A Bio-Info-Digital Universe Model (BIDUM version 1.1) – a short summary of the essential equations (each briefly explained)

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EXPLANATIONS / OBSERVATIONS / COMMENTS

<table>
<thead>
<tr>
<th>EQUATIONS AND ADDITIONAL EXPLANATIONS</th>
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<tbody>
<tr>
<td><strong>THE MAIN BINARY LOGARITHM VARIANT OF THE TELLER HYPOTHESIS (MBL-TH) AND THE PHYSICAL INFORMATION QUANTITY (Piq) SCALAR</strong></td>
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<tr>
<td>I have discovered an intriguing numerical coincidence that links the Fine Structure Constant (FSC) with the Gravitational Coupling Constant (GCC = $\alpha_g$). I consider this coincidence too simple and elegant to be just a pure coincidence: most probably, it “hides” a still undiscovered law of the Observable Universe (OU).</td>
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<td>I have named this numerical (non-)coincidence as <strong>BTH (the (main) Binary (Logarithm) Teller Hypothesis)</strong> as it is a special variant of Teller’s Large Number Hypothesis (TLNH), which is an alternative to Dirac’s Large Number Hypothesis (DLNH). I consider that BTH is an exact equality generated by an undiscovered law of nature by which all adimensional physical constant probably have a double definition, like FSC and GCC may have. BTH can also offer an alternative quantum definition for the classical (Newtonian) G, as explained later.</td>
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<tr>
<td>$\alpha_g^{-1}/2 = \hbar / (Gm_e^2 / c) \sim \alpha^{3/2} \pi^{2/3}$</td>
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<tr>
<td>$\log_2 \left[ \hbar / (\alpha^{3/2} Gm_e^2 / c) \right] \sim 137.0304 \sim (99.996%) \alpha_g$</td>
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<tr>
<td>$\hbar / (\alpha^{3/2} Gm_e^2 / c) \sim 1.78 \times 10^{11} \sim (99.613%) 2^\alpha$</td>
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<tr>
<td>with $\hbar = \hbar / 2\pi = \hbar / 4\pi$ and $FSC^{-1} \sim 137.0364$</td>
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<tr>
<td>and $\alpha_g^{-1} = \hbar c / (Gm_e^2 / c)$</td>
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<td>For the simplicity of BTH, I have defined another variant of GCC as $\alpha_g = \alpha_g^{-1} / 2$, as $\alpha_g$ is also a G-based constant with a relatively arbitrary definition.</td>
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<tr>
<td>$\alpha_g^{-1} = 2^{3/2} \alpha^{2/3} \pi^{2/3}$ (BTH)</td>
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<td>with $\alpha_g = \alpha_g^{-1} / 2 = \hbar / (Gm_e^2 / c)$</td>
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<tr>
<td>BTH proposes that both FSC and GCC have a double significance, both electromagnetic and gravitational and can be derived from a single (electrogravitational) constant</td>
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<tr>
<td>$N_a = 2^\alpha \sim 1.8 \times 10^{41}$</td>
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<td>which I consider (most probably) a very large integer with an informational significance, as the maximum number of (nof.) (equally probable) states of a specific system.</td>
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<tr>
<td>Both FSC and GCC have a two independent co-definitions in BIDUM: one (definition) of (each) may have an informational meaning. In this view, $\alpha$ is a logarithmic informational constant and $\alpha_g$ is a linearithmic informational constant that both measure the same nof. states ($N_a$) of a specific system.</td>
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<tr>
<td>$FSC = \alpha^{-1}$ can be interpreted as a logarithmic probability of a specific state chosen from the $N_a$ states of a specific system. $GCC = (2\alpha_g)^{-1}$ can be interpreted as a linearithmic probability of a specific state chosen from the $N_a$ states of the same specific system.</td>
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<tr>
<td>$\alpha = \log_2 \left( N_a \right) = \hbar / (K_eq_e^2 / c)$</td>
</tr>
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The (electrostatic/EM) Coulomb constant ($K_e$) may be considered a scalar function that indirectly measures (and “hides”) the Planck constant ($h_p = h$): this scalar function can be expressed using the inverse of the FSC as co-defined (theoretically independent of $h$) as:

