Derivation of fundamental constants and SI units via black-hole electron

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The fundamental physical constants are regarded as immutable and as non-derivable from more fundamental principles. They can be categorized between dimensionless and dimensionful constants, i.e.: those that describe a physical quantity but whose numerical value depends on the system of units used. Described here is a model of a geometrical electron function from which can be derived the SI system of units and the dimensionful constants. The electron is understood as periodically oscillating between 2 states; a magnetic-monopole (temperature) 'electric-state' and a (Planck time = 1, Planck mass = 1) 'mass-state' suggesting a Planck black-hole center. The mass-state occurs when the units for the magnetic-monopole combine with time and cancel each other according to this ratio M^9T^{11}/L^{15} (units = 1); as such the mass M, length L and time T dimensions of this electron function are not independent but overlap. The dimensionless geometry components of mass M=1, time T=2π, length L=$2\pi^2\Omega^2$ suggest angular motion may be the means by which dimensionality is conferred upon dimensionless geometrical forms, a key condition for a mathematical universe hypothesis. The sqrt of Planck momentum is used to link the charge constants with the mass constants, this permits us to define and solve the least accurate dimensionful constants G, h, e, m_e, k_B... using alpha and the 3 most accurate dimensionful constants; c, μ_0 (exact values), and the Rydberg constant (12-13 digits precision).

Table 1	Calculated using R, c, μ_0, α	CODATA 2014
Fine structure constant alpha	(137.035999 139)	α = 137.035 999 139(31) [14]
Rydberg constant	(10973731.568 508)	R_∞ = 10 973 731.568 508(65) [12]
Planck constant	h^* = 6.626 069 134 e-34	h = 6.626 070 040(81) e-34 [13]
Elementary charge	e^* = 1.602 176 511 30 e-19	e = 1.602 176 6208(98) e-19 [15]
Electron mass	m_e^* = 9.109 382 312 56 e-31	m_e = 9.109 383 56(11) e-31 [16]
Boltzmann's constant	k_B^* = 1.379 510 147 52 e-23	k_B = 1.380 648 52(79) e-23 [19]
Gravitation constant	G^* = 6.672 497 192 29 e-11	G = 6.674 08(31) e-11 [18]

keywords: mathematical universe hypothesis, magnetic monopole, fundamental constants, fine structure constant alpha, omega, black-hole electron, Dirac Kerr–Newman electron, Planck unit theory;

1 Background

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...”
-M Planck [11].

”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* [2].

L. and J. Hsu have argued that ”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” [1].

2 Dimensionless ratio M^9T^{11}/L^{15}

A mass-time-length ratio is introduced in which the 3 MTL units appear to overlap and cancel leaving a dimensionless formula f_e (units = 1) that dictates the periodicity of the electron. Accordingly, via the electron geometry we may reduce the number of required units to derive and solve the dimensionful constants and the SI units to 2.

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;

$$Q = 1.019\ 113\ 411...,\ unit = q \tag{1}$$

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

2.1. The mass constants in terms of units Q^2, c, l_p;

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

$$E_p = m_P c^2 = 2\pi Q^2 c,\ units = \frac{kg.m^2}{s^2} = \frac{q^4}{kg} \tag{3}$$

$$t_p = \frac{2l_p}{c},\ unit = s \tag{4}$$

$$F_p = \frac{2\pi Q^2}{t_p},\ units = \frac{q^2}{s} \tag{5}$$

2.2. The charge constants in terms of Q^3, c, α, l_p;

$$A_Q = \frac{8c^3}{\alpha Q^3},\ unit\ A = \frac{m^3}{q^3 s^3} = \frac{q^3}{kg^3} \tag{6}$$

$$e = A_Q t_p = \frac{8c^3}{\alpha Q^3}.\frac{2l_p}{c} = \frac{16 l_p c^2}{\alpha Q^3},\ units = A.s = \frac{q^3 s}{kg^3} \tag{7}$$

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

$$k_B = \frac{E_p}{T_p} = \frac{\pi^2 \alpha Q^5}{4c^3},\ units = \frac{kg^3}{q} \tag{9}$$

2.3. 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.

