# Programming Planck units from a virtual electron; a Simulation Hypothesis

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The simulation hypothesis proposes that all of reality is an artificial simulation. In this article I describe a simulation model that derives Planck level units as geometrical forms from a virtual (dimensionless) electron formula $f_e$ that is constructed from 2 unit-less mathematical constants; the fine structure constant $\alpha$ and $\Omega$ = 2.00713494... ($f_e = 4\pi^2 r^3, r = 2^6 3\pi^2 \alpha\Omega^5$). The mass, space, time, charge units are embedded in $f_e$ according to these ratio; $M^9 T^{11}/L^{15} = (AL)^3/T$ (units = 1), giving mass M=1, time T=$2\pi$, length L=$2\pi^2\Omega^2$, ampere A = $(4\pi\Omega)^3/\alpha$. We can thus for example create as much mass M as we wish but with the proviso that we create an equivalent space L and time T to balance the above. The 5 SI units $kg, m, s, A, K$ are derived from a single unit u = sqrt(velocity/mass) that also defines the relationships between the SI units; kg = $u^{15}$, m = $u^{-13}$, s = $u^{-30}$, A = $u^3$, $k_B = u^{29}$. To convert MLTA from the above $\alpha, \Omega$ geometries to their respective SI Planck unit numerical values (and thus solve the dimensioned physical constants $G, h, e, c, m_e, k_B$) requires an additional 2 unit-dependent scalars. Results are consistent with CODATA 2014. The rationale for the virtual electron was derived using the sqrt of momentum P and a black-hole electron model as a function of magnetic-monopoles AL (ampere-meters) and time T.

| Table 1 | Calculated values from $(\alpha, \Omega, k, \upsilon)$ [11] | CODATA 2014 |
|---|---|---|
| Speed of light | V = 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 $u^{13}$ | $R_\infty$ = 10973731.568 508(65) [15] |
| Planck constant | $h^*$ = 6.626 069 134 e-34 $u^{19}$ | $h$ = 6.626 070 040(81) e-34 [16] |
| Elementary charge | $e^*$ = 1.602 176 511 30 e-19 $u^{-27}$ | $e$ = 1.602 176 6208(98) e-19 [19] |
| Electron mass | $m_e^*$ = 9.109 382 312 56 e-31 $u^{15}$ | $m_e$ = 9.109 383 56(11) e-31 [17] |
| Boltzmann's constant | $k_B^*$ = 1.379 510 147 52 e-23 $u^{29}$ | $k_B$ = 1.380 648 52(79) e-23 [22] |
| Gravitation constant | $G^*$ = 6.672 497 192 29 e-11 $u^6$ | $G$ = 6.674 08(31) e-11 [21] |

keywords: computer universe, virtual universe, mathematical universe, simulated universe, sqrt Planck momentum, Planck unit, magnetic-monopole, fine structure constant alpha, Omega, black-hole electron;

## 1 Background

The general universe 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 [2].

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].

Max Tegmark's Mathematical Universe Hypothesis: 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" [10].

Planck units are a set of natural units of measurement defined exclusively in terms of five universal physical constants, in such a manner that these five physical 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.

"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..."

-Max Planck [10].

"There are two kinds of fundamental constants of Nature: dimensionless (alpha) 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].

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." [25]

## 2 Virtual units

Mathematical universe hypotheses presume that our physical universe has an underlying mathematical origin. The simulation hypothesis posits a mathematical universe that is in some sense programmed, thus implying an Intelligence (the Programmer). The principal difficulty of such hypotheses lies in the problem of how to construct physical units such as mass, space and time (i.e.: the units that confer 'physical-ness' to our universe) from their respective mathematical forms.

This article describes a simulation universe model based on a virtual (unit-less) electron formula $f_e$

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

The fine structure constant $\alpha$ (3.4) and a recurring number $\Omega$ (3.5) are dimensionless mathematical constants, thus $f_e$ is also a mathematical constant, and as such has a numerical solution that is independent of the system of units used.

Planck equivalent units can be derived from $f_e$ as geometrical forms; mass M=1, time T=$2\pi$, length L=$2\pi^2\Omega^2$ ... (3.1).

The 5 SI units $kg, m, s, A, k$ are derived from a single unit $u$, units = $\sqrt{velocity/mass}$ (4.0) which also defines the relationships between the SI units.

To convert these geometrical forms to their respective SI numerical values (or any system of units) requires 2 unit-dependent scalars (3.1). In table (p1) I used as scalars $k, v$ to solve $G, h, c, e, m_e, k_B$. The values for $\alpha, \Omega, k, v$;

$k = m_P = .2176728175...x10^{-7}\ u^{15}$ (kg)
$v = (2\pi\Omega^2)/c = 11843707.9...\ u^{17}$ (m/s)
$\alpha = 137.035999139$ CODATA 2014 mean
$\Omega = 2.0071349496...$

Thus we may construct $G, h, c, e, m_e, k_B$ from 2 dimensionless constants $(\alpha, \Omega)$, 2 dimensioned scalars and $u$.

