Original research paper.

A SUITABLE WAY OF NORMALIZING SI TO MAKE c AND h UNITIES

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Abstract. Motivated by the successes of Yarman's Approach that engendered YARK (Yarman-Arık-Kholmetskii) theory of gravity, we question the correctness of Natural Units commonly used in Quantum Field Theory and other areas of physics and advance a suitable way of normalizing SI in order to make the utmost theoretical speed limit of light c and the Planck Constant h unities, as well as universal constants, respectively. Our metrological approach reveals a rectified value for the elementary charge e when SI is normalized and then re-normalized without disturbing the meaningfulness of the related physical dimensions. All this is especially relevant within the context of the 20 May 2019 international decision to fix the Planck Constant to a definite value while letting the kilogram vary instead. One thus remarkably ends up with the need to restore the uncertainty parts of the elementary charge in contrast to the latest redefinition.

Keywords: Metrology, SI, Natural Units, Planck Constant, Fine Structure Constant, Elementary Charge

AMS Subject Classification: 97F70, 97Q80

1. INTRODUCTION

One doubts the internal consistency of Natural Units (SI formalism adopted from the historical *Heaviside-Lorentz* approach where $\varepsilon_0 = \mu_0 = \hbar = c = 1$) when our meticulous method is presented below for making the speed of light c and the Planck Constant h unities, as well as universal constants, respectively in the proper way.

The normalization and the subsequent re-normalization (*i.e.* ergonomization) of weights and measures we propose herein, including common units of the electromagnetic domain, leads to a different value for the elementary charge e compared to that given by the "New SI" (Système International [d'Unités]: International System of Units) or under Natural Units. In particular, contrary to the 20 May 2019 international redefinition by the concerted efforts of metrology workgroups worldwide that resulted in the "New SI" [cf. 1], the need to restore the uncertainty digits of the elementary charge value becomes apparent. Furthermore, it is shown that setting $\varepsilon_0 = \mu_0 = 1$ along with $h = c = 1$ turns out to be improper.

Our metrological approach preserves the corresponding physical dimensions at every step of the way and does not disturb their empirical meaningfulness.

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§ Manuscript last format date: 29 June 2021.
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2. MAKING c AND ħ UNITIES IN THE PROPER WAY

Yarman's Approach, which was later extended to YARK (Yarman-Arık-Kholmetskii) theory of gravitation (regarding which do refer to the APPENDIX for an exposition of how said framework underlies our main reasoning towards this contribution), holds that lightspeed (c) — either in differential or integral form — and Planck Constant (h) are Lorentz Invariant universal physical constants outside or under gravity, or any other type of force interaction whatever the frame of reference (cf. [2]). Based on this outlook, it would stand to reason that they should both be defined as "1" in their respective dimensions. To this end, however, Natural Units was found problematic.

To make c unity, while initially preserving the *second* as the arbitrary unit period of time (as defined through the lapse of 9 192 631 770 ticks of radiation from any Cesium-133 atomic clock) — and keeping in mind that the *meter* is taken as 1 out of 299,792,458 portions of the rectilinear distance travelled by light in empty space throughout the aforementioned period of time — we can straightforwardly multiply the *meter* by 299,792,458, which gives us a new unit of length (NLU):

$$c = \frac{1\ meter \times 299,792,458}{1\ second}\ , \tag{2.1a}$$

$$c = \frac{1\ NLU}{1\ second}\ , \tag{2.1b}$$

$$1\ NLU = 299,792,458\ meters\,. \tag{2.1c}$$

Given that Planck's Constant has the dimensions of $\mathrm{m}^2 \times \mathrm{kg} / \mathrm{sec}$, and keeping in mind the latest decision by the *General Conference on Weights and Measures* to fix it to a certain value [cf. 1], it is possible to substitute NLU in place of the *meter* to find out the new unit of mass (NWU) that will make h unity:

$$h = \frac{6.62607015 \times 10^{-34}\ kg \times m^2}{s}\ , \tag{2.2a}$$

$$h = \left[\frac{6.62607015 \times 10^{-34}}{299,792,458^2}\ kg\right] \cdot \left[1\ \frac{NLU^2}{s}\right]\ , \tag{2.2b}$$

$$1\ NWU = \left[\frac{6.62607015 \times 10^{-34}}{299,792,458^2}\ kg\right]\ , \tag{2.2c}$$

$$1\ NWU = 7.37249732381271 \times 10^{-51}\ kg\ , \tag{2.2d}$$

$$h = 1\ \left[\frac{NWU \times NLU^2}{s}\right]\ . \tag{2.2e}$$

The letter W was chosen in the acronym NWU to stress the historically inseperable physical connection between mass and weight. Otherwise, NWU is a unit of mass free from gravitational acceleration that is the equivalent of about $7.3725\ldots \times 10^{-51}$ *kgs*.

In eq.(2.2e), "*NLU per second*" will not vary according to Yarman's Approach or YARK, but "$NWU \times NLU$" product components will vary each. Because Planck's Constant is now firmly secured onto a given value, they must vary conformally and in opposite directions.

