$ $\Rightarrow\frac{pit/s}{s}=\frac{pit}{s^2}=W(Watt)(\equiv 1)$
Force (F) (the I transfer per unit of d [linear or circular distance usually perpendicular on the direction of IF] and per unit of t) **(as it can be observed physical power is ALSO adimensional [as P is] as I is equivalent to a space/time/spacetime area)**	$F=\frac{E}{d}=\frac{I/t}{d}=\frac{I/d}{t}=\frac{I}{d\cdot t}\left(\equiv\frac{I}{d^2}\equiv 1\right)\Rightarrow$ $\Rightarrow\frac{pit}{m\cdot s}=N(Newton)\left(\equiv\frac{pit}{m^2}\equiv\frac{pit}{s^2}\equiv 1\right)$
Square root of F (a 0.5D Cantor-fractal sampled I distributed per unit of 0.5D Cantor-fractal sampled time t and distance d) (0.5D Cantor-fractal pulsated I transfer) **(as force [F] is adimensional, the square root of F is ALSO adimensional [as P is] as I is equivalent to a space/time/spacetime area)**	$\sqrt{F}=\frac{E^{1/2}}{d^{1/2}}=\frac{I^{1/2}/t^{1/2}}{d^{1/2}}=\frac{I^{1/2}}{d^{1/2}\cdot t^{1/2}}\left(\equiv\frac{I^{1/2}}{d}\equiv\frac{t}{d}\equiv 1\right)\Rightarrow$ $\Rightarrow\frac{pit^{1/2}}{m^{1/2}\cdot s^{1/2}}=N^{1/2}\left(\equiv\frac{pit^{1/2}}{m}\equiv\frac{pit^{1/2}}{s}\equiv\frac{m}{s}\equiv 1\right)$

Mass (information flow [LMI transfer flow] per unit of area [an area usually perpendicular to the direction of LMI transfer]). Mass also may have the significance of an informational distribution over a linear/curved distance (informational pressure over a distance) (the I/area-based energy-mass equivalence principle of BIDUM)	$M=\frac{F(Force)}{a(acceleration)}=\frac{I\cdot t}{d^2}\left(\equiv\frac{I}{d}\equiv\frac{I}{s}\equiv d\equiv t\equiv E\right)\Rightarrow$ $\Rightarrow\frac{N}{m/s^2}=\frac{pit\cdot s}{m^2}=kg\left(\equiv\frac{pit}{m}\equiv\frac{pit}{s}\equiv m\equiv s\equiv J\right)$ Mass is equivalent to energy as both Mqua and Equa are string-based (as also predicted by SSTs)
Square root of mass (0.5D Cantor-fractal sampled LMI flow [1 of the 2 LMIP pair of the mass field in a 0.5D Cantor-fractal sampled time interval] distributed per unit of distance/length [a linear/circular distance usually perpendicular to the direction of LMI transfer]) (0.5D Cantor-fractal pulsated LMI flow)	$\sqrt{M}=\sqrt{\frac{IFT}{d^2}}=\frac{I^{1/2}\cdot t^{1/2}}{d}=\frac{d\cdot t^{1/2}}{d}$ $\left(\equiv t^{1/2}\equiv d^{1/2}\equiv E^{1/2}(Cantor\ sets)\right)\Rightarrow$ $\Rightarrow\sqrt{kg}=\frac{pit^{1/2}\cdot s^{1/2}}{m}=\frac{m\cdot s^{1/2}}{m}$ $\left(\equiv s^{1/2}\equiv m^{1/2}\equiv J^{1/2}(Cantor\ sets)\right)$
Square of mass (informational 2D "super"-flow per unit of 4D hyper volume) (the I-area-square mass equivalence principle of BIDUM which explains the apparition of mass/K_e-charge products in many physical scalars)	$M^2=\left(\frac{IFT}{d^2}\right)^2=\frac{I^2\cdot t^2}{d^4}\left(\equiv d^2\equiv t^2\equiv I\right)\Rightarrow$ $\Rightarrow kg^2=\frac{(pit\cdot s)^2}{m^4}=\frac{pit^2\cdot s^2}{m^4}\left(\equiv m^2\equiv s^2\equiv pit\right)$

