A virtual black-hole electron and the sqrt of Planck momentum

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In this article the sqrt of Planck momentum is applied as a distinct Planck unit and is used as a link between the mass constants and the charge (electric) constants. From these constants, formulas for a magnetic monopole (AL = ampere-meter) and an electron frequency f_e (A^3L^3/T) are constructed. The electron is seen as oscillating between an electric-state whose duration in units of Planck time t_p is dictated by f_e, and a mass-state whose duration equals to (or is defined by) 1 Planck time T. The premise being that after 1 oscillation cycle the magnetic monopoles $(AL)^3$ combine with time T and cancel, f_e units = $(AL)^3/T$ = 1, exposing for $1t_p$ the mass-state black-hole electron center. The SI units kg, m, s, A, K are thus not independent but overlap and cancel in this electron frequency ratio. This permits us to reduce the number of required units to 2 and develop relationships between the fundamental physical constants. For example, we can define the least precise constants G, h, e, m_e, k_B in terms of the most precise c, μ_0 (exact values), the fine structure constant alpha (10-12 digits) and the Rydberg constant (12-13 digits). Results are consistent with CODATA 2014 (table). This thus becomes a Planck unit theory where the dimensionless electron formula f_e dictates the frequency of Planck events, i.e.: electron mass as the frequency of occurrence of units of Planck mass.

Table 1	Calculated* (c, μ_0, α, R)	CODATA 2014
Planck constant	$h^* = 6.626\ 069\ 134$ e-34 u^{19}	$h = 6.626\ 070\ 040(81)$ e-34 [4]
Elementary charge	$e^* = 1.602\ 176\ 511\ 30$ e-19 u^{-27}	$e = 1.602\ 176\ 6208(98)$ e-19 [7]
Electron mass	$m_e^* = 9.109\ 382\ 312\ 56$ e-31 u^{15}	$m_e = 9.109\ 383\ 56(11)$ e-31 [9]
Boltzmann's constant	$k_B^* = 1.379\ 510\ 147\ 52$ e-23 u^{29}	$k_B = 1.380\ 648\ 52(79)$ e-23 [12]
Gravitation constant	$G^* = 6.672\ 497\ 192\ 29$ e-11 u^6	$G = 6.674\ 08(31)$ e-11 [11]

keywords: Planck unit theory, sqrt of Planck momentum, magnetic-monopole, black-hole electron, physical constants, fine structure constant alpha, Rydberg constant;

1 Sqrt of Planck momentum

In this section I introduce the sqrt of momentum as a distinct Planck unit and suggest how this could be used as a link between the mass and charge domains.

From the formulas for the charge constants I then derive a formula for a magnetic monopole (ampere-meter AL) and from this subsequently a formula for an electron function f_e.

The electron formula is constructed from monopoles (AL) and from time T yet it is also dimensionless as the charge and time units are not independent but rather are related, collapsing within the electron whereby; $f_e = (AL)^3/T$, units = 1. Being dimensionless and so independent of any system of units, this electron formula is a mathematical constant.

Note: for convenience I use the commonly recognized value for alpha as $\alpha \sim 137.036$.

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

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

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

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

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

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

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

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

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

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

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

1.4. As with c, the permeability of vacuum μ_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.

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

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

1.5. Rewritting Planck length l_p in terms of Q, c, α, μ_0;

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

1.6. 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 [2]. I propose a magnetic monopole σ_e from α, e, c ($\sigma_e = 0.13708563x10^{-6}$);

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

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

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

1.7. The most precisely measured of the natural constants is the Rydberg constant R_∞ (see table) and so it is important to this model. The unit for R_∞ is $1/m$. For m_e see eq(22);

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

This however now gives us 2 solutions for length m, see eq(1) and eq(15), if they are both valid then there must be a ratio whereby the units q, s, kg overlap and cancel;

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

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

$$s = \frac{kg^6}{q^{15/2}} \quad (17)$$

$$\mu_0 = \frac{kg^6}{q^4 s} = q^{7/2} \quad (18)$$

1.8. We find that this ratio is embedded in that electron function f_e (eq 14), and so f_e is a dimensionless mathematical constant whose function appears to be dictating the frequency of the Planck units;

$$f_e = \frac{\sigma_e^3}{t_p};\ units = \frac{q^{15}s^2}{kg^{12}} = 1 \quad (19)$$