Thus, we have not touched the *second* as the adopted unit period of time at this stage, but simply modified the traditional mass and distance units to unicitize c and h. After this set of operations, it is possible to linearly transform the units, including the *second*, without destroying the unicity of c and h. But since the *second* is quite common, applicable in other areas which we shall momentarily tread, and possible to determine with great precision when taking as reference atomic or stellar objects (such as Pulsars), let us hence keep using it.

At this point, we can advance further into the electromagnetic realm through the established MKS (meter-kilogram-second) definition of the *Fine Structure Constant*:

$$\alpha = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{\hbar c} \ , \tag{2.3a}$$

$$\alpha = \frac{e^2}{2\varepsilon_0 hc} \ , \tag{2.3b}$$

where, in accordance with *Ampère's Force Law* and *Maxwell's Equations*, we must adhere to the classical relationship

$$c^2 = \frac{1}{\mu_0 \varepsilon_0} \tag{2.4a}$$

as presenting us with the *de facto* definition of the "permittivity of free space" ε_0, since the "magnetic permeability of vacuum" μ_0 is historically fixed at:

$$\mu_0 = 4\pi \times 10^{-7} \left[\frac{\mathrm{Henry}}{\mathrm{meter}}\right] . \tag{2.4b}$$

Now we face a challenge, since we have at hand the task of normalizing *Henry*, *Farad*, and consequently *Ohm* and *Siemens* units. Fortunately, we have the possibility of quickly finding out the desired "*new Ohm*" through a novel upcoming reformulation of the Fine Structure Constant, given that

$$\varepsilon_0 = \frac{10^7}{4\pi\,|c_{\mathrm{MKS}}|^2}\left[\frac{\mathrm{C}^2}{\mathrm{N} \times \mathrm{m}^2}\right] = \frac{10^7}{4\pi\,|c_{\mathrm{MKS}}|^2}\left[\frac{\mathrm{Farad}}{\mathrm{m}}\right] , \tag{2.4c}$$

which has the dimensions of *Coulombs* squared per *Newtons* times *Area* (*i.e. Farads per meter*); where the modulus of the utmost theoretical speed limit of light in empty space in MKS units is taken (*i.e.* just the number 299,792,458 without any units, denoted as $|c_{\mathrm{MKS}}|^2$).

Our reformulation of the Fine Structure Constant will be as follows: By replacing the abovegiven permittivity term in the denominator of Eq.(2.3b) with the RHS of Eq.(2.4c), we can right away get to

$$\alpha = \frac{e^2}{hc} \times \left(\frac{4\pi \, |c_{\mathrm{MKS}}|^2}{2 \times 10^7} \left[\frac{\mathrm{meter}}{\mathrm{Farad}} \right] \right) = \left(\frac{e^2 \, 2\pi}{h} \right) \times \left(\frac{299,792,458}{10^7} \left[\frac{\mathrm{second}}{\mathrm{Farad}} \right] \right) . \tag{2.5a}$$

Given that 1 *second* over 1 *Farad* equals 1 *Ohm*, and since $299,792,458 \,/\, 10^7$ makes 29.9792458, it is then possible to arrive at

$$\alpha = \frac{e^2}{\hbar} \left[\Omega^{-1} \right] \times 29.9792458 \, [\Omega] \; ; \tag{2.5b}$$

at which point, we have taken into account the dimension of the ratio $e^2 / \hbar$ as being Ω^{-1} (*Siemens*). Thus, through the cancellation of the unit of resistance (in *Ohms*) with its reciprocal (in *Siemens*), this relationship alternatively furnishes the expected dimensionless Fine Structure Constant α in the form of a specific electrical resistance times elementary charge squared divided by the reduced Planck Constant.

However, due to the 2019 redefinition of the SI base units, where the vacuum permeability μ_0 in eq.(2.4b) now gets a tentative fudge factor of 1.000 000 000 82(20) before the 10^{-7} term [4, 5], the amount of Ω in eq.(2.5b) becomes precisely 29.97924582(46429), with the last five digits denoting uncertainty in measurement.

Therefore — and keeping in mind the new 2019 redefinition of the elementary charge as exactly $1.602176634\mathrm{E}-19$ *Coulombs* — the 1 "*new Ohm*" (*NOhm*) which will yield α as the designated $1 \,/\, 137.035999046(07)$ will be larger than *Ohm* by as much as $1.00000000082(20) \times 29.9792458$ times the 2π coming from the reduced Planck Constant:

$$1\mathbb{N}\Omega = [29.97924582(46429) \times 2\pi] \, \Omega = 188.365156(885721) \, \Omega \, . \tag{2.5c}$$

