

**A Bio-Info-Digital Universe Model (BIDUM version 1.1, in a short summary)  
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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(Open development interval: 2008 – 2016 - ?) (Preprint <sup>[1,2]</sup>)

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**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 essay (which is a short essentialised summary of the author's BIDUM version 1.1<sup>[5]</sup> [8]), I argue that *energy and time are indissolubly connected* and can be integrated in a concept of *physical information (PI)* measurable in *qbits* as an alternative interpretation to the (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, together with the concept of *biological information (BI)* which is also measurable in *qbits* [9].

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[1] Online preprints that can be downloaded from the following URLs: [1] [univermed-cdgm.academia.edu/AndreiLucianDragoi](http://univermed-cdgm.academia.edu/AndreiLucianDragoi); [2] [vixra.org/author/andrei\\_lucian\\_dragoi](http://vixra.org/author/andrei_lucian_dragoi)

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[5] ORDA registration number for BIDUMv1.1: 2471/24.03.2016 (URL: [orda.ro/cautare\\_cerere.aspx?mid=1&rid=1&cerere=2471](http://orda.ro/cautare_cerere.aspx?mid=1&rid=1&cerere=2471))

## 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 and on the Pauli Exclusion Principle)*. 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 is obviously a relative classification as all the EQPs can function as both messages (when the macro-objects interchange NGPs as also 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.

**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  $K_{PI}=1$  <sup>[6]</sup>. For further details and arguments, see the full BIDUM version 1.1 **[8]**

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

**The hypothetical graviton and its subtle subquantum action.** GBs may be considered not only energetic quanta (*e-quanta [Equa]*) and (kinetic and/or rest) mass quanta (*m-quanta [Mqua]*), 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* ( $N_s$ ) of an NGP<sup>[7]</sup> is a the product between  $N_Q$  (all the possibly *distinguishable* quantum [macro]states of that NGP) and  $N_{SQ}$  (all the possibly *distinguishable* sub-quantum [micro]states of that QP). The *total intrinsic PI quantity* of a NGP [**PI**( $N_s$ )] can be generally defined as the binary-logarithmic measure of  $N_s$  of that NGP (as the binary logarithm is generally used in the definition of any type of information quantity).

$$\boxed{N_s = N_Q \times N_{SQ}} \Rightarrow \boxed{PI(N_s) = \log_2(N_s) = \log_2(N_Q \times N_{SQ}) = \log_2(N_Q) + \log_2(N_{SQ})} \quad \text{(E-I-2.1, 2.2)}$$

**[6]** This PIq definition has also 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 amount of time are needed.

**[7]** As all the NGP interact by gravity, no matter if gravity is a quantized fundamental force (mediated by the hypothetical graviton, as predicted by the quantum field theory [**QFT**]) or the result of interaction with a curved spacetime vacuum (as predicted by the General Relativity [**GR**])

**The PIq scalar is “hidden” in the photon’s energy scalar.** As frequency ( $\nu$ ) is the inverse of the time interval ( $\Delta t$ ) taken by a full cycle of a periodical physical process (including the full oscillation of a wave-like EQP),  $\nu = c/\lambda = 1/\Delta t$ , the energy of a single photon scalar  $E_{ph}(\lambda)$  can be expressed as a function of this time interval ( $\Delta t$ ):

$$\nu = c/\lambda = 1/\Delta t \Rightarrow \left[ \begin{array}{l} E_{ph}(\nu) = h\nu \Leftrightarrow E_{ph}(\Delta t) = h/\Delta t \Leftrightarrow \\ \Leftrightarrow \boxed{h = E_{ph}(\Delta t) \cdot \Delta t = PI \text{ quantity}} \end{array} \right] \quad (\text{E-I-3.1, 3.2, 3.3, 3.4})$$

**The PIqua emission/reception process.** As a generalization, all the GBs<sup>[8]</sup> 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 PI quantity*) 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 PI quantity (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 PI* ( $PI_T$ ) of an NGP is obviously related to a 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) PI* ( $PI_{int}$ ) (as measured in  $\Delta t$  interval or previously), an *input (received) PI* ( $PI_{in}$ ) and an *output (emitted) PI* ( $PI_{out}$ ) of that NGP such as:

$$\boxed{PI_T(\Delta t) = PI_{int}(\Delta t) + PI_{in}(\Delta t) - PI_{out}(\Delta t)} \quad (\text{E-I-4})$$