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

Analogously, the Newtonian universal gravitational constant ($G$) may “hide” a quantum scalar that indirectly measures a hypothetical (electro)gravitational ($EGF$) Plank-like constant ($h_{eg}$) 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 $\alpha_{eg}^{-1}$ as co-defined (theoretically independent of $h$) as

$$\alpha_{eg}^{-1} = 2\left[ \log_2 (N_a) \right]^{3/2} N_a.$$ The eg-energy quanta can be defined analogously to the photon energy quanta.

As gravity cannot be shielded (at least to the present), all the physical systems (PSs) permanently receive (hypothetical) egs from all the OU. Each eg absorbed by a quantum particle (QP) may increase the intrinsic physical information quantity (PIq) of that QP: the intrinsic PIq is defined as the nof. maximum subquantum states of that QP. The total increase in the intrinsic PIq of a QP is directly proportional ($dp$) to the nof. egs absorbed by that QP which can be quantized as a product between: nof. egs absorbed per unit of time (which imply an energy quantity $[Eq]$ per time unit) AND classical linear time interval ($dt = t_2 - t_1$ measured in the same arbitrary classical time units). For the purpose of simplicity, the constant of direct proportionality ($K_{PI}$) is considered 1 (by hypothesis H-I of BIDUM): the scalar of the PIq becomes identical to the scalar of (quantum) angular momentum ($QAM$): the difference to the QAM is that (intrinsic) PIq also has a co-definition as the nof. maximum states ($N_S$) of that QP, which is the product between the maximum nof. quantum states ($N_Q$) and the maximum nof. subquantum states ($N_{SQ}$).

This equation is also a potential candidate for the hypothetical quantum (“big”) G scalar, in which G is defined as a function of quantum physical constants.

$$G = f (h_{eg}) = k_G \cdot h_{eg}$$ with $k_G = \frac{c}{m_e^2 (2\pi \alpha G)}$

and $h_{eg} = \frac{h}{\alpha_{eg}^{-1} / \alpha} = \frac{h}{2\left[ \log_2 (N_a) \right]^{1/2}} N_a (\sim 1.58 \times 10^{-76} Js)$

$$E_{eg}(\nu) = h_{eg} \nu.$$
In BIDUM, I argue that energy is indissolubly related to a classical linear time frame of measurement, so that Einstein’s (mass-energy) equivalence principle (EEP) should be rewritten to include the time frame \( dt(=t_2-t_1) \). The Energy Conservation Principle (ECP) becomes the consequence of the more profound and general Plq Conservation Principle (PICP).

The total Plq \( (I_T) \) of a non-gauge QP (NGP) is obviously related to a (classical linear) time interval \( (dt) \) of measurement (in a specific reference frame) and can be defined (and generalized) as a function of an intrinsic (internal) Plq \( (I_{in}) \) (as measured in dt interval or previously), an input (received) Plq \( (I_{in}) \) and an output (emitted) Plq \( (I_{out}) \) of that NGP: this is the most general form of PICP that can be also applied to the EEP as any QP probably emits and/or receives undetectable (hypothetical) egs independently to any possible additional electromagnetic (EM) radiation when it transforms into energy (and egs are hypothesized to generally have the same speed \( c \) as the real/virtual photons).

As the (hypothetical) egs cannot be shielded, it is inevitable that any form of matter emits and receives egs 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 egs 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 egs in the dt interval and \( E_{gr} \) is the average energy of these egs.

\[
E(\text{dt}) = E + \left( N_{gr(in)(\text{dt})} - N_{gr(out/esc)(\text{dt})} \right) \cdot E_{gr}
\]

\[
m c^2(\text{dt}) = m c^2 + \left( N_{gr(in)(\text{dt})} - N_{gr(out/esc)(\text{dt})} \right) \cdot E_{gr} \Rightarrow
\]

\[
\left( N_{gr(in)(\text{dt})} - N_{gr(out)(\text{dt})} \right) \cdot E_{gr} << E
\]

\[
E(\text{dt}) = m c^2(\text{dt}) \text{ AND } E \sim m c^2
\]

**THE INTRINSIC Plqs OF THE MAIN QPs**

As the graviton has a very small intrinsic Plq, it can be simplified as associated with just 2 quantum states (which may become two additional subquatum states of the QP that absorbs that eg).

