# A "Mirrored" Universe (toy-)Model (MUM) based on a relative big G, a variable quantum big G and a finite mass ambitus of our universe (short variant of the original full preprint)

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## 0. Abstract (with main abbreviations used in this paper)

This paper proposes a simple "Mirrored" Universe (toy-)Model (**MUM**) based on a relative big G (Newtonian gravitational constant [**G**]), a variable quantum big G and a finite mass ambitus of our universe (**OU**), with far reaching implications leading to new paths beyond the Standard model (**SM**) of particle physics (**PP**) and Einstein's General Relativity (**EGR**).

MUM also (empirically) predicts (see the original [full] preprint of this paper):

(**1**) the total mass of all possible known and unknown life forms (**LFs**) from our observable universe (**ObU**);

(**2**) a very strong quantum gravitational field (**QGF**) acting inside elementary particles (**EPs**);

(**3**) an average non-zero radii of all known EPs;

(**4**) that a nucleon (proton/neutron) and generally an atomic nucleus can be regarded as a binary logarithmic "map" of OU AND OU can be considered a binary exponential map/expansion of a standard nucleon or atomic nucleus;

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## 1. The concept of relative big G $G_{rel}$

**The relative big G $G_{rel}$ concept definition**. Let us consider the special case of a Newtonian gravitational force $F_g = G \cdot \frac{M \cdot m}{r^2}$ between one large mass (**M**) (of a relatively heavy physical object [**PO**]) and one (relatively) much smaller mass (**m<<M**) (of a relatively lighter PO), with mass ratio $\phi_{rel} \overset{def.}{=} M/m$ and both POs (defined by $M$ and $m$) being considered point-like in respect to the distance $r$ between those two distinct POs. Because both POs are composed of elementary particles (**EPs**), let us consider the even more special case $F_{g1} = G \cdot \frac{M \cdot m_{EP}}{r^2}$, with $\phi_{rel} \overset{redef.}{=} M/m_{EP}$. As all EPs composing that larger PO (with mass $M = \sum m_{EPs} >> m_{EP}$) are concentrated in an almost point-like region (**PLR**) (when compared to the distance r between those two distinct POs), **the relatively "isolated" EP (with mass $m_{EP} << M$) may "subjectively" experience a (subjectively) much larger relative gravitational force/field (relGF) with any of its "clone-EPs" with mass $m_{EP(M)}$ located in that PLR (and composing that larger M): this relGF has a strength measured by $G_{rel} \overset{def.}{=} \phi_{rel} \cdot G$, with $\phi_{rel} \overset{redef.}{=} M/m_{EP(M)}$, so that $F_{g2} = G_{rel} \cdot \frac{m_{EP(M)} \cdot m_{EP}}{r^2} = F_{g1}$: even if the force remains the same (because $F_{g2} = F_{g1}$), the isolated EP (with mass $m_{EP}$) may thus "subjectively" experience a much stronger GF (named "relGF" with strength defined by $G_{rel}$) when gravitationally "linking" with one of its "sister-EPs" (with mass $m_{EP(M)}$) relatively "strictly" located in that "targeted"-PLR.**

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**Important note. The generic ratio $G_{rel}/G \overset{(def.)}{=} \phi_{rel}$ (defining the strength of relGF) is thus directly related to the (generic) mass ratio/"ambitus" $M/m_{EP(M)} \left( \overset{redef.}{=} \phi_{rel} \right)$ of various POs from our universe (OU) so that $G_{rel}/G \overset{(def.)}{=} M/m_{EP(M)}$. Estimations of $\phi_{rel}$ maximums as related to some maximum mass ambituses allowed in OU**. In the case of the largest (and heaviest) conceivable star known to be allowed in our (observable) universe (with mass $M_{S(\max)} \cong 10^2 M_{Sun} \in \left[ \overset{\cong}{} 120 M_{Sun}, \overset{\cong}{} 300 M_{Sun} \right]$ and mass of our Sun $M_{Sun} \cong 10^{30} kg$) versus a single electron neutrino (**en**) (the lightest known EP, with en mass estimated as $m_{en} \cong 1eV/c^2$), one can estimate

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$$\phi_{rel(\max 1)} \overset{def.}{=} G_{rel(\max 1)} / G\left(\overset{estim.}{=} M_{S(\max)} / m_{en}\right) \cong 10^{68}.$$

In the case of the total mass of the observable universe (**ObU**) (with $M_{ObU} \cong 1.5\times 10^{53} kg$ ) versus the same (single) en, one can estimate

$$\phi_{rel(\max 2)} \overset{def.}{=} G_{rel(\max 2)} / G\left(\overset{estim.}{=} M_{ObU} / m_{en}\right) \cong 10^{88}.$$

