

No electromagnetic charge and no photon without gravity: the electromagnetic field (EMF) as an epiphenomenon caused by the gravitational field (GF)

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Abstract (with main abbreviations used in this paper)

This article argues that the electromagnetic field (EMF) might be an epiphenomenon caused by the gravitational field (GF).

This paper continues (from alternative angles of view) the work of other past articles/preprints of the same author [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27].

1. Electromagnetic field (EMF) as an epiphenomenon caused by the gravitational field (GF)

Observation no. 1a (Obs1a). When analyzing all known elementary particles (EPs) from the Standard model (SM) of particle physics, one may easily observe that non-zero (nz) electromagnetic charge (nzEMC) is only associated with EPs possessing non-zero rest masses (nzrm)/energies (nzrmEPs): a part of leptons (the electron, the muon, the tauon and their antiparticles), all known quarks (and their antiparticles: antiquarks) and a part of bosons (the W^+ boson and its antiparticle: the W^- boson): in other words, nature seems to state “no nzEMC without nzrm <<support/storage>>”.

Observation no. 1b (Obs1b). Interestingly, when a virtual fermionic particle-antiparticle pair (VPAP)^[3] of EM-charged EPs

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[3] Because vacuum is permeated by quantum fundamental physical fields (FPFs) like electromagnetic field (EMF), strong nuclear field (SNF), Higgs field (HF) etc., VPAPS are actually created by the splitting of the virtual bosonic carriers/propagators (and quanta!) of those fields (the photon, the gluon and the Higgs boson [Hb] respectively) which bosons are firstly “extracted” from (created out of) the vacuum by EMF, SNF or HF and then secondly split in various types of VPAPS. For example: (1) a virtual electron-positron pair is generated by a virtual photon (quanta of EMF, which “photonic” quanta is extracted from the vacuum by EMF and then splits to a VPAP); (2) a virtual quark-antiquark pair is generated by a virtual photon (as described by photon structure function) or a virtual gluon (quanta of SNF, which “gluonic” quanta is extracted from the vacuum by SNF and then splits to a VPAP); (3) HF also creates/extracts Hbs out of the quantum vacuum, which Hbs further split in various types of VPAPS. The existence of VPAPS was proved by both static Casimir effect (CE) and dynamic CE (even creating real photons from virtual photons [URL2]). Note. The collision of the two EPs (an EP and its anti-EP forming that VPAP) re-create the initial virtual boson once again

(cEPs which are all nzrmEPs) spontaneously pops out from the EM-neutral (almost-)zero-energy vacuum (ZEV) (a phenomenon known as quantum fluctuation and explained by Heisenberg's uncertainty principle [HUP]), there is a dichotomy of the zero-EMC (of that local ZEV) between a positive (integer/fractional) EMC and an equal EMC of opposite sign, with both EMCs being generators of real photons and electromagnetic field (EMF) (quantized by virtual photons): in the same time, there is ALSO a dichotomy between the positive (rest) energy E_{EPs} of the two EPs composing that VPAP and the negative energy ^[URL2] E_g of the gravitational field (GF) which interconnects those two EPs (subcomponents of that VPAP) by a gravitational attraction force.

Principle no. 1 (Prin1). Based on Obs1b, the initial speculation of Obs1a (“no nzEMC without nzrm <<support/storage>>”) would then translate to a principle no.1 (Prin1) (launched by this paper) which conjectures that: “Zero-EMC dichotomy (in two opposite-sign eEMCs which generate EMF) <<sine-qua-non-ly>> needs a simultaneous energetic dichotomy between positive (total) rest energy/mass (fermionic matter) and negative-energy gravitational attractive force (obviously associated with a negative-energy EM attractive force between those eEMCs resulted from the dichotomy of that initial zero-EMC of that local ZEV)”. In other simpler words, EMC dichotomy seems to be produced only by mass/(energy)-gravitation dichotomy (MGD). In this alternative and more concise form (which inspired the title of this paper), Prin1 conjectures: “No EMC (and thus no photon) without gravity/MGD.”.

