

# A "Simply...Gravitonic" Universe (toy-)Model (SGUM)

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Andrei-Lucian Drăgoi<sup>1,2</sup>  
(independent researcher)

## 1. Abstract

This paper proposes a Simple...Graviton(-based) Universe (toy-)Model (SGUM) which implies a short list of postulates, statements and assumptions (subquantum movement generating rest masses for almost all known elementary particles; a large palette of gravitons with various quantum angular spins, non-zero volumes and a common energetic density for all known elementary particles with non-zero positive rest energies/masses etc) with far reaching predictions and consequences beyond the [Standard Model \(SM\)](#) of particle physics, bringing quantum mechanics (QM) and Einstein's general relativity (EGR) very close to each other:

- (1) the existence of at least three more scalar bosons (called "X bosons" [Xbs]) heavier than Higgs boson (Hb), with the heaviest of them (named "super-Higgs boson" [SHb]) predicted to be the quanta of a "super-Higgs field" (SHF) which is a plausible candidate for a hypothetical primordial gravitational [unified field](#) that dominated the pre-[Big-Bang](#) quasi-singularity;
- (2) a set of non-zero radii (and thus volumes) for all known elementary particles (EPs) with non-zero positive rest masses (rM)/ energies;
- (3) a set of Planck-like gravitonic constants (measuring the quantum angular momentum of gravitons identified with EPs) for all known EPs with rM>0;

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## 2. A Simple Gravitonic Universe (toy-)Model (SGUM)

**Observation (Obs) (plus explanation and motivation/pretext of SGUM) on a strong link between [Einstein's General Relativity \(EGR\)](#) and [quantum chromodynamics \(QCD\)](#).** It is well known/demonstrated that ~99% of a [nucleon \(proton \[p\] or neutron \[n\]\) rest mass](#)  $\left(m_{p/n}\right)$  (which  $m_{p/n}$  is actually the [inertial mass](#) of a nucleon measured by an observer which is "at rest" in respect to that nucleon) IS IN FACT produced by BOTH

the [kinetic energy](#) of their subcomponent [gluons](#) (the quanta of the [strong nuclear field \[SNF\]](#), which gluons bind "nucleonic" [up and down quarks](#) together, by the so called [quantum chromodynamics binding energy](#) which is actually the SNF energy) and the [kinetic energy](#) quarks: only ~1% of  $m_{p/n}$  is due to the rest masses of all

its subcomponent quarks, HOWEVER all  $(99\% + 1\%)m_{p/n}$  couples gravitationally (because the [gravitational mass](#) <sup>[URL2]</sup> and [inertial mass](#) of a nucleon were experimentally proved to be equal, at least in the error limit of the experiments) SO THAT it is almost obvious that the movement of both gluons and quarks actually produces a [spacetime \(ST\) micro-deformation](#) (micro-curvature [[micro-C/micro-STC](#)] definable by a set of [geodesics](#)) AND it is that micro-STC which generates (micro-)gravity which SHOULD NOT be treated as a real force, but only the consequence of STC, as it is treated by the successful Einstein's [General Relativity \(EGR\)](#): in other words, EGR and [quantum chromodynamics \(QCD\)](#) (the quark-gluon model of [hadrons](#)) are compatible and EGR somehow anticipated QCD by also predicting STCs not only at large macrocosmic scales (macro-STCs), but also micro-STCs at microcosmic scales. In the case of [Newtonian gravitational force](#)

$$F_g = G \frac{m_1 m_2}{r^2}$$
 for example, although both  $m_1$  and  $m_2$  are considered point-like (in respect to the distance  $r$  between those two masses), each mass  $(m_1, m_2)$  is approximately the sum  $\left(\sum m_{p/n}\right)$  of all its subcomponent nucleons, because the [electrons](#) have a very small contribution (<1/1000) of the total rest energy (implicitly mass) of [atoms](#) (with nucleons at rest): it is also clear that any macro-STC generated by a macrocosmic mass may be modeled as the resultant of all micro-STCs generated by each nucleon (subcomponent of that mass) in part.

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Based on Obs and using an "analogical-inductive" generalization pushed to its limits, this paper proposes a [Simple "Gravitonic" Universe \(toy-\)Model \(SGUM\)](#) based on the following statements and assumptions (listed in the descending order of their importance in SGUM):

**1) SGUM's principle no. 1 (SP1). In our universe (OU) nothing is absolutely static.**

- i. SP1 is sustained by the [unattainability principle](#) (the impossibility to cool physical particle [PP] or physical system [PS] down to 0 [Kelvins](#) [aka [absolute zero](#)] aka the 3<sup>rd</sup> law of thermodynamics [[3LT](#)], which was recently and definitively demonstrated mathematically [see [URL](#)]) AND the non-zero energy ground state of vacuum (aka [vacuum state](#)) (as based on Heisenberg's [uncertainty principle](#) and [virtual particles](#) pair production/spontaneous creation by [quantum fluctuations](#)).

[1] Email: [dr.dragoi@yahoo.com](mailto:dr.dragoi@yahoo.com)

[2] Main pages: [www.dragoi.com](http://www.dragoi.com); [www.rg.dragoi.com](http://www.rg.dragoi.com);

[www.academia.dragoi.com](http://www.academia.dragoi.com); [www.vixra.dragoi.com](http://www.vixra.dragoi.com); [www.gsj.dragoi.com](http://www.gsj.dragoi.com)

- ii. the term “rest“ (often used in physics, for example in the concept of “rest mass” [rM]) is obviously formal at usually refers to very low positive (but never zero!) energy scales;

**2) SGUM’s principle no. 2 (SP2).** The experimental observation of “rest mass” (rM), “inertial mass” (iM) and “gravitational mass” (gM) (assigned to some elementary particle [EPs] from the [Standard Model](#) [SM] of particle physics and to all composite physical particles [cPPs] that contain such EPs with non-zero rM/iM/gM) cannot be explained by anything absolutely static, BUT rM/iM/gM can ONLY be generated by a subsidiary/hidden/ subquantum dynamic phenomenon/movement.