**Important observation. Interestingly enough, both $\phi_{rel(\max 1)} \cong 10^{68}$ and $\phi_{rel(\max 2)} \cong 10^{88}$ are in quite "round" exponential ratios with the maximum field/force (F) strength ambitus of ObU defined by the strengths ratio (which is truly fundamental for OU!)**

$$N_F \overset{def.}{=} \phi_{F(\max)} = \alpha_S / \alpha_G \cong 1/\ \alpha \cdot \alpha_G\ \cong 5.71\times 10^{44}$$

**between the strong nuclear field (SNF) (with strength at rest measured by the SNF coupling constant $\alpha_S \cong 1$ ) and gravitational field (GF) (with strength at rest measured by the GF coupling constant $\alpha_G \cong 10^{-45}$ ): more exactly,**

$\phi_{rel(\max 1)} \cong N_F^{3/2}$ and $\phi_{rel(\max 2)} \cong N_F^{2}$, with $\alpha \cong 1/137$ being the electromagnetic field (**EMF**) coupling constant at rest (also known as the fine structure constant [**FSC**]).

**Other important estimations**. Additionally, $\phi_{rel(tq)} = m_{tq} / m_{en} \cong 10^{11} \cong N_F^{1/4}$ with $m_{tq} \cong 173 GeV / c^2$ being the rest mass of the top quark (which is the heaviest known EP).

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## 2. A "Mirrored" Universe (toy-)Model (MUM) based on the relative big G concept, a variable quantum big G and a finite mass ambitus of our universe

**Statement no. 1a (Stat1a) of MUM. The main classes of POs in our observable universe (ObU) tend have their masses around values of $\cong N_F^{x} \cdot m_{en}$, with x≤2 being a small integer or a generic fraction f=n/m (with n and m also being small integers): this is a predicted/anticipated uniform logarithmic mass distribution of the known main classes of POs.**

**Important note**. As NO other specific/notable class of POs occupies the "mass domain" centered around $\cong N_F^{1/2}$ and $\cong N_F$, all life forms (**LFs**) mentioned above are the only significant worth to mention POs that interestingly fill those empirical "gaps" left by non-LF POs, when applying Stat1a.

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**Statement no. 1b (Stat1b) of MUM**. Based on the previous estimations, **LFs are stated (and predicted by empirical induction!) to have a logarithmically-symmetrical distribution around $N_F$ of their associated/corresponding $\phi_{rel}$ . Prediction**. Based on this empirical "symmetry principle" proposed by Stat1b, MUM predicts that, if the small virus (**vir**)-associated ratio $\phi_{rel(vir)} = m_{vir} / m_{en} \cong N_F^{0.35} \cong N_F^{1+(-0.65)}$, then there may be real or potential biospheres in OU (in other possibly LF-friendly solar systems) which may reach $\phi_{rel(BS)(\max)} \cong N_F^{1+(0.65)} \cong N_F^{1.65}$ corresponding to an approximated maximum BS mass (locally or globally extended in OU)

$$m_{BS(\max)} \cong N_F^{1.65} \cdot m_{en} \cong 10^{38} kg \cong 10^{26} m_{BS} \cong 10^{8} M_{Sun},$$

which predicts that ObU may contain a total amount of LFs with a total mass $10^8$ times larger than our Sun's mass. This prediction of MUM is in relative agreement with some new so-called "surprising" (and very optimistic!) estimations of the relative high occurrence of Earth-like planets/exoplanets in ObU [URL0a, URL0b, URL0c, URL0d, URL1, URL2, URL3, URL4].

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**Checkpoint conclusion**. Both Stat1a and Stat1b (combined with the other previous observations from this paper) indicate/suggest that LF may somehow be deeply encoded in the laws of OU. The author has also dedicated other past papers to this possible "life code" "encrypted" by OU [**1**, **2**, **3**, **4**, **5**, **6**, **7**, **8**, **9**].

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**Statement no. 2 (Stat2) of MUM (work hypothesis). Based on $\phi_{rel(\max 2)} = G_{rel(\max 2)} / G = M_{ObU} / m_{en} \cong 10^{88}$ (as derived from the general $G_{rel}$ concept, together with its notes, observations and estimations) and the maximum mass ambitus of our ObU $N_U \overset{def.}{=} N_F^{2} \cong 3.26\times 10^{89}$ (with $\phi_{rel(\max 2)} \cong N_U$ ), MUM proposes a hypothetical ("running"/variable) quantum big G $G_q\ \lambda$ defined to vary inverse-proportionally with the length scale $\lambda$ and to reach $G_{rel(\max 2)} \cong N_U \cdot G$ at Planck length scale $l_{Pl} \cong \sqrt{\hbar G / c^3} \cong 10^{-35} m$, so that $G_q\ \lambda \cong N_U^{\,l_{Pl}/\lambda} \cdot G$**

