

An elegant Adimensional Cyclic Universe (toy-)

Model (ACUM) mainly based on the electrograviton hypothesis (EGH), the quantized gravitational waves hypothesis (QGW-Hyp) and the dimensional relativity hypothesis (DRH)

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1st Motto^[2]: „[„God” addressing Man:] Space is time... demonstrated. In truth there is no such thing as space—pure, <<empty>> space, with nothing in it. Everything is something.[...] Invisible <<energy>> is the <<space>> which holds <<matter together.>> Once—using your linear time as a model—all the matter in the universe was condensed into a tiny speck. You cannot imagine the denseness of this—but that is because you think that matter as it now exists is dense. [...] At one point the entire universe actually was <<solid>>. There was virtually no space between the particles of matter. All the matter had the <<space>> taken out of it—and with the enormous <<space>> gone, that matter filled an area smaller than the head of a pin. [...] [Man:] Is the universe now expanding? [God:] At a rate of speed you cannot imagine! [Man:] Will it expand forever? [God:] No. There will come a time when the energies driving the expansion will dissipate, and the energies holding things together will take over—pulling everything “back together” again. [Man:] You mean the universe will contract? [God:] Yes. Everything will, quite literally, “fall into place!” [...] [Man:] That means that we will no longer exist! [God:] Not in physical form. But you will always exist. You cannot not exist. You are that which Is. [Man:] What will happen after the universe “collapses”? [God:] The whole process will start over again! There will be another so-called Big Bang, and another universe will be born. It will expand and contract. And then it will do the same thing all over again. And again. And again. Forever and ever. World without end. This is the breathing in and breathing out of God.”

2nd Motto^[3] (with my insertions between brackets): „An important lesson we learn from the way that pure numbers like α [the fine-structure constant, which is the electromagnetic coupling constant at rest] define the World is what it really means for worlds to be different. The pure number we call the fine structure constant and denote by α is a combination of the electron charge, e , the speed of light, c , and Planck's constant, h . At first we might be tempted to think that a world in which the speed of light was slower would be a different world. But this would be a mistake. If c , h , and e were all changed so that the values they have in metric (or any other) units were different when we looked them up in our tables of physical constants, but the value of α remained the same, this new world would be observationally indistinguishable from our World. The only thing that counts in the definition of worlds are the values of the dimensionless constants of Nature. If all masses were doubled in value you cannot tell, because all the pure numbers defined by the ratios of any pair of masses are unchanged.”

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[2] Walsch N.D. (1999). „Conversations with God: An Uncommon Dialogue (Book 2)” (book: ISBN: 0-399-14278-9). Chpater 6 ([URL1](#), [URL2](#))

[3] Barrow, John D. (2002). „The Constants of Nature; From Alpha to Omega - The Numbers that Encode the Deepest Secrets of the Universe”, Pantheon Books, ISBN 978-0-375-42221-8 ([URL2](#))

Abstract

This paper proposes an elegant Adimensional Cyclic Universe (toy-Model) (ACUM) mainly based on the electrograviton hypothesis (EGH), the quantized gravitational waves hypothesis (QGW-Hyp) and the dimensional relativity hypothesis (DRH). DRH pushes the relativity of space and time to its...“informational” extremes (defining them as illusions created by the exchange of information in a bulk virtual matrix [BVM]): I have chosen the “ACUM” acronym also because “acum” means “now” in Romanian AND because ACUM emphasizes that both space and time are illusions created by pure-adimensional information transfer/exchange.

An Adimensional Cyclic Universe Model (ACUM)

Observation no. 1 (Obs1) of ACUM. The adimensional (dimensionless) fine-structure constant (FSC) at rest

$$\alpha = (k_e q_e^2 / c) / \hbar \cong 137^{-1} \quad (\text{which is the electromagnetic [EM] coupling constant at rest, measuring the strength of EM field [EMF] and being directly measurable by quantum Hall effect [QHE] and the adimensional gravitational coupling constant (GCC) at rest } \alpha_G = (G m_e^2 / c) / \hbar \cong 10^{-45} \text{ are both “more” fundamental than all their “subcomponent” dimensional physical constants (PCs): the Coulomb constant } k_e, \text{ the elementary EM charge } q_e, \text{ the gravitational constant } G, \text{ the electron rest mass } m_e \text{ (equal to the positron rest mass), the speed of light in vacuum } c \text{ and the Planck constant } h \text{ (with reduced Planck constant } \hbar = h / (2\pi)). \text{ FSC and GCC are “more fundamental” in the sense that our observable universe (OU) would be indistinguishable from a universe “X” in which } k_{e(x)} = x \cdot k_e, q_{e(x)} = x \cdot q_e, G_x = x \cdot G, m_{e(x)} = x \cdot m_e, c_x = x \cdot c \text{ and } \hbar_x = x \cdot \hbar, \text{ with } x \text{ being a common proportionality factor of all these PCs resulting } \alpha_x = \alpha \text{ and } \alpha_{G(x)} = \alpha_G \text{ (see also the 2}^{\text{nd}} \text{ motto of this paper).}$$