## 3 Planck geometries

3.1. Proposed in section 5 is an electron formula $f_e$ that is constructed from Planck units yet is dimensionless (units = 1), the Planck units for mass M, length L, time T and charge A are premised to overlap and cancel in these ratio (units for $M^9T^{11}/L^{15} = (AL)^3/T = 1$). As these ratio are unit-less, they are independent of the system of units used, and so will solve to the same numerical value regardless of which system of units are used, even non-terrestrial and non-human ones. In terms of AVT, $f_e$ is written;

$$f_e = (\frac{3\alpha^2 ATV}{2\pi^2})^3 \frac{1}{T} = .23895453...x10^{23},\ units = 1$$

We may then replace the SI Planck units for $A$ (ampere), $V = c, T = t_p$ with any set of AVT units under the proviso that they also reduce numerically to $f_e = .2389545...x10^{23}$

In this section I describe a system of fundamental units for MLTA as geometrical forms constructed from 2 mathematical constants $(\alpha, \Omega)$, from 2 unit-dependent scalars, and from $u$. By choosing the appropriate numerical values for the 2 scalars I may then solve the SI values for $G, h, c, e, m_e, k_B$.

Initially I assign scalars $kltvpa$ to the $(\alpha, \Omega)$ geometries.

$$M = (1)k,\ unit = u^{15}\ (mass) \quad (2)$$

$$T = (2\pi)t,\ unit = u^{-30}\ (time) \quad (3)$$

$$P = (\Omega)p,\ unit = u^{16}\ (sqrt\ of\ momentum) \quad (4)$$

$$V = (2\pi\Omega^2)v,\ unit = u^{17}\ (velocity) \quad (5)$$

$$L = (2\pi^2\Omega^2)l,\ unit = u^{-13}\ (length) \quad (6)$$

$$A = (\frac{2^6\pi^3\Omega^3}{\alpha})a,\ unit = u^3\ (ampere) \quad (7)$$

3.2 As my MLTVPA units overlap in those unit-less ratios, I can reduce the number of required units to 2. In this example I derive $MLTA$ from $PV$ ($p$ units = $u^{16}$, $v$ units = $u^{17}$). Scaling $p, v$ to their SI numerical values (eq 26, 27) gives the Planck units M=$m_P$, L=$l_p$, T=$t_p$, V=$c$, P=$Q$ (5.0). Setting;

$$P = (\Omega)p,\ unit = u^{16} \quad (8)$$

$$V = (2\pi\Omega^2)v,\ unit = u^{17} \quad (9)$$

We can derive MTVA from PV

$$M = \frac{2\pi P^2}{V} = (1)\frac{p^2}{v},\ unit = u^{16*2-17=15} \quad (10)$$

$$T^2 = (2\pi\Omega)^{15}\frac{P^9}{2\pi V^{12}} \quad (11)$$

$$T = (2\pi)\frac{p^{9/2}}{v^6},\ unit = u^{16*9/2-17*6=-30} \quad (12)$$

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

$$A = \frac{8V^3}{\alpha P^3} = (\frac{2^6\pi^3\Omega^3}{\alpha})\frac{v^3}{p^3},\ unit = u^{17*3-16*3=3} \quad (14)$$

From MLTVPA I can derive $G, h, e, m_e, k_B$. For clarity I replace $p$ with $r = \sqrt{p}$, unit $u^{16/2=8}$ such that $r^9 = p^{9/2}$;

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

$$h^* = 2\pi MVL = 2^3\pi^4\Omega^4\frac{r^{13}}{v^5},\ u^{15+17-13=8*13-17*5=19} \quad (16)$$

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

$$e^* = AT = \frac{2^7\pi^4\Omega^3}{\alpha}\frac{r^3}{v^3},\ u^{3-30=3*8-17*3=-27} \tag{18}$$

$$k_B^* = \frac{\pi VM}{A} = \frac{\alpha}{2^5\pi\Omega}\frac{r^{10}}{v^3},\ u^{17+15-3=10*8-17*3=29} \tag{19}$$

$$m_e^* = \frac{M}{f_e},\ u^{15} \tag{20}$$

$$\lambda_e^* = 2\pi L f_e,\ u^{-13} \tag{21}$$

$$\mu_0^* = \frac{\pi V^2 M}{\alpha L A^2} = \frac{\alpha}{2^{11}\pi^5\Omega^4}r^7,\ u^{17*2+15+13-6=7*8=56} \tag{22}$$

$$\epsilon_0^{*-1} = \frac{\alpha}{2^9\pi^3}v^2 r^7,\ u^{34+56=90} \tag{23}$$

$$r_\sigma^* = (\frac{8\pi^5 k_B^4}{15h^3c^3}) = \frac{\alpha}{2^{29}15\pi^{14}\Omega^{22}}r,\ u^{29*4-19*3-17*3=8} \tag{24}$$

$$R^* = (\frac{m_e}{4\pi l_p \alpha^2 m_P}) = \frac{1}{2^{23}3^3\pi^{11}\alpha^5\Omega^{17}}\frac{v^5}{r^9},\ u^{13} \tag{25}$$