Costatement no. 1a (Cost1a) of Prin1. The electron/(positron) with nzrm $m_e \cong 9.1 \times 10^{-31} \text{ kg}$ is the lightest known EM-charged EP (with the electron neutrino being much lighter but EM-neutral): based on this observation, Prin1 ambitiously conjectures that the electron and the positron are actually the lightest cEP of all known and unknown EPs of our universe (OU). Based on Ob1, Prin1 also states that nature has to use a subtype of MGD with sufficiently large minimum massic/energetic gradient/quantum m_q (imposed by the

elementary charge $q_e \cong (\pm) 1.6 \times 10^{-19} \text{ C}$ quantum of both the electron and the positron) to produce a VPAP composed of two cEPs with opposite nzEMC, so that the previous conjecture of Prin1 translates as $m_q = m_e = f(q_e)$, with m_q (and m_e

implicitly!) being a conjectured function of the quantum q_e (because it is “imposed”/“requested” by q_e). Possible explanation

for Prin1. If we conceive our universe as being a universe with at least 5 spatial dimensions (similarly to Randall–Sundrum [RS] 5D universe models, especially RS1) composed from two 4D-branes not in direct contact (one gravitational 4D-brane [in which only GF exists and manifests] and one non-gravitational 4D-brane [in which all the other non-gravitational fundamental physical fields exist and manifest]) parallel and sufficiently close to each other (as departed by a 5D bulk), the gravitational 4D brane needs a minimal curvature (with amplitude measured by Gm_q^2) to “touch” the

(which boson may then re-split and so on) so that both the number of “creator” virtual bosons and the number of “created” VPAPS are actually in a dynamical equilibrium per unit of spacetime.

other non-gravitational 4D-brane and allow the EMF (from the non-gravitational 4D-brane) to manifest in the gravitational 4D-brane.

Costatement no. 1b (Cost1b) of Prin1. Prin1 also states/conjectures that *the quite large mass gap (larger than 5 orders of magnitude) between the EM-neutral [electron neutrino](#) (with $n_{zrm} m_{en} < 1eV/c^2$) and the EM-charged [electron/positron](#) (with $n_{zrm} m_e \cong 0.51MeV/c^2$) can only be explained by a self-repulsiveness (sr) of nzEMC (EMCsr) principle which states that nzEMC cannot be infinitely “compressed” in a n_{zrm} because of EMCsr and that is why the charge-to-mass ratio/“concentration” of any conceivable cEP of our universe is stated to take finite values only: furthermore, because nzEMCs of all known cEPs take discrete values only and because the n_{zrms} of all those cEPs also take discrete values only, the $x_{cEP(n)} (= q_{cEP(n)} / m_{cEP(n)})$ ratio (generalized for any n -th type of cEP, with finite or infinite integer index $n \geq 1$) is also conjectured to can only take discrete values for all (both known and unknown) cEPs of our universe.*

Costatement no. 1c (Cost1c) of Prin1. Prin1 also states that EMCsr and the discrete values of $x_{cEP(n)}$ cannot be both simultaneously be explained other than by conjecturing that spacetime (ST) is actually composed from a huge (possibly infinite) number identical/“clone” ST “granules” (STGs) (“ST-atoms/voxels”) sharing the same non-zero volume V_{STG} , the same $n_{zrm} m_{STG}$ (generating a quantum GF [QGF] for each STG in part) and the same finite and non-infinitesimal micro-nzEMC $\pm |q_{STG}|$ (with $|q_{STG}| \ll |q_e|$) (generating a micro-EMF for each STG in part), so that both n_{zrm} and nzEMC are actually granular (and composed from the same STGs, because ST is granular and composed of those STGs) and cannot allow any random STGs packing modes, but only fixed and relatively stable packing modes with fixed discrete densities of regular packing $\rho_{cEP(n)} (< 1)$ indirectly measured by $x_{cEP(n)} \propto \rho_{cEP(n)}$ and possibly linked to [sphere packing](#) theory (in 3D, 4D or any other number of space dimensions) if STGs will be ever proved to be spherical (although it may not be necessarily the case): in this case, the electron and positron may correspond to the densest packing mode of STGs allowed by the granular ST of our universe (cEPs with $n_{zrm} m_{cEP(n)} > m_e$ are stated to have smaller EMC-to- n_{zrm} ratios probably due to some less compact packing modes of those STGs).