- i. Essentially, SP2 “pushes” Obs to its “analogical”... limits and generalizes it to all known EPs from SM.
- ii. SP2 implies that all EPs with rM>0 actually hide subquantum movement (SQM), and that SQM actually deforms the local spacetime (ST): this ST deformation (STD) (which also has a geometrical center and legitimates the “inside” attribute for all EPs with rM>0) generates a constant/perpetual friction-like phenomenon (FLP) which tends to oppose (by its “generator” SQM) to any other external force that tries to dislocate that EP (together with its assigned/associated STD) from position A to a distinct position B from that ST. SP2 additionally states that it’s this (same) constant FLP which generates (and explains!) non-gravitational/gravitational inertia and thus generates both iM and gM (which iM and gM actually store active energy and thus active force) and explains why iM=gM(=rM) for all EPs with rM>0, because this FLP will have the same magnitude, no matter if an EP will move along a “natural” (gravitational-only) ST geodesic or a “forced” (gravitational plus non-gravitational) ST geodesic
- iii. SP2 also implies that all EPs with rM>0 aren’t zero-dimensional (0D) geometrical points (as they are defined by [quantum mechanics](#), including [quantum field theory](#)), BUT actually have non-zero volumes (represented by the non-zero volumes of those STDs to which all EPs with rM>0 are indissolubly bounded).

**3) SGUM’s principle no. 3 (SP3).** SGUM assumes both [Einstein’s Special Relativity \(ESR\)](#) and [Einstein’s General Relativity \(EGR\)](#) by stating that any subquantum movement (SQM) from “inside” any EP-associated ST deformation (STD) (an STD produced by that SQM, for EPs with rM>0) is ALWAYS conserved AND has its speed ALSO limited to the speed of light in vacuum  $c \cong 3 \times 10^8 m / s$ , defined as a common finite upper speed limit for both SQM and quantum movement.

- i. SP3 may actually explain [Einstein’s \(energy-mass\) equivalence principle \(EEP\)](#), by the fact that SQM is always conserved, but may be converted to external particle emission (emitted EPs with speeds v<c if their rM>0)

and/or radiation emission (emitted bosons with speeds v=c if their rM=0).

- ii. Micro-STDs may “add” together and generate macro-STDs explaining and legitimating EGR. If (1) ONLY SQM can generate micro-STD (with inherent rM/iM/gM) and (2) all macro-STD are composed from micro-STDs, from these two propositions, SGUM easily deduces that ONLY cumulated SQM can generate a macro-STD (as a final “product” of SQM) and thus SQM may be considered the common (highly explanatory!) foundation of both EGR and quantum mechanics. In this view, “time” and spacetime deformation (generating gravity) have a common origin in SQM, which SQM is defined by SGUM as a “primordial energy” and is attributed to the [gravitons](#), which are predicted by SGUM to be of many various types (as detailed later in this paper): so, in SGUM’s view, gravitons are very plausible candidates for that subquantum...“something” that moves “inside” STD-assigned EPs with rM>0 (and thus defining SQM).

- iii. By its proposed SQM, SP3 may also explain the phenomenon of (quantized angular) [spin](#) which is inherent to all non-scalar EPs and which may be regarded as an “internal clock” of each EP in part.

- iv. **Important note.** SP1, SP2 and SP3 all together can be considered the hard core of SGUM, with all the other statements of SGUM being based on these 3 main principles.

- v. **Important prediction.** Based on its SP2 and SP3, SGUM predicts that the extreme cooling of any EP (with rM>0) may slightly (and direct-proportionally with the degree of cooling) diminish its rM (=iM-gM) and even its quantum angular spin, by diminishing its inherent SQM: if sufficiently sensitive, this type of experiments may confirm or infirm SGUM and may bring a quasi-revolution in understanding the concept of “mass” in the future physics.

**4) SGUM’s principle no. 4 (SP4).** [Gravitons \(grs\)](#) truly exist and all EPs with rM>0 are stated to be composed from positive energy gravitons (generating subquantum movement. micro-STDs and iM/gM/rM>0 implicitly), gravitons which are all modeled by SGUM as wave-like 1D [strings/branes](#) (1-branes) and there are at least 5 major types of grs (each type of gr with a [positive-energy](#) variant and a [negative-energy](#) variant respectively):

- i. [spin-0 gravitons \(0grs\)](#), which may be called (wmbc) “scalar gravitons”;
- ii. [spin-\(±\)1/2 gravitons \(1/2grs\)](#). wmbc “fermionic gravitons”;
- iii. [spin-1 gravitons \(1grs\)](#), wmbc “photonic gravitons”;
- iv. [spin-\(±\) 3/2 gravitons \(3/2grs\)](#)
- v. [spin-2 gravitons \(2grs\)](#), which 2grs also predicted by [quantum gravity](#) theories like [string theory](#) and [loop quantum gravity](#).
- vi. **Important note.** The possibility of gravitons with a large spectrum of quantum spins was also approached in another (older) paper of the author [1].

5) SGUM assumes ESR, EGR and the quantum nature of the [electromagnetic field \(EMF\)](#) (including the [photon](#) as the EMF quanta) AND SO it proposes a unified energy scalar  $E_{gr(x)}$  for all types of gravitons similarly to the photon, as based on a set of Planck-like gravitonic constants  $h_{gr(x)}$ , such as

$$E_{gr(x)} = h_{gr(x)}c.$$

6) SMUG models any (spin-1/2) [lepton](#) with non-zero rest mass  $m_{L(x)} > 0kg$  as a specific closed circular 1/2gr(x) (a standing 1D wave/string with a closed circular/circumferential variable trajectory  $2\pi r_{L(x)}n$  enclosing a positive non-zero 3D quasi-spherical volume of space with radius  $r_{L(x)} > 0m$  by surrounding it 1, 2 or 3 times [on 1, 2 or all 3 axes of our 3D space, similarly to a 1D circle, a [2D torus 3a1 double-knot](#) or a [3D torus triple/trefoil knot](#)] as counted by the rotational integer index  $n \in \{1, 2, 3\}$ ) with

$$E_{1/2gr(x)} = \frac{h_{1/2gr(x)}c}{2\pi r_{L(x)}n} = m_{L(x)}c^2, \text{ which implies}$$

$$h_{1/2gr(x)} = (m_{L(x)}c) \cdot (2\pi r_{L(x)}n) \text{ and a rest mass}$$

$m_{L(x)}$  actually generated by the micro-STC produced by that circular permanent (spin-1/2) movement of that 1/2gr(x).