Scalars $r$ and $v$ were chosen as they can be determined directly from $c, \mu_0$ (these constants have exact known values).

$$v = \frac{c}{2\pi\Omega^2} = 11843707.9...\ m/s \tag{26}$$

$$r^7 = \frac{2^{11}\pi^5\Omega^4\mu_0}{\alpha},\ r = .712562514...\ \frac{kg^{1/4}m^{1/4}}{s^{1/4}} \tag{27}$$

Beginning with the SI values for M = $m_P$, T = $t_p$, L = $l_p$, A = $A_Q$ (5.2) we find that the scalars *klta* cancel within those ratios $M^9T^{11}/L^{15} = (AL)^3/T$ leaving only the unit-less $(\alpha, \Omega)$ geometries. Consequently these ratios are independent of the system of units used. Setting;

$$\frac{L^{15}}{M^9T^{11}} = \frac{l_p^{15}}{m_P^9 t_p^{11}} = \frac{(2\pi^2\Omega^2)^{15}}{(1)^9(2\pi)^{11}}.\frac{l^{15}}{k^9t^{11}} = 2^4\pi^{19}\Omega^{30} \tag{28}$$

$$\frac{l^{15}}{k^9t^{11}} = \frac{(.20322087^{-36})^{15}}{(.217672818^{-7})^9(.171585513^{-43})^{11}}\frac{u^{-13*15}}{u^{15*9}u^{-30*11}} = 1 \tag{29}$$

$$\frac{A^3L^3}{T} = \frac{A_Q^3 l_p^3}{t_p} = \frac{(2^6\pi^3\Omega^3)^3(2\pi^2\Omega^2)^3}{(\alpha)^3(2\pi)}.\frac{a^3l^3}{t} = \frac{2^{20}\pi^{14}\Omega^{15}}{\alpha^3} \tag{30}$$

$$\frac{a^3l^3}{t} = \frac{(.12691859^{23})^3(.20322087^{-36})^3}{(.171585513^{-43})}\frac{u^{3*3}u^{-13*3}}{u^{-30}} = 1 \tag{31}$$

In 3.2 I defined MLTA in terms of PV, replacing MLTA with the PV derivations, we find that P and V themselves cancel leaving only the dimensionless components. In the unit-less ratios we find a commonality $(\Omega^{15})^n$.

$$\frac{L^{30}}{M^{18}T^{22}} = \frac{2^{180}\pi^{210}\Omega^{225}P^{135}}{V^{150}}/\frac{2^{18}\pi^{18}P^{36}}{V^{18}}.\frac{2^{154}\pi^{154}\Omega^{165}P^{99}}{V^{132}} \tag{32}$$

$$\frac{L^{30}}{M^{18}T^{22}} = (2^4\pi^{19}\Omega^{30})^2 \tag{33}$$

$$\frac{A^6L^6}{T^2} = \frac{2^{18}V^{18}}{\alpha^6P^{18}}.\frac{2^{36}\pi^{42}\Omega^{45}P^{27}}{V^{30}}/\frac{2^{14}\pi^{14}\Omega^{15}P^9}{V^{12}} \tag{34}$$

$$\frac{A^6L^6}{T^2} = (\frac{2^{20}\pi^{14}\Omega^{15}}{\alpha^3})^2 \tag{35}$$

3.3. The electron formula $f_e$ is both unit-less and non scalable $v^0r^0u^0 = 1$. It is therefore a natural (mathematical) constant, $\sigma_e$ is a magnetic monopole (5.5), $\sigma_{tp}$ a hypothetical 'temperature monopole'.

$$T = (2\pi)\frac{r^9}{v^6},\ u^{-30} \tag{36}$$

$$\sigma_e = \frac{3\alpha^2AL}{\pi^2} = 2^7 3\pi^3\alpha\Omega^5\frac{r^3}{v^2},\ u^{-10} \tag{37}$$

$$f_e = \frac{\sigma_e^3}{T} = \frac{(2^7 3\pi^3\alpha\Omega^5)^3}{2\pi},\ units = \frac{(u^{-10})^3}{u^{-30}} = 1 \tag{38}$$

$$\sigma_{tp} = \frac{3\alpha^2T_P}{2\pi} = 2^6 3\pi^2\alpha\Omega^5\frac{v^4}{r^6},\ units = u^{20} \tag{39}$$

$$f_e = t_p^2\sigma_{tp}^3 = 4\pi^2(2^6 3\pi^2\alpha\Omega^5)^3,\ units = (u^{-30})^2(u^{20})^3 = 1 \tag{40}$$