coupling constant at rest, measuring the strength of EM field [EMF] and being directly measurable by quantum Hall effect [QHE] and the adimensional gravitational coupling constant (GCC) at rest $\alpha_G = (G m_e^2 / c) / \hbar \cong 10^{-45}$ are both “more” fundamental than all their “subcomponent” dimensional physical constants (PCs): the Coulomb constant k_e , the elementary EM charge q_e , the gravitational constant G , the electron rest mass m_e (equal to the positron rest mass), the speed of light in vacuum c and the Planck constant h (with reduced Planck constant $\hbar = h / (2\pi)$). FSC and GCC are “more fundamental” in the sense that our observable universe (OU) would be indistinguishable from a universe “X” in which $k_{e(x)} = x \cdot k_e$, $q_{e(x)} = x \cdot q_e$, $G_x = x \cdot G$, $m_{e(x)} = x \cdot m_e$, $c_x = x \cdot c$ and $\hbar_x = x \cdot \hbar$, with x being a common proportionality factor of all these PCs resulting $\alpha_x = \alpha$ and $\alpha_{G(x)} = \alpha_G$ (see also the 2nd motto of this paper).

In other words, the known dimensional PCs are regarded by ACUM as only the results of a formal asymmetric product “split” of FSC and GCC.

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Statement no. 1a (Stat1a) of ACUM. The FSC-to-GCC ratio (at rest) is the ratio between the strength of the electromagnetic field (EMF) and the strength of the gravitational field (GF), which is named “electrogravitational” (**eg**) ratio at rest

$$\phi_{eg} = \alpha / \alpha_G \cong 10^{42} . \text{ ACUM pushes Obs1 to “its limits” and states that } \phi_{eg} \text{ is a 1}^{\text{st}} \text{ rank parameter of nature even “more$$

states that ϕ_{eg} is a 1st rank parameter of nature even “more

fundamental” than α and α_G in the sense that that our OU would be indistinguishable from a universe “X” in which $\alpha_x = x \cdot \alpha$ and $\alpha_{G(x)} = x \cdot \alpha_G$, with x being a common proportionality factor of both α and α_G resulting that $\phi_{eg(x)} = \phi_{eg}$.

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Statement no. 1b (Stat1b) of ACUM (optional statement, as explained next). ACUM observes that

$$\log_2 \left(\frac{\phi_{eg}}{2\sqrt{a}} \right) \cong (99.996\%) a \Leftrightarrow \phi_{eg} \cong (100.4\%) 2\sqrt{a} 2^a \Leftrightarrow \alpha_G^{-1} (= \phi_{eg} / \alpha) \cong (100.4\%) 2a^{3/2} 2^a \quad (\text{Obs2}) \quad (\text{with}$$

$a = 1/\alpha \cong 137.036$) and states that this numerical closeness is too accurate to be just a simple “pure” coincidence. Based on the potential high sensitivity of this numerical relation, ACUM inversely defines an electrogravitational (eg) scaling factor of nature $N_{eg} (\cong 2^a \cong 1.786 \times 10^{41})$ as 1st rank parameter of nature (stated to be indirectly measured as FSC by quantum Hall effect) along with other redefined equivalent 1st rank parameters

$$\text{like } \alpha_{ACUM}^{redf.} = 1 / \log_2(N_{eg}) \cong 1/137, \quad a = 1/\alpha,$$

$$\phi_{eg, ACUM}^{redf.} = 2\sqrt{a} N_{eg} \cong 4.18 \times 10^{42} \quad \text{and}$$

$$\alpha_G = \alpha / \phi_{eg, ACUM}^{redf.} = \frac{1}{2a^{3/2} N_{eg}} / (\cong 10^{-45}) \quad \text{which are all just}$$

“variations” on the same N_{eg} “theme” or the other various “faces” of this same electrogravitational scaling factor of nature $N_{eg} (\cong 1.786 \times 10^{41})$ which is somehow “hidden under our nose”.