- i. SGUM (pre-)states that only EPs/grs with  $n=3$  can exist “autonomously” (in the sense of “not closely/indissolubly bounded to any other EP”, which is in contrast with [quarks](#) which cannot exist otherwise than in multi-quark bounded states) in a 3D space like ours (for example [leptons](#) and some non-zero rest mass bosons like [W/Z bosons](#) and the [Higgs boson](#)).
- ii. SGUM (pre-)states that [quarks](#) are 1/2grs with  $n \in \{1, 2\}$  and that is one of the reasons they cannot exist “autonomously” in our 3D space (see next).
- iii. SGUM (pre-)states that bosons with zero rest-masses (like [photons](#) and [gluons](#)) are grs with open trajectories and thus have  $n=0$  (see next).
- iv. SGUM (pre-)states that, in general, closed grs (wmbc “gravitonic standing waves” [GSWs]) can create ST ripples that spread all around its surroundings explaining the [wave function](#) as described by the [Schrödinger equation](#) (thus de Broglie [matter waves](#) and the [wave-particle duality](#)) of all [quantum EPs \(qEPs/QPs\)](#) and all isolated [quantum systems](#). When they are sufficiently “powerful”, these GSWs/grs may produce ST vortices so strong that they may create additional extended torsional geodesics in ST

generating EM charge and EMF/electromagnetism: in the case of charge-generating 1/2gr, the vortex created by this (circular closed) 1/2gr could be so powerful that it may create ditch/gutter-like EMF geodesics in ST which may bring together two opposite-charge EPs much more quickly than the gravitational field (GF) would do it (on its “natural/normal” GF ST geodesics); this may also explain why ONLY closed grs (identified with non-zero rest mass EPs, no matter the spin) can generate/have EM charge (EMC), because EMC is always associated with a non-zero rest mass, because there is no known EM-charged EPs with zero rest mass. (see next)

- v. The electromagnetic (EM) [charge \(EMC\)](#) of any (spin-1/2) lepton is defined as the [vortex effect](#) (which also torsions the surrounding ST) created by that rotating 1/2gr (identified with that lepton). The charged leptons with EMC equal to the [elementary charge](#) ( $q_e \cong 1.6 \times 10^{-19}C$ ) (like the [electron \(e\)](#), the [muon \( \$\mu\$ \)](#), the [tauon \( \$\tau\$ \)](#) and their [antiparticles](#)) are stated to be 1/2gr with  $n=3$ . For example, in the case of the electron (e) for which  $r_{L(e)} < 10^{-22}m$  (the upper limit of the electron’s radius as established by using [Penning traps \[URL\]](#)), the gravitonic Planck-like constant of the electron also has an upper limit:

$$h_{1/2gr(e)} < 7.8 \times 10^{-10}h. \text{ If one considers that the } \mu \text{ and } \tau \text{ are both just two distinct excited states of the electron with } r_{L(\mu)} < 10^{-22}m \text{ and } r_{L(\tau)} < 10^{-22}m$$

also, then  $h_{1/2gr(\mu)} < 1.6 \times 10^{-7}h$  and

$$h_{1/2gr(\tau)} < 2.7 \times 10^{-6}h.$$

- vi. **Important co-statement.** SGUM additionally states that all point-like EPs (like the electron is regarded in [quantum mechanics](#), with all EPs being also modeled as adimensional/0D geometrical points by the quantum field theory [QFT], which QFT approach may not be accurate however!) should be limited to this upper limit

$$r_{EP(\text{sup})} = 10^{-22}m \text{ so that all physical radii of all EPs}$$

with non-zero rest energies/masses  $r_{EP(x)} < r_{EP(\text{sup})}$  :

- vii. **Important remark.** Note that the  $h_{1/2gr(x)}$  values of “leptonic” 1/2grs get progressively closer (directly-proportional to the rest mass increase of leptons) to Planck constant  $h$ , a fact which suggests that, at least in the context of SGUM, gravity may be easily unifiable with the other 3 fundamental physical fields (FPFs) at length scales possibly comparable to  $r_{EP(\text{sup})}$ , which is much larger than [Planck](#)

length ( $l_{Pl} = \sqrt{\hbar G / c^3} \cong 1.6 \times 10^{-35} m$ ) (for the further development of this idea, see the paragraph dedicated to the [Higgs boson](#))

viii. Neutral (zero EM charge) leptons (like the electron, muon and tauon [neutrinos](#)) are also assigned  $n=3$  by SGUM. However, based on the electron being the elementary particle (**EP**) with the largest known charge-to-mass ratio ( $q_e / m_e \cong 1.76 \times 10^{11} C / kg$ ) and the upper limit

$$\boxed{h_{1/2gr(e)} < 7.8 \times 10^{-10} h}$$

SGUM also states that, even if neutral (zero EM charge) leptons are also assigned  $n=3$  (by SGUM), only 1/2grs(x) with sufficiently large (gravitational) quantum angular momentums

$$\boxed{h_{1/2gr(x)} \geq h_{1/2gr(e)}} \text{ (with values relatively close to}$$

Planck constant  $h$ ) have the capacity to produce non-zero EM charges (no matter the value of the integer rotational index  $n$ ). For example, if we assign the [electron neutrino](#)

( $\nu_e$ ) (which is the lightest known spin-1/2 EP having a non-zero rest mass estimated as  $m_{\nu_e} < 2.2 eV / c^2$  [[URL-Table1](#)], thus being a circular 1/2gr) a Planck volume with radius equal to  $l_{Pl}$  (which is largely considered the smallest theoretical/hypothetical distance with a physical sense) so that  $\boxed{r_{L(\nu_e)} = l_{Pl}}$ , then the Planck-like gravitonic constant

$h_{1/2gr(\nu_e)}$  of that closed 1/2gr (identified with  $\nu_e$ ) is estimated at

$$\boxed{h_{1/2gr(\nu_e)} = (m_{\nu_e} c) \cdot (2\pi l_{Pl} 3) < 5.4 \times 10^{-28} h}$$

(for  $n=3$ ) which is much smaller than and insufficient to create a non-zero EMC for the electron neutrino (as previously ruled by SGUM). If we consider the muon neutrino ( $\nu_\mu$ ) and the tauon neutrino ( $\nu_\tau$ ) to be the excited states of the 1/2gr( $\nu_e$ ), then:

$$\boxed{h_{1/2gr(\nu_\mu)} = (m_{\nu_\mu} c) \cdot (2\pi l_{Pl} 3) < 4.2 \times 10^{-23} h}$$

(for an experimentally estimated  $m_{\nu_\mu} < 0.17 MeV / c^2$  [[URL-Table1](#)]) and

$$\boxed{h_{1/2gr(\nu_\tau)} = (m_{\nu_\tau} c) \cdot (2\pi l_{Pl} 3) < 4.5 \times 10^{-21} h} \text{ (f}$$

or an experimentally estimated  $m_{\nu_\tau} < 18.2 MeV / c^2$  [[URL-Table1](#)]); in a checkpoint conclusion, no matter if

$$\boxed{r_{L(\nu_e)} = l_{Pl}} \text{ (or not), both } h_{1/2gr(\nu_\mu)} \text{ and } h_{1/2gr(\nu_\tau)} \text{ are}$$

plausibly much smaller than  $h_{1/2gr(e)}$ —and that is how SGUM explains why they are also EM neutral (with zero EMC).