The linear/translational momentum (informational quantity transferred per unit of distance/length [a linear/circular distance usually perpendicular to the direction of LMI transfer]) (the classical momentum-energy-distance-time equivalence principle)	$p = M \cdot v = \frac{IFT}{d^2} \cdot \frac{d}{t} = \frac{I}{d}\left(\equiv \frac{I}{t} \equiv d \equiv t \equiv E \right) \Rightarrow$ $\Rightarrow kg \cdot \frac{m}{s} = \frac{pit \cdot s}{m^2} \cdot \frac{m}{s} = \frac{pit}{m}\left(\equiv \frac{pit}{s} \equiv m \equiv s \equiv J \right)$
The classical Newtonian G and the classical Coulombian scalar $K_eQ_e^2$ have the significance of an inverse of the informational distribution over and area (informational pressure over and area) (G and $K_eQ_e^2$ and their squares/roots are all considered adimensional in BIDUM, as force [F], the square root of F are ALSO adimensional [as P is] as I is equivalent to a space/time/spacetime area)	$G \equiv K_e Q_e^2 = \frac{F \cdot d^2}{M^2} = \frac{d^3 / t^2}{M} = \left(\frac{I \cdot t^3}{d^5} \right)^{-1} [\equiv 1] \Rightarrow$ $\Rightarrow \frac{m^3}{kg \cdot s^2} = \left(\frac{pit \cdot s^3}{m^5} \right)^{-1} [\equiv 1]$

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A h_{eg} series (hs_{eg}) prediction for any atom, based on the average nuclear binding energy per nucleon (E_{BN}) as a measure of ST level of contraction/"compression" at high nuclear internal „pressures"

The nof. egs emitted by a specific NGP is dp to the frequency of emision of egs (which is inp to its real spatial diameter) and to the relativistic energy-mass of that NGP (as a higher mass permits the firing of more co-phase egs per each pulse of emission). The nof. egs emitted by an atom is dp to nof. NGPs composing that atom and also dp to the sum of all masses/energies of those subatomic NGPs (proton, neutron and electron). The **protons/neutrons total rest mass (M_{ps} and M_{ns})** in a neutral (intact) atom can be aproximated as a function of the nof. (atomic, not-free) protons/neutrons (**N_{ap}/N_{an}**) and also considering the mass „defect"/**E_{BN}** of the protons/neutrons in the atom:

$$\boxed{M_{ps}(N_{ap},E_{BN}) = N_{ap}\cdot(m_p - E_{BN}/c^2)};\ \boxed{M_{ns}(N_n,E_{BN}) = N_n\cdot(m_n - E_{BN}/c^2)}$$

The total (dynamic) mass of the electrons (**M_{es}**) in a neutral atom can be aproximated as a function of the **nof. (atomic, not-free) electrons** (**N_{ae}=N_{ap}**) and also considering the dynamic mass of the electrons in the atom's electronic shell as a function of an average speed of the electrons (v_e) from that shell:

$$\boxed{M_{es}(N_{ae},v_e) = N_{ae}\cdot(m_e + m_e\cdot v_e^2/c^2)}$$

The **atom's total (rest) mass** (**M_a**) (considering hyper-dynamic electrons and cvasi-static nucleons) is the sum of the 3 functions described before (**M_{ns}**, **M_{ps}** and **M_{es}**):

$$\boxed{M_a(N_{ap},N_{an},E_{BN},v_e) = M_{ps}(N_{ap},E_{BN}) + M_{ns}(N_{an},E_{BN}) + M_{es}(N_{ae},v_e)}$$

