Programming Planck units from a virtual electron; a Simulation Hypothesis (summary)

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The Simulation Hypothesis proposes that all of reality, including the earth and the universe, is in fact an artificial simulation, analogous to a computer simulation, and as such our reality is an illusion. In this essay I describe a method for programming mass, length, time and charge (MLTA) as geometrical objects derived from the formula for a virtual electron; $f_e = 4\pi^2 r^3$ ($r = 2^6 3\pi^2 \alpha\Omega^5$) where the fine structure constant α = 137.03599... and Ω = 2.00713494... are mathematical constants and the MLTA geometries are; M = (1), T = (2π), L = ($2\pi^2\Omega^2$), A = $(4\pi\Omega)^3/\alpha$. As objects they are independent of any set of units and also of any numbering system, terrestrial or alien. As the geometries are interrelated, we can replace designations such as (kg, m, s, A) with a rule set; mass = u^{15}, length = u^{-13}, time = u^{-30}, ampere = u^3. The formula f_e combines these geometries in the following ratio M^9T^{11}/L^{15} and $(AL)^3/T$, as such this electron formula is unit-less (u^0). To translate MLTA to their respective SI Planck units requires an additional 2 unit-dependent scalars. We may thereby derive the CODATA 2014 physical constants via 2 (fixed) mathematical constants (α, Ω), 2 (variable) dimensioned scalars and the rule set u. As all constants can be defined geometrically, the least precise constants $(G, h, e, m_e, k_B...)$ can also be solved via the most precise $(c, \mu_0, R_\infty, \alpha)$, numerical precision then limited by the precision of the fine structure constant α.

Table 1	Calculated values from $(c, \mu_0, R_\infty, \alpha)$ [10]	CODATA 2014
Fine structure constant	α^* = 137.035999139	α = 137.035999139(31)
Speed of light	c^* = 299792458 u^{17}	c = 299792458
Permeability	${\mu_0}^* = 4\pi/10^7$ u^{56}	$\mu_0 = 4\pi/10^7$
Rydberg constant	${R_\infty}^*$ = 10973731.568 508 u^{13}	R_∞ = 10973731.568 508(65)
Planck constant	h^* = 6.626 069 134 e-34 u^{19}	h = 6.626 070 040(81) e-34
Elementary charge	e^* = 1.602 176 511 30 e-19 u^{-27}	e = 1.602 176 6208(98) e-19
von Klitzing (h/e^2)	R_K^* = 25812.807 45559	R_K = 25812.807 4555(59)
Electron mass	m_e^* = 9.109 382 312 56 e-31 u^{15}	m_e = 9.109 383 56(11) e-31
Electron wavelength	λ_e^* = 2.426 310 2366 e-12 u^{-13}	λ_e = 2.426 310 2367(11) e-12
Boltzmann's constant	k_B^* = 1.379 510 147 52 e-23 u^{29}	k_B = 1.380 648 52(79) e-23
Gravitation constant	G^* = 6.672 497 192 29 e-11 u^6	G = 6.674 08(31) e-11
Planck length	l_p^* = .161 603 660 096 e-34 u^{-13}	l_p = .161 6229(38) e-34
Planck mass	m_P^* = .217 672 817 580 e-7 u^{15}	m_P = .217 6470(51) e-7
Gyromagnetic ratio	$\gamma_e/2\pi^*$ = 28024.953 55 u^{-42}	$\gamma_e/2\pi$ = 28024.951 64(17)e-7

Keywords: virtual electron, mathematical electron, black-hole electron, simulation hypothesis, computer universe, mathematical universe, physical constants, Planck units, sqrt Planck momentum, magnetic monopole, fine structure constant, alpha, Omega;

1 Background

Max Tegmark proposed a Mathematical Universe Hypothesis that states: Our external physical reality is a mathematical structure. That is, the physical universe is mathematics in a well-defined sense, and in those [worlds] complex enough to contain self-aware substructures [they] will subjectively perceive themselves as existing in a physically 'real' world" [9].

Mathematical Platonism is a metaphysical view that there are abstract mathematical objects whose existence is independent of us [1]. Mathematical realism holds that mathematical entities exist independently of the human mind. Thus humans do not invent mathematics, but rather discover it. Triangles, for example, are real entities, not the creations of the human mind [3].