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

$$\alpha = \frac{2h}{\mu_0 e^2 c} \tag{41}$$

$$\alpha = 2(8\pi^4\Omega^4)/(\frac{\alpha}{2^{11}\pi^5\Omega^4})(\frac{128\pi^4\Omega^3}{\alpha})^2(2\pi\Omega^2) = \alpha \tag{42}$$

$$scalars = \frac{r^{13}}{v^5}.\frac{1}{r^7}.\frac{v^6}{r^6}.\frac{1}{v} = 1 \tag{43}$$

$$units = \frac{u^{19}}{u^{56}(u^{-27})^2u^{17}} = 1 \tag{44}$$

3.5. I have also premised a 2nd mathematical constant which I have denoted $\Omega$ = 2.0071349496...;. We can find a solution for $\Omega$ using the formulas for the most precise constants $(c^* = V, \mu_0^*, R^*)$ and then solve by replacing the geometrical $(c^*, \mu_0^*, R^*)$ with the CODATA values for $(c, \mu_0, R, \alpha)$. We begin with a unit-less ratio for $(c^*, \mu_0^*, R^*)$;

$$\frac{(c^*)^{35}}{(\mu_0^*)^9(R^*)^7},\ units = \frac{(u^{17})^{35}}{(u^{56})^9(u^{13})^7} = 1 \tag{45}$$

$$\frac{(c^*)^{35}}{(\mu_0^*)^9(R^*)^7} = (2\pi\Omega^2)^{35}/(\frac{\alpha}{2^{11}\pi^5\Omega^4})^9.(\frac{1}{2^{23}3^3\pi^{11}\alpha^5\Omega^{17}})^7 \tag{46}$$

Rewriting the above in terms of $\Omega$;

$$\Omega^{225} = \frac{(c^*)^{35}}{2^{295}3^{21}\pi^{157}(\mu_0^*)^9(R^*)^7\alpha^{26}},\ units = 1 \tag{47}$$

There is a close natural number for $\Omega$ that is a sqrt and so may have a plus and minus solution when derived from $\Omega^2$ (5.0);

$$\Omega = \sqrt{\left(\frac{\pi^e}{e^{(e-1)}}\right)} = 2.0071\ 349\ 5432... \tag{48}$$

3.6. We can also numerically solve $G, h, e, m_e, k_B$ by first rewriting their geometrical formulas in terms of $(c^*, \mu_0^*, R^*)$ and then replacing with the CODATA values for $(c, \mu_0, R, \alpha)$ as in 3.5. Here I solve for Planck's constant.

$$h^* = 2^3\pi^4\Omega^4\frac{r^{13}}{v^5},\ u^{19} \tag{49}$$

$$(h^*)^3 = (2^3\pi^4\Omega^4\frac{r^{13}}{v^5})^3,\ u^{19*3} = \frac{2\pi^{10}(\mu_0^*)^3}{3^6(c^*)^5\alpha^{13}(R^*)^2},\ unit = u^{57} \tag{50}$$

Likewise with the other physical constants (5.8). The results are equivalent to those given in table p1.

$$(e^*)^3 = \frac{4\pi^5}{3^3(c^*)^4\alpha^8(R^*)},\ unit = u^{-81} \tag{51}$$

$$(k_B^*)^3 = \frac{\pi^5(\mu_0^*)^3}{3^3 2(c^*)^4\alpha^5(R^*)},\ unit = u^{87} \tag{52}$$

$$(G^*)^5 = \frac{\pi^3(\mu_0^*)}{2^{20}3^6\alpha^{11}(R^*)^2},\ unit = u^{30} \tag{53}$$

$$(m_e^*)^3 = \frac{16\pi^{10}(R^*)(\mu_0^*)^3}{3^6(c^*)^8\alpha^7},\ unit = u^{45} \tag{54}$$

$$(r_d)^3 = \frac{3^3 4\pi^5(\mu_0^*)^3\alpha^{19}(R^*)^2}{5^3(c^*)^{10}},\ unit = u^{24} \tag{55}$$

## 4 Unit $u$

Here I assign a constant $\beta$; unit = $u$ and 2 unit-less ratios $i, j$.

$$\beta = 2\pi\Omega a^{1/3} = \frac{2\pi\Omega v}{r^2} = \frac{2\pi\Omega}{t^{2/15}k^{1/5}} = \frac{2\pi\Omega\sqrt{v}}{\sqrt{k}}\ ...,\ unit = u \tag{56}$$

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

$$j = \frac{r^{17}}{v^8},\ unit = \frac{u^{8*17}}{u^{17*8}} = 1$$

In terms of $\beta, i, j$ we can reproduce the formulas in 3.2

$$A = \beta^3(\frac{2^3}{\alpha}) = \frac{2^6\pi^3\Omega^3}{\alpha}\frac{v^3}{r^6},\ u^3 \tag{57}$$

$$G = \frac{\beta^6}{2^3\pi^2}(j) = 2^3\pi^4\Omega^6\frac{r^5}{v^2},\ u^6 \tag{58}$$

$$R = \beta^8(\sqrt{i}j) = \Omega^8 r,\ u^8 \tag{59}$$

$$L^{-1} = 4\pi\beta^{13}(ij) = \frac{1}{2\pi^2\Omega^2}\frac{v^5}{r^9},\ u^{13} \tag{60}$$