As the NGP-nodes „rest" on the four webs of GB-internodes layers (from which EGF-layers is the most „deformable" as gravity is the most weak force of the 4 FFs), the rest and kinetic masses of the NGP-nodes can produce the firing of more egs with higher eg in the EGF-web-layer of (GB-)internodes. For simplicity, BIDUM proposes a plausible simple grade-I function to describe the relationship between E_{BN} and the informational quanta / energy of a single emitted eg (E_{eg}=function(heg_n)); **BIDUM** considers hs_{eg} as dp to the ST level of compression which is also relative to the initial free masses of the proton and neutron at rest, which differ slightly from one another). E_{BN} measures the level of the SNF exerted on a nucleon in a specific nucleus, and the ST compression/quantum pressure**[132,133]** is dp to that level of force (measured by E_{BN}). The level of the ST compression in a particle can be measured supra-unitary by the (inverse) ratio between a particle rest mass and the compressed particle mass (the rest mass - mass defect): see **P_{CR} (proton compression ratio), N_{CR} (neutron compression ratio)** and **E_{CR} (electron compression ratio)** functions (E_{CR} is sub-unitary as the electrons have negative mass „defects" generated by their high relativistic average speed[v_e] in the atom)

$$\boxed{P_{CR}(E_{BN}) = m_p/(m_p - E_{BN}/c^2)};\ \boxed{N_{CR}(E_{BN}) = m_n/(m_n - E_{BN}/c^2)};$$
$$\boxed{E_{CR}(v_e) = m_e/(m_e + m_e\cdot v_e^2/c^2)}$$

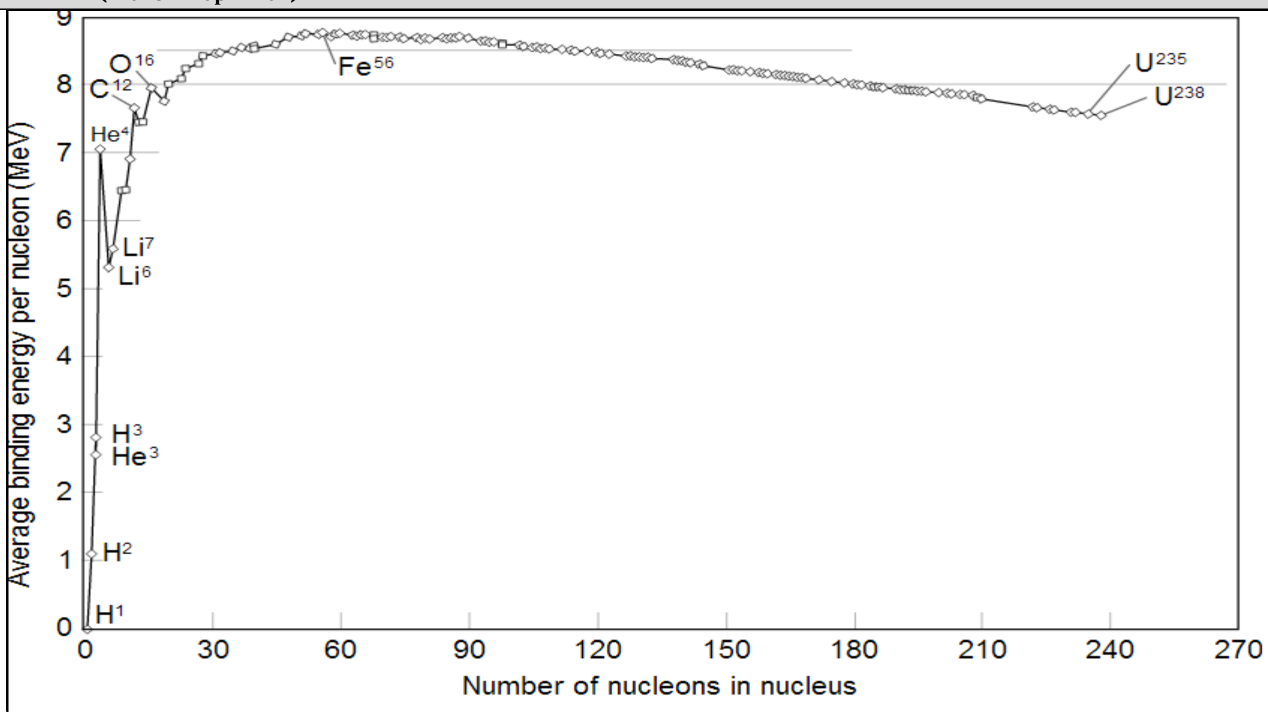
In any atom, the standard h_{eg} (and the single eg energy: $E_{eg}[\lambda]$) may have a specific grade-I function type distorsion for any type of subatomic particle from that atom, as function of **P_{CR}**, **N_{CR}** and **E_{CR}**: **h_{egP}** (intranuclear proton specific h_{eg} of emission), **h_{egN}** (intranuclear neutron specific h_{eg} of emission) and **h_{egE}** (atom's electrons specific h_{eg} of emission, when moving with an average speed [**v_e**])**:**