But here already we are at a crossroads, because the 2018 CODATA recommended value of α at $1 \,/\, 137.035999084(21)$ is somewhat at odds with the value arrived at above by relying on the 2019 redefinitions despite the claimed accuracy of 1.5×10^{-10} relative standard uncertainty [6]. The situation is not much different with the 2012 QED-based measurement [3] that gave $1 \,/\, 137.035999174(35)$ either, as well as with other recent experimental findings such as by Guellati-Khélifa et al. [7, 8] (for which it is said: "*Surprisingly, her new measurement differs from Müller's 2018 result in the tenth digit, a bigger discrepancy than the margin of error of either measurement.*"). Since no amount of meddling with the uncertainty parts of 29.97924582(46429) will rectify the conspicuous mismatch at hand — and since both the adopted $Coulumb^2$ in the numerator of eq.(2.4c) and the $\mathrm{kg} \times \mathrm{m}^2 \,/\, \mathrm{s}$ times $\mathrm{m} \,/\, \mathrm{s}$ terms (having the dimensions of the Planck Constant times the speed of light) out of $\mathrm{N} \times \mathrm{m}^2$ in the denominator of eq.(2.4c) are absolute — the only sensible way out to ascertain a suitable α without changing anything else at this juncture is to re-evaluate the elementary charge value, which we will come back to soon.

Seeing as it has already been mentioned that 1 *second* over 1 *Farad* equals *1 Ohm*, the "*new Farad*" (*Narad*) will be:

$$[29.97924582(46429)\ \text{x}\ 2\pi]\ \Omega = \left[\frac{1\ \text{second}\ \text{x}\ [29.97924582(46429)\ \text{x}\ 2\pi]}{\text{Farad}}\right], \tag{2.6a}$$

$$1\ \text{Narad} = {}^{1}\!/_{188.365156(885721)}\ \text{Farad} = 0.005308837454(51228)\,\text{Farad}. \tag{2.6b}$$

With this accomplished, we now have the means to find out the "*new Henry*" (*Nenry*) we want, given that the traditional unit of inductance 1 *Henry* is equal to 1 *second* squared over 1 *Farad*:

$$1\ \text{Henry} = \left[\frac{1\ \text{s}^2}{1\ \text{Farad}}\right] = \left[\frac{1\ \text{s}^2}{[29.97924582(46429)\ \text{x}\ 2\pi]\ \text{Narad}}\right], \tag{2.7a}$$

$$1\ \text{Nenry} = 188.365156(885721)\,\text{Henry}. \tag{2.7b}$$

Returning to the relationship (2.4a), we can substitute these new units for a cross-check via also dismissing a priori the aforesaid unwieldy 1.000 000 000 82(20) multipliers, for they eventually cancel each other out from μ_0's denominator and ε_0's numerator in the ratio below (so long as an extra fudge factor to attain α without re-touching e is avoided):

$$c^2 = \frac{1}{\left[(4\pi\ \text{x}\ 10^{-7})\dfrac{\text{Nenry}\ \text{x}\ 299,792,458}{(29.9792458\ \text{x}\ 2\pi)\,\text{NLU}}\right]\text{x}\,\varepsilon_0}, \tag{2.8a}$$

$$c^2 = \frac{1}{\left[\dfrac{2}{1}\ \text{x}\ \dfrac{\text{Nenry}}{\text{NLU}}\right]\text{x}\left[\left(\dfrac{10^7}{4\pi\,|c_{\text{MKS}}|^2}\right)\dfrac{(29.9792458\ \text{x}\ 2\pi)\ \text{x}\ \text{Narad}\ \text{x}\ 299,792,458)}{\text{NLU}}\right]}, \tag{2.8b}$$

$$c^2 = \frac{1}{\left[\dfrac{2}{1}\ \text{x}\ \dfrac{\text{Nenry}}{\text{NLU}}\right]\ \text{x}\ \left[\dfrac{1}{2}\ \text{x}\ \dfrac{\text{Narad}}{\text{NLU}}\right]}, \tag{2.8c}$$

$$\frac{1\ \text{NLU}^2}{1\ \text{second}^2} = \frac{1\ \text{NLU}^2}{1\ \text{Nenry}\ \text{x}\ 1\ \text{Narad}}. \tag{2.8d}$$

This furnishes *en bloc* the magnetic permeability of vacuum in our new units as:

$$\mu_0 = 2\ \text{x}\ \left[\frac{\text{Nenry}}{\text{NLU}}\right]. \tag{2.9}$$

Subsequently, we now have the permittivity of free space *en bloc* in our new units as:

$$\varepsilon_0 = \left[\frac{1}{2}\right]\text{x}\left[\frac{\text{Narad}}{\text{NLU}}\right]. \tag{2.10}$$

What is interesting is that setting $\varepsilon_0 = \mu_0 = 1$ turns out to be improper, and uncertainties in *Nenry* (inductance) and *Narad* (capacitance) must also thence vary in an interrelated fashion by exactly the same amount, but in opposite directions, to ensure the universality and constancy of the speed of light (as long as the aforesaid extra fudge factor meant for ε_0 so as not to re-touch the 2019 redefinition of e is eschewed).

