ON THE FUNDAMENTAL CONSTANTS

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ABSTRACT

It is assumed by modern physics that there exists no theory which can predict the values of the fundamental physical constants. This assumption however is incorrect as there is undoubtedly an underlying connection between the constants being that of angular momentum. In particular the angular momentum of the electron in the hydrogen atom which appears to obey the laws of Kepler. It may be considered that the model of hydrogen as suggested by Bohr, is not an accurate representation however it would appear that the origin of many of the constants appear to rely upon the orbital model. This paper will illustrate this connection and correctly predicts all of the values of the physical constants with accuracy, equal to or greater than that of the currently accepted and published values[i]. As a consequence of this the orbital model of Bohr should be considered in a new light.

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Introduction

Modern physics in the twenty first century appears to neglect the basic fundamental constants and just take the published values at face value. No further enquiry is made to ascertain the correctness or the source of the values. One example of this extremely peculiar trait is the popular finely balanced universe which relies upon an assumption that the fundamental constants are set in stone by a higher power. Nothing could be further from the truth as it will be shown in this paper that all of the prominent physical constants are indeed actually related to the properties of the hydrogen atom and appear to follow the laws of Kepler.

In the interests of consistency and an effort to reduce complexity in translation of numerical standards the calculation of the values of the constants are shown exclusively in SI units.

§ 1. Numbering System

If the human race were descended from arachnids it would be entirely possible that the choice of a numbering system would be octal and advances in computing may indeed have occurred more rapidly. Unfortunately, the existence of five fingers on each hand has created a historical preference for a base ten numbering system. As such the most basic minimum values of a base ten numbering system are required, the ideal candidate being the values of the hydrogen atom. Although the accuracy of all values are not empirically proven the agreed upon published values will serve well for this paper.

The hydrogen atom has the following generally accepted properties and values for its electron;

Mass = $m = 9.109389919181 * 10^{-31}$
Orbital radius = $r = 5.2917721067 * 10^{-11}$
Orbital velocity = $\omega = 2.1876912628 * 10^{6}$

The final item required for this paper is a base 10 point of reference which is the speed of light in a vacuum being $2.99792458 * 10^{8}$. It is often stated that the speed of light is a constant, however this is not entirely correct as the speed is dependent upon the medium. Being that the only force available on the Earth to accelerate light is electromagnetic which itself travels at the speed of light this would restrict any attempt to accelerate any object to velocities greater than c. At this point there is also no empirical evidence to suggest that two-way velocities for the speed of light are actually identical.

Of course the speed of light may indeed be constant in a vacuum it is only suggested that insufficient proof exists confirming this either way.

Having established a baseline of measurements the relationship between all of the physical constants can be defined.

§ 2. Universal Constants

The Fine Structure constant

The first and possibly most simple constant to define is the fine structure constant. The fine structure constant became popular from one of Richard Feynman's lectures, when he

declared that "*It's one of the greatest damn mysteries of physics: a magic number that comes to us with no understanding by man*". Feynman was talking about the coincidental value of 1/137. This is far from the truth, its actual value being nothing more than the proportionality between the orbital velocity of the electron in a hydrogen atom and the speed of light in a vacuum.

$$\alpha = \frac{\omega}{c} = 7.2973525665 * 10^{-3} \quad (1)$$

The reason for why this choice is correct, apart from prediction of its exact value will be explained in a subsequent paper. For the moment it can be assumed correct being that the result of the proposal is correct to ten decimal places.

The Magnetic constant

The magnetic constant μ_0 has a value of $4\pi * 10^{-7}$ which arises from Ampere's force law representing the force between two parallel wires one meter apart with a current flow of one amp, its value in SI units is therefore;

$$\mu_0 = 1.2566370614 * 10^{-6} \quad (2)$$

The Electric constant

The electric constant is directly derived from the magnetic constant being;

$$\varepsilon_0 = \frac{1}{\mu_0 * c^2} = 8.8541878176 * 10^{-12} \quad (3)$$

Once more the value of the constant is consistent with official values being accurate to within ten decimal places.