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

$$\boxed{PI_{[pit]} = E_{[J]} \cdot \Delta t_{[s]}} \Leftrightarrow \boxed{E_{[J]} = PI_{[pit]} / \Delta t_{[s]}} \quad (\text{E-I-5.1, 5.2})$$

$$\boxed{pit = J \cdot s = k_{pit} \cdot qbit} \quad \text{with } k_{pit} = ? \text{qbits/pit (an adimensional integer constant with an uncertain value)} \quad (\text{E-I-5.3})$$

**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 ( $J_s = J \cdot s$ ), 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  $E_{ph}$  scalar, the relation between the PIq and energy is also obvious:

$$h \sim 6.626 \times 10^{-34} \text{ pits} (= 6.626 \times 10^{-34} Js); \quad \boxed{E_{ph}(\Delta t)_{[J]} = h_{[pit]} / \Delta t_{[s]}} \quad (\text{E-I-6.1, 6.2})$$

**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])*:

$$\boxed{E_{[J]} = \frac{PI_{[pit]}}{\Delta t_{[s]}} \Leftrightarrow J = \frac{pit}{s} = \frac{k_{pit} \cdot qbit}{s}} \quad (\text{E-I-7})$$

[8] the [spin-1] gluon, the [spin-1]  $W^+ / W^- / Z$  bosons, the [spin-1] photon and the hypothetical [spin-2] graviton

In this view, *energy and matter are NOT fundamental as PI is, but they are just the result of measuring (in various ways) the quantity of PI interchanged between the observer (including his measuring tools) and the physical system observed, but also between the subcomponents of that system, a PI interchange that is observed and measured 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 PI to the observer or the capacity of the observed system’s subcomponents to interchange IPs per unit of (subjective and/or objective) time. In conclusion, *energy and matter are generated by PI 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  $\Delta t = t_P = [\hbar G/c^5]^{1/2}$  (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 equations).

$$\boxed{I = E \cdot \Delta t} \tag{E-I-8}$$

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

**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 particle probably emits and/or receives undetectable (hypothetical) gravitons independently to any possible additional electromagnetic radiation (and gravitons are hypothesized to generally have the same speed  $c^{[9]}$  than the additional optional real/virtual photons) when it transforms into energy (which is generally and mostly electromagnetic and [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.

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

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

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

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[9] c is the speed of light in vacuum

## Part 2. The informational quanta for the four known fundamental forces

All the classical 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<sub>e</sub>], the masses/charges of the EQPs etc.) that appear in the quantitative formulations of the physics laws are essentially scalar functions of different PIqua (that generates 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 PI quantities measured as defined in equation E-I-1.1 (as any product/division of 2 real numbers may be transformed in addition/subtraction of 2 exponential factors [generated logarithmically] with the same exponential base).*

$$\boxed{PI(N_S) = \log_2(N_S)} \Leftrightarrow \boxed{PI(N_{S1}) + PI(N_{S2}) = \log_2(N_{S1}) + \log_2(N_{S2}) = \log_2(N_{S1} \cdot N_{S2})} \quad (\text{E-II-1.1,1.2})$$

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

(logical equivalences)

In the view of H-II, (electrostatic/electromagnetic) Coulomb constant (K<sub>e</sub>) may be considered an indirect measure scalar function of the photon/EM PIqua (h<sub>ph</sub>[=h]). This scalar function can be expressed using the inverse of the (EM) Fine Structure Constant (FSC), α= 1/FSC:

$$\boxed{K_e = f(h) = k_C \cdot h}, \text{ with } \boxed{k_C = \frac{c}{q_e^2 (2\pi\alpha)}} \text{ and } \boxed{\alpha = \frac{1}{FSC} = \frac{\hbar c}{K_e q_e^2} (\sim 137.036)} \quad [10] \quad (\text{E-II-3.1, 3.2, 3.3})$$

Analogously, the Newtonian universal gravitational constant (G) may be considered an indirect measure scalar function of a hypothetical (electro)gravitational (EGF) Planck-like PIqua (h<sub>eg</sub>) of a hypothetical electrograviton (eg) having a scalar exactly analogous to K<sub>e</sub> (this scalar analogy being the reason for calling this hypothetical graviton an “electrograviton”)