The Simulation Hypothesis proposes that all of reality, including the earth and the universe, is in fact an artificial simulation, analogous to a computer simulation [2].

In the "Trialogue on the number of fundamental physical constants" was debated the number of fundamental dimension units required, noting that "There are two kinds of fundamental constants of Nature: dimensionless (α) and dimensionful (c, h, G). To clarify the discussion I suggest to refer to the former as fundamental parameters and the latter as fundamental (or basic) units. It is necessary and sufficient to have three basic units in order to reproduce in an experimentally meaningful way the dimensions of all physical quantities. Theoretical equations describing the physical world deal with dimensionless quantities and their solutions depend on dimensionless fundamental parameters. But experiments, from which these theories are extracted and by which they could be tested, involve measurements, i.e. comparisons with standard dimensionful scales. Without standard dimensionful units and hence without certain conventions physics is unthinkable" -*Trialogue* [5].

J. Barrow and J. Webb on the physical constants; 'Some things never change. Physicists call them the *constants of nature*. Such quantities as the velocity of light, c, Newton's constant of gravitation, G, and the mass of the electron, m_e, are assumed to be the same at all places and times in the universe. They form the scaffolding around which theories of physics are erected, and they define the fabric of our universe. Physics has progressed by making ever more accurate measurements of their values. And yet, remarkably, no one has ever successfully predicted or explained any of the constants. Physicists have no idea why they take the special numerical values that they do. In SI units, c is 299,792,458; G is 6.673e-11; and m_e is 9.10938188e-31 -numbers that follow no discernible pattern. The only thread running through the values is that if many of them were even slightly different, complex atomic structures such as living beings would not be possible. The desire to explain the constants has been one of the driving forces behind efforts to develop a complete unified description of nature, or "theory of everything". Physicists have hoped that such a theory would show that each of the constants of nature could have only one logically possible value. It would reveal an underlying order to the seeming arbitrariness of nature.' [6].

At present, there is no candidate theory of everything that is able to calculate the mass of the electron [12].

Planck units (m_P, l_p, t_p, ampere A_p, T_P) are a set of natural units of measurement defined exclusively in terms of five universal physical constants, in such a manner that these five constants take on the numerical value of $G = \hbar = c = 1/4\pi\epsilon_0 = k_B = 1$ when expressed in terms of these units. These units are also known as natural units because the origin of their definition comes only from properties of nature and not from any human construct. Max Planck [7] wrote of these units; "we get the possibility to establish units for length, mass, time and temperature which, being independent of specific bodies or substances, retain their meaning for all times and all cultures, even non-terrestrial and non-human ones and could therefore serve as natural units of measurements...".

2 Geometrical objects MLTA

In 1963, Dirac noted regarding the fundamental constants; "The physics of the future, of course, cannot have the three quantities $\hbar, e, c$ all as fundamental quantities, ***only two of them can be fundamental, and the third must be derived from those two***." [16]

Our 'physical' universe is defined in terms of fundamental measurable quantities which we measure using the SI units or imperial unit equivalents and assign them to (dimensioned) physical constants that we use as reference, for example all velocities may be measured relative to c. These units however are terrestrial units, although Max Planck proposed a set of natural units, his Planck units are still measured in terrestrial terms; Planck mass m_P = 2.17647... x10^{-8} kg or 4.79825... x10^{-8} lbs.

Mathematical universe hypotheses presume that our physical universe has an underlying mathematical origin. The principal difficulty of such hypotheses lies in the problem of how to construct these physical units, the units that confer 'physical-ness' to our universe, from their respective mathematical forms. In the following I describe a system of units that is based on geometrical objects and so is independent of any particular system of units and also of any numbering system, yet may be used to reproduce our physical constants (see table p1) [14]. The model is based on a virtual (unitless) electron formula f_e from which natural units of mass M, length L, time T and charge A (ampere) may be derived according to these ratio.

