Quintessence-momentum as link between mass and charge

Malcolm Macleod

E-mail: maclem@platoscode.com

The natural constants, G, h, e, μ_0 and m_e are presented as geometrical shapes in terms of Planck momentum, α (Sommerfeld fine structure constant) and c. A square root solution of Planck momentum denoted Quintessence-momentum Q links the mass and charge constants. The electron formula describes a dimensionless magnetic monopole. The Rydberg constant R_∞, the most accurate of the natural constants, is used for cross-reference, the solutions are consistent with CODATA 2010 precision.

1 Introduction

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, me, are assumed to be the same at all places and times in the universe. They form the scaffolding around which the 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 me 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. [1]

Formulas are proposed for the natural constants G, h, e (or μ_0) and m_e, as derivatives of the square root of Planck momentum (denoted Q), c and α. The electron is formed from dimensionless magnetic monopoles. The formulas and units are cross referenced with each other to confirm continuity and the numerical solutions, including the Rydberg constant, are consistent with CODATA 2010 precision.

Quintessence momentum Q is proposed as a square root solution to Planck momentum, whereby;

$$Q = 1.019\ 113\ 41...\ units = \sqrt{\frac{kg.m}{s}}$$

$$Planck\ momentum = 2.\pi.Q^2\ ,\ units = \frac{kg.m}{s}$$

2 General formulas

If we assign to the Ampere;

$$A = \frac{8.c^3}{\pi.\alpha.Q^3},\ units = \frac{m^2}{kg.s^2.\sqrt{(kg.m/s)}} \tag{1}$$

then by replacing the SI units for the natural constants with $2.\pi.Q = kg.m/s,\ l_p = m$ and $c = m/s$;

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

$$G = \frac{l_p.c^3}{2.\pi.Q^2},\ units = \frac{m^3}{kg.s^2} \tag{3}$$

$$h = 2.\pi.Q^2.2.\pi.l_p,\ units = \frac{kg.m^2}{s} \tag{4}$$

$$\hbar = 2.\pi.Q^2.l_p \tag{5}$$

$$e = \frac{16.l_p.c^2}{\alpha.Q^3},\ units = \frac{m^2}{kg.s.\sqrt{(kg.m/s)}} \tag{6}$$

$$\mu_0 = \frac{\pi^2.\alpha.Q^8}{32.l_p.c^5} \tag{7}$$

$$\epsilon_0 = \frac{32.l_p.c^3}{\pi^2.\alpha.Q^8} \tag{8}$$

$$k_e = \frac{\pi.\alpha.Q^8}{128.l_p.c^3} \tag{9}$$

3 Planck length l_p

l_p in terms of $Q,\ \alpha,\ c$. The magnetic constant μ_0 has a fixed value. From eqn.7

$$l_p = \frac{\pi^2.\alpha.Q^8}{2^7.\mu_0.c^5} \tag{10}$$

$$\mu_0 = 4.\pi.10^{-7}\ N/A^2$$

$$l_p = \frac{5^7.\pi.\alpha.Q^8}{c^5} \tag{11}$$

4 Reference formulas

Here the formulas and their units are cross referenced with common physics equations.

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

$$2\ 2.\pi.Q^2.2.\pi.l_p\ \frac{32.l_p.c^5}{\pi^2.\alpha.Q^8}\ \frac{\alpha^2.Q^6}{256.l_p^2.c^4}\ \frac{1}{c}$$

$$\alpha = \alpha \tag{12}$$

$$c = \frac{1}{\sqrt{\mu_0.\epsilon_0}}$$

$$\mu_0.\epsilon_0 = \frac{\pi^2.\alpha.Q^8}{32.l_p.c^5}\ \frac{32.l_p.c^3}{\pi^2.\alpha.Q^8} = \frac{1}{c^2}$$