$$M = 2\pi\beta^{15}(ij^2) = \frac{r^4}{v},\ u^{15} \tag{61}$$

$$P = \beta^{16}(ij^2) = \Omega r^2,\ u^{16} \tag{62}$$

$$V = \beta^{17}(ij^2) = 2\pi\Omega^2 v,\ u^{17} \tag{63}$$

$$T_P^* = \frac{2^3\beta^{20}}{\pi\alpha}(ij^2) = \frac{2^7\pi^3\Omega^5}{\alpha}\frac{v^4}{r^6},\ u^{20} \tag{64}$$

$$T^{-1} = 2\pi\beta^{30}(i^2j^3) = \frac{1}{2\pi}\frac{v^6}{r^9},\ u^{30} \tag{65}$$

$$\mu_0^* = \frac{\pi^3\alpha\beta^{56}}{2^3}(i^4j^7) = \frac{\alpha}{2^{11}\pi^5\Omega^4}r^7,\ u^{56} \tag{66}$$

$$\epsilon_0^{*-1} = \frac{\pi^3\alpha\beta^{90}}{2^3}(i^6j^{11}) = \frac{\alpha}{2^9\pi^3}v^2r^7,\ u^{90} \tag{67}$$

In SI units these $\beta$, $j$ scalar ratios solve to;

$$a^{1/3} = \frac{v}{r^2} = \frac{1}{t^{2/15}k^{1/5}} = \frac{\sqrt{v}}{\sqrt{k}}... = 23326079.1...;\ unit = u \tag{68}$$

$$\frac{r^{17}}{v^8} = k^2 t = \frac{k^{17/4}}{v^{15/4}} = ... = .812997...x10^{-59},\ units = 1 \tag{69}$$

Here I repeat the above but with units (and SI equivalents);

$$u,\ units = \sqrt{\frac{L}{MT}} = \sqrt{\frac{m}{kgs}} \tag{70}$$

$$x,\ units = \sqrt{\frac{M^9T^{11}}{L^{15}}} = \sqrt{\frac{kg^9s^{11}}{m^{15}}} = 1 \tag{71}$$

$$y,\ units = M^2T = kg^2s = 1\ (eq69) \tag{72}$$

In terms of $u, x, y$, we can reproduce the units;

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

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

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

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

$$u^{16}(xy^2) = \frac{M^{1/2}L^{1/2}}{T^{1/2}} = P,\ (Q...q),\ (eq76)$$

$$u^{17}(xy^2) = L/T = V,\ (c...m/s)$$

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

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

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

$$T/(AL)^3;\ units = \frac{(u^{13}*x*y)^3}{u^9*(u^{30}*x^2*y^3)} = x \tag{73}$$

$$T^2T_P^3;\ units = \frac{(u^{20}*x*y^2)^3}{(u^{30}*x^2*y^3)^2} = 1/x \tag{74}$$

$$M^9T^{11}/L^{15};\ units = \frac{(u^{15}*x*y^2)^9*(u^{13}*x*y)^{15}}{(u^{30}*x^2*y^3)^{11}} = x^2 \tag{75}$$

Appendix: In this example I derive LPVA in terms of MT

$M = (1)k$

$T = (2\pi)t$

$$P = (\Omega)\ \frac{k^{4/5}}{t^{2/15}} \tag{76}$$

$$V = \frac{2\pi P^2}{M} = (2\pi\Omega^2)\ \frac{k^{3/5}}{t^{4/15}} \tag{77}$$

$$L = \frac{TV}{2} = (2\pi^2\Omega^2)\ k^{3/5}t^{11/15} \tag{78}$$

$$A = \frac{8V^3}{\alpha P^3} = \left(\frac{64\pi^3\Omega^3}{\alpha}\right)\ \frac{1}{k^{3/5}t^{2/5}} \tag{79}$$

## 5 Virtual electron

Here I reproduce the axioms using only SI units. In section 3 I set $P$ = sqrt of momentum, here I set the SI equivalent $Q$ = sqrt of Planck momentum and use this to link the mass and the charge constants. From the formulas for the charge constants I then derive a formula for a magnetic monopole (ampere-meter AL) and from this a formula for $f_e$.

Defining $Q$ as the sqrt of Planck momentum where Planck momentum $= m_P c = 2\pi Q^2 = 6.52485...\ kg.m/s$, and a unit $q$ whereby $q^2 = kg.m/s$ giving;

$$Q = 1.019\ 113\ 411...,\ unit = q \tag{80}$$

Planck momentum; $2\pi Q^2,\ units = q^2$,

Planck length; $l_p,\ units = m = q^2 s/kg$,

$c,\ units = m/s = q^2/kg$;