Yet, one must not forget that *Henrys per meter* is classically the equivalent of *Newtons per Ampere squared* — from the retired definition of *Ampere* as the constant electrical current that generates 2×10^{-7} *Newtons* attractive force per *meter* length of wire between two endlessly extended parallel wires of negligible cross-section placed 1 *meters* apart [9]. Note how the force of pull generated from two identical parallel steady electrical currents I_1 and I_2 intensifies, say, thrice after a reduction of the distance D thrice as per:

$$\textit{Magnetic force intensity per unit length} = \frac{\mu_0 \times I_1 \times I_2}{2\pi \times D}\,. \tag{2.11}$$

Be that as it may, we shall introduce our new force and new current units in accordance with NOT the latest internationally fixed elementary charge value (which was shown above to be in need of correction — because otherwise the uncertainty in the permittivity of free space cannot be guaranteed unless by dint of an extra dimensionless and unphysical coefficient), but according to an updated form of the old standard definition.

To do so, we start by calculating 1 *Newton* in our new mass and distance units:

$$1\ \mathsf{Newton} = 1\ \left[\frac{\mathsf{kg} \times \mathsf{m}}{\mathsf{s}^2}\right] = \left[\frac{10^{51}\ \mathsf{NWU} \times \mathsf{NLU}}{7.37249732381271 \times \mathsf{s}^2 \times 299,792,458}\right], \tag{2.12a}$$

$$1\ \mathsf{Newton} = \left[\frac{10^{51}\ \mathsf{NWU} \times \mathsf{NLU}}{0.221021909430423 \times 10^{10}\ \mathsf{s}^2}\right], \tag{2.12b}$$

$$1\ \mathsf{Newton} = 4.52443833544382 \times 10^{41} \left[\frac{\mathsf{NWU} \times \mathsf{NLU}}{\mathsf{s}^2}\right]. \tag{2.12c}$$

Let's call $1 \,/\, 4.52443833544382\mathsf{E}+41$ *Newtons* force hereinafter "1 *Lewton*". After this, we can refer to the dimensional equivalence of the LHS and RHS of equation (2.4c) to calculate the "*New Coloumb*" (*Loulomb*):

$$\left[\frac{\mathsf{C}^2}{\mathsf{N} \times \mathsf{m}^2}\right] = \left[\frac{\mathsf{Farad}}{\mathsf{m}}\right], \tag{2.13a}$$

$$\left[\frac{\mathsf{C}^2 \times 299,792,458^2}{4.524... \times 10^{41} \left[\frac{\mathsf{NWU} \times \mathsf{NLU}}{\mathsf{s}^2}\right] \times \mathsf{NLU}^2}\right] = \left[\frac{\mathsf{Narad} \times 299,792,458}{[29.97924582(46429) \times 2\pi]^{-1} \times \mathsf{NLU}}\right], \tag{2.13b}$$

$$\left[\frac{\mathsf{C}^2}{4.524... \times 10^{41}\ \mathsf{NWU} \times \mathsf{NLU}^3}\right] = \left[\frac{[29.97924582(46429) \times 2\pi]\ \mathsf{Narad}}{299,792,458 \times \mathsf{NLU} \times \mathsf{s}^2}\right], \tag{2.13c}$$

$$\mathsf{C}^2 = \left[\frac{4.524...\,\mathsf{x}\;10^{41}\;\mathsf{NWU}\;\mathsf{x}\;\mathsf{NLU}^2\;\mathsf{x}\;\mathsf{Narad}}{1.591549429(6107)\,\mathsf{x}\,10^6\;\mathsf{x}\;\mathsf{s}^2}\right], \tag{2.13d}$$

$$\mathsf{C}^2 = 2.842788449(58684)\,\mathsf{x}\,10^{35}\;\left[\frac{\mathsf{NWU}\;\mathsf{x}\;\mathsf{NLU}^2\;\mathsf{x}\;\mathsf{Narad}}{\mathsf{s}^2}\right], \tag{2.13e}$$

$$\mathsf{C} = \sqrt{2.842788449(58684)\,\mathsf{x}\,10^{35}}\,\mathsf{Loulomb} = 5.331780612(12841)\,\mathsf{x}\,10^{17}\,\mathsf{Loulomb}\,, \tag{2.13f}$$

$$\mathsf{Loulomb} = \frac{\mathsf{C}}{5.331780612(12841)\,\mathsf{x}\,10^{17}}\,, \tag{2.13g}$$

$$\mathsf{Loulomb} = 1.875546037(51936)\,\mathsf{x}\,10^{-18}\;\mathsf{C}\,; \tag{2.13h}$$

revealing incidentally that the uncertainty in NWU must, at the outset, be of the order of 10^{-10} also.

Immediately, one will notice that the ratio of 1 *Loulomb* in *Coulombs* to the novelly adopted SI elementary charge value (whose uncertainty digits have been arbitrarily and inappropriately cut off by 2019 so as to result in) $1.602176634\mathsf{E}-19$ in *Coulombs* (*i.e.* 11.706237612746) is verily the inverse of the squareroot of the Fine Structure Constant $(1/\sqrt{\alpha})$; which is otherwise the so-called "Planck charge". In fact, one can, based on the precise QED-based value of α [3], re-calculate the elementary charge from Eq.(2.13h) to find $1.602176633(25010)\;\mathsf{x}\;10^{-19}$ *Coulombs*; but with the uncertainty parts restored and all of the procedure depending eventually on how precisely the MKS quantity of the Planck Constant is initially taken.