$$c = c \tag{13}$$

$$R_\infty = \frac{m_e.e^4.\mu_0^2.c^3}{8.h^3}$$

$$m_e\ \frac{65536.l_p^4.c^8}{\alpha^4.Q^{12}}\ \frac{\pi^4.\alpha^2.Q^{16}}{1024.l_p^2.c^{10}}\ c^3\ \frac{1}{8}\ \frac{1}{8.\pi^3.Q^6.8.\pi^3.l_p^3}$$

$$R_\infty = \frac{m_e}{4.\pi.l_p.\alpha^2.m_P} \tag{14}$$

$$E_n = -\frac{2.\pi^2.k_e^2.m_e.e^4}{h^2.n^2}$$

$$2.\pi^2\ \frac{\pi^2.\alpha^2.Q^{16}}{16384.l_p^2.c^6}\ m_e\ \frac{65536.l_p^4.c^8}{\alpha^4.Q^{12}}\ \frac{1}{4.\pi^2.Q^4.4.\pi^2.l_p^2}$$

$$E_n = -\frac{m_e.c^2}{2.\alpha^2.n^2} \tag{15}$$

$$q_p = \sqrt{4.\pi.\epsilon_0.\hbar.c}$$

$$q_p = \sqrt{4.\pi\ \frac{32.l_p.c^3}{\pi^2.\alpha.Q^8}\ 2.\pi.Q^2.l_p\ c} = \sqrt{\alpha}.e \tag{16}$$

$$r_e = \frac{e^2}{4.\pi.\epsilon_0.m_e.c^2}$$

$$r_e = \frac{256.l_p^2.c^4}{\alpha^2.Q^6}\ \frac{1}{4.\pi}\ \frac{\pi^2.\alpha.Q^8}{32.l_p.c^3}\ \frac{1}{m_e.c^2} = \frac{l_p.m_P}{\alpha.m_e} \tag{17}$$

$$m_e = \frac{B^2.r^2.e}{2.V}$$

$$V_p = \frac{E_p}{e}$$

$$\frac{B^2.r^2.e^2}{E_p} = \frac{\pi^2.\alpha^2.Q^{10}}{64.l_p^4.c^4}\ l_p^2\ \frac{256.l_p^2.c^4}{\alpha^2.Q^6}\ \frac{1}{2.\pi.Q^2.c}$$

$$\frac{B^2.r^2.e^2}{E_p} = m_P \tag{18}$$

5 Electron as magnetic monopole

m_e in terms of $m_P,\ t_p,\ \alpha,\ e,\ c$.

The ampere-meter is the SI unit for pole strength (the product of charge and velocity) in a magnet (A.m = e.c). A magnetic monopole [2] is a hypothetical particle that is a magnet with only 1 pole. Proposed is a dimensionless geometrical formula for the electron constructed from magnetic monopoles M_{pole}. Planck mass = m_P, electron mass = m_e.

$$m_e = 2.m_P.t_x.M_{pole}^3 \tag{19}$$

where...

$$M_{pole} = \frac{2.\pi^2}{3.\alpha^2.e_x.c_x} \tag{20}$$

the conversion of Planck time t_p, elementary charge e and speed of light c to $1s, 1C, 1m/s$ requires dimensionless frequencies whose numerical values are equivalent (t_x, e_x, c_x).

$$\frac{t_p}{t_x} = \frac{5.3912...e^{-44}s}{5.3912...e^{-44}} = 1s$$

$$\frac{e}{e_x} = \frac{1.6021764...e^{-19}C}{1.6021764...e^{-19}} = 1C$$

$$\frac{c}{c_x} = \frac{299792458m/s}{299792458} = 1m/s$$

6 Numerical reference

α in terms of Q.