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

$$\mu_0 = \frac{\pi^2 \alpha Q^8}{32 l_p c^5} = \frac{4\pi}{10^7},\ units = \frac{kg.m}{s^2 A^2} = \frac{kg^6}{q^4 s} \tag{11}$$

2.4. Planck length l_p in terms of Q, c, α, μ_0 from eq(11);

$$l_p = \frac{\pi^2 \alpha Q^8}{32 \mu_0 c^5},\ unit = \frac{q^2 s}{kg} = m \tag{12}$$

2.5. A magnetic monopole in terms of Q, c, α, 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 σ_e is a hypothetical particle that is a magnet with only 1 pole [8].
A proposed magnetic monopole $\sigma_e = 0.137085627x10^{-6}$;

$$\sigma_e = \frac{3\alpha^2 ec}{2\pi^2},\ units = \frac{q^5 s}{kg^4} \tag{13}$$

An electron periodicity function $f_e = 0.2389545246x10^{23}$;

$$f_e = \frac{\sigma_e^3}{t_p} = \frac{2^8 3^3 \alpha^3 l_p^2 c^{10}}{\pi^6 Q^9} = \frac{3^3 \alpha^5 Q^7}{4\pi^2 \mu_0^2},\ units = \frac{q^{15} s^2}{kg^{12}} \tag{14}$$

2.6. Rydberg constant R_∞, note for m_e see eq(23);

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

We now have 2 solutions for m, if they are both valid then we find a ratio whereby our units overlap and cancel;

$$m = \frac{q^2 s}{kg}.\frac{q^{15} s^2}{kg^{12}} = \frac{q^{17} s^3}{kg^{13}};\ \frac{q^{15} s^2}{kg^{12}} = 1 \tag{16}$$

and so we can reduce the number of units required from 3 to 2, for example we can define s in terms of kg, q;

$$s = \frac{kg^6}{q^{15/2}} \tag{17}$$

$$R = \frac{q^{11/2}}{kg^5} \tag{18}$$

$$\mu_0 = q^{7/2} \tag{19}$$

We find this ratio is defined in the electron function f_e eq(14);

$$f_e = \frac{\sigma_e^3}{t_p};\ units = \frac{q^{15} s^2}{kg^{12}} = 1 \tag{20}$$

Replacing q with the more familiar m eq(16) gives this ratio in terms of MLT;

$$q^2 = \frac{kg.m}{s};\ q^{30} = (\frac{kg.m}{s})^{15} = \frac{kg^{24}}{s^4} \tag{21}$$

$$\frac{kg^9 s^{11}}{m^{15}} = 1 \tag{22}$$

Electron mass:

$$m_e = \frac{m_P}{f_e},\ unit = kg \tag{23}$$

Electron wavelength:

$$\lambda_e = 2\pi l_p f_e,\ units = m = \frac{q^2 s}{kg} \tag{24}$$

Gravitation coupling constant:

$$\alpha_G = (\frac{m_e}{m_P})^2 = \frac{1}{f_e^2},\ units = 1 \tag{25}$$

The Rydberg constant R_∞ = 10973731.568508(65) [12] with a 12-13 digit precision is the most accurate of the natural constants. The known precision of Planck momentum and so Q is low, however with the solution for the Rydberg constant eq(15) we may re-write Q in terms of; c, μ_0, R and α;

$$Q^{15} = \frac{2^5 c^5 \mu_0^3}{3^3 \pi \alpha^8 R},\ units = \frac{kg^{12}}{s^2} = q^{15} \tag{26}$$

Using the formlas for Q^{15} eq(26) and l_p eq(12) we can re-write the least accurate constants in terms of the most accurate (table p1). We convert the constants until they include a Q^{15} term which can then be replaced by eq(26). Setting unit x as;

$$x = \frac{kg^{12}}{q^{15} s^2} = 1 \tag{27}$$

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

$$e = \frac{16 l_p c^2}{\alpha Q^3} = \frac{\pi^2 Q^5}{2\mu_0 c^3},\ units = \frac{q^3 s}{kg^3} \tag{28}$$

$$e^3 = \frac{\pi^6 Q^{15}}{8\mu_0^3 c^9} = \frac{4\pi^5}{3^3 c^4 \alpha^8 R},\ units = \frac{kg^3 s}{q^6} = (\frac{q^3 s}{kg^3})^3.x \tag{29}$$