Remark. One may derive $a(=1/\text{FSC})$ directly from ϕ_{eg} as

$$\text{the unique real solution of the equation } 2x^{3/2} 2^x = \alpha_G^{-1} \quad (\text{an}$$

equation suggested by Obs2) by using the Lambert W function (W), but this would be a less elegant approach with fewer advantages, as explained next. However, the relation

$$2a^{3/2} 2^a = \alpha_G^{-1} \quad \text{allows the deduction of } \alpha_G \text{ from}$$

$a (= \alpha^{-1})$ but also viceversa. **Important note.** Stat1b is optional in ACUM differentiating between a special ACUM (**spACUM**) (containing/assuming Stat1b) and a more general ACUM (**genACUM**) which maintains Stat1a only (thus still assuming ϕ_{eg} as a 1st rank adimensional parameter and also considering FSC and GCC as being ϕ_{eg} -related 1st rank parameters). genACUM may

also support a fixed or a variable ϕ_{eg} or N_{eg} : this paper discusses only the spACUM with fixed N_{eg} .

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The “Electro-Graviton” Hypothesis (EGH) of ACUM. If it exists, the hypothetical graviton (gr) may be modeled analogously to a photon, such as $E_{gr} = h_{gr}c / \lambda = h_{gr}\nu$, with E_{gr} being the intrinsic energy of that gr, h_{gr} being the intrinsic quantum angular momentum (a Planck-like gravitational constant analogous to the Planck constant h) of that gr, c being the speed of light in vacuum (identified with the speed of gravity), λ (Greek letter lambda) being the gr wavelength and ν (Greek letter Nu) being the gr frequency.

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The Quantized Gravitational Waves Hypothesis (QGW-Hyp) of ACUM. ACUM states (and predicts) that gravitational waves (GWs) can be composed from either entangled or non-entangled egrs. However, QGW-Hyp specifically states (conjectures) that egrs can entangle only in groups of 2^n egrs with integer exponent $n (\geq 1) \in \{1, 2, 3, \dots, 137, \dots\}$. A specific GW composed from 2^n entangled egrs is briefly noted GW(n): a single egr (as $2^0 = 1$) is identified with a GW(0), a group of $2^1 (= 2)$ entangled egrs is identified with a GW(1), a group of $2^2 (= 4)$ entangled egrs is identified with a GW(2) and so on. In other words, each distinct GW(n) can be considered a distinct quantized gravitonic excitation state of the vacuum itself: QGW can be regarded as a **quantized entanglement**, in the sense that the entanglement of gravitons is strictly quantized in only 2^n -egrs groups.

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ACUM’s N_{eg} -based redefinition of the photon. ACUM states (and predicts) that the photon is actually a GW(137) composed from a number of $N_{eg} (\cong 2^{137} \cong 10^{41})$ entangled/(reciprocally) “resonant” egrs. Based on this redefinition,

$$\text{ACUM estimates that } h_{gr, ACUM}^{estim.} = h / N_{eg} \cong h / 2^{137} \cong 10^{-41} h.$$

Prediction (1). Any other GW(n) is predicted to have a quantum

$$\text{angular momentums (QAM) } h_{gr(n), ACUM}^{def.} = 2^n h_{gr} \quad \text{with}$$

$$h_{gr} = h_{gr(0)}. \quad \text{Explanation. } N_{eg} (\cong 10^{41}) \quad \text{and}$$

$\phi_{eg} = \alpha / \alpha_G \cong 10^{42}$ (the strength ratio between EMF and GF(EGF) (at rest)) have comparable values and this is concordance with ϕ_{eg} being considered by ACUM a 1st rank parameter depending on both average quantum angular momentums (QAM)

transferred between any two [elementary particles](#) (EPs) (with force strength/magnitude being defined as transferred QAM per unit of time and length) when interchanging [virtual photons](#) (in the case of EMF) while also interchanging real grs/egrs/GWs(n) (in the case of GF/EGF). **Prediction (2)**. An electron may emit not only photons, but also are predicted (by ACUM) to can emit any specific GW($1 \leq n \leq 137$): because the photon (defined as a GW(137)) is just one of the 137 possible GWs, this is how ACUM explains why the experimental value of FSC at rest (which is also defined as the probability of a real electron to emit a real photon: Feynman's interpretation of FSC) is $\sim 1/137$ corresponding to $1/\log_2(N_{eg})$