**and** $G_q\ l_{Pl} \cong N_U \cdot G = G_{rel(\max 2)}$. $G_q\ \lambda$ can be also rewritten as a function of a variable (photonic) energy scale $E = hc/\lambda$ and based on Planck energy $E_{Pl} = \sqrt{\hbar c^5 / G} \cong 1.2 \times 10^9 GeV$ so that $G_q\ E \cong N_U^{\,E/E_{Pl}} \cdot G$. Based on $G_q\ E$, MUM proposes a variable quantum GF coupling constant $\alpha_{Gq}\ E = G_q\ E \cdot m_e^{\,2} / \hbar c \cong N_U^{\,E/E_{Pl}} \cdot G m_e^{\,2} / \hbar c$, which grows in a "smooth" exponential manner which appears linear when graphed in a logarithmic scale.

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**"Assembling" on the same graph the running coupling constants of all known fundamental physical fields (FPFs): SNF, the weak nuclear field (WNF), EMF and the MUM-proposed quantum GF with strength defined by $\alpha_{Gq}\ E$ ).**

SNF. The running coupling constant of the strong nuclear field (**SNF**) $\alpha f_S\ E \cong \dfrac{2\pi}{7 \ln E / E_{SNF}}$ [**10**] (with a variable energy scale $E >> E_{SNF}$) is determined in quantum chromodynamics (**QCD**) (also) by using the beta function, with $E_{SNF} \cong 210 \pm 40\ MeV$ being the QCD energy scale of quark confinement as determined experimentally. [**11**]

WNF. The running coupling constant of the weak nuclear field (**WNF**) $\alpha f_W\ E \cong \dfrac{E_W^{\,2} G_F / \hbar c^{\,3}}{e^{E_W/E}}$ (with a variable energy scale E) includes the rest energies of the W/Z bosons (which are the propagators of the WNF) and is also based on the Fermi coupling constant $G_F / \hbar c^{\,3}{}^{\text{exp.}} \cong 1.1663787 \times 10^{-5} GeV^{-2}$ (with $G_F \cong 1.43585 \times 10^{-62} Jm^3$), which can be indirectly determined by measuring the muon lifetime experimentally: $E_W = m_W c^2$ is the rest energy of the $W^{+/-}$ boson with rest mass $m_W$ [**12**,**13**,**14**,**15**] [**11**].

EMF. The running coupling constant of EMF $\alpha_f\ E \cong \dfrac{\alpha}{1 - \frac{\alpha}{3\pi} \ln\left[ E / E_e^{\,2} \right]}$ is determined in quantum electrodynamics (**QED**) by using the beta function, with $E_e = m_e c^2 \cong 0.51 MeV$ and $\alpha \cong 1/137$ being the electromagnetic field (**EMF**) coupling constant at rest (also known as the fine structure constant [**FSC**]) **[16,17][11].**

**We may now assemble all the previously-defined FPF-coupling constants in a single graph (see the next figure).**

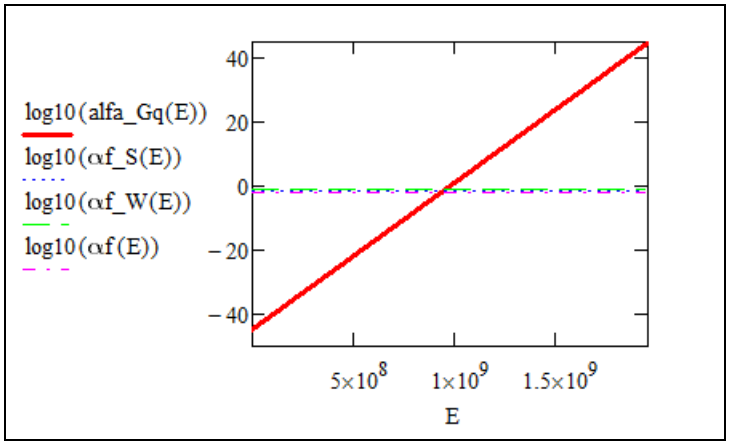


**Figure 1. The combined (logarithmic) graph of** $\log_{10}\left[\alpha_{Gq}\ E\right]$, $\log_{10}\left[\alpha f_S\ E\right]$, $\log_{10}\left[\alpha f_W\ E\right]$ **and** $\log_{10}\left[\alpha f\ E\right]$ **for** $E \in E_{en}, E_{Pl}$ **(expressed in GeV units), with** $E_{en} = m_{en} c^2$ **being the rest energy of the electron neutrino.**

**Important note. From the previous figure, one may easily observe that the strength-ratio between quantum GF and the other three FPFs invert/"twist"/inter-switch around** $E_{inv} \cong 1 \times 10^9 GeV$**. Interestingly,** $E_{inv}$ **corresponds to a length scale** $l_{inv} \cong hc / E_{inv} \cong 10^{-24} m$ **which is approximately 100 times lower than the upper limit of the hypothesized non-zero electron diameter (size)** $l_{e(\sup)} \cong 10^{-22} m$ (as estimated by using "trapped" electrons by Penning traps), so that $l_{inv} \cong 10^{-2} \times l_{e(\sup)} \cong 10^{11} \times l_{Pl}$.