The Impedance of a vacuum

Finally the impedance of a vacuum which will be instantly recognizable to scientists familiar with electronics is derived from the magnetic and the electric constant whose value is;

$$Z_0 = \sqrt{\frac{\mu_0}{\varepsilon_0}} = 3.7673031346 * 10^{2} \quad (4)$$

The Planck constant

The Planck constant is often referred to as the quantum of action and plays a central role in quantum mechanics. This paper does not consider how Max Planck arrived at the value its utility or indeed the practical application of the constant. The value of the Planck constant can be seen to be the angular momentum of an electron in a hydrogen atom;

$$mr\omega = 6.6260746672 * 10^{-34} \quad (5)$$

There is a second interpretation of this value often used by physicists which is the Dirac constant or the reduced Planck constant being simply;

$$\hbar = \frac{mr\omega}{2\pi} = 1.0545725336 * 10^{-34} \quad (6)$$

This only further confirms that the Planck constant is actually an angular momentum being that the accepted reduced value is obtained by a division of 2π, common in orbital theories.

§ 3. Electromagnetic

The Elementary Charge

The most basic of the Electromagnetic constants is the elementary charge;

$$e = \sqrt{4\pi mr\omega^2} = 1.6021771803 * 10^{-19} \quad (7)$$

The Magnetic flux quantum

Using once more the Kepler equation for the angular momentum of the electron in the hydrogen atom and the previously obtained value for the elementary charge, the magnetic flux quantum is found to be;

$$\Phi_0 = \frac{mr\omega}{e} = 2.0678345531 * 10^{-15} \quad (8)$$

The Conductance Quantum

This is the quantized unit of electrical conductance which can be obtained from;

$$G_0 = \frac{2e^2}{mr\omega} = 7.7480917311 * 10^{-5} \quad (9)$$

The Josephson constant

The Josephson constant is commonly used to provide a standard for precision instruments that measure potential difference. The value represents the proportionality between voltage and the frequency of irradiation across a Josephson junction.

$$K_j = \frac{2e}{mr\omega} = 4.8359768361 * 10^{14} \quad (10)$$

The Von Klitzing constant

The Von Klitzing constant is related to quantized hall resistance and was recently discovered in experiment which used silicon MOSFET electronic devices at low temperatures. This came as a surprise to many physicists, but was quickly recognized as being accurate;

$$R_k = \frac{mr\omega}{e^2} = 2.5812807455 * 10^{4} \quad (11)$$

The Bohr Radius

The Bohr radius is the orbital radius of an electron in a hydrogen atom. Bohr assumed that the model of the atom was similar to a miniature solar system.

$$a_0 = \frac{4\pi r\omega\varepsilon_0}{e^2} = 5.2917721067 * 10^{-11} \quad (12)$$

In spite of suggestions by many physicists that the model is incorrect the value predicted is accepted as being the orbital radius of the electron in a hydrogen atom.

The Bohr Magneton

The Bohr Magneton is the magnetic moment of an electron caused by its angular momentum as such it's value can be obtained simply from;

$$a_0 = \frac{er\omega}{2} = 2.0678345531 * 10^{-15} \quad (13)$$

Once more it the value of the Bohr magneton relies upon the acceptance of an orbital model of the atom.

The Rydberg constant

This constant explains the atomic spectrum of the hydrogen atom. Later however Niels Bohr suggested a model which simplified the prediction of the spectra using a combination of fundamental constants;

$$R_\infty = \frac{\omega}{4\pi rc} = 1.0973731569 * 10^{7} \quad (14)$$

The Hartree energy

The Hartree energy is defined as being twice the binding energy of the electron in a hydrogen atom in the lowest energy state.

$$E_h = m\omega^2 = 4.3597476946 * 10^{-18} \quad (15)$$

This value is naturally predicted as being correct to within ten decimal places of the published value.