which is also very close to $1/\log_2(\phi_{eg}) \cong 1/141.6$. The electron may also emit one or more non-entangled egrs and that may slightly distort the predicted probability $p=1/137$ to a value between $1/137$ and $1/138$ like FSC $\sim 1/137.036$ has. **In other words**, FSC $\sim 1/137$ just because the photons is the 136th "[octave](#)" "[harmonic](#)" of the egr (an egr identified with GW(0) in the GWs($n \leq 137$) series) and because there are 137 QAM magnitude "octaves" between a single egr and a single photon. Both $N_{eg} (\cong 10^{41})$ and $a \stackrel{redf.}{ACUM} = \log_2(N_{eg})$ measure the subquantum gravitonic information "stored" by a single photon. We may define a gravitonic bit (**gbit**) $1gbit = h_{gr} = h_{gr(0)}$ and a photonic/electromagnetic (**em**) bit (**embit**) $1embit \cong 137gbits$ describing the $\sim 2^{137}$ (gravitonic) subquantum states of a photon. ACUM thus offers a new interpretation of FSC as being the inverse measure of the number of gbits of one photon.

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The Dimensional Relativity Hypothesis (DRH) of ACUM.

Let us consider the product (measured in angular momentum units J*s) between the (experimentally) estimated/measured total energy of our [observable universe](#) (OU)

$E_{OU} \cong 3.2 \times 10^{75} J$ and the estimated/measured present age of OU

$t_{OU(pres)} \cong 13.8 \times 10^9 years$ such as:

$H_{OU(pres)} = E_{OU} \cdot t_{OU(pres)} \cong 1.4 \times 10^{89} Js$. Interestingly

(and stated by ACUM as non-coincidental)

$\log_2(H_{OU(pres)} / h) \cong 3a$ and

$\log_2(H_{OU(pres)} / h_{gr}) \cong 4a$ (with $a = 1/\alpha$) implying that

$H_{OU(pres)} \cong N_{eg}^3 \cdot h$ and $H_{OU(pres)} \cong N_{eg}^4 \cdot h_{gr}$

respectively, which is equivalent to a predicted ratio

$\log_2(H_{OU(pres)} / h) / \log_2(H_{OU(pres)} / h_{gr}) \cong 3/4$.

DRH ambitiously states (and predicts) that we currently

perceive/observe OU to be 3D (when using photon/h-based light to

observe OU) just because $H_{OU(pres)} \cong N_{eg}^3 \cdot h$ so that the

electrogravitational scaling factor $N_{eg} (\cong 2^a)$ and the

$H_{OU(pres)} / h$ ratio are the main determinants of the perceived

number of dimensions (N_D) of OU, with

$$N_{D(x)} = \log_2(H_{OU(x)} / h) / a.$$

Prediction (1). DRH predicts that, if we used a gravitonic h_{gr} -

based "light" to observe our present OU then DRH estimates that we would then perceive a 4D spacetime, because

$N_D = \log_2(H_{OU(pres)} / h_{gr}) / a \cong 4$. **In other words**, the

number of dimensions of space ($N_D = 3$) is predicted by

ACUM's DRH to be just a subjective result of observing OU by

using (h-based) photonic light: the $N_D (= 3)$ assigned to space

should then NOT be considered an a priori value, but a (relative)

function of $N_{eg} (\cong 2^a)$ and $H_{OU(pres)} / h$ ratio. OU is thus

modeled by ACUM as a "bulk" virtual (abstract/mathematical/geometrical) matrix (**BVM**) of

coordinates/information which takes a variable number of

dimensions (**ND**), depending on the h/h_{gr}-"key" we use to

read/observe that BVM. By using DRH, ACUM pushes the

relativity of space and time to its... "informational" extremes, by

defining them as illusions created by the exchange of information

between us as observers and the BVM; in conclusion, based on its

DRH, ACUM emphasizes that both space and time are relative

illusions created by pure-adimensional informational exchange. **In**

other words, **BVM** supports at least two alternative

descriptions/perceptions: one using embits (photons) and one using

gbits (gravitons). The adimensional relativity expressed by DRH

may be also regarded as an adimensional "absoluteness", in the

sense that the adimensional parameters govern everything,

including space/spacetime appearance. **Important note**. One may

easily remark that gravity/GF "extracts" an additional spatial (aka

"temporal") dimension from the BVM (by using its egrs as

observational "tools" for scrutinizing BVM). The number of

(observed) dimensions of space/spacetime is considered by ACUM

a mind (re)construct from the objective fact that

$\log_2(H_{OU(pres)} / h) / a \cong 3$.