In what follows, because $1\,\mathsf{C} = 1\,\mathsf{A}\cdot 1\,\mathsf{s}$, we are able to straightforwardly establish the *New Ampere* (*Lampere*):

$$5.331780612(12841)\,\mathsf{x}\,10^{17}\;\mathsf{Loulomb} = 1\,(\mathsf{A}\cdot\mathsf{s})\,, \tag{2.14a}$$

$$\mathsf{Loulomb} = \left[\frac{\mathsf{A}}{5.331780612(12841)\,\mathsf{x}\,10^{17}}\right]\cdot\,\mathsf{s}\,, \tag{2.14b}$$

$$\mathsf{Lampere} = 1.875546037(51936)\,\mathsf{x}\,10^{-18}\;\mathsf{A}\,, \tag{2.14c}$$

$$1\,\mathsf{Loulomb} = 1\,(\mathsf{Lampere}\cdot\,\mathsf{s})\,. \tag{2.14d}$$

Now is the perfect time to re-adjust the scales since we are dealing with unreasonably huge or too miniscule numbers, where, in particular, NLU itself is a very long distance unit and is quite inapplicable in a real experiment of *Ampère's Force Law* as well as other laboratory setups. An acceptable recalibration would require the placement of the aforementioned parallel wires at about 30 *cms* from each other so that a 30 *cm* long segment of the cable is exerted force upon by the full length of the other. This is possible if we take 10^{-9} NLU as the designated unit length for both the distance and the current-carrying cable segment. In such a case, the resulting force will be the same as when taking 1 *meter* as the unit length for both the seperation between the wires and the individual wire segment.

Let us thereby, with the substitution of our newly found "normalized MKS" units, backtrack to *Ampère's Force Law* as had been shown in eq.(2.11) to find the commensurate LHS and RHS terms in eq.(2.15) below for the wires in question given 2×10^{-7} *Newtons* or $9.048876670(88764)\mathsf{E}+34$ *Lewtons* force (times the neoteric fudge factor of 1.000000000822) per 10^{-9} *NLU* (0.299792458 *meters* or "1/3.33564095198152nd of a *meter*") length of cable over the same 10^{-9} *NLU* distance between the wires under vacuum conditions:

$$\frac{\mathsf{F} \times 1.00000000082(20)}{\ell_{10^{-9}\ NLU}} = \frac{\mu_0\, \mathsf{I}_1\, \mathsf{I}_2}{2\pi\, D_{10^{-9}\ NLU}}\,, \tag{2.15a}$$

$$\frac{2 \times 10^{-7} \times 4.52444... \times 10^{41}\ \mathsf{Lewton}}{1.00000000082(20)^{-1} \times 10^{-9}\ \mathsf{NLU}} = \frac{2\ \mathsf{Nenry} \times (5.33178... \times 10^{17})^2\ \mathsf{Lampere}^2}{\mathsf{NLU} \times 2\pi \times 10^{-9}\ \mathsf{NLU}}\,, \tag{2.15b}$$

$$\frac{9.048876678(32582) \times 10^{34}\ \mathsf{L}}{10^{-9}\ \mathsf{NLU}} = \frac{9.048876678(32582) \times 10^{34}\ \mathsf{Nenry} \times \mathsf{Lampere}^2}{10^{-9}\ \mathsf{NLU}^2}\,, \tag{2.15c}$$

$$\frac{9.048876678(32582) \times 10^{34}\ \mathsf{Lewton}}{10^{-9}\ \mathsf{Lampere}^2} = \frac{9.048876678(32582) \times 10^{34}\ \mathsf{Nenry}}{10^{-9}\ \mathsf{NLU}}\,. \tag{2.15d}$$

Notice that the *Lampere* value in eq.(2.15d) is to be reduced at present by as much as $10^{4.5}$, leading to astronomical quantities such as $(5.93099733506480\mathsf{E}-23\ \textit{Amperes})^2$ in the denominator of the LHS; which presents us with the oppurtunity to carry over the 10^{34} orders of magnitude from the numerator of the RHS to the denominator of the LHS so as to re-normalize and rename our units:

$$\frac{9.048876678(32582) \times 10^{34}\ \mathsf{Lewton}}{10^{25}\ \mathsf{Lampere}^2} = \frac{9.048876678(32582)\ \mathsf{Nenry}}{\mathsf{NanoNLU}}\,, \tag{2.16a}$$

$$\frac{90.48876678(32582)\ \mathsf{GigaYotta\ Lewton}}{100 \times 10^{25}\ \mathsf{Lampere}^2} = \frac{9.048876678(32582)\ \mathsf{Nenry}}{100 \times \mathsf{NanoNLU}}\,, \tag{2.16b}$$

$$\frac{0.9048876678(32582)\ \mathsf{ExaYotta\ Lewton}}{\mathsf{Dihectoteradeca\ Lampere}^2} = \frac{9.048876678(32582)\ \mathsf{CentiNenry}}{\mathsf{NanoNLU}}\,, \tag{2.16c}$$