The micro-QGF of each STG in part is additionally stated to be generally attractive but also to revert and become repulsive under a specific distance $d_{min(1)}$ between any two STGs that approach each other: furthermore, QGF is stated to become infinitely repulsive for a specific distance $d_{min(0)} < d_{min(1)}$ (an asymptotical freedom of QGF). **Explanation.** This dual/hybrid revertible “attractive-then-repulsive” micro-QGF may explain the finite and non-infinitesimal n_{zrms} of all three known types of neutrinos which are also prevented to gravitationally collapse to a singularity by this reverted repulsive micro-QGF of all subcomponent STGs of any known/unknown type of neutrino.

Definition. The zero-EMC (“neutral”) vacuum (ZEV) is stated to be actually composed from STGs organized in pairs of STGs (with opposite sign $\pm |q_{STG}|$) with both a reverted repulsive QGF and an attractive EMF gluing them together in dynamical QGF-EMF equilibrium (without fusing them): the 1:1 ratio between positive- q_{STG} STGs and negative- q_{STG} STGs explains why ZEV appears as EM-neutral.

Explanation The granularity of nzEMC is conjectured to explain EMCsr by the fact that STGs cannot be brought infinitesimally close to one another by their own QGFs (or by any other external spatial/volumic compression achievable by using any type of external compressive force) because both their repulsive individual micro-EMF (generated by their assigned q_{STG}) and their repulsive reverted micro-QGF (generated by their assigned m_{STG}) would both reach infinite strength at those infinitesimal distances (and thus efficiently oppose to that extreme asymptotical induced closeness/spatial compactness and prevent the fusion between any two distinct STGs implicitly): the average non-infinitesimal distance between any two STGs (from inside an electron/positron) would then very plausibly depend on V_{STG} also; briefly naming those STGs possessing fractional nzEMC $|q_{STG}|$ as “+STGs” (and naming those STGs possessing fractional nzEMC $-|q_{STG}|$ as “-STGs”), both $m_q (= m_e)$ and q_e (of the electron and positron) can be explained by that same finite exact number N_e of \pm STGs (composing that positron/electron with $n_{zrm} m_e (= m_q)$) for which the collective attractive QGF (of these \pm STGs composing that positron/electron) exactly compensates their repulsive collective EMF (generated by the combined $\pm |q_{STG}|$ of all \pm STGs composing that same positron/electron) (a perfect dynamical equilibrium which is also conjectured to correspond to the maximum packing density of STGs allowed in our universe, also depending on V_{STG}) so that to explain the huge (and possibly infinite) stability of electrons in time, so that $|q_e| = N_e |q_{STG}|$, $m_e (= m_q) = N_e m_{STG}$ and electron/positron non-zero volume $V_e (= V_q) \propto N_e V_{STG}$, $V_e (= V_q) \propto d_{STGs(e)}$ (with $d_{STG(e)}$ being the average distance between any two -STGs from inside an electron): N_e is (conjectured to be) thus determined by the ratio between the strength of the (attractive) QGF (a strength determined by m_{STG} and a specific and possibly collectively-shared universal gravitational constant [big G] G_{STG}) and the (repulsive) EMF (a strength determined by q_{STG} and a specific and possibly collectively-shared electrostatic Coulomb constant $k_{e(STG)}$) at the size scale of an electron/positron, with both G_{STG} and $k_{e(STG)}$ having probably scale-dependent magnitudes. **Checkpoint**

conclusions on Prin1. (1) Prin1 actually states that $m_q (= m_e)$, $|q_e| (= N_e |q_{STG}|)$ and N_e are all determined by the generic $\pm STG$ with assigned constants m_{STG} , G_{STG} , $\pm |q_{STG}|$, V_{STG} (this last parameter partially determining, together with the other parameters of the generic STG, the distance between the STGs composing an electron/positron). (2) The elementary EMC $|q_e| (= N_e |q_{STG}|)$ necessarily requires $m_q (= m_e = N_e |m_{STG}|)$ (to be “stored on”) simply because the nzrms of STGs stabilize $|q_e|$ by their collective QGF which acts like a “glue” opposing to the repulsive collective EMF of those same $\pm STGs$ (which collective EMF explains the EMCsr principle): $m_{q(\min)}$ thus indirectly acts as a gravitational “glue” not only between those cEPs of a (cEP-based) VPAP but also inside each cEP (of that same VPAP); (3) EMCsr (explained by the existence of $\pm STGs$) can be considered a repulsive quantum “spring” which prevents the total gravitational collapse of any EP or group of EPs down to a infinite-density singularity and only allows gravitational quasi-singularities (GQS)/micro black holes (mbhs) with huge but finite massic/energetic densities: furthermore, all EPs are predicted to be actually such mbhs (both super-extremal and naked GQS), a prediction which may be considered a generalization of the black hole electron hypothesis (BHEH).