Planck constant h = 6.626 069 134 e-34

$$h = 2\pi Q^2 2\pi l_p = \frac{4\pi^4 \alpha Q^{10}}{8\mu_0 c^5},\ units = \frac{q^4 s}{kg} \tag{30}$$

$$h^3 = (\frac{4\pi^4 \alpha Q^{10}}{8\mu_0 c^5})^3 = \frac{2\pi^{10}\mu_0^3}{3^6 c^5 \alpha^{13} R^2},\ units = \frac{kg^{21}}{q^{18} s} = (\frac{q^4 s}{kg})^3.x^2 \tag{31}$$

Boltzmann constant k_B = 1.379 510 14752 e-23

$$k_B = \frac{\pi^2 \alpha Q^5}{4c^3},\ units = \frac{kg^3}{q} \tag{32}$$

$$k_B^3 = \frac{\pi^5 \mu_0^3}{3^3 2 c^4 \alpha^5 R},\ units = \frac{kg^{21}}{q^{18} s^2} = (\frac{kg^3}{q})^3.x \tag{33}$$

Gravitation constant G = 6.672 497 19229 e-11

$$G = \frac{c^2 l_p}{m_P} = \frac{\pi \alpha Q^6}{64\mu_0 c^2},\ units = \frac{q^6 s}{kg^4} \tag{34}$$

$$G^5 = \frac{\pi^3 \mu_0}{2^{20} 3^6 \alpha^{11} R^2},\ units = kg^4 s = (\frac{q^6 s}{kg^4})^5.x^2 \tag{35}$$

Planck length eq(12)

$$l_p^{15} = \frac{\pi^{22}\mu_0^9}{2^{35} 3^{24} c^{35} \alpha^{49} R^8},\ units = \frac{kg^{81}}{q^{90} s} = (\frac{q^2 s}{kg})^{15}.x^8 \tag{36}$$

Planck mass

$$m_P^{15} = \frac{2^{25}\pi^{13}\mu_0^6}{3^6 c^5 \alpha^{16} R^2},\ units = kg^{15} = \frac{kg^{39}}{q^{30} s^4}.\frac{1}{x^2} \tag{37}$$

Electron mass m_e = 9.109 382 31256 e-31

$$m_e^3 = \frac{16\pi^{10} R \mu_0^3}{3^6 c^8 \alpha^7},\ units = kg^3 = \frac{kg^{27}}{q^{30} s^4}.\frac{1}{x^2} \tag{38}$$

Ampere

$$A_Q^5 = \frac{2^{10}\pi 3^3 c^{10} \alpha^3 R}{\mu_0^3},\ units = \frac{q^{30} s^2}{kg^{27}} = (\frac{q^3}{kg^3})^5.\frac{1}{x} \tag{39}$$

2.7. ($\sqrt{q}$)

There is a solution for an $\sqrt{q}$, it is the radiation density constant from the Stefan Boltzmann constant σ;

$$\sigma = \frac{2\pi^5 k_B^4}{15 h^3 c^2},\ r_d = \frac{4\sigma}{c},\ units = q^{1/2} \tag{40}$$

$$r_d^3 = \frac{3^3 4\pi^5 \mu_0^3 \alpha^{19} R^2}{5^3 c^{10}},\ units = \frac{kg^{30}}{q^{36} s^5}.\frac{1}{x^2} = \frac{kg^6}{q^6 s} = q^{3/2} \tag{41}$$

2.8. ($s^{1/3}$)

The unit s can be reduced to the magnetic monopole σ_e units = $s^{1/3}$ and to Planck temperature T_P, units = $s^{2/3}$;

$$\sigma_e = \frac{3\alpha^2 ec}{\pi^2},\ units = s^{1/3} \tag{42}$$

$$f_e = \frac{\sigma_e^3}{t_p},\ units = \frac{(s^{1/3})^3}{s} = 1 \tag{43}$$

$$T_P = \frac{A_Q c}{\pi},\ units = \frac{1}{s^{2/3}} \tag{44}$$

$$\sigma_{tp} = \frac{3\alpha^2 T_P}{2\pi},\ units = \frac{1}{s^{2/3}} \tag{45}$$

$$f_e = t_p^2 \sigma_{tp}^3,\ units = \frac{s^2}{(s^{2/3})^3} = 1 \tag{46}$$

3 Base units

The dimensionful constants G, h, c, e, k_B, m_e can be defined in terms of the geometry of 2 dimensionless terms α, Ω and 2 (scalable) units. Example 3.1. uses the scalar units (k, t), example 3.2. uses scalar units (p, v).