$$f_e = 4\pi^2(2^6 3\pi^2 \alpha\Omega^5)^3 = .23895453...x10^{23} \tag{1}$$

$$units = \frac{(AL)^3}{T} = \sqrt{\frac{L^{15}}{M^9 T^{11}}} = 1$$

The fine structure constant α (4.5.) and Ω (4.7.) are mathematical constants, thus the electron formula f_e is also a mathematical constant (units = 1). From the above ratio we can extract geometrical objects for ALT (AL as ampere-meter are units for a magnetic monopole) and MLT. The following are proposed;

$$M = (1) \tag{2}$$

$$T = (2\pi) \tag{3}$$

$$L = (2\pi^2\Omega^2) \tag{4}$$

$$A = (\frac{2^6\pi^3\Omega^3}{\alpha}) \tag{5}$$

3 Unit u

If the mass, space, time and charge units are not independent of each other then we can then assign a rule set that designates the relationships between them.

u^{15} (mass)
u^{-30} (time)
u^{-13} (length)
u^3 (ampere)

We can then construct a table of units, for example;

Velocity V = length/time = $u^{-13+30=17}$
Elementary charge = ampere x time = $u^{3-30=-27}$

4 Scalars

4.1. In order to translate from geometrical objects to a numerical system of units, (dimensioned) scalars are required. I assign these scalars *kltvpa* with their corresponding unit u.

$$k,\ unit = u^{15}\ (mass) \tag{6}$$

$$t,\ unit = u^{-30}\ (time) \tag{7}$$

$$p,\ unit = u^{16}\ (sqrt\ of\ momentum) \tag{8}$$

$$v,\ unit = u^{17}\ (velocity) \tag{9}$$

$$l,\ unit = u^{-13}\ (length) \tag{10}$$

$$a,\ unit = u^{3}\ (ampere) \tag{11}$$

The formulas for base units MLTVPA now become;

$$M = (1)k,\ unit = u^{15}\ (mass) \tag{12}$$

$$T = (2\pi)t,\ unit = u^{-30}\ (time) \tag{13}$$

$$P = (\Omega)p,\ unit = u^{16}\ (sqrt\ of\ momentum) \tag{14}$$

$$V = (2\pi\Omega^2)v,\ unit = u^{17}\ (velocity) \tag{15}$$

$$L = (2\pi^2\Omega^2)l,\ unit = u^{-13}\ (length) \tag{16}$$

$$A = (\frac{2^6\pi^3\Omega^3}{\alpha})a,\ unit = u^{3}\ (ampere) \tag{17}$$

4.2.1. To convert to CODATA 2014 values only 2 of these 6 *kltvpa* scalars are required to define the other 4. In this example I derive LPVA from MT. The formulas for MT;

$$M = (1)k,\ unit = u^{15} \tag{18}$$

$$T = (2\pi)t,\ unit = u^{-30} \tag{19}$$

From the ratio $M^9T^{11} = L^{15}$ (eq.1) we extract *pvla*;

$$P = (\Omega)\ \frac{k^{12/15}}{t^{2/15}},\ unit = u^{12/15*15-2/15*(-30)=16} \tag{20}$$

$$V = \frac{2\pi P^2}{M} = (2\pi\Omega^2)\ \frac{k^{9/15}}{t^{4/15}},\ unit = u^{9/15*15-4/15*(-30)=17} \tag{21}$$

$$L = \frac{TV}{2} = (2\pi^2\Omega^2)\ k^{9/15}t^{11/15},\ unit = u^{9/15*15+11/15*(-30)=-13} \tag{22}$$

$$A = \frac{8V^3}{\alpha P^3} = \left(\frac{64\pi^3\Omega^3}{\alpha}\right)\ \frac{1}{k^{3/5}t^{2/5}},\ unit = u^{9/15*(-15)+6/15*30=3} \tag{23}$$

4.2.2. In this example I derive MLTA from PV;

$$P = (\Omega)p,\ unit = u^{16} \tag{24}$$

$$V = (2\pi\Omega^2)v,\ unit = u^{17} \tag{25}$$

MTVA in terms of PV

$$M = \frac{2\pi P^2}{V} = (1)\frac{p^2}{v},\ unit = u^{16*2-17=15} \tag{26}$$

$$T^2 = (2\pi\Omega)^{15}\frac{P^9}{2\pi V^{12}} \tag{27}$$

$$T = (2\pi)\frac{p^{9/2}}{v^6},\ unit = u^{16*9/2-17*6=-30} \tag{28}$$

$$L = \frac{TV}{2} = (2\pi^2\Omega^2)\frac{p^{9/2}}{v^5},\ unit = u^{16*9/2-17*5=-13} \tag{29}$$

$$A = \frac{8V^3}{\alpha P^3} = (\frac{2^6\pi^3\Omega^3}{\alpha})\frac{v^3}{p^3},\ unit = u^{17*3-16*3=3} \tag{30}$$