Replacing q with the more familiar m gives this ratio;

$$q^2 = \frac{kg.m}{s};\ q^{30} = (\frac{kg.m}{s})^{15} = \frac{kg^{24}}{s^4} \quad (20)$$

$$units = \frac{kg^9 s^{11}}{m^{15}} = 1 \quad (21)$$

Electron mass as frequency of Planck mass:

$$m_e = \frac{m_P}{f_e},\ unit = kg \quad (22)$$

Electron wavelength via Planck length:

$$\lambda_e = 2\pi l_p f_e,\ units = m = \frac{q^2 s}{kg} \quad (23)$$

Gravitation coupling constant:

$$\alpha_G = (\frac{m_e}{m_P})^2 = \frac{1}{f_e^2},\ units = 1 \quad (24)$$

1.9. The Rydberg constant $R_\infty = 10973731.568508(65)$ [3] has been measured to a 12 digit precision. The known precision of Planck momentum and so Q is low, however with the solution for the Rydberg eq(15) we may re-write Q as Q^{15} in terms of; c, μ_0, R and α;

$$Q^{15} = \frac{2^5 c^5 \mu_0^3}{3^3\pi\alpha^8 R},\ units = \frac{kg^{12}}{s^2} = q^{15} \quad (25)$$

Using the formulas for Q^{15} eq(25) and l_p eq(12) we can re-write the least accurate dimensioned constants in terms of the most accurate constants; R, c, μ_0, α. I first convert the constants until they include a Q^{15} term which can then be replaced by eq(25). Setting unit x as;

$$unit\ x = \frac{kg^{12}}{q^{15}s^2} = 1 \quad (26)$$

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

$$e = \frac{16 l_p c^2}{\alpha Q^3} = \frac{\pi^2 Q^5}{2\mu_0 c^3},\ units = \frac{q^3 s}{kg^3} \quad (27)$$

$$e^3 = \frac{\pi^6 Q^{15}}{8\mu_0^3 c^9} = \frac{4\pi^5}{3^3 c^4\alpha^8 R},\ units = \frac{kg^3 s}{q^6} = (\frac{q^3 s}{kg^3})^3.x \quad (28)$$

Planck constant h = 6.626 069 134 e-34

$$h = 2\pi Q^2 2\pi l_p = \frac{4\pi^4\alpha Q^{10}}{8\mu_0 c^5},\ units = \frac{q^4 s}{kg} \quad (29)$$

$$h^3 = (\frac{4\pi^4 \alpha Q^{10}}{8\mu_0 c^5})^3 = \frac{2\pi^{10}\mu_0^3}{3^6 c^5 \alpha^{13} R^2},\ units = \frac{kg^{21}}{q^{18} s} = (\frac{q^4 s}{kg})^3.x^2 \quad (30)$$

Boltzmann constant k_B = 1.379 510 14752 e-23

$$k_B = \frac{\pi^2 \alpha Q^5}{4c^3},\ units = \frac{kg^3}{q} \quad (31)$$

$$k_B^3 = \frac{\pi^5 \mu_0^3}{3^3 2c^4 \alpha^5 R},\ units = \frac{kg^{21}}{q^{18} s^2} = (\frac{kg^3}{q})^3.x \quad (32)$$

Gravitation constant G = 6.672 497 19229 e-11

$$G = \frac{c^2 l_p}{m_P} = \frac{\pi \alpha Q^6}{64\mu_0 c^2},\ units = \frac{q^6 s}{kg^4} \quad (33)$$

$$G^5 = \frac{\pi^3 \mu_0}{2^{20} 3^6 \alpha^{11} R^2},\ units = kg^4 s = (\frac{q^6 s}{kg^4})^5.x^2 \quad (34)$$

Planck length

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

Planck mass

$$m_P^{15} = \frac{2^{25}\pi^{13}\mu_0^6}{3^6 c^5 \alpha^{16} R^2},\ units = kg^{15} = \frac{kg^{39}}{q^{30} s^4}.\frac{1}{x^2} \quad (36)$$

Electron mass m_e = 9.109 382 31256 e-31

$$m_e^3 = \frac{16\pi^{10} R \mu_0^3}{3^6 c^8 \alpha^7},\ units = kg^3 = \frac{kg^{27}}{q^{30} s^4}.\frac{1}{x^2} \quad (37)$$

Ampere

$$A_Q^5 = \frac{2^{10}\pi 3^3 c^{10} \alpha^3 R}{\mu_0^3},\ units = \frac{q^{30} s^2}{kg^{27}} = (\frac{q^3}{kg^3})^5.\frac{1}{x} \quad (38)$$

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

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

$$\sigma = \frac{2\pi^5 k_B^4}{15h^3 c^2},\ r_d = \frac{4\sigma}{c},\ units = r \quad (39)$$

$$r_d^3 = \frac{3^3 4\pi^5 \mu_0^3 \alpha^{19} R^2}{5^3 c^{10}},\ units = \frac{kg^{30}}{q^{36} s^5}.\frac{1}{x^2} = \frac{kg^6}{q^6 s} = r^3 \quad (40)$$

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