The ratio between \( h \) and \( h_{eg} \) was named \( K_{eg} \) (electrogravitational constant) as it relates the EMF-Plq \( (h) \) to EGF-Plq\( (h_{eg}) \). \( K_{eg} \) helps measuring \( h \) in qbits and also helps measuring the Js (Joule-second) in qbits. In BIDUM, I’ve alternatively named the Js unit as “pit” (from “physical bit” \([\text{pbit}] \) or briefly \([\text{pit}] \)), as Js (=pit) measure the \( N_S \) of a QP: \( k_{pit} \) is the constant that relates the pit with the qbit quantitatively.

BIDUM emits the hypothesis that the Plq scalar can also be used to approximate the intrinsic Plq (at rest) of the other QPs as the product between the intrinsic Eq at rest of those QPs and their mean lifetime.
The intrinsic PIq at rest of a single \( W / W^* \) boson (\( h_w \)) is a function of its rest mass (\( m_w \sim 80.385 \pm 0.015 \text{GeV/c}^2 \)) and its half-life (\( t_w \sim 3 \cdot 10^{-25} \text{s} \))

\[
h_w = (m_w c^2) \cdot t_w \approx 4.9 \times 10^{43} \text{ states} \sim 145 \text{ qbits} \quad \text{[as W-boson is considered a “heavy” photon, it carries almost 6 times more PIq (at rest) than a photon]}
\]

The intrinsic PIq at rest of a single Z boson (\( h_z \)) is also a function of its rest mass (\( m_z \sim 91.1876 \pm 0.0021 \text{GeV/c}^2 \)) and its half-life (\( t_z \sim 3 \cdot 10^{-25} \text{s} \))

\[
h_z = (m_z c^2) \cdot t_z \approx 5.5 \times 10^{43} \text{ states} \sim 145 \text{ qbits} \quad \text{[as Z-boson is also considered a “heavy” photon, it carries almost 7 times more PIq (at rest) than a photon]}
\]

For the Strong Nuclear Force (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 (\( \alpha_{\text{SNF}} \)) which has a value close to 1 (practically ~137 times larger than FSC at rest)

\[
h_{gl} = (\alpha_{\text{SNF}} \cdot FSC) \cdot h_{ph} = FSC \cdot h_{ph} \approx 6.1 \times 10^{40} \text{ states} \sim 135 \text{ qbits}
\]

with \( h_{gl} / h_{ph} > 1/137 \text{ and } h_{gl} / h_{eg} > 3 \times 10^{40} \text{[as 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]}

The intrinsic PIq at rest of a single proton (\( h_p \)) is a function of its rest mass (\( m_p \sim 0.938 \text{GeV/c}^2 \)) and its mean lifetime (with an experimental lower bound \( t_p > 10^{31} \text{ years} \))

\[
h_p > [(m_p c^2) \cdot t_p \approx 6 \times 10^{44} \text{ states} \sim 348 \text{ qbits}],
\]

with \( h_p / h_{ph} > 7.2 \times 10^{6} \text{ and } h_p / h_{eg} > 3 \times 10^{40} \)

The intrinsic PIq at rest of a single up quark (\( h_{qu} \)) (which is the most stable of all types of quarks, with a mean lifetime probably comparable to that of the proton) is a function of its rest mass (\( m_{qu} \sim 2.3 \text{MeV/c}^2 \)) and its mean lifetime (with an experimental lower bound comparable to that of the proton \( t_{qu} \sim t_p > 10^{31} \text{ years} \))

\[
h_{qu} > [(m_{qu} c^2) \cdot t_p \approx 1.5 \times 10^{42} \text{ states} \sim 339 \text{ qbits}],
\]

with \( h_{qu} / h_{ph} > 1.8 \times 10^{9} \text{ and } h_{qu} / h_{eg} > 7.3 \times 10^{40} \)