From the Planck units we can solve the physical constants G, h, e, m_e, k_B. To maintain integer exponents (for clarity) I replace p with $r = \sqrt{p} = \sqrt{\Omega}$, unit $u^{16/2=8}$

$$G^* = \frac{V^2L}{M} = 2^3\pi^4\Omega^6\frac{r^5}{v^2},\ u^{34-13-15=8*5-17*2=6} \tag{31}$$

$$h^* = 2\pi MVL = 2^3\pi^4\Omega^4\frac{r^{13}}{v^5},\ u^{15+17-13=8*13-17*5=19} \tag{32}$$

$$T_P^* = \frac{AV}{\pi} = \frac{2^7\pi^3\Omega^5}{\alpha}\frac{v^4}{r^6},\ u^{3+17=17*4-6*8=20} \tag{33}$$

$$e^* = AT = \frac{2^7\pi^4\Omega^3}{\alpha}\frac{r^3}{v^3},\ u^{3-30=3*8-17*3=-27} \tag{34}$$

$$k_B^* = \frac{\pi VM}{A} = \frac{\alpha}{2^5\pi\Omega}\frac{r^{10}}{v^3},\ u^{17+15-3=10*8-17*3=29} \tag{35}$$

$$m_e^* = \frac{M}{f_e},\ u^{15} \tag{36}$$

$$\lambda_e^* = 2\pi L f_e,\ u^{-13} \tag{37}$$

$$\mu_0^* = \frac{\pi V^2M}{\alpha LA^2} = \frac{\alpha}{2^{11}\pi^5\Omega^4}r^7,\ u^{17*2+15+13-6=7*8=56} \tag{38}$$

$$\epsilon_0^{*-1} = \frac{\alpha}{2^9\pi^3}v^2r^7,\ u^{34+56=90} \tag{39}$$

$$r_\sigma^* = (\frac{8\pi^5k_B^4}{15h^3c^3}) = \frac{\alpha}{2^{29}15\pi^{14}\Omega^{22}}r,\ u^{29*4-19*3-17*3=8} \tag{40}$$

$$R^* = (\frac{m_e}{4\pi l_p\alpha^2m_P}) = \frac{1}{2^{23}3^3\pi^{11}\alpha^5\Omega^{17}}\frac{v^5}{r^9},\ u^{13} \tag{41}$$

As (α, Ω) have fixed values we need only assign appropriate numerical values to 2 of the scalars (i.e.: k, t or r, v) to solve these constants with results as listed in table 1.

4.3. We then note within the electron f_e ratios M^9T^{11}/L^{15} and $(AL)^3/T$, the scalars and units cancel leaving only the unit-less (α, Ω) geometrical objects (eq. 2-5). Consequently these 'electron' ratios are independent of any system of units, to quote Max Planck 'whether terrestrial or alien'.

$$k = m_P = .21767281758...\ 10^{-7},\ u^{15}\ (kg) \tag{42}$$

$$t = \frac{t_p}{2\pi} = .17158551284...10^{-43},\ u^{-30}\ (s) \tag{43}$$

$$l = \frac{l_p}{2\pi^2\Omega^2} = .20322086948...10^{-36},\ u^{-13}\ (m) \tag{44}$$

$$a = \frac{A_p \alpha}{64\pi^3\Omega^3} = .12691858859...10^{23},\ u^3\ (A) \quad (45)$$