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

$$\boxed{h_{eg} = \frac{h}{K_{eg}} = (\sim 1.58 \times 10^{-76} \text{ pit})}, \text{ with } \boxed{K_{eg} = \alpha_G / \alpha (\sim 4.182 \times 10^{42})} \text{ and } [11] \quad (\text{E-II-4.3, 4.4})$$

$$\boxed{\alpha_G = \frac{1}{\alpha} = \frac{\hbar c}{G m_e^2} (\sim 2.85 \times 10^{44})} \quad (\text{E-II-4.5})$$

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<sub>eg</sub>). The energy scalar of the eg with a ν frequency [E<sub>eg</sub>(ν)] can be expressed in analogy with [E<sub>ph</sub>(ν)=hν]=[E<sub>ph</sub>(Δt)=h/Δt] such as: E<sub>eg</sub>(ν)=h<sub>eg</sub>ν= E<sub>eg</sub>(Δt)=h<sub>eg</sub>/Δt. K<sub>eg</sub> (as defined in equation E-II-4.4) is an electrogravitational constant, named as such because it interconnects the two (EM and EG) PIqua (h and h<sub>eg</sub>). k<sub>C</sub> (as defined in equation E-II-3.2) and k<sub>G</sub> (as defined in equation E-II-4.2) are 2 analogous (secondary) constants defined to simplify the expressions of K<sub>e</sub>=k<sub>C</sub>·h and G= k<sub>G</sub>·h as functions of h and h<sub>eg</sub> respectively. α<sub>G</sub> is the inverse of the reduced gravitational coupling constant (GCC=α<sub>G</sub>)

**The logical equivalence between the Planck-like EGF PIqua (h<sub>eg</sub>) and the qbit (hypothesis H-III).** Even if k<sub>pit</sub> (as defined in equation E-I-5.3) has an uncertain numerical value, there is a method that can

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

[11] m<sub>e</sub> is the rest mass of the electron; c is speed of light in vacuum

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) 2 extreme space-dependent quantum states (x-polarized and y polarized eg) and (at least) 2 time-dependent quantum states (a phase and an anti-phase state that can amplify or annihilate another receiver- eg that can also be in one of these2 extreme quantum states when related to the incidental eg): that’s why  $h_{eg}$  (also measured in pits=Js) can be(logically) associated with 1 qbit (logical equivalence of minimal quantities of PI). 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-PI: **prediction P-III-1**):*

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

$$h_{eg} \sim 1.6 \times 10^{-76} \text{ pits} = 1qbit \Rightarrow k_{pit} = \frac{1pit}{1qbit} = \frac{1}{1.6 \times 10^{-76}} \sim 6.3 \times 10^{75} (\text{qbits} / \text{pit}) \quad (\text{E-III -2.1, 2.2})$$

$$h_{ph} = h = K_{eg} \cdot h_{eg} = K_{eg} \cdot 1qbit \left[ \sim 4.2 \times 10^{42} \text{ qbits} \right] \quad (\text{E-III-3})$$

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 estimation of the other GBs intrinsic PIqua (at rest) [ $I_{int(rest)}$ ] but also the NGP intrinsic PIqua (at rest) 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**.