The intrinsic PIq at rest of a single electron (\( h_e \)) is a function of its rest mass (\( m_e \sim 0.511 \text{MeV/c}^2 \)) and its mean lifetime (with an experimental lower bound \( t_e > 6.6 \cdot 10^{28} \text{ years} \)).

Electrons can be considered “hyper” photons, with \( h_e > 10^{54} \text{h} \) (this \( h_e \) gives them a non-0 rest mass and some common photon-electron proprieties)

\[
h_e > [(m_e c^2) \cdot t_e \approx 1.5 \times 10^{37} \text{ states} \sim 323 \text{ qbits}],
\]

with \( h_e / h_{ph} > 1.8 \times 10^{52} \text{ and } h_e / h_{eg} > 7.5 \times 10^{48} \)

**CHECKPOINT CONCLUSIONS**

BIDUM is centered on these four PIqs \( h_{ph} = h_e, h_{eg}, h_{w/z} \) and \( h_{gl} \) of the four gauge bosons (GBs) which mediate the four fundamental (physical) forces (FFs). I consider these four PIqua as more important that the energy-quanta (Eq) and mass-quanta (Mq) of the four GBs, that is why I argue that energy, force, mass and all their derivatives (together with their SI units of measurement which are essentially based on the kilogram) should be “inversely” redefined from this PIq-scalar of the angular momentum.

For the simplicity of notation, PIq is denoted as “I”, time is denoted as “t” and linear/circular lengths/distances (denoted as “d”):

\[
\text{PIq} = (I = E \cdot t) \Rightarrow \text{pit} = J = k_{pit} \cdot \text{qbit}
\]

\[
E(\text{energy}) = I / t \Rightarrow J = \text{pit} / s = k_{pit} \cdot \text{qbit} / s
\]

\[
P(\text{power}) = I / t^2 \Rightarrow W = \text{pit} / s^2 = k_{pit} \cdot \text{qbit} / s^2
\]

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

\[
M(\text{mass}) = (I \cdot t) / d^2 \Rightarrow k_g = \text{(pit} / s > m^2 = (k_{pit} \cdot \text{qbit} \cdot s) / m^2
\]

As seen, BIDUM offers a new (informational) hypothetical definition for energy as the PIq transfer speed (qbits transferred in [unit of] a time interval [s]).
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 \((dt=t_2-t_1)\). What is perceived physically as the “energy/matter of an observed system” (and/or through measuring to objects 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 PIq per unit of (subjective and/or objective) (classical linear) time interval time. In conclusion, energy and matter are generated by PIq flows of different types.

In my BIDUM, I argue that many physical constants support co-definitions (additional independent interpretation), as if all the physical constants (of the OU) are double-connected and support two parallel definitions: one energetic and one informational.

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 EPB between the (quantum/classical) angular momentum (measured in Joule·second) and pure information (measured in pure numbers of bits and/or qbits) so that: \(\text{QAM} = \text{Plq} = \text{nof. states} (N_S = N_Q \cdot N_{SQ})\)

As G and \(K_Q \cdot c^2\) (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 Plq and area-quanta \(\text{aq}\) so that \(\text{Plq} = \text{aq} (I = d^2 = t^2 = d \cdot t)\) and \(\text{Plq}/\text{aq} = K_G = \frac{G}{c} = K_Q (\equiv K_Qc^2)\) (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 \(\pi\) multiples). This distance-time equivalence also predicts the energy-mass EEP.