7) SGUM models any (spin-1/2) [quark](#) (Q) with non-zero rest mass  $m_{Q(x)} > 0 kg$  in the same way as it models leptons (as previously explained), by identifying them with closed circular 1/2grs with  $\boxed{h_{1/2gr(x)} = (m_{Q(x)} c) \cdot (2\pi r_{Q(x)} n)}$ , with a rotational integer index  $n \in \{1, 2\}$ . Circular 1/2gr(x) identified with quarks are predicted by SGUM to have  $h_{1/2gr(x)}$  values larger than  $h_{1/2gr(e)}$  and thus to possess non-zero EMC, BUT that non-zero EMC is predicted to be generally  $\boxed{\pm(n/3)q_e}$ :  $\pm(1/3)q_e$  for  $n=1$  and  $\pm(2/3)q_e$  for  $n=2$ .

8) SGUM also models (spin-1) [W/Z bosons](#) (**Wb/Zb**) with non-zero rest masses  $m_{Wb} \cong 80 GeV / c^2$  and  $m_{Zb} \cong 91 GeV / c^2$  as specific closed circular 1grs with rotational integer index  $n=3$ , given the fact the Zb has zero EMC and Wb has  $\pm q_e$  EMC) with

$$\boxed{h_{1gr(Wb)} = (m_{Wb} c) \cdot (2\pi r_{Wb} n)},$$

$$\boxed{h_{1gr(Zb)} = (m_{Zb} c) \cdot (2\pi r_{Zb} n)} \text{ and Wb/Zb rest masses}$$

$m_{Wb}$  and  $m_{Zb}$  are actually generated by a micro-STCs produced by the circular permanent (spin-1) movement of those 1grs(W/Z). For  $\boxed{r_{Wb} < r_{EP(sup)}}$  and  $\boxed{r_{Zb} < r_{EP(sup)}}$ , SGUM

estimates:  $\boxed{h_{1gr(Wb)} < 1.2 \times 10^{-4} h}$  and

$$\boxed{h_{1gr(Zb)} \cong 1.4 \times 10^{-4} h}.$$

9) SGUM also identifies the [photon](#) (**ph**) with an open (/non-closed trajectory) specific 1gr(ph) with zero rest mass, rotational index  $n=0$  (thus zero EM charge) and possessing only relativistic kinetic energy  $\boxed{E_{1gr(ph)} = h_{1gr(ph)} c}$ , with

$$\boxed{h_{1gr(ph)} = h}.$$

SGUM defines 1gr(ph) (wmbc “photonic graviton”) as an open gravitonic [transverse wave](#), with two oscillating [electric](#) and [magnetic field](#) components perpendicular to each other and to the direction of photon’s (forward) motion.

**10)** SGUM also identifies the [gluon \(gl\)](#) with an [open](#) (/non-closed trajectory) specific 1gr(gl) (wmbc “gluonic graviton”) with zero rest mass, rotational index  $n=0$  (thus zero EM charge) and possessing only [color charge](#) and relativistic kinetic energy

$$E_{1gr(gl)} = h_{1gr(gl)} c.$$

i. In contrast with ph (which is modeled as an open transverse spin-1 gravitonic wave abbrev. “1gr(ph)”), SGUM models gl as an [open torsional wave](#) (with torsions of the oscillating gluonic/strong nuclear/color charge field around the [longitudinal] axis of gl’s forward motion): more specifically, [SGUM proposes ST torsion as the unique generator of “color” charge \(possessed by both gluons and quarks\): that is why, even if quarks were stated to be closed 1grs with integer rotational indexes  \$n < 3\$  \( \$n > 0\$ \), they are modeled by SGUM to have an additional integer torsional index  \$t=1\$ , which explains their color charge; in contrast, all the other non-gluon and non-quark EPs are modeled by SGUM as being non-torsional, with  \$t=0\$ .](#)

**11)** SGUM also identifies the [Higgs boson \(Hb\)](#) with non-zero rest mass  $m_{Hb} \cong 125 GeV / c^2$  as a specific circular 0gr(Hb) with

$$\text{rotational index } n=3, \quad h_{0gr(Hb)} = (m_{Hb} c) \cdot (2\pi r_{Hb} n).$$

For  $r_{Hb} < r_{EP(sup)}$ , SGUM estimates

$$h_{0gr(Hb)} < 1.9 \times 10^{-4} h.$$

i. **Important remark.**  $h_{0gr(Hb)}$  has its upper limit relatively close to  $h$ , which indicates that quantum GF (**QGF**) and EMF may get their strengths relatively close (and potentially unifiable!) at length scales smaller than  $r_{EP(sup)}$ , but only using additional (Higgs-like) scalar “X” bosons (**Xbs**) (which also imply additional “X [scalar] fields” [**XFs**]), Xbs with generic (non-zero) rest mass  $m_{Xb}$  at least 3-4 orders of magnitude larger than  $m_{Hb}$  so that

$$(m_{Xb} c) \cdot (2\pi r_{Xb} n) \geq h \quad (\text{with } r_{Xb} \leq r_{EP(sup)}).$$

ii. **Important prediction.** Based on the inequality  $r_{Xb} \leq r_{EP(sup)}$ , SGUM predicts the existence of at least three more **Xbs** (additionally to Hb) to “fill”, in the same time: (1) the “gap” (of at least 4 orders of magnitude) between  $h_{0gr(Hb)} (< 1.9 \times 10^{-4} h)$  and  $h$ , AND ALSO (2) to “fill” the 5<sup>th</sup> (vertical) column of the [Standard Model \(SM\)](#) table of EPs (with this 5<sup>th</sup> column dedicated to scalar bosons only). The heaviest of these three (predicted) additional Xbs shall be

formally named “super-Higgs boson” (**SHb**). For simple special case  $h_{0gr(SHb)} = h \wedge r_{SHb} = r_{EP(sup)}$  (so that any  $r_{EP(x)} < r_{SHb}$ ), SGUM predicts the (non-zero) rest mass of SHb (in this simple special case only)

$$m_{SHb} = \frac{h_{0gr(SHb)}}{r_{SHb} c \cdot (2\pi \cdot 3)} = \frac{h}{r_{EP(sup)} c \cdot (2\pi \cdot 3)} \cong 5 \times 10^3 m_{Hb},$$

which is however far beyond the capabilities of the [Large Hadron Collider \(LHC\)](#) to be discovered/demonstrated.

iii. **Prediction.** Each of the four Xbs is stated to correspond to a distinct scalar “X field” (**XF**) so that our universe (**OU**) is stated (and predicted) to have at least 4 “layers” of mass-energy (each “layer” identified with a distinct XF). SGUM pushes this prediction further and states that [spacetime \(ST\)](#) may appear to have 4 dimensions (as modeled by EGR) because of these 4 distinct XFs, each XF corresponding to one distinct ST dimension.

