Planck unit theory: Fine structure constant alpha and sqrt of Planck momentum

Malcolm Macleod

e-mail: mail4malcolm@gmx.de

The primary constants; G, c, h, e (or μ_0), α and m_e range in precision from low G (4-digits) to exact values (c, μ_0). A major problem in constructing a Planck unit theory is that the Planck units are limited to the precision of G. By postulating the sqrt of Planck momentum as a link between mass and charge, a 'Planck' ampere A_Q may be constructed as a geometrical shape; the volume of velocity/mass. From this Planck Ampere can then be derived e and μ_0 (permeability of vacuum). We may then use μ_0 to solve Planck length l_p and this gives a formula for the electron (as a magnetic monopole). G, h, e and m_e can be now be solved using the 4 most accurate constants c, μ_0, Rydberg constant R (12 digit precision) and the fine structure constant alpha α (10 digit precision). The electron magnetic monopole suggests a Planck unit theory whereby particles are dimensionless formulas dictating the frequency of Planck events via a periodic (analog) electric wave-state to digital (integer) mass Planck-event (Planck-time) point-state oscillation. This wave-particle duality (oscillation) becomes the basis for a MUH Mathematical Universe Hypothesis. The dimensions of our universe reduce to the 3 units of motion; sqrt of Planck momentum, Planck time and c.

1 Introduction

J. Barrow et al noted in a Scientific American article... '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 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 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.' [1]

2 Quintessence momentum

Planck momentum (velocity*mass) = $2.\pi.Q^2$ [18]

$$Q = 1.019\ 113\ 4112...\ units = \sqrt{\frac{kg.m}{s}} \tag{1}$$

3 Mass constants

Defining in terms of Planck momentum (instead of Planck mass), the mass constants as Planck units become;

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

$$G = \frac{l_p.c^3}{2.\pi.Q^2} \tag{3}$$

$$h = 2.\pi.Q^2.2.\pi.l_p \tag{4}$$

$$t_p = \frac{2.l_p}{c} \tag{5}$$

$$F_p = \frac{E_p}{l_p} = \frac{2.\pi.Q^2}{t_p} \tag{6}$$

4 Ampere A_Q

(Proposed) Ampere A_Q = velocity/mass [18]

$$A_Q = \frac{8.c^3}{\alpha.Q^3},\ units = \frac{m^2}{kg.s^2.\sqrt{(kg.m/s)}} = (\sqrt{\frac{m}{kg.s}})^3 \tag{7}$$

5 Elementary charge

$$e = A.s = A_Q.t_p$$

$$e = \frac{8.c^3}{\alpha.Q^3}.\frac{2.l_p}{c} = \frac{16.l_p.c^2}{\alpha.Q^3},\ units = \frac{m^2}{kg.s.\sqrt{(kg.m/s)}} \tag{8}$$

6 Vacuum permeability

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.

$$\frac{F_{electric}}{A_Q^2} = \frac{2.\pi.Q^2}{\alpha.t_p}.(\frac{\alpha.Q^3}{8.c^3})^2 = \frac{\pi.\alpha.Q^8}{64.l_p.c^5} = \frac{2}{10^7} \quad (9)$$

gives:

$$\mu_0 = \frac{\pi^2.\alpha.Q^8}{32.l_p.c^5} = \frac{4.\pi}{10^7} \quad (10)$$

$$\epsilon_0 = \frac{32.l_p.c^3}{\pi^2.\alpha.Q^8} \quad (11)$$

$$k_e = \frac{\pi.\alpha.Q^8}{128.l_p.c^3} \quad (12)$$

7 Planck length l_p

l_p in terms of $Q,\ \alpha,\ c$.
The magnetic constant μ_0 has a fixed value. From eqn.10

$$l_p = \frac{\pi^2.\alpha.Q^8}{2^7.\mu_0.c^5} \quad (13)$$

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

$$l_p = \frac{5^7.\pi.\alpha.Q^8}{c^5} \quad (14)$$

8 Electron as magnetic monopole

m_e in terms of $m_P,\ t_p,\ \alpha,\ e,\ c$. [18]