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The Planck constant \( (h=\hbar) \) is also the (central) PIqua unit in the (natural) Planck Units System (PUS) a system which can be generalized for any other Planck-like (PIq) constant \( (h_{gl}, h_{W/Z} \text{and } h_{eg}) \) and called Planck-Like Units System (PLUS[h_x]), such as PSU is the private case PLUS[h_{ph}]).

The coupling \((\alpha)\) 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 \(K_{e\text{q}e}^2\), but is conventionally expressed as a function of \(Gm_e^2/c\) and \(h\) only.

The Bekenstein bound (BB) (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 \( k_{BB}=(2\pi)^2/\ln(2) \)

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 \( N_{s}=N_Q \times N_{S_Q} \) (as the emission/reception of egs may generate all the possible subquantum energetic/momentum [micro]states \( N_{S_Q} \) that can be “hidden” in a single quantum state of a QP).

The Planck constant \((h)\) has also an other important significance, as it 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 PIq \( \leq h \) 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.

If the intrinsic PIq of all QP are pre-considered finite, an important consequence is that all QPs will finally decay (by finite lifetimes).

- \( m \cdot t \leq \frac{\hbar}{c^2} \) for photons, gluons and egs
- \( m \cdot t > \frac{\hbar}{c^2} \) for W / Z bosons, Higgs boson, neutrinos, leptons and quarks
The (apparently) at rest energy of the White Universe (WU) (defined as directly observable and complementary to the dark energy and matter) ($E_{arWU}$) can be estimated using the recent measurements of the total (apparent rest) mass of WU ($M_{arWU}$).

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).

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 ($t_p$) [Error! Bookmark not defined., Error! Bookmark not defined.] ($t_{arWU} > t_p$ 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 $E_{arWU}$.

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 $I_{akWU}$).

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 (average) rest masses of the three protonic (up/down) quarks $m_{pq}=2m_{up}+m_{ud}$ is only ~1.002% of the total proton (nucleon) rest mass and $\Phi = m_{pq}/m_{pep} - 1.001\%$. In conclusion, the real (global) rest PIq of the WU

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 (vacuum) the rest and dynamic pep may occupy (the BIDUM definition of pep/STA).

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 ($t_p$) (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 $E_{arWU}$.

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) was estimated by Valev D.T in 2009* at ~3/10(0.3) of the (apparent) rest energy of the WU ($E_{arWU}$) and indicates an average overall speed of $v_{WU} = (E_{arWU}/M_{arWU})^{1/2} \sim 0.5c$.

If the mean lifetime of the apparent (kinetic) WU ($t_{akWU}$) is (hypothetically) considered equal to the mean lifetime of the (apparent rest) WU ($t_{arWU}$) (no matter if WU is cyclic or not), one can estimate the apparent kinetic (global) PIq of WU ($I_{akWU}$) using the PIq scalar.

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 $I_{akWU}$).

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 (average) rest masses of the three protonic (up/down) quarks $m_{pq}=2m_{up}+m_{ud}$ is only ~1.002% of the total proton (nucleon) rest mass and $\Phi = m_{pq}/m_{pep} - 1.001\%$. In conclusion, the real (global) rest PIq of the WU

$M_{arWU} \sim 1.45 \times 10^{53} \text{kg} \Rightarrow E_{arWU} = M_{arWU}c^2 \sim 1.3 \times 10^{70} \text{J}$

$E_{akWU} = 0.3 E_{arWU} \sim 3.9 \times 10^{69} \text{J}$

$E_{tWU} = E_{arWU} + E_{akWU} \Rightarrow \Phi = m_{pq}/m_{pep} \sim 1.001\%$

$I_{tWU} = I_{arWU} + I_{akWU} \sim [\sim 614 qbits]$
The up/down quarks and electrons from the WU (I\(_{\text{eqWU}}\)) is in fact only the real (global) rest Plqs of all the up/down quarks and electrons from the WU (I\(_{\text{eqWU}}\)) (which is only \(\Phi \sim 1.001\%\) of I\(_{\text{arWU}}\)) AND (1-\(\Phi\))-98.999\% of I\(_{\text{arWU}}\) is in fact (also) kinetic/dynamic Plq generated by the kinetic energy of all the gluons of the WU (I\(_{\text{eqWU}}\)) (as gluons may also be considered white/WU radiation). In this context, the real kinetic (global) Plq of the WU (I\(_{\text{kWU}}\)) is in fact I\(_{\text{kWU}}\) (= I\(_{\text{wzWU}}\) - I\(_{\text{rWU}}\)) ~ 99.23\% of I\(_{\text{rWU}}\), which is significantly larger than I\(_{\text{rWU}}\) (= 23.1\% of I\(_{\text{rWU}}\)).