The accepted standard (experimental) values for the physical constants may be referenced from the CODATA website. The CODATA 2010 values:

R_∞ = 10 973 731.568 539(55) [3]
h = 6.626 069 57(29) $e-34$ [4]
α = 137.035 999 074(44) [5]
l_p = 1.616 199(97) $e-35$ [6]
e = 1.602 176 565(35) $e-19$ [7]
m_e = 9.109 382 91(40) $e-31$ [8]

$\mu_0 = 4.\pi.10^{-7}$ (fixed) [9]
$G = 6.673\ 84(80)\ e - 11$ [10]

The Rydberg constant R, which incoprorates the other constants, is the most accurately measured fundamental physical constant and so may be used to cross-check the results.

$$R_\infty = \frac{m_e.e^4.\mu_0^2.c^3}{8.h^3}$$

Using the CODATA 2010 precision range as a data filter, α and Q as the variables and by replacing Planck length l_p with eqn.11, the range of possible solutions for α and Q may be determined.

$for\ \alpha = 137.0359...\ to\ 137.0361...$
$for\ Q = 1.019112...\ to\ 1.019114...$
$h = 2^2 * 5^7 * \pi^3 * \alpha * Q^{10}/c^5$
$if\ (h > hmin\ and\ h < hmax)\ then$
$R = \pi^2 * c^5/(2^{10} * 3^3 * 5^{21} * \alpha^8 * Q^{15})$
$if\ (R > rmin\ and\ R < rmax)\ then$
$e = 16 * 5^7 * \pi * Q^5/c^3$
$if\ (e > emin\ and\ e < emax)\ then$
$m_e = (2 * \pi * Q^2/c) * (\pi^4/(2^8 * 3^3 * 5^{14} * \alpha^5 * Q^7))$
$if\ (m_e > mmin\ and\ m_e < mmax)\ then$
$print\ (alpha, Q)...$

This gives the following range of values for α and Q;
$\alpha = 137.035\ 997\ 274\ (980)$
$Q = 1.019\ 113\ 418\ 388\ (3885)$

Note: As the *Rydberg* numerical precision far exceeds the other constants, generally we can use it to numerically define Q in terms of α with this precision.

$$x = \alpha^8 * Q^{15}$$

$$10\ 973\ 731.568\ 539(55) = \pi^2 * c^5/(2^{10} * 3^3 * 5^{21} * x)$$

$$x = 165\ 201\ 929\ 560\ 725953(828000)$$

$$Q = (x * \alpha^8)^{1/15}$$

7 Magnetic (electric) constant

$$\mu_0 = 4.\pi.10^{-7}\ N/A^2$$

Therefore, in a vacuum, the force per meter of length between the two infinite straight parallel conductors carrying a current of 1 A and spaced apart by 1 m, is exactly $2.10^{-7} N/m$

Planck force F_p;

$$F_p = \frac{E_p}{l_p} = \frac{2.\pi.Q^2.c}{l_p} \tag{21}$$

The electric force is weaker than the strong force by a factor of alpha.

$$F_{electric} = \frac{F_p}{\alpha} \tag{22}$$

A (Planck) Amperes force law and from eqn.1

$$\mu_e = \frac{F_{electric}}{A^2} \tag{23}$$

$$\mu_e = \pi.\mu_0 = 4.\pi^2.10^{-7} \tag{24}$$

8 Conclusion

A mathematical (ie: geometrical) solution to the natural constants is presented in terms of 3 components; (square root of) Planck momentum, α and c. As α is dimensionless, momentum and velocity (and time), the 3 dimensions of motion, arguably have a more significant role than is normally considered.

References

1. SciAm 06/05, P57: Constants, J Barrow, J Webb
2. Magnetic monopole, (last revision 9, Jan 2011) http://en.wikipedia.org/wiki/Magnetic-monopole
3. http://physics.nist.gov/cgi-bin/cuu/Value?ryd
4. http://physics.nist.gov/cgi-bin/cuu/Value?ha
5. http://physics.nist.gov/cgi-bin/cuu/Value?alphinv
6. http://physics.nist.gov/cgi-bin/cuu/Value?plkl
7. http://physics.nist.gov/cgi-bin/cuu/Value?e
8. http://physics.nist.gov/cgi-bin/cuu/Value?me
9. http://physics.nist.gov/cgi-bin/cuu/Value?mu0
10. http://physics.nist.gov/cgi-bin/cuu/Value?bg