Costatement no. 1d (Cost1d) of Prin1. The proces of creating a virtual/real electron-positron pair is defined by Prin1 to be actually a process of segregation between a number of N_e -STGs (which all compose the electron) and the same number of N_e +STGs (which all compose the positron): this process of segregation may imply the segregation of distinct spin between those segregated -STGs and +STGs.

Costatement no. 1e (Cost1e) of Prin1. All the EM-neutral EPs (nEPs) (including neutrinos) are conjectured by Prin1 to be actually composed from an exactly equal number of positive STGs (with fractional EMC $+|q_{STG}|$) and negative STGs (with fractional EMC $-|q_{STG}|$).

Costatement no. 2 (Cost2) of Prin1. The boson-fermion dichotomy (BFD) also sine-qua-non-ly depends on MGD (simply because fermions [which are all nzrmEPs] are generated from bosons by MGD only) and that is why MGD appears to be the “most” fundamental dichotomy and phenomenon in nature (and thus in physics too): the “most” fundamental/basic MGD subtype is actually the granularity of spacetime (ST) itself which is composed from ST granules (STGs) organized in +STG-(-)STG pairs with both an attractive/repulsive QGF and an attractive EMF gluing them together (without fusing them).

Costatement no. 3 (Cost3) of Prin1. Interestingly, the gluon (which is a massless EP theoretically, having only relativistic energy) has non-zero color charge (nzCC): thus nzCC also appears to be a primary phenomenon (as MGD is), “more” fundamental than EMC (which EMC additionally needs MGD, to exist). **Argument.** However, there are many nzrmEPs which don’t have nzCC, which is an additional argument that MGD is the most fundamental phenomenon of all (when compared to BFD, CC and EMC).

Costatement no. 4 (Cost4) of Prin1. Because EMF is a quantized phenomenon (PH) and epiphenomenon of GF at the same time (as stated by Prin1), Prin1 also considers GF to be most probably a quantized PH too, because it seems *very improbable* for a non-quantized/continuum GF to generate a quantized EMF. Assuming the quantized nature of GF and the *hypothetical spin-2 massless graviton* (gr) true existence (as *quantum of GF*), Prin1 also states that the photon (quantum of EMF) is probably an epiphenomenon generated by gravitons, most probably a large group of co-phase entangled (reciprocally-“resonant”) gravitons and thus a special unique subtype of quantized gravitational wave, which may also explain why the inverse-square law is shared by both EMF and GF scalars of force $F_e = k_e q_1 q_2 / r^2$

(electrostatic force⁴ exerted by EMF) and $F_g = G m_1 m_2 / r^2$ (Newtonian gravitational force⁵ exerted by GF) (both scalar formulas valid only for the cases in which distance r [between the nzEMCs or nzrms respectively] is much larger than the average linear sizes of those nzEMCs or nzrms), because both gravitons and photons would spread out in the surrounding 3D space of those nzEMCs (q_1 and q_2) and masses (nzrm m_1 and m_2) respectively “diluting” on the surface of two spheres at the same time (centered in each nzEMC or nzrm) with progressively larger common (double-spherical) area of spreading (of photons/gravitons) $A_{(r)} = 8\pi r^2$: both F_e and F_g can be

redefined as functions of $A (= 8\pi r^2)$ and redefined $G_r = 8\pi G$ and $k_{e(r)} = 8\pi k_e = 2 / \varepsilon_0$ such as: $F_e = k_{e(r)} q_1 q_2 / A_{(r)}$ and $F_g = G_r m_1 m_2 / A_{(r)}$. Note that $G_r (= 8\pi G)$ (which measures the strength of GF) also appears as a subcomponent of Einstein’s constant $\kappa = 8\pi G / c^4 (= G_r / c^4)$, which is the coupling constant used in Einstein’s field equation (EFE)