I\(_{\text{eqWU}}\) and can be analyzed as the sum between: (1) I\(_{\text{eqWU}}\); (2) the sum of the kinetic Plqs of all the hypothetical egs from the WU (I\(_{\text{egWU}}\)); (3) the sum of the (kinetic) Plqs of all the photons from the WU (I\(_{\text{phWU}}\)); (4) the (hybrid) sum between rest and kinetic Plqs of all the W/Z ever emitted/received in the WU (I\(_{\text{wzWU}}\)). Based on I\(_{\text{eqWU}}\) and h\(_{\text{eq}}\), the total nof. real gluons in the WU (N\(_{\text{glWU}}\)) can also be estimated. Interestingly, N\(_{\text{eqWU}}\) - N\(_{\text{ph(OU)}}\) ~ 10\(^{184}\), which can be interpreted in a dual way: (1) Each eg that generates the accelerated expansion of the OU has also generated a Planck volume (V\(_{\text{Pl}}\)); (2) Each Planck volume (V\(_{\text{Pl}}\)) has generated an eg that contributes to the accelerated expansion of the OU (as if dark energy [DE] and dark matter [DM] may be hidden at Planck scale). Both interpretations also mean that I\(_{\text{eqWU}}\) has its lower bound of ~612qbits very close to the binary logarithm of the nof. of Planck volumes (V\(_{\text{Pl}}\)) contained in the (total) Volume of the Observable Universe (V\(_{\text{OU}}\)).

In conclusion, the eg (as quantitatively defined by h\(_{\text{eg}}\) in BIDUM) counts the Planck 3D volumic “granulation” of the OU, as each eg corresponds to a volumic-Planck-pixel of the OU: in this way, BIDUM interprets that egs are the morpho-functional “lattice”/matrix of the (apparently) empty ST, a gravitonic quantum “foam”. The total nof. real photons in the WU (N\(_{\text{phWU}}\)) can be approximated from the baryons-to-photons ratio in the present WU, which is constrained relatively tightly as \(\eta \sim (5.7 - 6.7) \times 10^{-10}\) baryons/photons given the primordial abundance of \(^7\text{Li}\) inferred from the latest observations. Based on N\(_{\text{phWU}}\) and h\(_{\phi}(=h)\), I\(_{\text{phWU}}\) can also be estimated.

I\(_{\text{wzWU}}\) 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 ($h_{W/Z} \approx h_{\gamma}$), 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 $[N_{WZ}^{WU}]$ in the WU is much lower than the nof. of photons in the same WU) and that is why $I_{WZ}^{WU}$ is very probably much (with many orders of magnitude) smaller than $I_{ph}^{WU}$.

**THE FOUR LAYERS OF (WEBS OF) INTERNODES OF THE OU 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 $N_e$.

The basic EGF (real) web has a nof. $N_{EGF}$ internodes (populated by real egs interconnecting all the $N_{qe}$ nodes by each-to-all type of connection so that $N_{EGF} = N_{qe}^2$). Using $I_{eg}^{WU}$ and $N_{EGF}$, one can also calculate a flow of a maximum nof. real egs interchanged per EGF-internode and per unit of time (second) of $t_{WU}$ ($F_{eg}^{WU}$). (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 $N_{eg}^{WU}$ is defined by an inequality to a minimum as $I_{eg}^{WU}$ is also defined by an inequality to a minimum, and that why the minimum/maximum is aspect uncertain)