The scalars *ktla* and units *u* cancel;

$$\frac{L^{15}}{M^9T^{11}} = \frac{l_p^{15}}{m_p^9 t_p^{11}} = \frac{(2\pi^2\Omega^2)^{15}}{(1)^9(2\pi)^{11}}.\frac{l^{15}}{k^9t^{11}} = 2^4\pi^{19}\Omega^{30} \quad (46)$$

$$\frac{l^{15}}{k^9t^{11}} = \frac{(.203...x10^{-36})^{15}}{(.217...x10^{-7})^9(.171...x10^{-43})^{11}}\frac{u^{-13*15}}{u^{15*9}u^{-30*11}} = 1 \quad (47)$$

$$\frac{A^3L^3}{T} = \frac{A_p^3 l_p^3}{t_p} = \frac{(2^6\pi^3\Omega^3)^3(2\pi^2\Omega^2)^3}{(\alpha)^3(2\pi)}.\frac{a^3l^3}{t} = \frac{2^{20}\pi^{14}\Omega^{15}}{\alpha^3} \quad (48)$$

$$\frac{a^3l^3}{t} = \frac{(.126...x10^{23})^3(.203...x10^{-36})^3}{(.171...x10^{-43})}\frac{u^{3*3}u^{-13*3}}{u^{-30}} = 1 \quad (49)$$

In 4.2.2. I defined MLTA in terms of PV. Replacing MLTA with those PV derivations, we find that P and V themselves cancel leaving only the dimensionless components. We may note that throughout this model we find the geometry Ω^{15} indicative of unit-less ratios, a geometrical 'base 15'.

$$\frac{L^{30}}{M^{18}T^{22}} = \frac{2^{180}\pi^{210}\Omega^{225}P^{135}}{V^{150}} / \frac{2^{18}\pi^{18}P^{36}}{V^{18}}.\frac{2^{154}\pi^{154}\Omega^{165}P^{99}}{V^{132}} \quad (50)$$

$$\frac{L^{30}}{M^{18}T^{22}} = (2^4\pi^{19}\Omega^{30})^2 \quad (51)$$

$$\frac{A^6L^6}{T^2} = \frac{2^{18}V^{18}}{\alpha^6P^{18}}.\frac{2^{36}\pi^{42}\Omega^{45}P^{27}}{V^{30}} / \frac{2^{14}\pi^{14}\Omega^{15}P^9}{V^{12}} \quad (52)$$

$$\frac{A^6L^6}{T^2} = (\frac{2^{20}\pi^{14}\Omega^{15}}{\alpha^3})^2 \quad (53)$$

4.4. The electron formula f_e is both unit-less and non scalable $k^0t^0v^0r^0u^0 = 1$. It is therefore a natural (mathematical) constant, σ_e has units for a magnetic monopole, σ_{tp} a hypothetical temperature monopole.

$$T = (2\pi)\frac{r^9}{v^6},\ u^{-30} \quad (54)$$

$$\sigma_e = \frac{3\alpha^2AL}{\pi^2} = 2^7 3\pi^3\alpha\Omega^5\frac{r^3}{v^2},\ u^{-10} \quad (55)$$

$$f_e = \frac{\sigma_e^3}{T} = \frac{(2^7 3\pi^3\alpha\Omega^5)^3}{2\pi},\ units = \frac{(u^{-10})^3}{u^{-30}} = 1 \quad (56)$$

$$\sigma_{tp} = \frac{3\alpha^2T_P}{2\pi} = 2^6 3\pi^2\alpha\Omega^5\frac{v^4}{r^6},\ units = u^{20} \quad (57)$$

$$f_e = t_p^2\sigma_{tp}^3 = 4\pi^2(2^6 3\pi^2\alpha\Omega^5)^3,\ units = (u^{-30})^2(u^{20})^3 = 1 \quad (58)$$

4.5. The Sommerfeld fine structure constant alpha is a dimensionless mathematical constant. The following uses a well known formula for alpha (note: for convenience I use the commonly recognized value for alpha as $\alpha \sim 137$);

$$\alpha = \frac{2h}{\mu_0 e^2 c} \quad (59)$$

$$\alpha = 2(8\pi^4\Omega^4)/(\frac{\alpha}{2^{11}\pi^5\Omega^4})(\frac{128\pi^4\Omega^3}{\alpha})^2(2\pi\Omega^2) = \alpha \quad (60)$$

$$scalars = \frac{r^{13}}{v^5}.\frac{1}{r^7}.\frac{v^6}{r^6}.\frac{1}{v} = 1$$

$$units = \frac{u^{19}}{u^{56}(u^{-27})^2u^{17}} = 1$$

4.6. The Planck units are known with a low numerical precision, 1 reason why they are not commonly used. Conversely 2 of the CODATA 2014 physical constants have been assigned exact numerical values; c and permeability of vacuum μ_0. Thus scalars r and v were used as they can be derived directly from the formulas for c^* and μ_0^* (4.2.2.).