3.1. MLTVPA in terms of mass k and time t;

$$M = (1)k,\ (mass) \tag{47}$$

$$T = (2\pi)t,\ (time) \tag{48}$$

$$P = (\Omega)p,\ p = \frac{k^{4/5}}{t^{2/15}}\ (sqrt\ of\ momentum) \tag{49}$$

$$V = \frac{2\pi P^2}{M} = (2\pi\Omega^2)v,\ v = \frac{k^{3/5}}{t^{4/15}}\ (velocity) \tag{50}$$

$$L = \frac{TV}{2} = (2\pi^2\Omega^2)l,\ l = k^{3/5} t^{11/15}\ (length) \tag{51}$$

$$A = \frac{8V^3}{\alpha P^3} = (\frac{64\pi^3\Omega^3}{\alpha})a,\ a = \frac{1}{k^{3/5} t^{2/5}}\ (ampere) \tag{52}$$

3.2. MLTVPA in terms of sqrt of momentum p, velocity v;

$$P = (\Omega)p \quad (53)$$

$$V = (2\pi\Omega^2)v \quad (54)$$

$$T = (2\pi)\ \frac{p^{9/2}}{v^6} \quad (55)$$

$$M = \frac{2\pi P^2}{V} = (1)\ \frac{p^2}{v} \quad (56)$$

$$L = \frac{TV}{2} = (2\pi^2\Omega^2)\ \frac{p^{9/2}}{v^5} \quad (57)$$

$$A = \frac{8V^3}{\alpha P^3} = \left(\frac{64\pi^3\Omega^3}{\alpha}\right)\ \frac{v^3}{p^3} \quad (58)$$

3.3. The dimensionful constants in terms of MLTVPA;

$$G^* = \frac{V^2 L}{M} \quad (59)$$

$$T_P^* = \frac{AV}{\pi} \quad (60)$$

$$\mu_0^* = \frac{\pi V^2 M}{\alpha L A^2} \quad (61)$$

$$e^* = AT \quad (62)$$

$$h^* = 4\pi^2 LMV \quad (63)$$

$$k_B^* = \frac{\pi VM}{A} \quad (64)$$

$$m_e^* = \frac{M}{f_e},\ f_e = \frac{\sigma_e^3}{T} = \frac{(2^7\pi^3 3\alpha\Omega^5)^3}{2\pi} \quad (65)$$

As α and Ω are dimensionless and so have fixed numerical values we need only determine the values of 2 scalars from *mltpva* to solve the physical constants for any set of units, we could measure mass k as an imperial unit using *lbs* instead of *kg* for example, thus these formulas retain their meaning for all times and all cultures, even non-terrestrial and non-human ones.

$M_{alien} = (1)k_{alien}$

$T_{alien} = (2\pi)t_{alien}$ ...

We may surmise that for a micro black hole $k_{bh} = t_{bh} = l_{bh}$ ... = 1. In SI units M = m_P, T = t_p, V = c, L = l_p...

3.4. Dimensionless c^*, μ_0^*, R^*;

$$R^* = \left(\frac{m_e}{4\pi l_p \alpha^2 m_P}\right) = \left(\frac{1}{2^{23}3^3\pi^{11}\alpha^5\Omega^{17}}\right).\frac{v^5}{p^{9/2}} \quad (66)$$

$$\mu_0^* = \frac{\pi V^2 M}{\alpha L A^2} = \left(\frac{\alpha}{2^{11}\pi^5\Omega^4}\right).\ p^{7/2} \quad (67)$$

$$\frac{(c^*)^{35}}{(\mu_0^*)^9 (R^*)^7},\ units = \frac{v^{35}}{(p^{7/2})^9 (v^5/p^{9/2})^7} = 1 \quad (68)$$