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

<b>Table T-IV-1. The intrinsic PIqua of all the GBs (generating all the four FFs) of our universe</b>	
<b>The (hypothetical) electrogravitational field/force (EGF) PIqua (<math>h_{eg}</math>)</b>	$h_{eg} \sim 1.6 \times 10^{-76} \text{ pits} \sim k_{pit} \cdot 1.6 \times 10^{-76} \text{ qbits} = 1qbit$ , with $k_{pit} \sim 6.3 \times 10^{75} \text{ qbits} / \text{pit}$
<b>The electromagnetic field/force (EMF) PIqua (<math>h_{ph}=h</math>)</b>	$h_{ph} = h \sim 6.626 \times 10^{-34} \text{ pits} \sim 4.2 \times 10^{42} \text{ qbits}$
<b>The weak nuclear field/force (WNF) PIqua (<math>h_w</math> and <math>h_z</math>)</b>	
The quantity of intrinsic information ( $h_w$ ) of a single $W^+/W^-$ boson (at rest) is as a function of its rest mass ( $m_w \sim 80.385 \pm 0.015 \text{ GeV}/c^2$ [11,12]) and its half-life ( $t_w \sim 3 \cdot 10^{-25} \text{ s}$ )	$h_w = (m_w c^2) \cdot t_w \left[ \sim 3.86 \times 10^{-33} \text{ pits} \sim 2.4 \times 10^{43} \text{ qbits} \right]$ , with $h_w / h_{ph} \sim 5.8^*$ *as W-boson is considered a “heavy” photon, it carries almost 6 times more PIq (at rest) than a photon
The quantity of intrinsic information ( $h_z$ ) of a single Z boson (at rest) is a function of its rest mass ( $m_z \sim 91.1876 \pm 0.0021 \text{ GeV}/c^2$ [11,12]) and its half-life ( $t_z \sim 3 \cdot 10^{-25} \text{ s}$ ), can be measured similarly to the W boson.	$h_z = (m_z c^2) \cdot t_z \left[ \sim 4.38 \times 10^{-33} \text{ pits} \sim 2.8 \times 10^{43} \text{ qbits} \right]$ , with $h_z / h_{ph} \sim 6.6^*$ *as Z-boson is also considered a “heavy” photon, it carries almost 7 times more PIq (at rest) than a photon
<b>The strong nuclear field/force (SNF) PI-qua (<math>h_{gl}</math>)</b>	
For the SNF, the intrinsic PIq ( $h_{gl}$ ) of a single gluon (at rest) cannot be measured directly using the PIq scalar definition (such as the W and Z bosons), but can be measured indirectly based on the known <i>strong force coupling constant</i> ( $\alpha_s$ ) which has a value close to 1 (practically $\sim 137$ times larger than the FSC at rest)	$h_{gl} = (\alpha_s \cdot FSC) \cdot h_{ph} \sim FSC \cdot h_{ph} \left[ \sim 4.8 \times 10^{-36} \text{ pits} \sim 3 \times 10^{40} \text{ qbits} \right]$ with $h_{gl} / h_{ph} \sim FSC \sim 1/137^*$ and $h_{gl} / h_{eg} \sim 3 \times 10^{40}$ *when compared to the photons and the W/Z-bosons, the gluons may be considered “(very) light” photons, as a gluon carry $\sim 137$ times less PIq (at rest) than a photon

<b>Table T-IV-2. The intrinsic PIqua of the main (known) NGP of our universe</b>	
The quantity of intrinsic information ( $h_p$ ) of a single proton (at rest) is as a function of its rest mass ( $m_p \sim 0.938\text{GeV}/c^2$ [13]) and its mean lifetime (with an experimental lower bound $t_p > 10^{31}$ years [14,15])	$h_p > \left[ (m_p c^2) \cdot t_p \sim 4.7 \times 10^{28} \text{ pits} \sim 3 \times 10^{104} \text{ qbts} \right],$ with $h_p / h_{ph} > 7.2 \times 10^{61}$ and $h_p / h_{eg} > 3 \times 10^{104}$
The quantity of intrinsic information ( $h_e$ ) of a single electron (at rest) is as a function of its rest mass ( $m_e \sim 0.511\text{MeV}/c^2$ [16]) and its mean lifetime (with an experimental lower bound $t_e > 6.6 \cdot 10^{28}$ years [17])	$h_e > \left[ (m_e c^2) \cdot t_e \sim 1.2 \times 10^{21} \text{ pits} \sim 7.5 \times 10^{96} \text{ qbts} \right],$ with $h_e / h_{ph} > 1.8 \times 10^{54}$ and $h_e / h_{eg} > 7.5 \times 10^{96}$

**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: [1] the intrinsic (essentially) subquantum PI quantity of any known (E)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]) and also [3] a new definition of energy (as PI 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  $E_x$  energy because its subcomponents interchange an  $I_x$  PIq 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 proposal. See **Table T-IV-3**.