$$v = \frac{c}{2\pi\Omega^2} = 11843707.9...,\ units = m/s \quad (61)$$

$$r^7 = \frac{2^{11}\pi^5\Omega^4\mu_0}{\alpha};\ r = .712562514...,\ units = (\frac{kg.m}{s})^{1/4} \quad (62)$$

The most precise of the experimentally measured constants is the Rydberg $R = 10973731.568508(65)\ m^{-1}$. Here c, μ_0, R are combined into a unit-less ratio;

$$\frac{(c^*)^{35}}{(\mu_0^*)^9(R^*)^7} = (2\pi\Omega^2)^{35}/(\frac{\alpha}{2^{11}\pi^5\Omega^4})^9.(\frac{1}{2^{23}3^3\pi^{11}\alpha^5\Omega^{17}})^7 \quad (63)$$

$$units = \frac{(u^{17})^{35}}{(u^{56})^9(u^{13})^7} = 1$$

4.7. I have premised a 2nd mathematical constant I denoted Ω. We can define using geometries for (c^*, μ_0^*, R^*) and then numerically solve by replacing the geometrical (c^*, μ_0^*, R^*) with the numerical (c, μ_0, R) CODATA 2014 values. Rewriting eq.63 in terms of Ω;

$$\Omega^{225} = \frac{(c^*)^{35}}{2^{295}3^{21}\pi^{157}(\mu_0^*)^9(R^*)^7\alpha^{26}},\ units = 1 \quad (64)$$

$$\Omega = 2.007\ 134\ 9496...,\ units = 1$$

There is a close natural number for Ω that is a sqrt implying that Ω can have a plus and a minus solution; $(+\Omega)^2 = (-\Omega)^2$.

$$\Omega = \sqrt{\left(\frac{\pi^e}{e^{(e-1)}}\right)} = 2.007\ 134\ 9543... \quad (65)$$

4.8. We can use the same approach to also numerically solve G, h, e, m_e, k_B by first rewriting their geometrical formulas in terms of (c^*, μ_0^*, R^*) and then replacing with the CODATA 2014 values for (c, μ_0, R, α). Here I solve for Planck's constant.

$$h^* = 2^3\pi^4\Omega^4\frac{r^{13}}{v^5},\ u^{19} \quad (66)$$

$$(h^*)^3 = (2^3\pi^4\Omega^4\frac{r^{13}}{v^5})^3,\ u^{19*3} = \frac{2\pi^{10}(\mu_0^*)^3}{3^6(c^*)^5\alpha^{13}(R^*)^2},\ unit = u^{57} \quad (67)$$

Likewise with the other constants.

$$(e^*)^3 = \frac{4\pi^5}{3^3(c^*)^4\alpha^8(R^*_\infty)},\ unit = u^{-81} \tag{68}$$

$$(k^*_B)^3 = \frac{\pi^5(\mu^*_0)^3}{3^3 2(c^*)^4\alpha^5(R^*_\infty)},\ unit = u^{87} \tag{69}$$

$$(G^*)^5 = \frac{\pi^3(\mu^*_0)}{2^{20}3^6\alpha^{11}(R^*_\infty)^2},\ unit = u^{30} \tag{70}$$

$$(m^*_e)^3 = \frac{16\pi^{10}(R^*_\infty)(\mu^*_0)^3}{3^6(c^*)^8\alpha^7},\ unit = u^{45} \tag{71}$$

$$(l^*_p)^{15} = \frac{\pi^{22}(\mu^*_0)^9}{2^{35}3^{24}\alpha^{49}(c^*)^{35}(R^*_\infty)^8},\ unit = (u^{-13})^{15} \tag{72}$$

$$(m^*_P)^{15} = \frac{2^{25}\pi^{13}(\mu^*_0)^6}{3^6(c^*)^5\alpha^{16}(R^*_\infty)^2},\ unit = (u^{15})^{15} \tag{73}$$

$$\gamma_e/2\pi = \frac{gl^*_p m^*_P}{2k^*_B m^*_e},\ unit = u^{-13-29=3-30-15=-42} \tag{74}$$

$$(\gamma_e/2\pi)^3 = \frac{g^3 3^3(c^*)^4}{2^8\pi^8\alpha(\mu^*_0)^3(R^*_\infty)^2} \tag{75}$$

Inserting the above in the alpha formula

$$\alpha^3 = \frac{8(h^*)^3}{(\mu^*_0)^3(e^*)^6(c^*)^3} = \alpha^3,\ units = 1 \tag{76}$$

As such, we may numerically solve the least precise physical constants in terms of the 4 most precise. Results are consistent with CODATA 2014 (table p1).