3.5. Setting p, v values for the SI units via c, μ_0;

$$V = c = (2\pi\Omega^2)v,\ v = 11843707.85\ m/s \quad (69)$$

$$p^{7/2} = \frac{2^{11}\pi^5\Omega^4\mu_0}{\alpha},\ p = 0.50774534\ q,\ (Q = \Omega p) \quad (70)$$

From eq(68) we can solve $\Omega = 2.0071349496...$, as the units cancel we may ignore them;

$$\frac{(c^*)^{35}}{(\mu_0^*)^9 (R^*)^7} = (2\pi\Omega^2)^{35}/\left(\frac{\alpha}{2^{11}\pi^5\Omega^4}\right)^9.\left(\frac{1}{2^{23}3^3\pi^{11}\alpha^5\Omega^{17}}\right)^7 \quad (71)$$

$$\Omega^{225} = \frac{(c^*)^{35}}{2^{295}3^{21}\pi^{157}(\mu_0^*)^9 (R^*)^7 \alpha^{26}},\ units = 1 \quad (72)$$

We can numerically solve the physical constants by replacing the mathematical (c^*, μ_0^*, R^*) with the CODATA mean values for (c, μ_0, R). For example (scalar units p, v);

$$h = 4\pi^2 LMV = \left(8\pi^4\Omega^4\ \frac{p^{13/2}}{v^5}\right) \quad (73)$$

We then find there is a combination of (c^*, μ_0^*, R^*) which reduces to h^3;

$$\frac{2\pi^{10}(\mu_0^*)^3}{3^6 (c^*)^5 \alpha^{13} (R^*)^2} = \left(8\pi^4\Omega^4\ \frac{p^{13/2}}{v^5}\right)^3 \quad (74)$$

We can now replace (c^*, μ_0^*, R^*) with the respective CODATA values to solve h^3 and so h (see table p1);

$$(h^*)^3 = \frac{2\pi^{10}(\mu_0^*)^3}{3^6 (c^*)^5 \alpha^{13} (R^*)^2} \quad (75)$$

Likewise with the other dimensionful constants;

$$e^* = AT = \left(\frac{128\pi^4\Omega^3}{\alpha}\right)\ \frac{p^{3/2}}{v^3} \quad (76)$$

$$(e^*)^3 = \frac{4\pi^5}{3^3 (c^*)^4 \alpha^8 (R^*)} = \left(\frac{128\pi^4\Omega^3}{\alpha}\right)^3\ \frac{p^{9/2}}{v^9} \quad (77)$$

$$k_B^* = \frac{\pi VM}{A} = \left(\frac{\alpha}{32\pi\Omega}\right)\ \frac{p^5}{v^3} \quad (78)$$

$$(k_B^*)^3 = \frac{\pi^5(\mu_0^*)^3}{3^3 2 (c^*)^4 \alpha^5 (R^*)} = \left(\frac{\alpha}{32\pi\Omega}\right)^3\ \frac{p^{15}}{v^9} \quad (79)$$

$$G^* = \frac{V^2 L}{M} = (8\pi^4\Omega^6)\ \frac{p^{5/2}}{v^2} \quad (80)$$

$$(G^*)^5 = \frac{\pi^3(\mu_0^*)}{2^{20}3^6\alpha^{11}(R^*)^2} = (8\pi^4\Omega^6)^5\,\frac{p^{25/2}}{v^{10}} \quad (81)$$

$$(m_e^*)^3 = \frac{16\pi^{10}(R^*)(\mu_0^*)^3}{3^6 (c^*)^8 \alpha^7}\ \left(units = \frac{p^6}{v^3}\right) \quad (82)$$

We note that these equations are equivalent to eq(28-38) derived from Q^{15} and l_p;

3.6. The electron frequency f_e;

$$\sigma_e = \frac{3\alpha^2 AL}{\pi^2} = \frac{3\alpha^2 ATV}{2\pi^2} = 2^7\pi^3 3\alpha\Omega^5,\ units = t^{1/3} \quad (83)$$

$$f_e = \frac{\sigma_e^3}{T} = \frac{(2^7\pi^3 3\alpha\Omega^5)^3}{2\pi},\ units = \frac{(t^{1/3})^3}{t} = 1 \quad (84)$$

$$\sigma_{tp} = \frac{3\alpha^2 T_P}{2\pi} = \frac{3\alpha^2 AV}{2\pi^2} = \frac{\sigma_e}{T} = 2^6\pi^2 3\alpha\Omega^5,\ units = \frac{1}{t^{2/3}} \quad (85)$$