<b>Table T-IV-3. Important consequences of the PIq scalar and the four PIqua of the four FFs</b>	
As this BIDUM treats the four FF PIqua [ $h_{(ph)}$ , $h_{eg}$ , $h_{W/Z}$ and $h_{gl}$ ] as central and more important than the energy/mass quantity, I argue that <i>energy, force and mass (and their SI measure units which are essentially based on the kilogram) (together with all their sub-derivatives) should be “inversely” redefined from this PIq scalar</i> (as defined by <b>E-I-1.1</b> and denoted as “I”) using also time intervals (denoted as “t”) and linear/circular lengths/distances (denoted as “d”)	$I = E \cdot t$ (pit=J·s)≡qbit
	$E = I/t$ (J=pit/s)≡qbit/s
	$P = I/t^2$ (W=pit/s <sup>2</sup> )≡qbit/s <sup>2</sup>
	$F = I/(d \cdot t)$ [N=pit/(m·s)]≡qbit/(m·s)
	$M = (I \cdot t)/d^2$ (kg=pit·s/m <sup>2</sup> )≡qbit·s/m <sup>2</sup>
The Planck constant ( $h_{ph}=h$ ) is also the (central) PIqua unit in the (standard) Planck (natural) Units System ( <b>PUS</b> ), a system which <i>can be generalized for any other Planck-like (PI-qua) constant</i> ( $h_{gl}$ , $h_{W/Z}$ and $h_{eg}$ ) and called Planck-Like Units System ( <b>PLUS</b> [ $h_x$ ], such as PSU is the private case PLUS[ $h_{ph}$ ]).	$PLUS(h_x), \text{ with } h_x \in \{h_{eg}, h_{ph}(=h), h_{W/Z}, h_{gl}\},$ with $PUS = PLUS(h_{ph})$
The coupling ( $\alpha$ ) constants (at rest) for the three non-EGF FFs <i>can be generalized as a PIq-function (in analogy to FSC definition), as GCC is not a function of the <math>K_e q_e^2</math>, but is conventionally expressed as a function of <math>Gm_e^2</math></i>	$\alpha_f(\hbar_x) = \frac{K_e q_e^2}{\hbar_x c}, \text{ with } \hbar_x \in \{\hbar_{gl}, \hbar_{ph}(=\hbar), \hbar_{W/Z}\}$
The <i>Bekenstein bound (BB)</i> [22,23,24] (defined as the maximum amount of information [I] [measurable in qbts or in the equivalent bits extracted from those qbts] contained in all the quantum [macro]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] information) can be reformulated as a two PIqs ratio using an additional adimensional constant $k_{BB} = (2\pi)^2/\ln(2)$	$I \leq \frac{2\pi ER}{\hbar c \ln(2)} \Leftrightarrow I \leq \frac{(2\pi)^2 E R}{\ln(2) c} \Leftrightarrow I \leq \frac{k_{BB} \cdot (E \cdot \Delta t_{r,c})}{h_{ph}} \Leftrightarrow I \leq \frac{k_{BB} \cdot I_{(E, \Delta t_{r,c})}}{h_{ph}}$
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 [micro]states [ $N_{SQ}$ ] that can be “hidden” in a single quantum state of a QP).	$I(E, \Delta t_{c,R}, h_x) \leq \frac{k_{BB} \cdot I_{(E, \Delta t_{c,R})}}{h_x},$ with $h_x \in \{h_{eg}, h_{ph}(=h), h_{W/Z}, h_{gl}\}$
$h$ 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 $\leq h$ 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.	$m_x \cdot t_x \leq \frac{h}{c^2} \text{ for photons, gluons and egs}$ $m_x \cdot t_x > \frac{h}{c^2} \text{ for W / Z bosons, Higgs boson, neutrinos, leptons and quarks}$