5.1. In Planck terms the mass constants are typically defined in terms of Planck mass, here I use Planck momentum;

$$m_P = \frac{2\pi Q^2}{c},\ unit = kg \tag{81}$$

$$E_p = m_P c^2 = 2\pi Q^2 c,\ units = \frac{kg.m^2}{s^2} = \frac{q^4}{kg} \tag{82}$$

$$t_p = \frac{2l_p}{c},\ unit = s \tag{83}$$

$$F_p = \frac{2\pi Q^2}{t_p},\ units = \frac{q^2}{s} \tag{84}$$

5.2. The charge constants in terms of $Q^3, c, \alpha, l_p$;

$$A_Q = \frac{8c^3}{\alpha Q^3},\ unit\ A = \frac{m^3}{q^3 s^3} = \frac{q^3}{kg^3} \tag{85}$$

$$e = A_Q t_p = \frac{8c^3}{\alpha Q^3}.\frac{2l_p}{c} = \frac{16 l_p c^2}{\alpha Q^3},\ units = A.s = \frac{q^3 s}{kg^3} \tag{86}$$

$$T_p = \frac{A_Q c}{\pi} = \frac{8c^3}{\alpha Q^3}.\frac{c}{\pi} = \frac{8c^4}{\pi\alpha Q^3},\ units = \frac{q^5}{kg^4} \tag{87}$$

$$k_B = \frac{E_p}{T_p} = \frac{\pi^2\alpha Q^5}{4c^3},\ units = \frac{kg^3}{q} \tag{88}$$

5.3. As with $c$, the permeability of vacuum $\mu_0$ has been assigned an exact numerical value so it is our next target. The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross section, and placed 1 meter apart in vacuum, would produce between these conductors a force equal to exactly $2.10^{-7}$ newton per meter of length.

$$\frac{F_{electric}}{A_Q^2} = \frac{F_p}{\alpha}.\frac{1}{A_Q^2} = \frac{2\pi Q^2}{\alpha t_p}.(\frac{\alpha Q^3}{8c^3})^2 = \frac{\pi\alpha Q^8}{64 l_p c^5} = \frac{2}{10^7} \tag{89}$$

$$\mu_0 = \frac{\pi^2\alpha Q^8}{32 l_p c^5} = \frac{4\pi}{10^7},\ units = \frac{kg.m}{s^2 A^2} = \frac{kg^6}{q^4 s} \tag{90}$$

5.4. Rewritting Planck length $l_p$ in terms of $Q, c, \alpha, \mu_0$;

$$l_p = \frac{\pi^2\alpha Q^8}{32\mu_0 c^5},\ unit = \frac{q^2 s}{kg} = m \tag{91}$$

5.5. A magnetic monopole in terms of $Q, c, \alpha, l_p$;

The ampere-meter is the SI unit for pole strength (the product of charge and velocity) in a magnet ($Am = ec$). A magnetic monopole $\sigma_e$ is a hypothetical particle that is a magnet with only 1 pole [12]. I propose a magnetic monopole $\sigma_e$ from $\alpha, e, c$ ($\sigma_e = 0.13708563x10^{-6}$);

$$\sigma_e = \frac{3\alpha^2 ec}{2\pi^2},\ units = \frac{q^5 s}{kg^4} \tag{92}$$

I then use this monopole to construct an electron formula $f_e$ ($f_e = 0.2389545x10^{23}$);

$$f_e = \frac{\sigma_e^3}{t_p} = \frac{2^8 3^3\alpha^3 l_p^2 c^{10}}{\pi^6 Q^9} = \frac{3^3\alpha^5 Q^7}{4\pi^2\mu_0^2},\ units = \frac{q^{15}s^2}{kg^{12}} \tag{93}$$

5.6. The most precisely measured of the natural constants is the Rydberg constant $R_\infty$ and so it is important to this model. The unit for $R_\infty$ is $1/m$. For $m_e$ see eq(101);

$$R_\infty = \frac{m_e e^4\mu_0^2 c^3}{8h^3} = \frac{2^5 c^5\mu_0^3}{3^3\pi\alpha^8 Q^{15}},\ units = \frac{1}{m} = \frac{kg^{13}}{q^{17}s^3} \tag{94}$$

This however now gives us 2 solutions for length $m$, if they are both valid then there must be a ratio whereby the units $q, s, kg$ overlap and cancel;

$$m = \frac{q^2 s}{kg}.\frac{q^{15}s^2}{kg^{12}} = \frac{q^{17}s^3}{kg^{13}};\ thus\ \frac{q^{15}s^2}{kg^{12}} = 1 \tag{95}$$

and so we can further reduce the number of units required, for example we can define $s$ in terms of $kg, q$;

$$s = \frac{kg^6}{q^{15/2}} \tag{96}$$

$$\mu_0 = \frac{kg^6}{q^4 s} = q^{7/2} \tag{97}$$

5.7. We find that this ratio is embedded in that electron formula $f_e$ (eq 89), and so $f_e$ is a dimensionless mathematical constant whose function appears to be dictating the frequency of the Planck units;

$$f_e = \frac{\sigma_e^3}{t_p};\ units = \frac{q^{15}s^2}{kg^{12}} = 1 \tag{98}$$