$G_{\mu\nu} + \Lambda g_{\mu\nu} = \kappa T_{\mu\nu} [= (G_r / c^4)] T_{\mu\nu}$. **Remark.** Note that a relatively small percent of photons and gravitons, more specifically those emitted by each mass (or charge) towards the other mass (or charge) on exactly the same \vec{r} direction and slightly near it (which is the same direction of vectors \vec{F}_g and \vec{F}_e) may be “received/reabsorbed” by the other mass or charge and so may actually contribute to the magnitude of those forces: that is why we estimated a corrected (cr) area $A_{(r)(cr)} = k_{cr} \pi r^2$ with

⁴ with $k_e = 1 / (4\pi\varepsilon_0) (\cong 8.99 \times 10^9 \text{ Nm}^2 / \text{C}^2)$ being the Coulomb constant in vacuum, with $\varepsilon_0 (\cong 8.854 \times 10^{-12} \text{ F / m})$ being is the vacuum permittivity of classical vacuum

⁵ with $G (\cong 6.674 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2})$ being the universal gravitational constant

$k_{cr} \in (7, 8)$, so that a corrected $G_{r(cr)}$ can be estimated as $G_{r(cr)} (= k_{cr} \pi G) \in (7\pi G, 8\pi G)$.

Costatement no. 5 (Cost5) of Prin1. The [electron](#) (e) and its antiparticle (the [positron](#)) are those EPs with the largest known redefined dimensional ratio $|q_e|/m_e \cong 1.76 \times 10^{11} C/kg$ and its corresponding dimensionless ratio $x_e = |q_e| \sqrt{k_e} / (m_e \sqrt{G_r}) \cong 4.07 \times 10^{20}$ (with $|q_e| \cong 1.6 \times 10^{-19} C$ being the [absolute value](#) of the [elementary EMC](#) assigned to both the electron and the positron): based on this observation, *Prin1 conjectures that x_e is a maximum dimensionless charge-to-mass ratio allowed by nature (for all known and unknown EPs of our universe): combined with the 1st conjecture of Prin1 (which states that $m_q = m_e = f(q_e)$ it results that q_e is the maximum nzEMC allowed in nature ($q_m = q_e$) for all known and unknown EPs of OU) so that*

$$x_{\max} = |q_m| \sqrt{k_e} / (m_q \sqrt{G_r}) = x_e \cong 4.07 \times 10^{20} :$$

furthermore, *Prin1 redefines $q_{\max} (= q_e)$ as a 1st rank fundamental (dimensional) constant of our universe*. Prin1 also conjectures x_{\max} to be actually a 1st rank dimensionless “hybrid” “electro-gravitational” constant of nature which is indissolubly related to $q_{\max} (= q_e)$ so that $m_{q(\min)}$ can be redefined as

$$m_q^{\text{redef.}} = \frac{|q_m| \sqrt{k_e}}{x_{\max} \sqrt{G_r}}. \text{ It is quite remarkable that the lightest}$$

known EM-charged EP (the electron/positron) has also the largest known charge-to-mass ratio of all known EPs: in other words, nature appears to have “invested” in the electron-positron pair two of its maximums (the dimensional $|q_m| (= q_e)$ and the dimensionless x_{\max}) and one of its minimums $m_q (= m_e)$.

An “electro-gravitational” ratio (of field strengths) $\phi_{eg} (= k_e / G_r)$ can be also inversely redefined as a function of the dimensionless squared ratio x_e^2 such as $\phi_{eg} (= k_e / G_r) = x_e^2 (m_e / q_e)^2$.

Costatement no. 6 (Cost6) of Prin1. There is a striking apparent numerical coincidence which relates the [fine-structure constant](#) (FSC) (at rest) $\alpha = k_e q_e^2 / (\hbar c) (\cong 1/137)$ (which is defined as “the probability/amplitude for a real electron to emit or absorb a real photon”: Feynman’s FSC interpretation) and $x_{\max} (= x_e \cong 4.07 \times 10^{20})$ (as expressed in [binary logarithmic units](#)) such as:

$$\alpha \stackrel{99.92\%}{\cong} 1 / \log_2 \left(x_{\max}^2 \right)_{(=1/\log_2(x_e^2))} \quad (1a),$$

with $1 / \log_2 (x_e^2) \cong 1/136.93$ and equivalent to (see below):