$$\boxed{h_{egP} = h_{eg}\cdot P_{CR}(E_{BN})};\ \boxed{h_{egN} = h_{eg}\cdot N_{CR}(E_{BN})};\ \boxed{h_{egE} = h_{eg}\cdot E_{CR}(v_e)}$$

In fact, what it is measured (indirectly) as h_{eg} (by measuring G in different experiments) is (very plausibly) the weighted mean between these 3 separate specific h_{eg} in any atom: h_{egP}, h_{egN} and h_{egE}. That's why BIDUM considers a h_{eg} series (named hs_{eg}) for all types of atoms in which each element ($hs_{eg(n)}$) is a weighted mean of all the 3 specific h_{eg} (h_{egP}, h_{egN} and h_{egE}) of each subatomic particle in each type of atom:

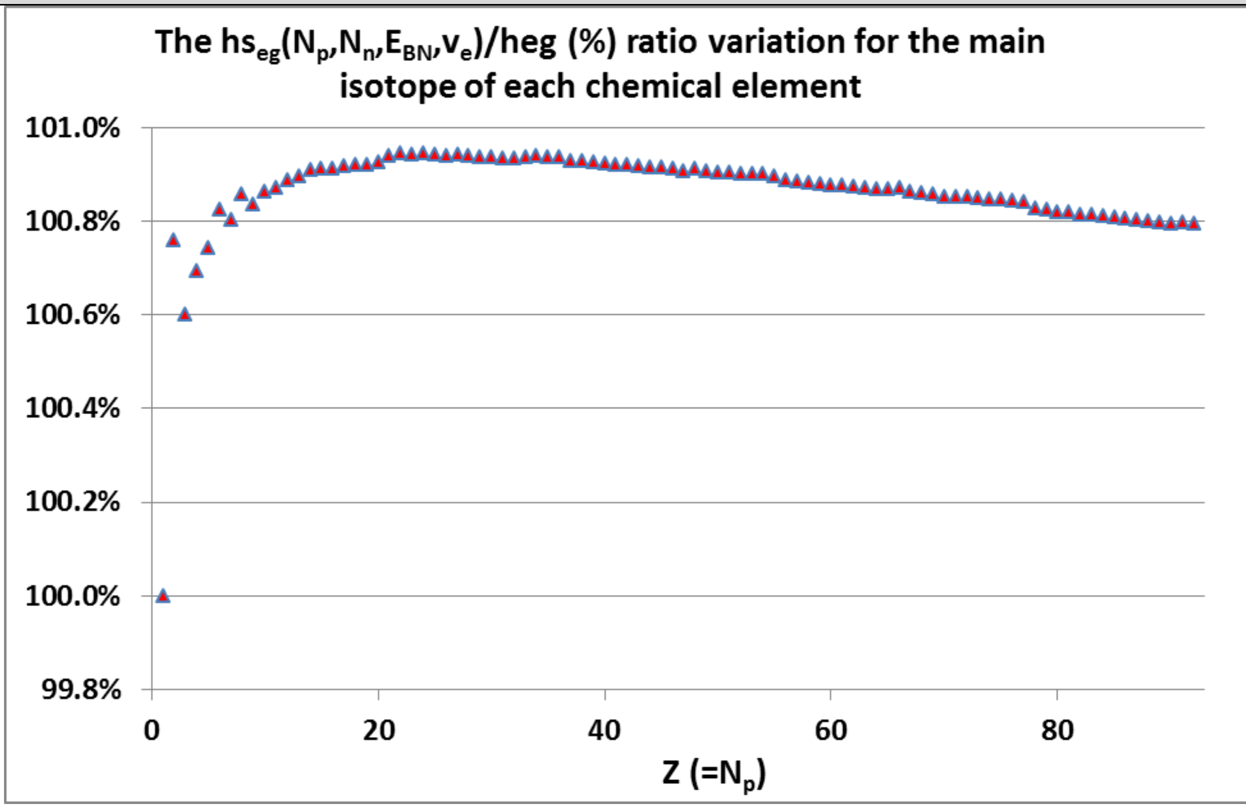
$$\boxed{hs_{eg}(N_{ap},N_{an},E_{BN},v_e)=h_{egP}\cdot\frac{M_{ps}(N_{ap},E_{BN})}{M_a(N_{ap},N_{an},E_{BN},v_e)}+h_{egN}\cdot\frac{M_{ns}(N_{an},E_{BN})}{M_a(N_{ap},N_{an},E_{BN},v_e)}+h_{egE}\cdot\frac{M_{es}(N_{ap},v_e)}{M_a(N_{ap},N_{an},E_{BN},v_e)}}$$