**12) The common energetic density for all EPs hypothesis (CEDH) proposed by SGUM.** CEDH states that all EPs with non-zero rest masses (identified with closed grs with various quantized spin) actually have/share THE SAME finite non-zero point-like energetic density, wmbc “common universal EP energetic density” and noted  $\rho_{com}$ . **For the simple special case**

$h_{0gr(SHb)} = h \wedge r_{SHb} = r_{EP(sup)}$  (as explained in the previous paragraph),  $\rho_{com}$  equals the SHb energetic density

(when SHb is assigned  $r_{SHb} (= r_{EP(sup)})$  and a spherical energy distribution), so that

$$\rho_{com} = \frac{m_{SHb} c^2}{\frac{4\pi}{3} r_{SHb}^3} \cong 2.5 \times 10^{61} J / m^3, \text{ which is also the}$$

predicted energetic density of a [hypothetical SH field \(SHF\)](#) (analogous/similar to the [Higgs field \(HF\)](#)), but which  $\rho_{com}$  is much smaller than the hypothetical [Planck energy \(e\) density](#)

$$\rho_{e(Pl)} = E_{Pl} / l_{Pl}^3 = c^7 / (\hbar G^2) \cong 10^{113} J / m^3 \quad (\text{which}$$

$\rho_{e(Pl)}$  is calculated by considering the [Newtonian](#)

[gravitational constant](#)  $G \cong 6.7 \times 10^{-11} kg^{-1} m^3 s^{-2}$  [with

this low value ONLY verified at macrocosmic scales!] identical and low-valued at all macrocosmic and microcosmic length scales, which may not actually be the case!)

i. **Important prediction (based on CEDH).** SGUM states that the maximum allowed/achievable energetic density of

our universe (**OU**)  $\rho_{\max(OU)}$  is finite and equal to  $\rho_{com}$  so that the hypothetical pre-[Big Bang](#) quasi-(gravitational) [singularity](#) (**pBBS**) also had a density

$\rho_{\max(OU)} (= \rho_{com})$  and was essentially composed from

SHBs only, so that all non-SHb EPs (sharing the same  $\rho_{com}$  with SHb [by CEDH]), which EPs appeared subsequently (with the cooling of OU), can be all considered “relics” (“cooled fragments”) of this pBBS. The relatively

small  $\rho_{\max(OU)} (= \rho_{com}) \cong 10^{61} J / m^3$  (“small” when compared to  $\rho_{e(Pl)}$ ) significantly reduces (with 113-61=52

orders of magnitude!) the [vacuum catastrophe](#) of ~120 orders of magnitude (aka the [cosmological constant problem](#)) between the very low (experimentally measured) value of the [cosmological constant](#)  $\Lambda \cong 10^{-52} m^{-2}$  (which indicates a very low energy density of vacuum

$$\rho_{e(vac)} = \frac{\Lambda c^4}{8\pi G} \cong 10^{-9} J / m^3 \quad \text{and}$$

$$\rho_{e(Pl)} \cong 10^{113} J / m^3 \quad \text{(predicted by [quantum field theory](#) [QFT]).}$$

Furthermore, SGUM predicts that pBBS was dominated (and held together) by a very strong QGF (identified with SHF, with SHb being its quanta) with its strength measured by a predicted (very large) quantum gravitational constant (associated with pBBS and its very strong QGF)  $G_{pBBS} = \sqrt{c^7 / (\hbar \rho_{\max(OU)})} \cong 10^{26} G$ .

- ii. **Prediction.** SGUM predicts that both Hb and [top quark](#) (**qt**) may actually gain their rest masses by interacting with this SHF (or with other “X field” [**XF**] quantized by a non-SHb Xb with rest mass  $m_{Xb} > m_{Hb}$  and  $m_{Xb} < m_{SHb}$ ) by a mechanism similar to the [Higgs mechanism](#) (triggered by [spontaneous symmetry breaking](#)) by which W/Z bosons also (subsequently) gain their rest masses from Hb: in consequence, SGUM predicts that all EPs (including Hb and non-SHb Xbs) gain their rest-masses from SHF, directly or indirectly.

- iii. **Prediction (also based on CEDH).** Based on this common energetic density of all EPs (including Hb and Xbs)

$$\rho_{com} (= \rho_{\max(OU)}) \cong 10^{61} J / m^3 \quad \text{all non-SHb EPs with}$$

non-zero rest masses are predicted to be perfectly spherical spacetime gravitonic quasi-singularities with non-zero radii

$$\text{defined as } r_{EP(x)} = \left( \frac{E_{EP(x)} / \rho_{com}}{4\pi / 3} \right)^{1/3}; \quad \text{the Planck-}$$

like gravitonic constants  $h_{gr(x)}$  corresponding to each distinct type of graviton (identified with each distinct type of EP in part) can be then (inversely) deduced and estimated as

$$h_{gr(x)} = \left( m_{EP(x)} c \right) \left( 2\pi r_{EP(x)} \cdot n_x \right) \quad \text{(see the next}$$

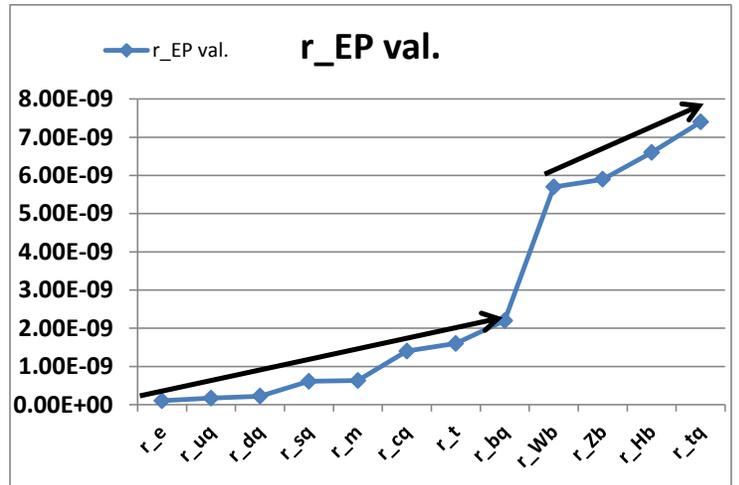
table and figures).