$$\frac{\hbar c}{k_e q_m^2} \stackrel{100.08\%}{\cong} \log_2 \left(\frac{k_e q_m^2}{G_r m_q^2} \right) (\cong 136.93) \quad (1b),$$

which is equivalent to (see below):

$$2^{1/\alpha} \stackrel{107.8\%}{(\cong 1.8 \times 10^{41})} \cong x_{\max}^2 \stackrel{107.8\%}{(\cong 1.7 \times 10^{41})} \quad (1c)$$

and also, by replacing q_m with $N_e |q_{STG}|$, m_q with $N_e |m_{STG}|$ and G_r with G_r , equivalent to (see below)

$$\alpha^{-1} \stackrel{100.08\%}{\cong} \log_2 \left(\frac{k_{e(STG)} q_{STG}^2}{8\pi G_{STG} m_{STG}^2} \right) \quad (1d)$$

and also equivalent to (see below)

$$\alpha^{-1} \stackrel{100.08\%}{\cong} \log_2 \left(\frac{\alpha \hbar c}{G_r m_q^2} \right) (\cong 136.93) \quad (1e)$$

Prin1 considers this numerical closeness to be *too elegant and logical for just a coincidence and offers a more profound gravitational explanation for the numerical values of both Planck constant and FSC by the following redefinition* (as also explained next, with the following list of notes/comments/remarks and arguments):

$$\alpha^{-1} \left(= \frac{\hbar c}{k_e q_m^2} \right)^{\text{redef.}} = \log_2 \left(\frac{k_e q_m^2}{G_r m_q^2} \right) \quad (2a),$$

which is equivalent to (see below)

$$\frac{\hbar}{c} = \frac{k_e q_m^2}{c} \log_2 \left(\frac{k_e q_m^2}{G_r m_q^2} \right) \quad (2b),$$

which is equivalent to (see below)

$$E_{ph}(\lambda) \left(= \frac{\hbar c}{\lambda} \right)^{\text{redef.}} = \frac{k_e q_m^2}{\lambda} \log_2 \left(\frac{k_e q_m^2 / \lambda}{G_r m_q^2 / \lambda} \right) \quad (2c),$$

which is equivalent to (see below)

$$E_{ph}(\lambda) \stackrel{\text{redef.}}{=} E_e(\lambda) \log_2 \left(\frac{E_e(\lambda)}{E_g(\lambda)} \right) \quad (2d),$$

with photon energy $E_{ph}(\lambda) = \hbar c / \lambda$, electrostatic energy

$$E_e(\lambda) = k_e q_m^2 / \lambda \text{ and gravitational energy}$$

$$E_g(\lambda) = G_r m_q^2 / \lambda$$

Argument no. 1 (Arg1). Although GF is very weak when compared to EMF at macroscopic (up to macrocosmic) and microscopic scales (up to atomic scale), at distances very close to

Planck length scale (which is implied in the process of an electron emitting or absorbing a photon), *the gravitational attraction force manifested by the electron's GF on its emitted or absorbed photon may be quite important and comparable to EMF strength at Planck scale*. More specifically, a many-fold increase of G_r only will result in a slightly lower x_e and thus a (slightly) larger $\alpha \left[\cong 1/\log_2(x_e^2) \right]$ which implies a larger capacity (and thus probability) of an electron or positron to absorb a photon, which is logical given the fact that a stronger GF of the electron (defined by that initial many-fold increase of G_r) favors the absorption of a photon by that electron (or positron).

Argument no. 2 (Arg2). The magnitude of G_r influences the probability of mass-gravity dichotomy (MGD) in the sense that a weaker GF (with low G_r) “facilitates”/favors MGD and alternatively, a stronger GF (with large G_r) tends to inhibit MGD and thus lowers the probability of any nzEMC (and thus EMF and photon) to appear in the first place: it is thus logical (and quite intuitive) that not only q_m but also G_r to influence/determine the numerical value of m_q in the sense that a lower G_r needs a larger m_q for that fixed x_{\max} to remain the same (and vice versa).