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 [4] is a hypothetical particle that is a magnet with only 1 pole. A dimensionless geometrical formula for a magnetic monopole σ_e and electron E_σ is proposed.

$$\sigma_e = \frac{2.\pi^2}{3.\alpha^2.e_x.c_x} \quad (15)$$

$$E_\sigma = t_x.\sigma_e^3 \quad (16)$$

nb. the conversion of Planck time t_p, elementary charge e and speed of light c to SI units $1s, 1C, 1m/s$ requires dimensionless numbers which are numerically equivalent (t_x, e_x, c_x).

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

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

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

Planck mass:

$$m_e = m_P.E_\sigma \quad (17)$$

Compton wavelength:

$$\lambda_e = \frac{2.\pi.l_p}{E_\sigma} \quad (18)$$

Frequency:

$$T_e = \frac{2.\pi.l_p}{E_\sigma.c} = \frac{t_p}{E_\sigma} = \frac{1}{\sigma_e^3}.\frac{t_p}{t_x} \quad (19)$$

Gravitation coupling constant:

$$\alpha_G = (\frac{m_P.E_\sigma}{m_P})^2 = E_\sigma^2 \quad (20)$$

para-positronium lifetime:

$$t_0 = \frac{\alpha^5}{\sigma_e^3}.\frac{t_p}{t_x} \quad (21)$$

ortho-positronium lifetime:

$$t_1 = \frac{\alpha^4}{4.\sigma_e^3.(\frac{\pi}{9} - \frac{1}{\pi})}.\frac{t_p}{t_x} \quad (22)$$

9 Bohr magneton

$$\mu = \frac{e.h.n}{4.\pi.m_e} = \frac{8.m_P.l_p^2.c^3}{\alpha.Q^3.m_e} = \frac{A_Q.l_p^2}{E_\sigma} = \frac{A_Q.l_p.c}{\sigma_e^3}.\frac{t_p}{t_x} \quad (23)$$

10 Reduced formulas

Replacing l_p with eqn.14, the natural constants can be reduced to $Q,\ \alpha,\ c$

$$h = \frac{2^2.5^7.\pi^3.\alpha.Q^{10}}{c^5} \quad (24)$$

$$e = \frac{2^4.5^7.\pi.Q^5}{c^3} \quad (25)$$

$$m_e = m_P.\ \frac{\pi^4}{2^8.3^3.5^{14}.\alpha^5.Q_x^7} \quad (26)$$

The Rydberg constant R_∞

$$R_\infty = \frac{m_e.e^4.\mu_0^2.c^3}{8.h^3} = \frac{\pi^2.c^5}{2^{10}.3^3.5^{21}.\alpha^8.Q^8.Q_x^7} \quad (27)$$

11 Quintessence momentum

The Rydberg constant, with a 12-digit precision
$R_\infty = 10\,973\,731.568\,539(55)$ [5]
is the most accurate of the natural constants. consequently we may re-define Q in terms of this constant.

$$Q^{15} = \frac{\pi^2.c^5}{2^{10}.3^3.5^{21}.\alpha^8.R_\infty} \tag{28}$$

$$Q = (\frac{\pi^2.c^5}{2^{10}.3^3.5^{21}.\alpha^8.R_\infty})^{\frac{1}{15}} \tag{29}$$

12 von Klitzing constant

The von Klitzing constant reduces to α and c.