<u>Figure F5-1</u>. E_{BN} ([average] nuclear binding energy [per each nucleon]) variation with the nof. nucleons ($N_{anc}=N_{ap}+N_{an}$)[29]



[29] URL (figure source): upload.wikimedia.org/wikipedia/commons/5/53/Binding_energy_curve_-_common_isotopes.svg

<u>Figure F5-2</u>. hs_{eg} as a function of each atom's specific E_{BN}: the hs_{eg}/h_{eg} ratio variation for the main isotope of each chemical element



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The multiple G hypothesis (MGH): a G_{qe} series (Gs_{qe}) prediction for any atom, based on the h_{eg} series (hs_{eg})

In BIDUM, the quantum electronic/positronic G series (Gs_{qe}) generated by a single atom is defined as a function of heg series (**hs_{eg}**), such as:

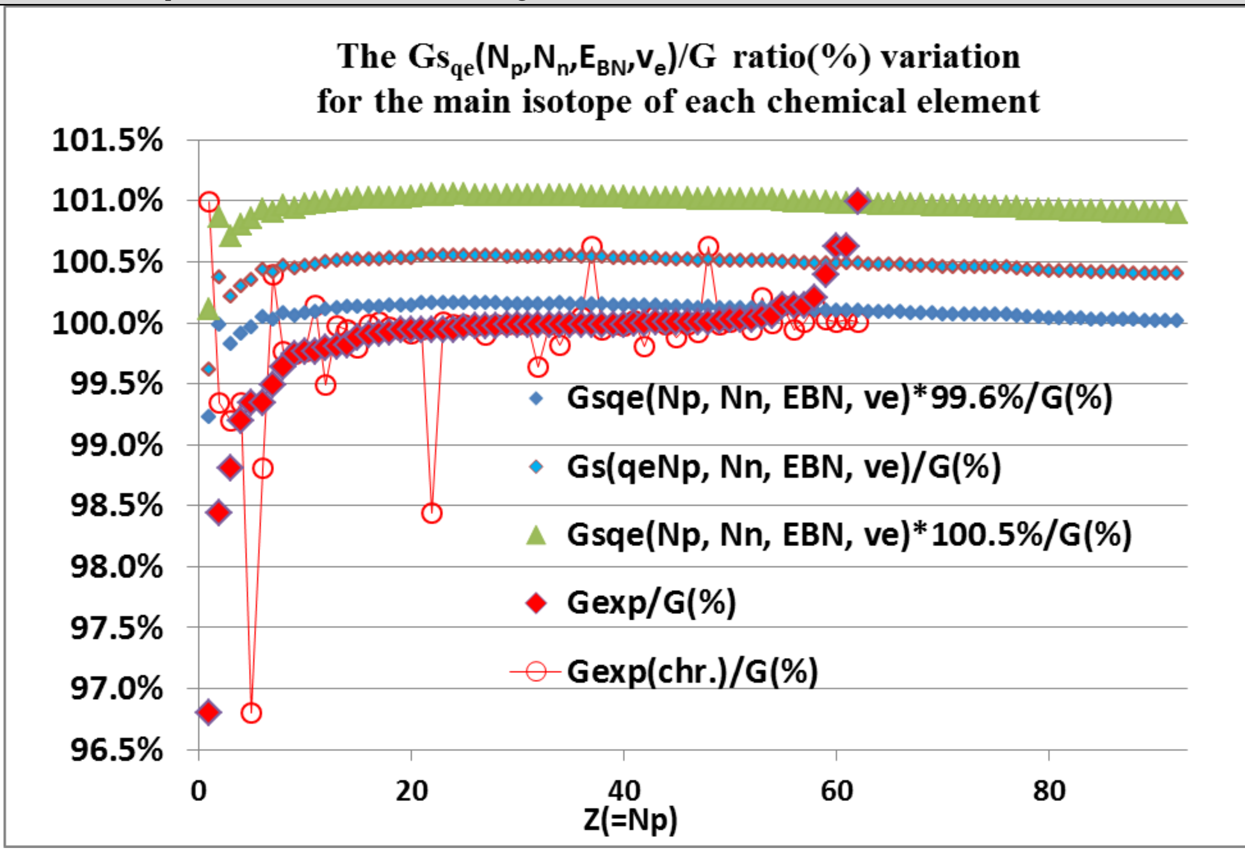
$$\boxed{Gs_{qe}(N_{ap},N_{an},E_{BN},v_e)=k_G\cdot hs_{eg}\left(N_{ap},N_{an},E_{BN},v_e\right)}, with\ \boxed{{}^*k_G=\frac{c}{m_e{}^2(2\pi\alpha)}}$$