$$f_e = t_p^2\sigma_{tp}^3 = 4\pi^2(2^6\pi^2 3\alpha\Omega^5)^3,\ units = \frac{t^2}{(t^{2/3})^3} = 1 \quad (86)$$

$$f_e = \sigma_e^2\sigma_{tp},\ units = \frac{(t^{1/3})^2}{t^{2/3}} = 1 \quad (87)$$

$$m_e = \frac{M}{f_e} \quad (88)$$

$$\lambda_e = 2\pi f_e L \quad (89)$$

$$\alpha_G = f_e^2 \quad (90)$$

eq(88-89) suggest a Planck unit theory whereby the frequency of the Planck units are dictated by the electron function f_e, eq(90) suggests gravity is a digital mass-state to mass-state interaction, thus gravity has a magnitude similar to the strong force but may occur only between particles simultaneously in the mass-state, hence its apparent weakness.

3.7. Example, defining scalars t in terms of $mlvpa$;

$$\frac{L^{15}}{M^9 T^{11}},\ \frac{P^{15}T^2}{M^{12}},\ \frac{V^{12}T^2}{P^9},\ \frac{T}{A^3L^3}...;\ units = 1 \quad (91)$$

such that we can solve numerically as SI units;

$t = t_p/(2\pi) = 0.1715855x10^{-43}$s
$m = 1m_p = 0.2176728x10^{-7}$kg
$l = l_p/(2\pi^2\Omega^2) = 0.20322087x10^{-36}$m eq(51)
$a = 0.126918589x10^{23}$A eq(52)

$$t = \frac{l^{15/11}}{m^{9/11}} = \frac{m^6}{p^{15/2}} = \frac{p^{9/2}}{v^6} = a^3 l^3 = \frac{l^{6/5}}{p^{9/10}} = \frac{1}{a^2 p^{3/2}}... \quad (92)$$

4 Notes

4.1. In this example MLTVPA are defined in terms of ampere and length a^3, l

$$A = \left(\frac{64\pi^3\Omega^3}{\alpha}\right) a^3 \quad (93)$$

$$L = (2\pi^2\Omega^2)\ l \quad (94)$$

$$T = (2\pi)\ l^3 a^9 \quad (95)$$

$$V = \frac{2L}{T} = (2\pi\Omega^2)\ \frac{1}{l^2 a^9} \quad (96)$$

$$M = \frac{8\pi V}{\alpha^{2/3}A^{2/3}} = (1)\frac{1}{l^2 a^{11}} \quad (97)$$

4.2. Statcoulomb q

$$q_1 q_2 = \frac{(e^*)^2}{4\pi(\epsilon_0^*)} = \frac{E_p l_p}{\alpha} = \frac{8\pi^4\Omega^6}{\alpha}.k^{14/5}t^{1/5} \quad (98)$$

4.3. Fine structure constant α

$$\alpha = \frac{2h}{\mu_0 e^2 c} = 2.2\pi Q^2 2\pi l_p.\frac{32 l_p c^5}{\pi^2\alpha Q^8}.\frac{\alpha^2 Q^6}{256 l_p^2 c^4}.\frac{1}{c} \quad (99)$$

$$\alpha = \frac{2(h^*)}{(\mu_0^*)(e^*)^2(c^*)}, units = 1 \quad (100)$$

$$2.(8\pi^4\Omega^4\frac{p^{13/2}}{v^5})/(\frac{\alpha}{2^{11}\pi^5\Omega^4}p^{7/2}).(\frac{128\pi^4\Omega^3}{\alpha}\frac{p^{3/2}}{v^3})^2.(2\pi\Omega^2 v) \quad (101)$$

4.4. Radiation density (2.7.)

$$r_d = \frac{4\sigma}{c} = \frac{\alpha^4}{2^{29}15\pi^{14}\Omega^{22}}r,\ (r = \sqrt{p} = \frac{k^{2/5}}{t^{1/15}}) \quad (102)$$