The superimposed layer of EMF (formed by a web of $N_{EMF}$ internodes populated by real photons interconnecting all the $N_{qe}$ nodes by each-to-all type of connection so that $N_{EMF} = N_{qe}^2$). Using $I_{ph}^{WU}$ and $N_{EMF}$, one can also calculate a flow of a maximum nof. real photons interchanged per EMF-internode and per unit of time (second) of $t_{WU}$ ($F_{ph}^{WU}$). (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 $N_{ph}^{WU}$ is defined by an inequality to a minimum as $I_{ph}^{WU}$ is also defined by an inequality to a minimum, and that’s why the minimum/maximum aspect is uncertain)

The superimposed layer of EWF (formed by a web of $N_{WNF}$ internodes populated by real and virtual W/Z bosons interconnecting theoretically all the $N_{qe}$ nodes in which they engage: EWF, EMF and EGF) by each-to-all type of connection so that $N_{WNF} = N_{qe}^2$). Using $I_{wz}^{WU}$ and $N_{WNF}$, one can also calculate a flow of a maximum nof. real W/Z bosons interchanged per

$$I_{wz}^{WU} \ll I_{ph}^{WU} \ll 439 qbits$$
WNF-internode and per unit of time (second) of $t_{\text{WU}}$ ($F_{\text{WU}}$). (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 $t_{\text{WU}}$ interval: on the other hand $N_{\text{WU}}(<<N_{\text{phWU}})$ is defined by an inequality to a maximum as $I_{\text{WU}}$ is also defined by a inequality to a minimum, and that’s why the minimum/maximum aspect is uncertain)

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 $^4\text{He}$ atoms] so that $N_{\text{SNF}}-N_q$). Using $I_{\text{gWU}}$ and $N_{\text{SNF}}$, one can also calculate a flow of a maximum nof. real gluons interchanged per SNF-internode and per unit of time (second) of $t_{\text{WU}}$ ($F_{\text{gWU}}$). (this is an apparent asymptotic maximum nof. gluons, as some gluons may be emitted in empty space without being ever received in the $t_{\text{WU}}$ interval: on the other hand $N_{\text{gWU}}$ is defined by an inequality to a minimum as $I_{\text{gWU}}$ is also defined by a inequality to a minimum, and that’s why the minimum/maximum aspect is uncertain)

Interestingly, the ratio between the flow of real gluons (per SNF-internode and per unit of time) ($F_{\text{gWU}}$) and the flow of real (hypothetical) egs (per EGF-internode and per unit of time) ($F_{\text{egWU}}$) predicts quite accurately the ratio between the electrostatic force of attraction between a proton 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). The $F_{\text{gWU}}/F_{\text{egWU}}$ ratio is a function of three other ratios: $I_{\text{gWU}}/I_{\text{egWU}}, h_g/h_{eg}$ and $N_{\text{SNF}}/N_{\text{EGF}}$.

\begin{align*}
N_{\text{SNF}} &\sim N_q \sim 2.6 \times 10^{80} \text{ (SNF internodes)} \\
F_{\text{gWU}} &= \left( N_{\text{gWU}} / N_{\text{SNF}} \right) / t_{\text{WU}}(s) \geq \left( \sim 1 \times 10^{25} \right)^

(* the maximum/minimum(?) nof. real gluons interchanged per SNF-internode and per second in the $t_{\text{WU}}$ interval)

\begin{align*}
F_{\text{gWU}} / F_{\text{egWU}} &\sim 5 \times 10^{40} \text{ and } \\
\left( K_e q_e^2 \right) / \left( G m_p m_e \right) &\sim 2.3 \times 10^{39} \\
I_{\text{gWU}} / I_{\text{egWU}} &\sim 3.3 \\
h_g / h_{eg} &\sim 5.7 \times 10^{44} \\
N_{\text{SNF}} / N_{\text{EGF}} &\sim 3 / \left( 4 N_{qe} \right) \sim 2.1 \times 10^{-81}
\end{align*}