BIDUM considers that experimental G (as measured between two atoms [a_1 and a_2]) is the result of measuring the interchange of two simultanously combined flows of egs (each characterized by $hs_{eg(1)}$ and $hs_{eg(2)}$, which are each defined as weighted means of **hegP**, **hegN** and **hegE**), each characterized by a specific quantum Gs_{qe} element (**$G_{sqe(1)}$** and **$G_{sqe(2)}$**): the resulting **$G_{sqe(1,2)}$** scalar can be defined as the geometric mean (not a arithmetic mean) of **$G_{sqe(1)}$** and **$G_{sqe(2)}$**, as multiplying two hs_{eg} elements (which are PIqs) means counting the nof. all the possible pair-combinations between all the (sub)quantum states of each of the two egs.

$$\boxed{\begin{aligned}&Gs_{qe}(N_{ap(1,2)},N_{an(1,2)},E_{BN(1,2)},v_{e(1,2)})=\sqrt{Gs_{qe(1)}\cdot Gs_{qe(2)}}=\\&=\sqrt{Gs_{qe}\left(N_{ap(1)},N_{an(1)},E_{BN(1)},v_{e(1)}\right)\cdot Gs_{qe}\left(N_{ap(2)},N_{an(2)},E_{BN(2)},v_{e(2)}\right)}=\\&=k_G\cdot\sqrt{hs_{eg}\left(N_{ap(1)},N_{an(1)},E_{BN(1)},v_{e(1)}\right)\cdot hs_{eg}\left(N_{ap(2)},N_{an(2)},E_{BN(2)},v_{e(2)}\right)}\end{aligned}},$$