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**Statement no. 3a (Stat3a) of MUM (as based on Stat2). MUM states that the so-called elementary particles (EPs) (as theorized and estimated by the Standard model [SM]) are NOT literarily zero-radii "point-like" entities (as they are currently/presently/"standardly" modeled by the mainstream Quantum field theory [QFT]), BUT EPs are ACTUALLY spacetime "bubbles"/(subquantum) deformations with average (av) non-zero radii** $l_{EP(av)} \cong l_{inv} \cong 10^{11} \times l_{Pl} > 0$ **and volumes** $l_{EP(av)}^{\,3} \cong l_{inv}^{\,3} > 0$ **implicitly.**

**Important note. MUM thus predicts a quantum GF that may be the strongest FPF at Planck scale (a scale at which SNF is predicted to have the lowest strength, due to asymptotic freedom of QCD): this is a MIRROR-LIKE INVERSION of macrocosmic FPFs-strengths-ratios when projected in the microcosm defined here as the length/scale domain under the**

**MUM-predicted average size of an EP** $l_{EP(av)} \cong l_{inv} \cong 10^{11} \times l_{Pl} > 0$, which is much smaller (by ~9 dimensional orders) than the **proton charge diameter** $d_p = 2r_p \cong 1.7\ fm \cong 10^{20} l_{Pl}$. **Remark. The fact that the electron is estimated by MUM as being ~$10^9$ times smaller than the proton may also indicate a very strong FPF (identified by MUM with this hugely strong quantum GF!) acting inside the electron and maximally compacting it.**

**Another "inductive" argument in favor of EPs with non-zero radii/sizes. The perfect spherical shape of the electron cloud [URL1, URL2, URL3] may be also an indirect proof of the huge strength of this MUM-proposed quantum GF acting at scales close to Planck scale.**

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**Statement no. 3b (Stat3b) of MUM (as based on Stat3a). MUM also states that, given the hypothesized (/predicted) very strong quantum GF (vs-QGF) at the (almost infinitesimal) Planck scale, EPs are actually quantized micro-black holes (mBHs), with the simple existence of EPs being actually the indirect proof of this vs-QGF at that Planck scale.**

**Important note. The author has many past papers which launched the thesis that EPs are actually spacetime deformations with non-zero radii/sizes, with various arguments [18, 19-"DVTM", 20-"eSR" (long variant), 21-"eSR" (short variant),** Error! Bookmark not defined.**-"SGUM"]: additionally, MUM and SGUM predict similar sizes for EPs.**

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**Important observation. MUM also emphasizes the very interesting numerical closeness between the SNF-over-EMF strength-ratio** $\alpha_S / \alpha \cong \alpha^{-1} \cong 137$ **(with SNF being the strongest FPF in the proton, at** $d_p \cong 1.7\ fm$ **scales and EMF being the weakest at that same** $d_p$ **length scale) AND the EMF-to-GF base-2/binary logarithmic strength-ratio** $\log_2 \alpha / \alpha_G \cong \log_2 4 \times 10^{42} \cong 141.52$ **(with EMF being the strongest FPF at macrocosmic scale and GF being the weakest of that same [macrocosmic] scale): this quasi-equality** $\alpha_S / \alpha \cong \log_2 \alpha / \alpha_G$ **indicates that a nucleon (proton/neutron) and generally an atomic nucleus can be regarded as a binary logarithmic "map" of our universe (OU) AND OU can be regarded as a binary exponential map/expansion of a standard nucleon or atomic nucleus.**

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## 3. The main conclusions of this paper

1) **Final conclusion (1). In MUM, EPs can be thus regarded as micro-universes in which the strongest FPF may be actually a very strong quantum GF (when judged from the estimated average diameter of an EP down to Planck length) and the weakest FPF may be a unified EMF-WNF-SNF field aka "Grand unified theory" (GUT) field (which may play the role of the weakest gravity-like FPF, similarly to gravity being the weakest force in the macro-universe).**
2) **Checkpoint conclusion (2). In other words, at its macrocosmic scales, our universe (OU) can be regarded as a cosmic "simulation" of the Planck scale and vice versa: this is a "mirrored"/"self-reflected" universe în which the macrocosmic is the inverted "reflection" of microcosm and vice versa.**
3) **A nucleon (proton/neutron) and generally an atomic nucleus can be regarded as a binary logarithmic "map" of OU AND OU can be regarded as a binary exponential map/expansion of a standard nucleon or atomic nucleus.**

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