Particle Physics Insights

ORIGINAL RESEARCH

Harmonic Quantum Integer Relationships of the Fundamental Particles and Bosons

Donald William Chakeres

Professor of Radiology, Department of Radiology, The Ohio State University, Room 485, 395 West 12th Avenue, Columbus, OH 43210-1228, 614 293 8315. Email: donald.chakeres@osumc.edu

Abstract: The hypothesis of this paper is that there is a quantum integer number system that is analogous to the numbers associated with the elements, the isotopes, or the different energy states of hydrogen. The quantum numbers in this new model are instead associated with different fundamental constants (i.e. the normalized properties of hydrogen, or masses of particles and bosons) rather than to a specific isotope or hydrogen energy state. This hypothesis is supported by many empirical observations and secondary predictions. A second hypothesis is that all of the fundamental constants are related to the neutron. The third hypothesis is that associated constants (i.e. the electron and Z) are related by common harmonic number products typical of harmonic systems. These quantum properties become obvious when appropriately plotted and analyzed. All constants are normalized to their annihilation frequency equivalents, independent of their primary units. The annihilation frequency of the neutron is the universal frequency to which all other constants are mathematically linked. All of the constants are evaluated as coupling constants, with the denominator equal to the annihilation frequency of the neutron and the numerator equal to the other physical constant's frequency. The annihilation frequency of the neutron (expressed as a dimensionless number) is raised to an exponent, and that value is equal to each coupling constant. Classic quantum number/spectral properties are demonstrated, including the property that the only possibilities are those of a consecutive integer series, and that there is symmetric line splitting in the presence of a force field (for electromagnetic or weak forces). These points for each exponent are plotted on a ln-ln plane. The neutron is plotted at the (0, 0) point. The only possible quantum x-axis points are related to integer fractions ($\pm 1/n$). The degenerate actual frequencies are all nearly equal to $1 \pm 1/n$ exponent values for the annihilation frequency of the neutron. The y-axis values are the minor differences of the known exponents and quantum fractions ($1 \pm 1/n$), analogous to Zeeman's splitting. These quantum integer patterns are only related to linear relationships of the fundamental constants. The ln-ln points associated with the properties of hydrogen are linked to all constants by two linear relationships, one for weak kinetic forces (Bohr radius, mass of the electron) and one for electromagnetic forces (Planck's constant, hydrogen ionization energy). The nuclear entity points all fall solely on lines between these hydrogen points, symmetrically plotted across both axes for quantum numbers 1–8 and the neutron only. The nuclear particles and bosons that are logically associated demonstrate their number lineage by harmonic integers which are related to hydrogen integer points (n = 1–8). Some nuclear quantum numbers (i.e. muon, 24) represent the product of an associated hydrogen integer (i.e. neutrino, 2) and a lower associated lineage nuclear integer (i.e. Z, 12). Derivations of the actual frequency equivalents, including the muon, tau, W, Z, pions, kaons, and the quarks, are possible from the properties of hydrogen only to an accuracy of many exponential digits, supporting the hypothesis. This model represents a new and powerful means of analyzing the relationships of the fundamental constants, generating unifying relationships between hydrogen and nuclear properties previously not described.

Keywords: harmonic systems, fundamental constants, unification model, fundamental particles and bosons, weak force, electromagnetic force

Particle Physics Insights 2009:2 1–20

This article is available from http://www.la-press.com.

Introduction

The hypothesis is that the neutron represents the fundamental harmonic frequency that is linked to all entities of physics by a simple quantum number exponential system

Quantum physics is based on the hypothesis that there are only discrete possible energy levels for specific related physical systems and states.[1–3] These energy levels can be defined and predicted utilizing equations based on an integer or integer quantum fraction series and a fundamental frequency. The periodic chemical and isotope tables represent some of the earliest examples where two integers, the number of protons and neutrons, define the only possible elemental/isotope states. Later, the properties of the quantum energy states of hydrogen were defined by four quantum numbers. These properties were described by Bohr, Rydberg, and Schrodinger.[2–7] The possible electron configurations accounting for the chemical properties of the elements are defined by four quantum numbers. Moseley's law is another quantum property that is also analogous to this model.[8,9] Moseley's law relates the spectral-like properties between different elements, not just of one single elemental spectrum. The model presented here is identical in concept and application to these classic quantum systems.