**Table 1.** The prediction of all non-zero radii  $r_{EP(x)}$  and Planck-like gravitonic constants  $h_{gr(x)}$  of all known elementary particles (**EPs**) (plus SHb) with non-zero rest masses from SM (which are identified with circular closed gravitons with rotational indexes n(x) and torsional indexes t(x)), as based on CEDH.

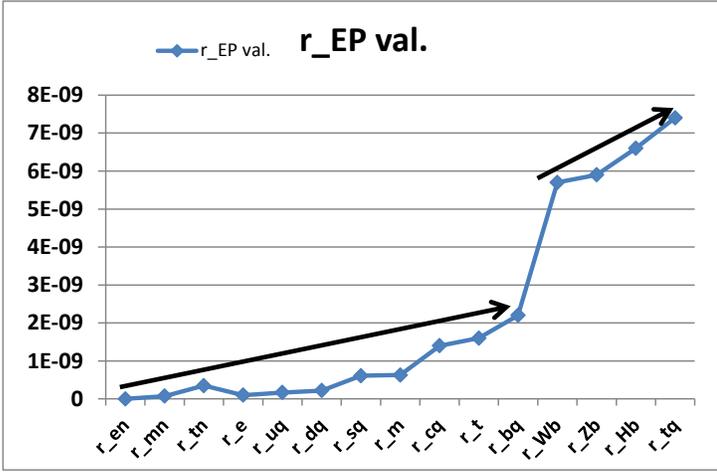
EP(x) of SM (plus SHb), its spin, its rotational index n(x) and torsional index t(x)	The approx. non-zero rest energy of that EP(x) in SM	The approx. predicted radius of that EP(x) (expressed in <a href="#">proton radius</a> $r_p$ units) in SGUM	The approx. $h_{gr(x)}$ (expressed in Planck units $h$ )
<a href="#">Electron</a> (e) (s=1/2) (n=3) (t=0)	0.5 MeV	$10^{-10} r_p$ ( $\cong 10^{-3} r_{EP(sup)}$ )	$7 \times 10^{-13} h$
<a href="#">Electron neutrino</a> (en) (s=1/2) (n=3) (t=0)	<2.2 eV	$< 1.8 \times 10^{-12} r_p$	$< 5 \times 10^{-20} h$
<a href="#">Muon</a> (m) (s=1/2) (n=3) (t=0)	106 MeV	$6.3 \times 10^{-10} r_p$	$9 \times 10^{-10} h$
<a href="#">Muon neutrino</a> (mn) (s=1/2) (n=3) (t=0)	<0.17 MeV	$< 7.3 \times 10^{-11} r_p$	$< 2 \times 10^{-13} h$
<a href="#">Tauon</a> (t) (s=1/2) (n=3) (t=0)	1.8 GeV	$1.6 \times 10^{-9} r_p$	$4 \times 10^{-8} h$
<a href="#">Tauon</a>			

<a href="#">neutrino</a> ( <b>tn</b> ) (s=1/2) (n=3) (t=0)	<18.2 MeV	$< 3.5 \times 10^{-10} r_p$	$< 8 \times 10^{-11} h$
<a href="#">Up quark</a> ( <b>uq</b> ) (s=1/2) (n=2) (t=1)	2.2 MeV	$1.7 \times 10^{-10} r_p$	$3 \times 10^{-12} h$
<a href="#">Down quark</a> ( <b>dq</b> ) (s=1/2) (n=1) (t=1)	4.7 MeV	$2.2 \times 10^{-10} r_p$	$5 \times 10^{-12} h$
<a href="#">Charm quark</a> ( <b>cq</b> ) (s=1/2) (n=2) (t=1)	1.28 GeV	$1.4 \times 10^{-9} r_p$	$1 \times 10^{-8} h$
<a href="#">Strange quark</a> ( <b>sq</b> ) (s=1/2) (n=1) (t=1)	96 MeV	$6.1 \times 10^{-10} r_p$	$3 \times 10^{-10} h$
<a href="#">Top quark</a> ( <b>tq</b> ) (s=1/2) (n=2) (t=1)	173.1 GeV	$7.4 \times 10^{-9} r_p$	$1 \times 10^{-5} h$
<a href="#">Bottom quark</a> ( <b>bq</b> ) (s=1/2) (n=1) (t=1)	4.18 GeV	$2.2 \times 10^{-9} r_p$	$4 \times 10^{-8} h$
<a href="#">W-boson</a> ( <b>Wb</b> ) (s=1) (n=3) (t=0)	80.4 GeV	$5.7 \times 10^{-9} r_p$	$6 \times 10^{-6} h$
<a href="#">Z-boson</a> ( <b>Zb</b> ) (s=1) (n=3) (t=0)	91.2 GeV	$5.9 \times 10^{-9} r_p$	$7 \times 10^{-6} h$
<a href="#">Higgs boson</a> ( <b>Hb</b> ) (s=0)	124.97 GeV	$6.6 \times 10^{-9} r_p$	$1 \times 10^{-5} h$

(n=3) (t=0)			
X boson 1 ( <b>Xb1</b> ) (s=0) (n=3) (t=0)	>124.97 GeV <658 TeV	$> r_{Hb}$ $< r_{Xb2}$	$> h_{0gr(Hb)}$ $< h_{0gr(Xb2)}$
X boson 2 ( <b>Xb2</b> ) (s=0) (n=3) (t=0)	$> E_{Xb1}$ $< E_{SHb}$	$> r_{Xb1}$ $< r_{SHb}$	$> h_{0gr(Xb1)}$ $< h_{0gr(SHb)}$
Super-Higgs boson ( <b>SHb</b> ) (s=0) (n=3) (t=0)	~658 TeV* (as predicted by SGUM)	$1.1 \times 10^{-7} r_p$ ( $= r_{EP(sup)}$ )	$h_{0gr(SHb)} = h$