Replacing $q$ with the more familiar $m$ gives this ratio;

$$q^2 = \frac{kg.m}{s};\ q^{30} = (\frac{kg.m}{s})^{15} = \frac{kg^{24}}{s^4} \tag{99}$$

$$units = \frac{kg^9 s^{11}}{m^{15}} = 1 \tag{100}$$

Electron mass as frequency of Planck mass:

$$m_e = \frac{m_P}{f_e},\ unit = kg \tag{101}$$

Electron wavelength via Planck length:

$$\lambda_e = 2\pi l_p f_e,\ units = m = \frac{q^2 s}{kg} \tag{102}$$

Gravitation coupling constant:

$$\alpha_G = (\frac{m_e}{m_P})^2 = \frac{1}{f_e^2},\ units = 1 \tag{103}$$

5.8. The Rydberg constant $R_\infty$ = 10973731.568508(65) [15] has been measured to a 12 digit precision. The known precision of Planck momentum and so $Q$ is low, however with the formula for the Rydberg we may re-write $Q$ as $Q^{15}$ in terms of; $c$, $\mu_0$, $R$ and $\alpha$;

$$Q^{15} = \frac{2^5 c^5 \mu_0^3}{3^3 \pi \alpha^8 R},\ units = \frac{kg^{12}}{s^2} = q^{15} \tag{104}$$

Using the formulas for $Q^{15}$ and $l_p$ we can re-write the least accurate dimensioned constants in terms of the most accurate constants; $R, c, \mu_0, \alpha$. I first convert the constants until they include a $Q^{15}$ term which can then be replaced by eq(104). I find these formulas are equivalent to the formulas in 3.6. Setting unit $x$ as;

$$unit\ x = \frac{kg^{12}}{q^{15}s^2} = 1 \tag{105}$$

Elementary charge $e$ = 1.602 176 51130 e-19 (table p1)

$$e = \frac{16 l_p c^2}{\alpha Q^3} = \frac{\pi^2 Q^5}{2\mu_0 c^3},\ units = \frac{q^3 s}{kg^3} \tag{106}$$

$$e^3 = \frac{\pi^6 Q^{15}}{8\mu_0^3 c^9} = \frac{4\pi^5}{3^3 c^4 \alpha^8 R},\ units = \frac{kg^3 s}{q^6} = (\frac{q^3 s}{kg^3})^3.x \tag{107}$$

Planck constant $h$ = 6.626 069 134 e-34

$$h = 2\pi Q^2 2\pi l_p = \frac{4\pi^4 \alpha Q^{10}}{8\mu_0 c^5},\ units = \frac{q^4 s}{kg} \tag{108}$$

$$h^3 = (\frac{4\pi^4 \alpha Q^{10}}{8\mu_0 c^5})^3 = \frac{2\pi^{10}\mu_0^3}{3^6 c^5 \alpha^{13} R^2},\ units = \frac{kg^{21}}{q^{18}s} = (\frac{q^4 s}{kg})^3.x^2 \tag{109}$$

Boltzmann constant $k_B$ = 1.379 510 14752 e-23

$$k_B = \frac{\pi^2 \alpha Q^5}{4c^3},\ units = \frac{kg^3}{q} \tag{110}$$

$$k_B^3 = \frac{\pi^5 \mu_0^3}{3^3 2 c^4 \alpha^5 R},\ units = \frac{kg^{21}}{q^{18}s^2} = (\frac{kg^3}{q})^3.x \tag{111}$$

Gravitation constant $G$ = 6.672 497 19229 e-11

$$G = \frac{c^2 l_p}{m_P} = \frac{\pi \alpha Q^6}{64\mu_0 c^2},\ units = \frac{q^6 s}{kg^4} \tag{112}$$

$$G^5 = \frac{\pi^3 \mu_0}{2^{20} 3^6 \alpha^{11} R^2},\ units = kg^4 s = (\frac{q^6 s}{kg^4})^5.x^2 \tag{113}$$

Planck length

$$l_p^{15} = \frac{\pi^{22}\mu_0^9}{2^{35} 3^{24} c^{35} \alpha^{49} R^8},\ units = \frac{kg^{81}}{q^{90}s} = (\frac{q^2 s}{kg})^{15}.x^8 \tag{114}$$

Planck mass

$$m_P^{15} = \frac{2^{25}\pi^{13}\mu_0^6}{3^6 c^5 \alpha^{16} R^2},\ units = kg^{15} = \frac{kg^{39}}{q^{30}s^4}.\frac{1}{x^2} \tag{115}$$

Electron mass $m_e$ = 9.109 382 31256 e-31

$$m_e^3 = \frac{16\pi^{10} R \mu_0^3}{3^6 c^8 \alpha^7},\ units = kg^3 = \frac{kg^{27}}{q^{30}s^4}.\frac{1}{x^2} \tag{116}$$

Ampere

$$A_Q^5 = \frac{2^{10}\pi 3^3 c^{10}\alpha^3 R}{\mu_0^3},\ units = \frac{q^{30}s^2}{kg^{27}} = (\frac{q^3}{kg^3})^5.\frac{1}{x} \tag{117}$$

5.9. Alpha the fine structure constant

$$\alpha = \frac{2h}{\mu_0 e^2 c} = 2.2\pi Q^2 2\pi l_p.\frac{32 l_p c^5}{\pi^2 \alpha Q^8}.\frac{\alpha^2 Q^6}{256 l_p^2 c^4}.\frac{1}{c} = \alpha \tag{118}$$