**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<sup>[12]</sup>). See Tables T-V-1A/1B.

<b>Table T-V-1A. The main global PIqs of the WU (part A)</b>	
The (apparently <sup>[13]</sup> ) 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]	$M_{arWU} \sim 1.45 \times 10^{53} \text{ kg} \Rightarrow E_{arWU} = M_{arWU} c^2 \sim 1.3 \times 10^{70} \text{ J}$
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 <sup>[14]</sup> ). 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).	$m_{pep} = m_p + m_e \Rightarrow$ $\Rightarrow N_p \sim M_{arWU} / m_{pep} \sim 8.7 \times 10^{79} \text{ (peps)}$
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 $E_{arWU}$	$t_{arWU} > [t_p > 10^{31} \text{ years}] \Rightarrow$ $[I_{arWU} = E_{arWU} \cdot t_{arWU}] > [\sim 2.5 \times 10^{184} \text{ qbits}]$
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 $\sim 3/10(0.3)$ of the (apparent) rest energy of the WU ( $E_{arWU}$ ) [26]	$E_{akWU} = 0.3 E_{arWU} \sim 3.9 \times 10^{69} \text{ J}$ $I_{akWU} \sim E_{akWU} \cdot t_{WU} \sim 7.8 \times 10^{183} \text{ qbits}$ $I_{egWU} \sim I_{akWU} \sim (23.1\%) I_{kWU} \sim (23.3\%) I_{tWU}$
If the mean lifetime of the apparent (kinetic) WU ( $t_{akWU}$ ) is (hypothetically) considered equal to the mean lifetime of the (apparent rest) WU ( $t_{arWU}$ ) (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)	$t_{akWU} = t_{arWU} = t_{WU} > [t_p > 10^{31} \text{ years}] \Rightarrow$ $\Rightarrow I_{akWU} = [E_{akWU} \cdot t_{WU}] > [\sim 7.8 \times 10^{183} \text{ qbits}]$
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 $I_{akWU}$ ).	$E_{tWU} = E_{arWU} + E_{akWU} \Rightarrow [I_{tWU} = E_{tWU} \cdot t_{WU}]$ $\Rightarrow [I_{tWU} = I_{arWU} + I_{akWU}] > [\sim 3.4 \times 10^{184} \text{ qbits}]$
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 $\sim 1.002\%$ of the total proton (nucleon) rest mass and $\Phi = m_{pq}/m_{pep} \sim 1.001\%$ . 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 $\Phi \sim 1.001\%$ of $I_{arWU}$ ) AND $(1-\Phi) \sim 98.999\%$ of $I_{arWU}$ is in fact (also) kinetic/dynamic PIq generated by the kinetic energy of the all the gluons of the WU ( $I_{gWU}$ ) (as gluons may also be considered white/WU radiation). In this context, the real kinetic (global) PIq of the WU ( $I_{kWU}$ ) is in fact $I_{kWU}(= I_{tWU} - I_{rWU}) \sim 99.23\%$ of $I_{tWU}$ , which is significantly larger than $I_{akWU}$ ( $\sim 23.1\%$ of $I_{tWU}$ ).	$m_{pq} / m_p \sim 1.002\% \Rightarrow [\Phi = m_{pq} / m_{pep} \sim 1.001\%]$ $I_{qeWU} = N_p [(m_{pq} c^2 \cdot t_{WU}) + h_e]$ $(I_{rWU} = I_{qeWU}) \sim (0.77\%) I_{tWU} > [\sim 2.6 \times 10^{182} \text{ qbits}]$ $I_{gWU} = I_{arWU} - I_{rWU} = (1 - \Phi) \cdot I_{arWU} \Leftrightarrow$ $\Leftrightarrow I_{gWU} \sim (76.153\%) I_{tWU} > [\sim 2.565 \times 10^{184} \text{ qbits}]$ $I_{kWU} = I_{tWU} - I_{rWU} \sim (99.23\%) I_{tWU} \sim 3.3 \times 10^{184} \text{ qbits}$
The WU may be represented as a 3D graph with $N_{qe}$ internodes and four layers of internodes, one per each type of FF/GB flow (EGF, EMF, WNF and SNF).	$N_{qe} = 4N_p \sim 3.5 \times 10^{80} \text{ (NGP - nodes)}$

[12] 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])

[13] 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  $\sim 99\%$  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 [14] 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  $M_{arWU}$

#### **Part 4. The PI-“gene” hypothesis and the materialization hypothesis**

**The PI-“gene” hypothesis.** 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 PI<sub>qua</sub> is an informational map of energy-matter structures and functions/dynamics that can also be considered an operating system [OS] 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 may 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 ( $n_{max}$ ) is a finite natural number, 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**) [27] 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-“gene” with the same index (n), which functions like a “PI-gene” that is used to produce multiple copies of the same fundamental particle. Using this **PI-gene hypothesis**, this BIDUM explains and re-brings in attention *Wheeler’s one-electron-universe intuition* [28]: 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. The same for the other EQPs.

**The PI<sub>qua</sub> four-steps (replication-dichotomization-materialization-particulation hypothesis).** The process of materialization of a PI<sub>qua</sub> can be preliminary analyzed as a four steps process: (1) the replication of the mPI-gene into a PI<sub>qua</sub>, in which the intrinsic PI<sub>q</sub> contained in that mPI-gene is copied into a replica (possibly stored in the human consciousness [**HC**]); (2) the software-hardware PI<sub>qua</sub> dichotomization in which the primary (“mother”) PI<sub>qua</sub> splits in two secondary (“daughter”) PI<sub>quas</sub> (sPI<sub>q</sub> and hPI<sub>q</sub>); (3) the energy-time splitting of the hPI<sub>q</sub> (by establishing a classical linear time construct, mind produces perceptible Equas from any PI<sub>qua</sub>); (3) the “particulation” process in which that specific **Equa** (produced from that PI<sub>qua</sub>) also decomposes into a specific particle with a specific rest mass (M<sub>qua</sub>) that moves with a specific speed (v). In this view,  $I_{tWU}$  (stored in the vacuum) may be considered a “hard-disk” (a read-only-memory [ROM]: a phase space [29] 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  $\nu_p$ ). The speed of light in vacuum (c) defines the Planck (maximum possible) frequency ( $\nu_p=c/l_p$ ) of local retrieval of a specific PI<sub>qua</sub> from the global PI<sub>qua</sub> ( $I_{tWU}$ ).