The Quantum of circulation

The quantum of circulation is used calculate fictitious magnetic charge and fictitious torsion mass, as well as the magnetic flux quantum and strong gravitational torsion flux quantum.

$$K = \pi r\omega = 3.6369475486 * 10^{-4} \quad (16)$$

The Compton wavelength

The Compton wavelength of a particle is equivalent to the wavelength of a particle whose energy is the same as its rest-mass is represented by and its value obtained from the following;

$$\lambda = \frac{2\pi r\omega}{c} = 2.4263102367 * 10^{-12} \quad (17)$$

The Coulomb constant

Coulombs law says that the force between a pair of point-charges is proportional to the product of the two charges divided by the square of the separation. Coulomb's constant is the constant of proportionality in this law;

$$k_e = \frac{mr\omega^2}{e^2} = 8.9875517874 * 10^{9} \quad (18)$$

Once more its value is the same as the currently accepted and published value.

The Schwinger limit

Although not a constant, it was considered relevant to in the context of this paper to include its value and derivation. In quantum electrodynamics, the Schwinger limit is a scale above which the electromagnetic field is expected to become nonlinear.

$$E_S = \frac{mc^3}{r\omega e} = 1.3232859273 * 10^{18} \quad (19)$$

Classical Electron radius

The classical electron radius is exactly what the description says when modelling an electron as a dimensional particle rather than a point particle;

$$r_e = \frac{r\omega^2}{c^2} = 2.8971403228 * 10^{-15} \quad (20)$$

Thompson cross section

The scattering of classical electromagnetic waves by free electrons is referred to as Thomson scattering. When the photon momentum and the recoil of the charged particle cannot be ignored this is known as the classical Thomson cross section**;**

$$\sigma_t = \frac{8\pi r^2\omega^4}{3c^4} = 6.6524587161 * 10^{-29} \quad (21)$$

§ 4. Gravitational

The Gravitational constant

Although included in many references of fundamental constants the only relevance is in the Planck mass. From the Planck mass the Planck length and time is derived. As such Newton's gravitational constant "G" is included in this paper although there appears to be some mathematical

inconsistency in its unconventional use in Planck mass. The Newtonian constant "G" is also clearly derived from Kepler's law being;

$$G = \frac{4\pi^2 r^3}{MT^2} = 6.674 * 10^{-11} \quad (22)$$

The derivation in this form is not commonly mentioned however it is valid as can be seen from an additional paper by the author on this very constant.

The Planck Mass

Planck mass is a unit of mass defined using only what Max Planck considered fundamental and universal units

$$m_p = \sqrt{\frac{mrwc}{G}} = 2.176484 * 10^{-8} \quad (23)$$

The Planck mass is unusual for its inclusion of the Gravitational constant of Newton.

The Planck Length

The Planck length is about 10^{-20} times the diameter of a proton. It can be defined using the radius of the hypothesized Planck particle.

$$l_p = \sqrt{\frac{mrwG}{c}} = 1.61621 * 10^{-35} \quad (24)$$

Perhaps the strangest of the Planck values is the Planck length. The numerator and denominator produce an area whereby the length is obtained by getting the square root. Although superficially correct it appears an unusual way to obtain a length.

The Planck Time

Planck time is the time required for light to travel, in a vacuum, a distance of one Planck length.

$$t_p = \frac{l_p}{c} = 5.3911 * 10^{-44} \quad (25)$$

§ 5. Summary

It can be seen quite clearly that all of the fundamental constants are based upon the human measurement system of a hydrogen atom. In effect there are actually no natural scalar values of fundamental constants but rather all are constant proportionalities between values implicitly related to the hydrogen atom.

Although the Planck constant could indeed be considered correct, the Planck mass and its subsequent derivative values are somewhat dubious to say the least, especially considering that Kirchhoff's law[ii] of thermal radiation certainly appears to be in doubt, this being a different subject unrelated to the source of the fundamental constants.

Although some suspicion as to the accuracy of the Planck units they are however included for the sake of completeness.

There can be little doubt that the fundamental constants are indeed derived from a common source being that of the hydrogen atom and its properties. Whether the orbital nature of the electron in the hydrogen atom which the results suggest is accurate or not is left to the opinion of the reader. Considering the accuracy of the derived values for the constants, it is thought by the author that the results demand significant consideration.

This paper is an original work by the author without dependency or reference to any other published works on the same subject.

[i] Fundamental constants NIST https://physics.nist.gov/cuu/Constants/

[ii] Kirchhoff's law http://vixra.org/pdf/1310.0126v1.pdf