5.10. $(r = \sqrt{q})$

There is a solution for an $r^2 = q$, it is the radiation density constant from the Stefan Boltzmann constant $\sigma$;

$$\sigma = \frac{2\pi^5 k_B^4}{15h^3 c^2},\ r_d = \frac{4\sigma}{c},\ units = r \tag{119}$$

$$r_d^3 = \frac{3^3 4\pi^5 \mu_0^3 \alpha^{19} R^2}{5^3 c^{10}},\ units = \frac{kg^{30}}{q^{36}s^5}.\frac{1}{x^2} = \frac{kg^6}{q^6 s} = r^3 \tag{120}$$

## 6 Virtual universe

The electron formula $f_e$ can be constructed from amperemeters AL and time T and yet it is a dimensionless (mathematical) constant;

$f_e = (AL)^3/T = 0.239x10^{23}$, units = 1

This formula has 3 space dimensions $L^3$ and 1 time dimension $T$. We could then speculate that if the vacuum of our 3-D space is electro-magnetic in nature such that it is also a construct of an ampere-meters $(AL)^3$ 'ether' instead of an empty void measured in $L^3$ meters, then the sum universe may also be a dimensionless (mathematical) constant (aka a virtual universe) where X determines the frequency of the universe [27];

$f_{universe} = X(AL)^3/T$, units = 1

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 deconstructed 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.

## 7 Notes

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? [24]

J. Barrow and J. Webb on the fundamental 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 [23].

"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 [26].

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].

This article is an extension of an earlier article [26] which has been incorporated as section 5. The formulas used in this article can be downloaded in maple format [11].

### References

1. Linnebo, Øystein, "Platonism in the Philosophy of Mathematics", The Stanford Encyclopedia of Philosophy (Summer 2017 Edition), Edward N. Zalta (ed.), plato.stanford.edu/archives/sum2017/entries/platonism-mathematics
2. Nick Bostrom, Philosophical Quarterly 53 (211):243–255 (2003)
3. https://en.wikipedia.org/wiki/Philosophy-of-mathematics (22, Oct 2017)
4. Leonardo Hsu, Jong-Ping Hsu; The physical basis of natural units; Eur. Phys. J. Plus (2012) 127:11

5. Michael J. Duff et al JHEP03(2002)023 Trialogue on the number of fundamental constants
6. J. Barrow, J. Webb, Inconstant Constants, Scientific American 292, 56 - 63 (2005)
7. M. Planck, Uber irreversible Strahlungsforgange. Ann. d. Phys. (4), (1900) 1, S. 69-122.
8. A. Burinskii, Gravitation and Cosmology, 2008, Vol. 14, No. 2, pp. 109–122; Pleiades Publishing, 2008.
DOI: 10.1134/S0202289308020011
9. Feynman, Richard P. (1977). The Feynman Lectures on Physics, vol. I. Addison-Wesley. p. 22-10. ISBN 0-201-02010-6.
10. Tegmark, Max (February 2008). ”The Mathematical Universe”. Foundations of Physics. 38 (2): 101–150.
11. planckmomentum.com/calc/ (online calculator)
12. Magnetic monopole
en.wikipedia.org/wiki/Magnetic-monopole (10/2015)
13. Fine structure constant
en.wikipedia.org/wiki/Fine-structure-constant (06/2015)
14. Burinskii, A. (2005). ”The Dirac–Kerr electron”. arXiv:hep-th/0507109
15. Rydberg constant
http://physics.nist.gov/cgi-bin/cuu/Value?ryd
16. Planck constant
http://physics.nist.gov/cgi-bin/cuu/Value?ha
17. Electron mass
http://physics.nist.gov/cgi-bin/cuu/Value?me
18. Fine structure constant
http://physics.nist.gov/cgi-bin/cuu/Value?alphinv
19. Elementary charge
http://physics.nist.gov/cgi-bin/cuu/Value?e
20. Vacuum of permeability
http://physics.nist.gov/cgi-bin/cuu/Value?mu0
21. Gravitation constant
http://physics.nist.gov/cgi-bin/cuu/Value?bg
22. Boltzmann constant
http://physics.nist.gov/cgi-bin/cuu/Value?k
23. https://en.wikipedia.org/wiki/Theory-of-everything (02/2016)
24. Ariel Amir, Mikhail Lemeshko, Tadashi Tokieda; 26/02/2016
Surprises in numerical expressions of physical constants
arXiv:1603.00299 [physics.pop-ph]
25. Dirac, Paul, The Evolution of the Physicist's Picture of Nature, June 25, 2010
https://blogs.scientificamerican.com/guest-blog/the-evolution-of-the-physicists-picture-of-nature/
26. Macleod, Malcolm, A virtual black-hole electron and the sqrt of Planck momentum,
http://vixra.org/pdf/1102.0032v9.pdf
27. Macleod, Malcolm; 2017 edition (online), God the Programmer, the philosophy behind a Virtual Universe,
http://platoscode.com/