Prediction (2). DRH predicts that an OU with a fixed h and h_{gr}

will appear to have less space/spacetime dimensions in its

"infancy"/past when $H_{OU(past)} \ll H_{OU(pres)}$: for example, for

$t_{OU(past)} \cong 1s$, $H_{OU(past)} = E_{OU} \cdot t_{OU(past)} \cong 10^{71} Js$,

with $\log_2(H_{OU(past)} / h) / a \cong 2.5$ and

$$\log_2(H_{OU(past)} / h_{gr}) / a \cong 3.5.$$

Prediction (3). DRH predicts that an OU with a fixed h and h_{gr} will appear to have more space/spacetime dimensions in its distant future (**fut**) when $H_{OU(fut)} \gg H_{OU(pres)}$: for example, for

$$t_{OU(fut)} \cong 10^{30} \text{ years},$$

$$H_{OU(fut)} = E_{OU} \cdot t_{OU(fut)} \cong 10^{109} \text{ Js},$$

$$\log_2(H_{OU(fut)} / h) / a \cong 3.5$$

$$\log_2(H_{OU(fut)} / h_{gr}) / a \cong 4.5.$$

Prediction (4). Based on DRH, ACUM predicts a Big Bounce universe (**BBU**) which may reach a perceived 5D appearance (when observed using egrs; a “minimal” 5D OU also predicted by super string theories [SST]) at the end of its expansion half-cycle after

$$t_{BBU(5D)} = N_{eg}^5 \cdot h_{gr} / E_{OU} \cong 10^{53} \text{ years}.$$

Important note. DRH was first proposed by the same author in an older paper as an “Info-Dimensional Relativity Principle (IDRP)” [1]: given its elegance (of a “pure” mathematical/abstract adimensional universe which doesn’t need a preset N_D parameter), DRH was reintegrated in ACUM.

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Important redefinitions. ACUM proposes the redefinition of all the other fundamental physical quantities as functions of physical information (**PI**) quantity (**PIq**) (which PIq is alternatively measured by h [in embits] and h_{gr} [in gbits]).

Table 1. A set of SI base units redefined by using the elementary physical information quantity (PIq or shortly “I”) (from which the number of space/spacetime coordinates is also derived) measured by the Planck constant (h) in embits or by the (electro-)gravitonic Planck-like constant h_{gr} in gbits, with both embit and gbit being considered generic physical bits (pbits)

The redefined SI base unit	SI base unit redefinition	Definition for each (redefined) SI base unit in part
Quantum angular momentum (L)	$L[J \cdot s] = I[pbites]$	Quantum angular momentum is identified with PIq

Energy (E)	$E[J] = I / t [pbits / s]$	PIq transfer speed
Power (P)	$P[W] = I / t^2 [pbits / s^2]$	PIq transfer acceleration
Force (F)	$F[N] = I / (d \cdot t)$ $[(pbits / s) / m]$	PIq transfer speed per unit of length
Mass (M)	$M[kg] = I \cdot t / d^2$ $[pbits \cdot s / m^2]$	PIq flow (in a time interval t) per unit of area

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A set of 1st rank functions proposed by ACUM. ACUM also defines the functions describing the variation of the [running coupling constants](#) (with the energy scale E) of all fundamental physical fields (**FPFs**) as 1st rank functions.

The running coupling constant of EMF

$$\alpha_f(E) \cong \frac{\alpha}{1 - \frac{\alpha}{3\pi} \ln[(E/E_e)^2]} \quad (\text{which is determined in})$$

quantum electrodynamics (**QED**) by using the [beta function](#), with $E_e = m_e c^2 \cong 0.51 \text{ MeV}$ [2,3]) may be interpreted/explained and redefined as the consequence of a plausible variation of N_{eg} with a variable energy scale E such as

$$Nf_{eg}(E) = N_{eg} / (E/E_e)^{\frac{\ln(4)}{3\pi}} \quad (\text{1st rank function in ACUM})$$

with $\alpha_f(E) \stackrel{redef.}{=} \frac{1}{\log_2[Nf_{eg}(E)]}$ (1st rank function of

ACUM) and a predicted $\alpha_G(E) \stackrel{redef.}{=} \frac{1}{2[\alpha_f(E)]^{3/2} Nf_{eg}(E)}$

(1st rank function of ACUM).