5 Unit u as $\sqrt{length/mass\ x\ time}$

5.1. Setting $u = \sqrt{L/M.T}$ we construct a table of units (3.).

$$u,\ units = \sqrt{\frac{L}{MT}} = \sqrt{u^{-13-15+30=2}} = u^1 \tag{77}$$

$$x,\ units = \sqrt{\frac{M^9T^{11}}{L^{15}}} = u^0 = 1 \tag{78}$$

$$y,\ units = M^2T = u^0 = 1 \tag{79}$$

This gives us;

$$u^3 = \frac{L^{3/2}}{M^{3/2}T^{3/2}} = A,\ (ampere)$$

$$u^6(y) = L^3/T^2M,\ (G)$$

$$u^{13}(xy) = 1/L,\ (1/l_p)$$

$$u^{15}(xy^2) = M,\ (m_P)$$

$$u^{17}(xy^2) = V,\ (c)$$

$$u^{19}(xy^3) = ML^2/T,\ (h)$$

$$u^{20}(xy^2) = \frac{L^{5/2}}{M^{3/2}T^{5/2}} = AV,\ (T_P)$$

$$u^{27}(x^2y^3) = \frac{M^{3/2}\sqrt{T}}{L^{3/2}} = 1/AT,\ (1/e)$$

$$u^{29}(x^2y^4) = \frac{M^{5/2}\sqrt{T}}{\sqrt{L}} = ML/AT,\ (k_B)$$

$$u^{30}(x^2y^3) = 1/T,\ (1/t_p)$$

$$u^{56}(x^4y^7) = \frac{M^4T}{L^2} = \frac{ML}{T^2A^2},\ (\mu_0)$$

5.2. To derive formulas for MLTVA we simply repeat the above, assigning β (unit = u), i (from x) and j (from y).

$$R = \sqrt{P} = \sqrt{\Omega}r,\ units = u^8 \tag{80}$$

$$\beta = \frac{V}{R^2} = \frac{2\pi R^2}{M} = \frac{A^{1/3}\alpha^{1/3}}{2}...,\ unit = u \tag{81}$$

$$i = \frac{1}{2\pi(2\pi\Omega)^{15}},\ unit = 1$$

$$j = \frac{r^{17}}{v^8} = k^2t = \frac{k^8}{r^{15}}...,\ unit = \frac{u^{17*8}}{u^{8*17}} = u^{15*2}u^{-30}... = 1$$

We can reproduce the (r, v) formulas from 4.2.2.

$$\beta = \frac{V}{R^2} = \frac{2\pi\Omega^2 v}{\Omega r^2}\ u \tag{82}$$

$$A = \beta^3(\frac{2^3}{\alpha}) = \frac{2^6\pi^3\Omega^3}{\alpha}\frac{v^3}{r^6},\ u^3 \tag{83}$$

$$G = \frac{\beta^6}{2^3\pi^2}(j) = 2^3\pi^4\Omega^6\frac{r^5}{v^2},\ u^6 \tag{84}$$

$$L^{-1} = 4\pi\beta^{13}(ij) = \frac{1}{2\pi^2\Omega^2}\frac{v^5}{r^9},\ u^{13} \tag{85}$$

$$M = 2\pi\beta^{15}(ij^2) = \frac{r^4}{v},\ u^{15} \tag{86}$$

$$P = \beta^{16}(ij^2) = \Omega r^2,\ u^{16} \tag{87}$$

$$V = \beta^{17}(ij^2) = 2\pi\Omega^2 v,\ u^{17} \tag{88}$$

$$h = \pi\beta^{19}(ij^3) = 8\pi^4\Omega^4\frac{r^{13}}{v^5},\ u^{19} \tag{89}$$

$$T^*_P = \frac{2^3\beta^{20}}{\pi\alpha}(ij^2) = \frac{2^7\pi^3\Omega^5}{\alpha}\frac{v^4}{r^6},\ u^{20} \tag{90}$$