$$\frac{0.9048876678(32582)\ \mathsf{Xiyotton}}{\mathsf{Dihtedempere}^2} = \frac{0.9048876678(32582)\ \mathsf{DeciNenry}}{\mathsf{NanoNLU}}\,, \tag{2.16d}$$

where *ExaYotta Lewton* or "*Xiyotton*" is 10^{43} *Lewtons* (amounting to practically 22.1022 *Newtons*), while *CentiNenry* is 0.01 and *DeciNenry* is 0.1 *Nenry*, with their divisor *NanoNLU* denoting 10^{-9} *NLU*, and *Dihectoteradeca Lampere* or "*Dihtedempere*" simply constitutes 10^{17} $(= 10^{4+13})$ *Lampere*.

Thus, after instituting the novelly proposed SI normalization in our contribution so far, the humane re-normalization (*i.e.* ergonomization) of all units — including those for the forthcoming normalized versions of Watt, Volt, Joule, Weber, Tesla, etc... — can be straightforwardly achieved.

3. SUMMARY OF RESULTS

The normalization and subsequent re-normalization procedure of the base units under SI formalism has been explained at length in the previous section. Our metrological approach can be readily extended to all accustomed units in gravitational physics and electromagnetism.

Crucially, we have shown that the system of Natural Units improperly tries to set $\varepsilon_0 = \mu_0 = \hbar = \mathsf{c} = 1$. One should instead have $\varepsilon_0 = 1/2$ and $\mu_0 = 2$ (with their respective dimensions) following the appropriate normalization procedure shown herein when unicitizing c and h (again with their corresponding dimensions). This also means that the impedance of free space $Z_0{=}\sqrt{(\mu_0/\varepsilon_0)}$ becomes 2 *NOhms*.

More importantly, we have demonstrated that the removal of the uncertainty parts in the elementary charge quantity messes up the value of the Fine Structure Constant to the detriment of experimental findings — as no amount of fiddling with the uncertainty digits of the new-fangled fudge factor 1.000 000 000 82(20) suffices to match the deviation order of magnitude from lab results, and it also leads to the impossibility to introduce uncertainty into the permittivity of free space (unless by virtue of an unphysical and devoid of meaning extra dimensionless coefficient).

To overcome this bottleneck, the 2019 international SI resolution must be revisited in just the way alluded to, wherefore we have taken the initiative to restore the uncertainty digits of the elementary charge value and proceeded to restitute a normalized *Ampere* called *Lampere* contingent upon a normalized *Coulomb* christened *Loulomb*. In this manner, as per eqs.(2.15d, 2.16d), the indeterminacy in electrical current now correctly reflects on the indeterminacy in inductance, whose uncertainty was already inserted at an early stage of our normalization.

Accordingly, the rectified elementary charge value is, contrary to what is asserted by the proponents of the system of Natural Units, $\sqrt{\alpha}$ *Loulombs*, thus requiring the nullification of the $\sqrt{4\pi}$ term from the *Heaviside-Lorentz* formalism.

Interesting of note is the parallelism between Quantum Field Theory (QFT) and YARK (Yarman-Arık-Kholmetskii) theory — absent with respect to classical relativity theory that says nothing about the discretization which arises from the presence of the Planck Constant — after the fact that both can now be said to rely on a common understanding of $\mathsf{h} = \mathsf{c} = 1$ rectified thanks to the proper SI normalization carried out in this contribution. Thus, the YARK approach begets $2\varepsilon_0 = (1/2)\mu_0 = (1/2)Z_0 = \mathsf{h} = \mathsf{c} = (1/\sqrt{\alpha})e = 1$, all with their respective normalized dimensions.

Further study, along the principles established here, on the normalization of other commonplace units such as Watt, Volt, Joule, Weber, Tesla, etc... can be tackled later. A summary of our results are provided in the comparative **Table 1** below:



Acknowledgement This contribution was realized thanks to many fruitful discussions with Prof. Metin Arık (Boğaziçi University), Prof. Alexander L. Kholmetskii (Belarusian State University), Prof. Garret Sobczyk (Universidad de las Américas-Puebla), Prof. Azmi A. Altıntaş (Okan University), Assoc. Prof. Fatih Özaydın (Tokyo International University), Dr. Can Yeşilyurt (Istanbul University), Dr. Paul de Haas (Radboud University) and researcher Steve Crothers (Alpha Institute of Advanced Study).