As Ω^{15} appears in dimensionless formulas;

$$P = \Omega p,\ units\ r^2 = p;\ r_d^2 \sim \frac{\Omega}{(\Omega^{15})^3} = \frac{1}{\Omega^{44}} \quad (103)$$

$$r_d^3 = \frac{3^3 4\pi^5(\mu_0^*)^3\alpha^{19}(R^*)^2}{5^3(c^*)^{10}} \quad (104)$$

4.5. Calculations using the CODATA 2006, 2010 values for α, R for comparison;

Calculated (R, c, μ_0, α)	CODATA 2010
(137.035999074)	α = 137.035999 074(44)
(10973731.568539)	R = 10973731.568 539(55)
6.626069 148 e-34	h = 6.626069 57(29) e-34
1.602176 513 e-19	e = 1.602176 565(35) e-19
9.109382 323 e-31	m_e = 9.109382 91(40) e-31
1.379 510149 e-23	k_B = 1.380 6488(13) e-23
6.672 497199 e-11	G = 6.673 84(80) e-11

Calculated (R, c, μ_0, α)	CODATA 2006
(137.035999679)	α = 137.035 999 679(94)
(10973731.568527)	R = 10973731.527 527(73)
6.626069 021 e-34	h = 6.626 068 96(33) e-34
1.602176 494 e-19	e = 1.602 176 487(40) e-19
9.109382 229 e-31	m_e = 9.109 382 15(45) e-31
1.379 510138 e-23	k_B = 1.380 6504(24) e-23
6.672 497134 e-11	G = 6.674 28(67) e-11

4.6. Dimensionful constants in terms of p, v

$$G^* = \frac{V^2 L}{M} = (8\pi^4\Omega^6)\ \frac{p^{5/2}}{v^2} \quad (105)$$

$$T_P^* = \frac{AV}{\pi} = \left(\frac{128\pi^3\Omega^5}{\alpha}\right)\ \frac{v^4}{p^3} \quad (106)$$

$$\mu_0^* = \frac{\pi V^2 M}{\alpha L A^2} = \left(\frac{\alpha}{2048\pi^5\Omega^4}\right)\ p^{7/2} \quad (107)$$

$$e^* = AT = \left(\frac{128\pi^4\Omega^3}{\alpha}\right)\ \frac{p^{3/2}}{v^3} \quad (108)$$

$$h^* = 2\pi LVM = (8\pi^4\Omega^4)\ \frac{p^{13/2}}{v^5} \tag{109}$$

$$k_B^* = \frac{\pi VM}{A} = \left(\frac{\alpha}{32\pi\Omega}\right)\ \frac{p^5}{v^3} \tag{110}$$

$$\epsilon_0^* = \frac{\alpha A^2 L}{\pi V^4 M} = \left(\frac{2^9\pi^3}{\alpha}\right)\ \frac{1}{p^{7/2}v^2} \tag{111}$$

4.7. Dimensionful constants in terms of k, t

$$G^* = \frac{V^2 L}{M} = (8\pi^4\Omega^6)\ k^{4/5}t^{1/5} \tag{112}$$

$$T_P^* = \frac{AV}{\pi} = \left(\frac{128\pi^3\Omega^5}{\alpha}\right)\ \frac{1}{t^{2/3}} \tag{113}$$

$$\mu_0^* = \frac{\pi V^2 M}{\alpha L A^2} = \left(\frac{\alpha}{2048\pi^5\Omega^4}\right)\ \frac{k^{14/5}}{t^{7/15}} \tag{114}$$

$$e^* = AT = \left(\frac{128\pi^4\Omega^3}{\alpha}\right)\ \frac{t^{3/5}}{k^{3/5}} \tag{115}$$

$$h^* = 2\pi LVM = (8\pi^4\Omega^4)\ k^{11/5}t^{7/15} \tag{116}$$

$$k_B^* = \frac{\pi VM}{A} = \left(\frac{\alpha}{32\pi\Omega}\right)\ k^{11/5}t^{2/15} \tag{117}$$

4.8. There is a close natural number solution for Ω;

$$\Omega = \sqrt{\left(\frac{\pi^e}{e^{(e-1)}}\right)} = 2.0071\ 349\ 5432... \tag{118}$$

5 Comment

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? [21]

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.' [3]. At present, there is no candidate theory of everything that is able to calculate the mass of the electron [20].

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 [10].

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 [5].

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