Argument no. 3 (Arg3). If the very large dimensionless physical constants (DPCs) (aka “big numbers” of physics) (which are GF-related in general, like $x_{\max} (\cong 10^{21})$ for example) are deeply related with the small DPCs (usually close to 1 and related to quantum mechanics, like FSC for example), by any (yet unknown) mathematical function, then a logarithmic function (LF) would be the simplest (and thus the most natural) candidate solution of connecting these large and small DPCs. Furthermore, even if it is not the case of such a logarithmical connection, a potential/possible LF (connecting those DPCs) would still have to be ruled out first. **Additional note.** In the last century, a small minority of physicists also considered a hypothetical binary logarithmic connection between the large and the small DPCs, which also implies a base-2 power law (Fürth, 1929; Eddington, 1938; Teller, 1948; Salam, 1970; Bastin, 1971; Sirag, 1980, 1983; Sanchez, Kotov and Bizouard, 2009, 2011, 2012; Kritov, 2013). **Secondary argument.** Until present, various LFs were proved to successfully describe the variation of the running coupling constants of fundamental physical fields with the energy scale. **Tertiary argument.** Interestingly, FSC is a minimum in nature (because the running coupling constant of EMF approaches only asymptotically to FSC value [which is an asymptotical minimum] and reaches that FSC value only at zero-energy scale, which zero-energy is only theoretical) which is directly connected to this other maximum of nature $x_{\max} (\cong 10^{21})$ (assigned to the electron/positron), with the existence of x_{\max} implying that $1/x_{\max}$ and $1/\log_2(x_{\max}) (\cong \alpha)$ are obviously minimums of nature.

Note no.1 (Not1). If large quantities of matter were demonstrated to “curve spacetime” at large scales (by distorting length and linear time intervals), then, it is expected from each

nzrmEP in part to create a round cone-like quantum gravitational pit (QGP) defined as a slight (very subtle/almost infinitesimal curvature of about 10^{-42} deviation from perfect ST flatness) depression in local ST of that nzrmEP, which QGP may variably extend in width (up to a finite width which is stated to be directly-proportional mainly to G_r but also with $G_r m_{EP}$ product), but may only have finite depth (which is stated to be directly-proportional mainly to m_{EP} but also with $G_r m_{EP}$ product, thus avoiding gravitational singularities with infinite massic/energetic densities): this $G_r m_{EP}$ product actually measures the volume of the cone-like QGP (which is directly-proportional to the QGP width*depth product) assigned to any nzrmEP. *This QGP (produced by any nzrmEP and its micro-GF) may also explain the resistance of that nzrm to movement, generating gravitational and inertial mass, both equal because produced by/identified with the same QGP of that same nzrmEP: in a checkpoint conclusion, the volume of any QGP (assigned to any nzrm with generic nzrm m_{EP}) is directly-proportional with $G_r m_{EP}$ product.* Because having quantum angular momentum (measured by Planck constant \hbar) and energy (measured as $E_{ph} = hc / \lambda$), both real and virtual photons couple with GF (with strength measured by G), thus G also measures the coupling of the GF (of any cEP [which is a nzrmEP]) with the absorbed/emitted (real/virtual) photon: as also shown by Eq.1a, the larger G_r the lower is the x_{EP} (assigned to that cEP) thus the larger is the probability of that electron to absorb a photon, a probability measured by $1/\log_2(x_{EP}^2)$; in other words, the larger is $G_r m_{EP}$ product, the larger the volume of that QGP (of that cEP) and the higher the probability of a cEP to intersect and absorb an incidental virtual/real photon from its surroundings and thus a stronger coupling with EMF (quantized by photons): QGP acts like a “quantum antenna” and Eq.1a may thus be a strong logarithmic link between EGR and quantum mechanics, as it may show that GF has relevance in quantum field theory (QFT) and may even explain the numerical value of FSC at rest; this approach shows a ridgy/“wrinkled” microcosmic quantum world full of QGPs in loose-packing (up to very dense-packing) groups of QGPs (produced by all known nzrmEPs and identifiable with spacetime micro/macro-curvature). The EMF generated by the nzEMC of the electron ALSO contributes to the volume of QGP (as described by [Reissner-Nordström metric](#) [for non-rotating charged bodies] and [Kerr-Newman metric](#) [for rotating charged bodies]): Eq.1e also shows how this EMF contributes to the value of FSC (most probably by influencing the QGP volume). **In other words** this paper claims that, even if the volume of QGP may remain indictable by any direct means, FSC may indirectly (and logarithmically!) measure QGP volume and thus the spacetime curvature (STC) associated with the electron/positron. **Explanation.** *A moving QGP (with positive non-zero speed and zero or other positive) is conjectured to generate spacetime ripples (which may oppose to movement and generate inertia): that is how QGP may explain the dual wave-particle character of any nzrmEPs but also the equality between inertial mass and gravitational mass.*