TABLE 1. Old MKS (meter-kilogram-second) system and New base units (proper normalization and ergonomic re-normalization of SI bases)

OLD UNIT	**MODIFIER**	**NEW UNIT**	**NUMERICAL VALUE**
second	1	1 second	1 s
meter	299,792,458	1 NLU	299,792,458 m
kilogram	$(6.62607015 \times 10^{-34}) / 299,792,458^2$	1 NWU	$7.372497323(81271)\mathrm{E}-51$ kg
Ohm	$1.00000000082(20) \times 29.9792458 \times 2\pi$	1 NOhm	188.365156(885721) Ohm
Siemens	reciprocal of above	1 Niemens	$5.308837454(51228)\mathrm{E}-03$ S
Farad	same as above	1 Narad	$5.308837454(51228)\mathrm{E}-03$ Fa
Henry	$1.00000000082(20) \times 29.9792458 \times 2\pi$	1 Nenry	188.365156(885721) Henry
μ_0 (vacuum permeability)	redefined by new units	2 Nenry / NLU	$4\pi \cdot \mathtt{fudge} \cdot 10^{-7}$ Henry/m
ε_0 (vacuum permittivity)	redefined by new units	Narad / 2 NLU	10^7 Fa$/(4\pi \cdot \mathtt{fudge} \cdot \lvert c_{\mathrm{MKS}}\rvert^2)$ m
Z_0 (vacuum impedance)	redefined by new units	2 NOhm	376.730313(77144) Ohm
Newton	$299,792,458 \;/\; (6.62607015 \times 10^{-34})$	1 Lewton	$1/4.524438335(44382)\mathrm{E}+41$ N
Coulomb	$\surd(\{6.62607015 \times 10^{-34}\} \;/\; \{29.97924582(46429) \times 2\pi\})$	1 Loulomb	$1.875546037(51936)\mathrm{E}-18$ C
Ampere	$\surd(\{6.62607015 \times 10^{-34}\} \;/\; \{29.97924582(46429) \times 2\pi\})$	1 Lampere	$1.875546037(51936)\mathrm{E}-18$ A
Elementary charge "e"	redefined by a new unit	$\sqrt{\alpha}$ Loulomb	0.08542454310(36803) Lou. or $1.602176633(25010) \times 10^{-19}$ C
FSC: α	$e^2/2\varepsilon_0 hc$	dimensionless	1 / 137.035999...(..)
RENORMALIZED NEW UNITS			
Lewton	Exa Yotta	1 Xiyotton	10^{43} Lewton
Xiyotton	x 0.1	1 ***DeciXiyotton***	10^{42} Lewton or ***2.21022... N***
Lampere	Dihecto Teradeca	1 Dihtedempere	10^{17} Lampere
Dihtedempere	x 10	1 ***ExaLampere***	10^{18} Lampere or ***1.87555... A***
Nenry	x 0.01	1 ***CentiNenry***	10^{-2} Nenry or ***1.88365... H***
Narad	x 100	1 ***HectoNarad***	10^{2} Narad or ***0.530884... Fa***
NLU	x 0.000000001	1 ***NanoNLU***	10^{-9} NLU or about ***30 cms***
NWU	Hecto Diyotta	1 ***Hectodiyotwu***	10^{50} NWU or ***0.73725... kgs***

4. APPENDIX: HIGHLIGHTS OF MOTIVATING THEORETIC FRAMEWORK

Yarman's Approach, as a generalized theoretic framework for all force fields, and YARK (Yarman-Arık-Kholmetskii) theory specific to gravitational interactions — with both of them fully conforming to Quantum Mechanics (QM) — together provide the motivation for and the main reasoning behind this metrological undertaking.

Case in point, when a test object such as the muon replaces an electron as the client entity in an atom, the experimentally affirmed resultant bound muon decay rate retardation [10, 11] is explained by T. Yarman through exactly the same mechanism as that governing gravitational redshift — *i.e.*, the frequency decrease of light emitted by, say, an Hydrogen (H) atom embedded inside a celestial body — insofar as matching the prediction of general theory of relativity (GTR) [16] up to a third order Taylor-Maclaurin expansion [12, 13, 14, 15]. Thus, Yarman's Approach provides an excellent account of both the bound muon decay rate retardation in line with experimental findings incomparably better than what Quantum Electrodynamics (QED) can furnish, and the redshift of light from a gravitationally embedded emitter just the same as GTR. In this way, T. Yarman not only bridges in a unique manner both the atomic and celestial domains, but also comes to frame the same change of metric near both a celestial host and a charged source as long as the test object of concern is in a state of interaction with its related field.

Yarman's Approach is based solely on the law of energy conservation embodying the mass and energy equivalence of the special theory of relativity (STR), and is built from the ground up to remain in full harmony with QM. Aside from that, it is also comparatively much easier to grasp.

To further clarify the example at hand, an H atom, having the relativistic energy $\mathfrak{m}_{00}\mathfrak{c}^2$ if weighed at an infinite distance from all else (with c being the speed of light in vacuum), will lose a minimal part of its internal energy when bound to a celestial host that amounts precisely to the static binding energy this H atom delineates vis-à-vis said stationary body (which is assumed to be immensely heavier as compared to the client object of concern). This makes that the energy eigenvalue intervals of the H atom shall become narrower, which in turn will result in the emission of already pre-redshifted electromagnetic (EM) radiation from said H atom while its energized electrons fall from excited levels to lower levels.