The running coupling constant of the [weak nuclear field](#)

$$(WNF) \quad \alpha_{f_W}(E) \cong \frac{E_W^2 G_F / (\hbar c)^3}{e^{E_W/E}} \quad (\text{1st rank function of})$$

ACUM) (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](#)

$$G_F / (\hbar c)^3 \cong 1.1663787 \times 10^{-5} \text{ GeV}^{-2} \quad (\text{with})$$

$$G_F \cong 1.43585 \times 10^{-62} \text{ Jm}^3, \text{ which can be indirectly determined}$$

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 [4,5,6,7]:

The running coupling constant of the strong nuclear field (SNF)

$$\alpha f_S(E) \cong \frac{2\pi}{7 \ln(E/E_{SNF})} \quad [8](1^{\text{st}} \text{ rank function of ACUM})$$

(with a variable energy scale $E \gg E_{SNF}$) is determined in quantum chromodynamics (QCD) (also) by using the beta function, with $E_{SNF} \cong 210(\pm 40) \text{ MeV}$ being the QCD energy scale of quark confinement as determined experimentally.

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Final conclusions. ACUM proposes a universe describable in

pure adimensional units with $N_{eg} (\cong 10^{41})$,

$$\alpha_{ACUM}^{redef.} = \log_2(N_{eg}), \quad \alpha_{ACUM}^{redef.} = 1/\alpha,$$

$$\phi_{eg}^{redef.} = 2\sqrt{a} N_{eg} \cong 4.18 \times 10^{42} \quad \text{and}$$

$$\alpha_G = \alpha / \phi_{eg}^{redef.} = \frac{1}{2a^{3/2} N_{eg}} / (\cong 10^{-45}) \quad \text{all being } 1^{\text{st}} \text{ rank}$$

parameters (at rest). ACUM also adds to these 1^{st} rank parameters some essential 1^{st} rank functions quantitatively describing the variations of the running coupling constants of all known FPFs:

$$Nf_{eg}(E) = N_{eg} / (E/E_e)^{\frac{\ln(4)}{3\pi}},$$

$$\alpha_f(E)_{ACUM}^{redef.} = 1/\log_2[Nf_{eg}(E)] \cong \frac{\alpha}{1 - \frac{\alpha}{3\pi} \ln[(E/E_e)^2]},$$

$$\alpha_G(E)_{ACUM}^{redef.} = \frac{1}{2[\alpha_f(E)]^{-3/2} Nf_{eg}(E)}$$

$$\alpha f_W(E) \cong \frac{E_W^2 G_F / (\hbar c)^3}{e^{E_W/E}}$$

$$\text{and } \alpha f_S(E) \cong \frac{2\pi}{7 \ln(E/E_{SNF})}.$$

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Some important final notes. ACUM is an alternative approach to another toy-model proposed by the same author named “A *Simply Gravitonic Universe (toy-)Model*” (SGUM) [9] which starts with a very important **observation (plus explanation and motivation/pretext of SGUM) on a strong link between [Einstein’s General Relativity](#) (EGR) and [quantum chromodynamics](#) (QCD) (see next).** It is well known/demonstrated that **~99%** of a [nucleon \(proton \[p\] or neutron \[n\]\) rest mass](#) ($m_{p/n}$) (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, primarily, 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, secondarily, the [kinetic energy](#) of quarks: tertiarily, only the rest of ~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](#) [URL2] 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 ($\sum m_{p/n}$) of all its subcomponent nucleons, because the [electrons](#) (with rest mass $m_e \cong m_{p/n} / 1837$) 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.**

Based on Obs and using an “analogical-inductive” generalization pushed to its limits, this [Simple “Gravitonic” Universe \(toy-\)Model](#) (SGUM) is based on the following main principles:

1) SGUM’s principle no. 1 (SP1). [Nothing is absolutely static in our universe \(OU\).](#)

- 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 3rd 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](#)).

- 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 (which is identified by ACUM with gravitonic/electrogravitonic 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 \(ST\)](#) (with 3LT stating that SQM cannot be completely stopped/annihilated by cooling): 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](#). In other words, **rM(=iM=gM)** of any elementary/composite physical particle (PP) is the friction force of that body with ST itself which isn't a perfect frictionless fluid-like entity, but a “fluid” with friction, which friction may also explain why the maximum speed of any PP (in ST vacuum) is limited asymptotically to the (finite) speed of light in vacuum $c \cong 3 \times 10^8 m / s$ (in the case of PPs/EPs with **rM>0**) or fixed to **c** (for EPs with **rM=0** like the photon and the gluon).

- 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.

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