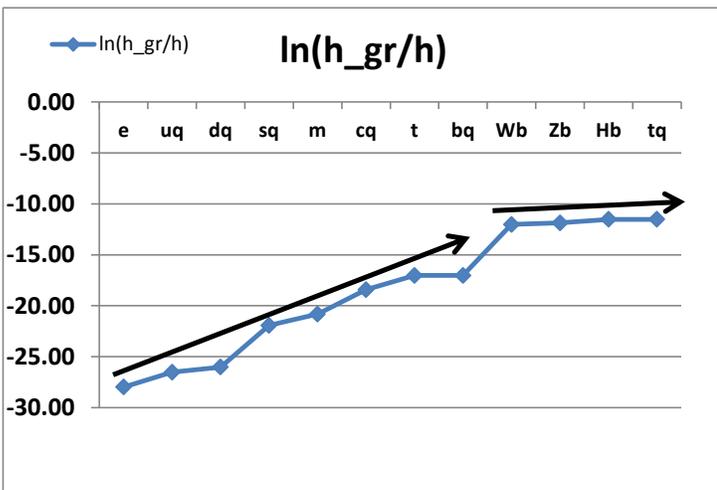


**Figure 1a.** The graphic of all predicted non-zero radii ( $r_{EP}$ ) of all known EPs for the simple special case  $h_{0gr(SHb)} = h \wedge r_{SHb} = r_{EP(sup)}$  (excluding the [neutrinos](#) which weren't exactly determined their rest masses until present) (as expressed in [proton radius](#)  $r_p$  units)



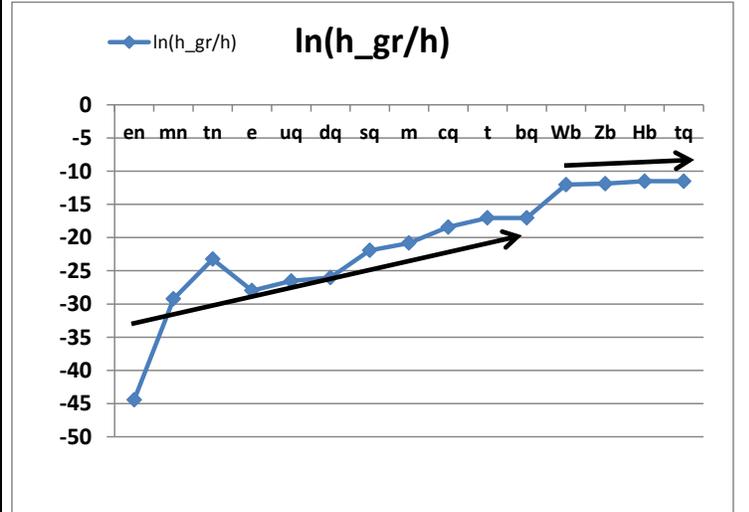
**Figure 1b.** The graphic of all predicted non-zero radii ( $r_{EP}$ ) of all known EPs for the simple special case  $\boxed{h_{0gr(SHb)} = h} \wedge \boxed{r_{SHb} = r_{EP(sup)}}$  (also including the upper limits of the [neutrinos](#) rest masses which weren't exactly determined their rest masses until present) (as expressed in [proton radius](#)  $r_p$  units)

**iv. Important observation.** From the previous Figures 1a & 1b, one may notice that: (1) the non-zero radii of almost all known fermions (except the top quark) grow approximately linearly; (2) the non-zero radii of all known bosons plus the top quark (**tq**) ALSO grow approximately linearly; (3) there is an obvious rest mass gap between the fermions and the bosons (plus the top quark [**tq**], which tq is interestingly “aligned” with bosons and NOT with fermions, which may suggest that both tq and Hb may get their (rest) masses directly from the SHF or other XF by a hypothetical SH or “X” mechanism respectively.



**Figure 2a.** The graphic of all predicted Planck-like gravitonic constants ( $h_{gr(x)}$ ) of all of circular closed grs (identified by SGUM with all known EPs with non-zero rest masses) for the simple special case  $\boxed{h_{0gr(SHb)} = h} \wedge \boxed{r_{SHb} = r_{EP(sup)}}$

(excluding the [neutrinos](#) which weren't exactly determined their rest masses until present) (as expressed in [proton radius](#)  $r_p$  units)



**Figure 2b.** The graphic of all predicted Planck-like gravitonic constants ( $h_{gr(x)}$ ) of all of circular closed grs (identified by SGUM with all known EPs with non-zero rest masses) for the simple special case  $\boxed{h_{0gr(SHb)} = h} \wedge \boxed{r_{SHb} = r_{EP(sup)}}$  (also including the upper limits of the [neutrinos](#) rest masses which weren't exactly determined their rest masses until present) (as expressed in [proton radius](#)  $r_p$  units)

**v. Important observation.** From the previous Figures 2a & 2b, one may notice that: (1) the  $h_{gr(x)}$  values of the closed grs identified with almost all known fermions (except the top quark) grow approx. exponentially (because the ratio  $\ln(h_{gr(x)}/h)$  grows linearly); (2) the  $h_{gr(x)}$  values of the closed grs identified with all known (non-zero rest mass) bosons plus the top quark (**tq**) ALSO grow approx. exponentially (because the ratio  $\ln(h_{gr(x)}/h)$  also grows linearly); (3) there is an obvious  $h_{gr(x)}$  values gap between the fermions and the bosons (plus the top quark [**tq**], which tq is interestingly “aligned” with bosons and NOT with fermions, which may suggest that both tq and Hb may get their (rest) masses directly from the SHF or other XF by a hypothetical SH or “X” mechanism respectively.

**vi.** Based on CEDH and its proposed  $\rho_{com}$ , SGUM may also throw a new “light” on the [Koide formula](#) (**KF**) and other Koide-like formulas (**KLFs**) which all gain a geometrical sense/significance in SGUM, because all rest masses of leptons (or other EPs with rest masses interrelated by such KLFs) may be reduced to volumes (by simplifying the

fraction with  $\rho_{com}$ ) such as (KF for example):

$$\frac{m_e + m_\mu + m_\tau}{(\sqrt{m_e} + \sqrt{m_\mu} + \sqrt{m_\tau})^2} \cong \frac{2}{3} \overset{SGUM}{\underset{CEDH}{\rightleftharpoons}} \frac{r_e^3 + r_\mu^3 + r_\tau^3}{(r_e^{3/2} + r_\mu^{3/2} + r_\tau^{3/2})^2} \cong \frac{2}{3}$$

(the “geometrical translation” of KF in SGUM).