So, this occurrence is (unlike what is claimed by the proponents of GTR) no more due to "curvature", but is a purely quantum mechanical phenomenon [cf. 17]. In that sense, broadly speaking, T. Yarman's localizing approach to gravity turns out to be not anymore different than the customary atomistic, thusly electric, interaction regime one encounters everyday; with the exception that he had, at the outset, assigned to both domains the same space-time changes in full symbiosis with QM as stated before.

As a matter of fact, T. Yarman and his colleagues have, in their recent paper [18] on the "enigmatic constancy" they unveiled with regards to dissociation energy times internuclear distance for the entire array of possible diatomic molecules, insinuated that gravitational attraction may be the manifestation of electric force leakage from otherwise neutral bodies over large distances. Some mathematical clues regarding the demonstration of such a proposition are seeded in the aforementioned publication.

In the initial stages of constructing his theoretical framework, T. Yarman advanced the designation "*Universal Matter Architecture*" (UMA) to imply suchlike quantum mechanical changes within the space-time around n-body closed systems with constant total energy. Briefly, UMA signifies how the period of time, size, mass and energy to be associated with a given entity must get altered interrelatedly insofar as satisfying the end results of STR were a test object in the given configuration brought to a uniform translational motion — or all the same, insofar as meeting the end results of GTR were it embedded in gravity or any other kind of field it might interact with [12, 13, 17, 19, 20, 21, 22, 23, 24].

Continued development of said precious framework by T. Yarman along with his colleagues resulted in the application of the root Yarman's Approach postulate to gravity (under the designation of YARK theory of gravity from the initials of its principal founders) [25, 26, 27, 28, 29, 30, 31]. Said root postulate states that the overall energy of the object with the proper mass m_0, initially measured at an infinitely far away distance from all other masses, acquires, in the presence of gravity, the form [12, 13]

$$E = \gamma m_0 c^2 (1 - E_B/m_0 c^2) = Constant, \tag{4.1}$$

where γ is the Lorentz factor associated with the motion of the test object, and E_B represents the "static binding energy" defined as the work one has to carry out in order to bring the object quasi-statically from infinity to the given location; with the RHS of the above equation getting necessarily set to a constant in a closed system owing to the law of energy conservation.

Note that Eq.(4.1), the way it is written, is valid for any field the client object can interact with. In fact, this equation states that the rest mass m_0 of said test object does not, from the viewpoint of a remote observer, remain a constant, but undergoes alterations within the gravitational environment of concern as much as the value $E_B/m_0 c^2$ (once again owing to the law of energy conservation). The postulate at hand hence implies that gravitational energy is localized inside interacting particles rather than getting distributed across the surrounding space.

Further, due to T. Yarman's intrinsic quantum mechanical relationships between the quantities "mass", "energy", "frequency", "time", and "size" as implied by UMA, the variation of the rest mass of a test particle by the static binding energy E_B affects the time rate for the particle, and induces a corresponding transformation of spatial intervals in the presence of gravity. Therefore, the variation of the rest mass of a test particle by the static binding energy does, in effect, alter — *just like in metric theories of gravity* — the *ad hoc* metric of space-time in YARK theory. What is interesting over here is that the velocity of light and the Planck Constant turn out to be universal invariants in YARK, and get in no way altered in gravitation, or during any kind of interaction in general, by the measure of any frame of reference... A concise summary of YARK has been provided by T. Yarman and his team in the recent paper [2].

Let the reader take heed that the binding energy E_B amounts here to $m_0 c^2[1-\exp(-GM/rc^2)]$; with G being the Gravitational Constant, M being the mass of the host body, and r being the altitude the client object is lowered to as referred to the center of M [12, 13]. It thus poses no challenge to verify that the abovegiven relationship, in the case of gravity, yields via differentiation Newton's Equation of Motion for a weak field.

When scrutinizing the already acquired centennial results seemingly in favor of GTR, there remains nothing in weak-gravity regimes which Einstein's formalism correctly predicts that YARK cannot just as successfully cope with; barring the difference that one is no longer burdened with singularities or black hole information paradoxes in T. Yarman's approach.

On the other hand, Yarman's Approach, unlike GTR, is capable of dealing with all scenarios where a test object interacts with any kind of field that it might get embedded into. Due to the symbiosis of Yarman's Approach with QM, all kinds of interactions are thus exceptionally handled in such a way as to unite the micro and macro worlds.

One more noticeable feature of YARK theory of gravity is the possibility to understand how *projectile-like* (corpuscular) photons can behave distinctly from *quantal* (resonant-bending) photons during their grazing of a celestial host. As a requirement of QM, YARK theory treats a quantally behaving light on the basis of the historical Pound & Rebka experiment [32], where we arrive at the same prediction as GTR and obtain the same empirical results within the offered margin of precision, yet contingent upon an entirely different philosophy. Otherwise, our formalism predicts practically no deflection in gravity for γ photons behaving like projectiles instead [26], which again happens to be in full conformity with experimental findings [33] that GTR cannot ever deal with.

To recapitulate, Yarman's Approach, as a generalized model for all force fields, and YARK theory, for the coupling of masses in the celestial domain, are outstandingly capable of tackling, in full harmony with QM, all kinds of interactions a test object can undergo.

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