**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 subroutine of the UOS, a microchip that can receive, process and emit/output PI<sub>quas</sub> (mPI[0]) as responses to any external PI stimuli.

**Essentially, BIDUM sustains the Simulation Hypothesis (SH) [30] by which WU and HC are parts of simulated reality based on PI<sub>q</sub> gradients (measurable in qbits and any other PI<sub>q</sub> units).**

## **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 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 PIquas from/to the entire 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])[31] (**definition D-BO**).

**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; all our biosphere (**BS**)/planet can be considered an extended phenotype, as Dawkins R. first defined it [32]): 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) is an alphabet which is different from the chemical structure of the DNA, RNA, enzymes and ribosomes that store this alphabet. BOM can be considered a pure un-materialized mPI-subsystem that can manipulate BOB. BOB can be considered a materialized mPI-subsystem that can also send PIquas 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 [33,34,35] is an additional strong argument that BOs are essentially informational entities (PI-processors) that manage their lifetimes by a form of BI conservation law (**BICL**) analogous to the **PICL**, in which the BOs tend to conserve as efficient as possible their 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 the BIq relatively constant (but progressively losing that intrinsic BI in a quasi-inevitable senescence). In the active part of their life-cycle ( $t_{ic}$ ), 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) [36,37, 38,39,40,41], without significantly changing their intrinsic BIq 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 BIq and implicitly prolong the lifetime of that BOB.

**BI and PI can both be digitized and measured in qbits.** 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 qbits (using PIqs and BIqs measured with base-2 logarithms of the maximum nof. physical/biological quantum/subquantum [macro/micro] states of a 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).

**The biological forces may be also considered fundamental forces of the WU.** 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 layer of PI flow (**PIF**). 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 PI, a layer for each FF): these additional layers of PI are commonly named biological information (**BI**). 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 each 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 5(social) attached to its name and abbreviation: (**BIF1**) the biological organelles LBIF (as viruses have only this LBIF as DNA, ARN and their

protective chemical envelopes may be considered subcellular/viral 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 very 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 consciousness-intelligence equivalence hypothesis.** 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 of intelligence can be measured by the number of levels of super-organization that a micro/macro object possesses (a human may have up to eleven layers of PI/BI flows). BO may be considered super-quantum systems governed by five or more FPF. 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 [42,43], in which human consciousness 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 the 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  $\sim 40$  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  $\sim 10^7$  meters ( $\sim$ the equatorial diameter of the Earth) a **BS** which permanently integrates the information of the four FPF (by converting any 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 (at least) a significant part of our solar system (using human BO as a vector of spreading) which makes **BS** extendable to scale of  $\sim 10^{13}$  m ( $\sim$ the equatorial diameter of our Solar System) in the distant future.

**A BI-scalar similar to the PI-scalar hypothesis.** The intrinsic BI<sub>q</sub> of a dead BOB ( $I_{BOB}$ ) can be defined in a similar/analogous way to the PI<sub>q</sub> 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:

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

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:

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

**The superposition between the global PIq and the global BIq – WU is 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 at a specific moment of the  $t_{WU}$  interval 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 ( $\mathbf{I}_{t_{WU}}$ ) and the global BIqua ( $\mathbf{B}_{t_{WU}}$ ) can be considered: the proved fact (by  $^{14}\text{C}$  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  $\sim 1/3t_{WU}$  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 biosphere is). As our biosphere 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 biosphere.

**Final conclusion of the BIDUM:** The BPI unified scalar definition (combined with the BPIF generalization of the fundamental force concept, the mPI-gene and PIqua materialization hypotheses) have the potential to integrate biology (as the science about BOs) in an (informational) BIDUM-like TOE.

## Part 6. References (listed in the order of their apparition in this paper)

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