As it can be seen in the next figure (**F5-3**), the theoretical Gs_{qe} triple variant graph approximates all the G measurements in the past over 200 years**[134,135,136,137,138] (**for clarity, the error limits for each determined value of G where not represented in the next graph) (**G_{exp}[red circle marks on figure F-XIV.B-1]**: a chronological order aproximating the rising accuracy of the devices used to determine G; **G_{exp}(chr.)[red rhomboidal marks with connecting lines on figure F-XIV.B-1]**: the experimental G values in a non-chronological but ascending order quite similar to the hs_{eg} graph curve from figure **F-XIV.A-2** used to determine Gs_{qe} series plotted in **figure F-XIV.B-1**). However, all the G results obtained on Earth are „contaminated" by the (already) curved ST/egs flow (by the Sun and the Earth) in which the experiments take place. BIDUM can aproximate Sun's and Earth's specific average Gs_{qe} based on their chemical composition. **Because of the abundance in hydrogen (H) (>70%)[139] (H is a chemical element with a specific Gs_{qe}~99.6%·G)**, **the Sun's specific average Gs_{qe} is smaller than G [blue rhomboidal marks** in figure **F5-3].** **Because of the abundance in oxygen (O) (>30%)**[**140**] **(O is a chemical element with a specific Gs_{qe}~100.5%·G)**, **the Earth's crust's specific average Gs_{qe} is larger than G [green triangled marks** on figure **F-XIV.B-1]**. When experiments are conducted into space, exprimental G will tend to be smaller (due to the influence of the hydrogen-based Gs_{qe} of the Sun generated by the Sun's gobal flow of egs emitted towards the Earth). When the experiments are conducted deep in the Earth's layers (as one experiment that took place in ~1km deep mines) they tend to generate a larger experimental G. BIDUM predicts that the G determination will ALSO depend on the altitude and latitude at which the experiment takes place, will depend on the Sun/other Stars-Earth momentary distance/configuration, but also on the chemical composition of that specific Earth region in which the experiment takes place.

Figure F5-3. Gs_{qe} series (as function of hs_{eg} series) compared to G experimental values



This multiple G hypothesis 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**[134]** used in past 200 years G determination experiments**)** and in the future by using the same experimental device at different altitudes/latitudes **[141,142,143]** and in different regions and using metal spheres of different atoms or single various atoms and analyze the systematic differences**[144]** between the experimental G as function of all these chemical and physical variables. BIDUM recommends Gundlach's and Merkowitz's method**[145]** and *atom inferometry using cold atoms* **[146,147]**. BIDUM also predicts that any change in the relative position/distance between the Sun and the Earth in the interval of the experiment can slightly influence the results: in 2002 Mikhail Gershteyn and his colleagues have successfully demonstrated experimentally that the well-known force of gravity between 2 test bodies varies with their orientation in space, relative to a system of distant stars **[148]**.

BIDUM proposes a plausible explanation to the apparent paradox of the divergent variation of experimental G values („despite" constant improvements of the measurement systems) as these measurement systems can now better differentiate between different chemical structures combined G „imprints" and Sun-Earth-star systems configurations „imprints" (in 1999, CODATA decided to officially increase the uncertainty of the accepted value for G from 128 ppm to 1500 ppm). As gravity is the key problem of the millenium **[149,150,151]**, measuring G with higher accuracy at micropic (including atomic) distances is a priority.

The multiple G hypothesis of BIDUM can change the paradigm in quantum gravity theory demonstration/verification (as an indirect elegant proof of eg existence and quantum gravity: a right „under our nose" quantum gravity proof hidden/masked by the experimental G value relatively high variability and open an unexpected gate to a potential informational TOE (as BIDUM is).

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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