Note no.2 (Not2). Equation 1d (Eq.1d) shows that FSC is actually an indirect (binary) logarithmic measure of all the main attributes of an individual “clone” spacetime granule (STG):

q_{STG} , $k_{e(STG)}$, m_{STG} and G_{STG} . FSC is thus redefined as a global attribute of the granular spacetime vacuum itself. For **Eq.1d** to be exact (by an exact equality of the right term [the binary logarithm] to the left term α^{-1}) combined with the $G_{STG} = G$ special case, one may use a corrected $G_{r(cr)} = k_{cr}\pi G_{STG}$ with $k_{cr} \cong 7.43$ which implies a percent of $1 - k_{cr}/8 (\cong 7\%)$ reabsorbed photons or gravitons between any two STGs (not necessarily adjacent to each other, although a progressive closeness between those two arbitrarily chosen STGs may also decrease k_{cr} and thus increase the percent of graviton or photon reabsorption $1 - k_{cr}/8$). For the $k_{cr} = 8$ special case (implying $G_{r(cr)} = G_r = 8\pi G_{STG}$), a G_{STG} numerical value of $\cong 6.2 \times 10^{-11} m^3 kg^{-1} s^{-2}$ will also generate the exact value of $\alpha^{-1} \cong 137.036$.

Redefinition of FSC. Given all the previous arguments (plus notes) and based on **Eq.1e** (transformed in a perfect equality), we propose the redefinition of FSC (at rest) as the unique solution w of the following base-2 [exponential function](#) based on a theoretical big G value at rest

$$G_0 \stackrel{def.}{=} \frac{\hbar c}{8\pi m_q^2 \alpha^{-1} 2^{1/\alpha}} \cong 6.193 \times 10^{-11} m^3 kg^{-1} s^{-2}$$

corresponding to FSC at rest $\alpha_0 \cong 1/137.036$ (with both G_0 and α_0 being the inferior limits to which the energy scale-dependent running coupling constants $\alpha(E)$ and $G(E)$ tend asymptotically when $E \rightarrow 0$):

$$w^{-1} 2^{1/w} = \frac{\hbar c}{8\pi G_0 m_q^2} \quad (3a)$$

The previous equation (**Eq.3a**) can be solved by using the [Lambert function](#) only after converting that equation to its natural-base (e) variant $w e^w = z$ such as:

$$\ln(2) w^{-1} e^{\ln(2)/w} = \frac{\hbar c \ln(2)}{8\pi G_0 m_q^2} \quad (3b)$$

The solution of Eq.3b would be:

$$\alpha_0 = \frac{\ln(2)}{W\left(\frac{\hbar c \ln(2)}{8\pi G_0 m_q^2}\right)} (\cong 1/137.036) \quad (3c)$$

The [running coupling constant](#) of the EMF

$$\alpha(E) = \frac{\alpha_0}{1 - \alpha_0 y(E)}$$

is known to vary with the energy scale

$E \geq E_0$ (with $f(E) = \ln\left[\left(E/E_0\right)^{2/(3\pi)}\right]$, $E_0 = u_\alpha \cdot eV$ and $u_\alpha = 0.15 \times 10^{-9}$ being the relative standard uncertainty of α_0 value at rest) BECAUSE $\alpha(E)$ is actually a function of a variable quantum big G $G_q(E)$ function (which depends on quantum physical constants assumed to be energy scale-invariant) which also varies with the energy scale, such as:

$$G_q(E) \stackrel{estim.}{=} \frac{\hbar c}{8\pi m_q^2 [\alpha(E)]^{-1} 2^{1/\alpha(E)}} \quad (4a)$$

which, also based on the sub-function $y(E)$ but independently of $\alpha(E)$, “translates” to (see below):

$$G_q(E) \stackrel{estim.}{=} \frac{G_0 2^{f(E)}}{1 - \frac{f(E)}{\log_2\left(\frac{\hbar c}{8\pi G_0 m_q^2}\right)}} \quad (4b)$$

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