$$e^{-1} = \frac{\alpha\pi\beta^{27}(i^2j^3)}{4} = \frac{\alpha}{128\pi^4\Omega^3}\frac{v^3}{r^3},\ u^{27} \tag{91}$$

$$k_B = \frac{\alpha\pi^2\beta^{29}(i^2j^4)}{4} = \frac{\alpha}{32\pi\Omega}\frac{r^{10}}{v^3},\ u^{29} \tag{92}$$

$$T^{-1} = 2\pi\beta^{30}(i^2j^3) = \frac{1}{2\pi}\frac{v^6}{r^9},\ u^{30} \tag{93}$$

$$\mu^*_0 = \frac{\pi^3\alpha\beta^{56}}{2^3}(i^4j^7) = \frac{\alpha}{2^{11}\pi^5\Omega^4}r^7,\ u^{56} \tag{94}$$

$$\epsilon_0^{*-1} = \frac{\pi^3 \alpha \beta^{90}}{2^3}(i^6 j^{11}) = \frac{\alpha}{2^9 \pi^3} v^2 r^7, \ u^{90} \quad (95)$$

5.3. We require 3 units to cancel both u and the 2 scalars. With 2 units we may cancel u but retain our numerical SI values, i, j suggest a limit to the values the SI constants can take, the boundary imposed between 10^{-59} to 10^{60}.

$$\frac{r^{17}}{v^8} = k^2 t = \frac{k^{17/4}}{v^{15/4}} = ... = .812997...x10^{-59}, \ units = 1 \quad (96)$$

In SI terms β has this value;

$$a^{1/3} = \frac{v}{r^2} = \frac{1}{t^{2/15} k^{1/5}} = \frac{\sqrt{v}}{\sqrt{k}} ... = 23326079.1...; unit = u \quad (97)$$

In summary I have described a programmable approach [15] using universal geometrical objects based on a formula for a virtual electron (mathematical constant) from which we may derive the CODATA 2014 values with associated units via;

- 2 (fixed) mathematical constants (α, Ω),
- 2 (variable) unit-dependent scalars
- a unit u rule-set.

In the "Trialogue on the number of fundamental physical constants" was debated the number, from 0 to 3, of dimensionful units required [5]. Here the answer is both 0 and 1; 0 in that the electron, being a virtual particle, has no units, yet it can unfold to form the Planck units and these can be de-constructed in terms of the unit u, and so in terms of the physical universe, being a dimensioned universe (a universe of measurable units) the answer is 1.

6 Additional notes on the physical constants

In the article "Surprises in numerical expressions of physical constants", Amir et al write ... In science, as in life, 'surprises' can be adequately appreciated only in the presence of a null model, what we expect a priori. In physics, theories sometimes express the values of dimensionless physical constants as combinations of mathematical constants like pi or e. The inverse problem also arises, whereby the measured value of a physical constant admits a 'surprisingly' simple approximation in terms of well-known mathematical constants. Can we estimate the probability for this to be a mere coincidence? [13]

"The fundamental constants divide into two categories, units independent and units dependent, because only the constants in the former category have values that are not determined by the human convention of units and so are true fundamental constants in the sense that they are inherent properties of our universe. In comparison, constants in the latter category are not fundamental constants in the sense that their particular values are determined by the human convention of units" -*L. and J. Hsu* [4].

A charged rotating black hole is a black hole that possesses angular momentum and charge. In particular, it rotates about one of its axes of symmetry. In physics, there is a speculative notion that if there were a black hole with the same mass and charge as an electron, it would share many of the properties of the electron including the magnetic moment and Compton wavelength. This idea is substantiated within a series of papers published by Albert Einstein between 1927 and 1949. In them, he showed that if elementary particles were treated as singularities in spacetime, it was unnecessary to postulate geodesic motion as part of general relativity [11].

The Dirac Kerr–Newman black-hole electron was introduced by Burinskii using geometrical arguments. The Dirac wave function plays the role of an order parameter that signals a broken symmetry and the electron acquires an extended space-time structure. Although speculative, this idea was corroborated by a detailed analysis and calculation [8].

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