$$R_K = \frac{h}{e^2} = \frac{\pi.\alpha.c}{5000000} \tag{30}$$

$R_K = 25812.807\,557(18)$ [16]

$$\alpha = 137.035\,999\,677(96)$$

1. $(17^4 + 11)/(1 + \sqrt{5}) = 25812.807\,574...$

$$\alpha = (17^4 + 11)/(c.\phi.\mu_0) = 137.035\,999\,768\,293...$$

2. James Gilson [17]

$$\alpha = 137.035\,999\,786\,699...$$

13 Numerical solutions

CODATA 2010 values
$\alpha = 137.035\,999\,074(44)$ [7]
$R_\infty = 10\,973\,731.568\,539(55)$ [5]
$h = 6.626\,069\,57(29)\,e - 34$ [6]
$e = 1.602\,176\,565(35)\,e - 19$ [9]
$m_e = 9.109\,382\,91(40)\,e - 31$ [10]
$G = 6.673\,84(80)\,e - 11$ [12]
$\mu_0 = 4.\pi/10^7$

Using $\alpha = 137.035\,999\,074$ gives
$h = 6.626\,069\,148\,e - 34$
$e = 1.602\,176\,513\,e - 19$
$m_e = 9.109\,382\,323\,e - 31$
$G = 6.672\,497\,199\,e - 11$
$R_\infty = 10\,973\,731.568\,539$
$\mu_0 = 4.\pi/10^7$

All results agree with experimental CODATA values except for G. However the same calculated values were used to solve Planck constant, the electron wavelength and electron mass and so by extension the Rydberg constant; and these 4 values all have the requisite precision. We may also note that the calculated G agrees with the Sandia National Laboratories G;

Parks et al $G = 6.672\,34(21)\,e - 11$ [13]

Refer to the website [18] for further details and a complete list of calculated constants.

14 Summary

From the proposed ampere, formulas for the natural constants were derived as geometrical shapes in terms of the 3 dimensions of motion; sqrt of Planck momentum, velocity c and Planck time. The dimensionless fine structure constant alpha presumably has a geometrical role analogous to pi. If the electron derives from magnetic monopoles then so do all particle charges, i.e.: the monopole becomes the quark of this theory. If particles dictate the frequency of Planck events via an analog electric wave-state to digital mass point-state oscillation then both mass mc2 and energy hv are simply functions of particle frequency, and so by altering this frequency [18], we may freely adjust particle mass and wavelength with respect to the 2 universal constants Planck time and c. Relativity thereby reduces to geometry.

15 Reference formulas

These formulas are cross referenced with common formulas

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

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

$$\alpha = \alpha \tag{31}$$

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

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

$$c = c \tag{32}$$

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

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

$$R_\infty = \frac{m_e}{4.\pi.l_p.\alpha^2.m_P} \tag{33}$$

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

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

$$E_n = -\frac{m_e.c^2}{2.\alpha^2.n^2} \tag{34}$$

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

$$q_p = \sqrt{4.\pi \; \frac{32.l_p.c^3}{\pi^2.\alpha.Q^8} \; 2.\pi.Q^2.l_p \; c} = \sqrt{\alpha}.e \tag{35}$$

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

$$r_e = \frac{256.l_p^2.c^4}{\alpha^2.Q^6} \; \frac{1}{4.\pi} \; \frac{\pi^2.\alpha.Q^8}{32.l_p.c^3} \; \frac{1}{m_e.c^2} = \frac{l_p.m_P}{\alpha.m_e} \tag{36}$$

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

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

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

$$\frac{B^2.r^2.e^2}{E_p} = m_P \tag{37}$$

Maple code:

$pi := 3.14159265358979323846 26 :$
$c := 299792458 :$
$a := 137.035999074 :$
$R := 10973731.568539 :$

$Q := (pi^2 * c^5/(2^{10} * 3^3 * 5^{21} * a^8 * R))^{(1/15)} :$
$lp := (5^7 * pi * a * Q^8/c^5) :$
$mP := (2 * pi * Q^2/c) :$
$tp := 2 * lp/c :$

$G = c^2 * lp/mP$
$e = 16 * lp * c^2/(a * Q^3)$
$h = 2 * pi * Q^2 * 2 * pi * lp$
$m_e = mP * tp * (pi^2 * Q^3/(24 * a * lp * c^3))^3$

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