**13)** SGUM proposes negative energy spin-2 gravitons (2grs) as the main constituent/“brick” of spacetime (ST) itself, which ST is defined as a negative energy quantum gravitational field (neQGF) mainly composed from 2grs, but also containing a minority of other open/closed grs with various spins  $s < 2$ . Furthermore, SGUM states that the total energy of neQGF exactly nullifies the total energy of all EPs (identified with positive energy open/closes grs with various spins  $s < 2$ ,  $s > 0$ ) so that the total energy of our universe (OU) is predicted to be zero: in this way, SGUM also incorporates the zero-energy universe hypothesis (ZEUH), which ZEUH is also the main subject of another (older) paper of the author [1].

i. 2grs have their speed  $\mathbf{v}_{2gr} \leq c$  and have the same

energy scalar  $E_{2gr} = h_{2gr} c$  like all other gravitons, BUT are modeled by SGUM with a very small quantum angular momentum  $h_{2gr}$  defined by the inequality

$$h_{2gr} \ll h_{1/2gr(en)} \left( \overset{estim.; <}{\underset{SGUM}{\cong}} 10^{-20} h \right) \ll h \quad \text{which}$$

may explain the very low value of the (Newtonian) universal gravitational constant  $G \cong 6.7 \times 10^{-11} \text{ kg}^{-1} \text{ m}^3 \text{ s}^{-2}$  at macroscopic (including macrocosmic!) scales: in fact, SGUM uses (the experimentally determined) G value (at macroscopic scales!) to inversely estimate  $h_{2gr}$ , such as

$$h_{2gr} = \frac{h}{\alpha / \alpha_G} \cong 10^{-42} h \quad (\text{with } \alpha = \frac{k_e e^2}{\hbar c} \cong 137^{-1})$$

being the EMF coupling constant [aka the fine structure constant] at rest and  $\alpha_G = \frac{G m_e^2}{\hbar c} \cong 10^{-45}$  being the gravitational coupling constant).

ii. The (hardly detectable!) gravitational waves are stated to be composed from (very) large numbers of (very low negative energy and very low quantum angular momentum) 2grs that may be partially entangled and move in relative co-phase.

**14)** The definition (/interpretation) of the universal gravitational constant G (an important parameter in both Newtonian gravity and Einstein’s General Relativity) **proposed by SGUM**. SGUM defines G as an “elasticity”/flexibility parameter of

spacetime (ST) which is classified as an intrinsic property of ST: G varies directly-proportionally with this ST elasticity (STE) so that, a (very) large STE (as measured by a [very] large G value) implies that even EPs (which have very low or zero rM) can produce (very) large ST deformations (STDs) (by their intrinsic subquantum movement [SQM]) that can generate strong gravity at (very) low length scales.

**i. Prediction on possible G variations with the age of our universe (OU) and with length scale.** SGUM predicts that G (and STE implicitly) is mainly determined by the (2gr-based) ST and varies with length scale so that: **(a)** at macroscopic scales (where ST may be more “stretched” by the accelerated expansion of OU [AE-OU], with OU aging), STE (and G implicitly) are predicted to be lower (because of the larger level of ST stretching by AE-OU at those macroscopic scales, with OU aging) and that may explain why G value is so low (when compared with the EMF strength for example) at such large macroscopic length scales; **(b)** at microscopic (including microcosmic) scales (where ST may be more “relaxed” and only minimally stretched by AE-OU, with OU aging), STE (and G implicitly) are predicted to be higher (because of the lower level of ST stretching at those microcosmic scales, with OU aging) and that may explain why G value may be much larger, up to  $G_{pBBs} \cong 10^{26} G$  at such low

microcosmic length scales:  $G_{pBBs}$  actually corresponds to the pre-Big-Bang (quasi-)singularity (pBBS) when (and where) the matter-energy volumic density was maximum but when (and where) the level of ST stretching was minimum (and thus ST had maximum STE and G value respectively);

**ii. Prediction on possible “faiths” of our universe (OU).** SGUM predicts that: **(a)** ST may stretch up to a maximum level of stretching after which gravity may become strongly attractive, like a global confinement of gravity acting on OU (similarly to the confinement generated by the strong nuclear force/field [SNF] when reaching a critical distance between quarks) so that OU may start to contract in a distant future (a Big Bounce scenario, with at least one inflation-deflation cycle); **(b)** ST may stretch up to a maximum level of stretching after which ST may literally break in two or more distinct regions, with each region becoming a distinct “son”-universe (SU) which SUs may temporarily contract (because of the initial breaking “shock”, similarly to a reaction/rebound-force) and the “naturally” expand until another possible break (it is not excluded that all generated SUs to be finally re-brought together by a gravity-like force that may exist between SUs);

**15)** An explanation (and prediction) offered by SGUM on “dark energy” (DE) and “dark matter” (DM). The high level of ST packing at microcosmic scales (as a super-

Higgs [SH] field [SHF] quantized in SH bosons [SHbs]) may actually drive the present AE-OU, mimicking DE (actually identified with SHF by SGUM) and DM (actually identified with SHbs by the SGUM).

**16) SGUM also proposes a solution for the main paradox of the string theory.** To solve the inherent paradox of [string theory](#) (on how 1D strings can generate spacetime [ST] without [tautologically](#) having an inherent/intrinsic ST) SGUM regards gravitons (modeled as 1D strings/branes, no matter their spin) NOT necessarily as physical entities, BUT as possible fluctuations of an [auto-reflecting/self-conscious pure-informational field \(PIF\)](#), which may subjectively appear to our minds, bodies, senses and their extension tools (the various apparatuses of measurement) as “spacetime” populated with “elementary particles” (EPs) and other EP-based composite physical particles: in this view, our minds can be identified with “regions” of this auto-reflecting/self-conscious PIF.

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### 3. The main conclusions of this paper

- 1) In conclusion, SGUM states (and predicts) a subquantum world based gravitons (with all types of quantum spin  $s$ ) classified in two major classes: (i) some types of gravitons (with  $s < 2$ ) are “specialized” in generating all known positive energy EPs-actors from SM by various circularly-closed, vibrational and/or torsional movements; (ii) spin-2 gravitons (2grs) “specialized” in generating the negative energy spacetime scene;
- 2) SGUM essentially proposes some essential updates to both Einstein’s General Relativity (EGR) and quantum mechanics (QM), and that is why SGUM can be considered a common “patch” for both of them, a “patch” which may bring EGR and QM very... close together.

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### 4. References

(partially integrated as Wikipedia URLs in the text)

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- [1] [Andrei-Lucian Drăgoi \(December 2018\)](#). (eZEH article-like preprint – version 1.0 – 8 pages -12.12.2018) **An extended zero-energy hypothesis predicting the existence of negative-energy gravitons and possibly explaining the accelerated expansion of our universe**. Research Gate preprint. DOI: 10.13140/RG.2.2.36245.99044. [URL](#) (Research Gate source).