This paper presents an analogous hypothesis, but expands the set of properties encompassed by a unified quantum number system. The hypothesis assumes that there is a simple consecutive integer quantum fraction number system that unifies all of the fundamental constants of physics. All of these different physical properties are examined in a manner similar to that of a single spectrum.

The second hypothesis is that all of the fundamental constants are directly mathematically related to the neutron. The neutron represents the most common fundamental entity that is essential to every aspect of physics and the universe.[10] The neutron is potentially the "mother" of all other entities in the universe, so this is a logical choice for a fundamental frequency. The annihilation frequency of the neutron (as a dimensionless number) is the numerical foundation of this hypothesis.

The third hypothesis is that associated constants (i.e. the electron and Z, or the quarks and mesons) are related by common harmonic quantum number products. This is a classic property of many harmonic systems.[11,12] These hypotheses are supported by many empirical observations and accurate predictions.

This paper initially focuses on the relationship between the properties of hydrogen and the neutron. Then the properties of hydrogen and their associated nuclear entities and harmonic number relationships are analyzed. These relationships become obvious when the fundamental constants are plotted and analyzed utilizing a new method first described in this paper. The first step of the method is the transformation of the fundamental constants associated with the beta decay products of hydrogen to a quantum integer fraction system. Then they are plotted on the ln-ln plane. Next, the points for related nuclear entities are plotted. The simple linear relationships and their simultaneous harmonic quantum numbers become apparent. The values for the nuclear properties are then accurately predicted from the hydrogen data, which supports the hypothesis. Finally, a brief summary of other fundamental properties that can be potentially analyzed using these methods is presented.

Initial summary and support for this hypothesis

The quantum number properties hypothesized in this paper are not apparent until the fundamental constants, including the neutron beta decay properties (neutrino and the properties of hydrogen), are first all converted to annihilation frequency equivalents independent of their original units (Tables 1, 2, 3). It is a straightforward process to convert known annihilation energies, masses, and distances of different fundamental constants to their annihilation frequency equivalents. All of the calculations are plotted on a ln-ln plane related to dimensionless numbers, the coupling constants.[13,14] The denominator is the annihilation frequency of the neutron and the numerator is the known frequency equivalent. The plotted exponents of the annihilation frequency of the neutron correspond to the known ratios of the two frequency values, representing inverse mathematical functions. The actual known exponent for each physical constant with the exponent base is equal to the annihilation frequency of the neutron, which is equal to

Table 1. Constants evaluated, their classic unit values, and their frequency equivalents.

Constant	Known value standard units	v_k equivalents Hz
electron binding gravitational energy	$1.922\ 10^{-057}$ J	$2.900\ 10^{-024}$ Hz
Planck's (h)	$6.626069\ 10^{-34}$ J	1 Hz
Rydberg (R)	$1.097373156\ 10^{-10}$ m^{-1}	$3.289841960\ 10^{15}$ Hz
Bohr radius (a_0)	$0.52917721\ 10^{-10}$ m	$5.6652563\ 10^{18}$ Hz
electron mass (*e*)	$5.10998918\ 10^{5}$ eV	$1.2355899\ 10^{20}$ Hz
up	$0.0015\ 10^{9}$–$0.005\ 10^{9}$ eV	$3.62698\ 10^{20}$–$1.29899\ 10^{21}$ Hz
top	173.7–$182.3\ 10^{9}$ eV	$4.200\ 10^{25}$ Hz–$4.4079\ 10^{25}$ Hz
down	$0.003\ 10^{9}$–$0.009\ 10^{9}$ eV	$7.254\ 10^{20}$–$2.176\ 10^{21}$ Hz
Z	$9.11876\ 10^{10}$ eV Hz	$2.20490\ 10^{25}$ Hz
W^+	$8.0425\ 10^{10}$ eV	$1.94466\ 10^{25}$ Hz
muon	$1.0565836\ 10^{8}$ eV	$2.5548081\ 10^{22}$ Hz
$pion^+$	$139.57018\ 10^{6}$ eV	$3.3747921\ 10^{22}$ Hz
$pion^0$	$134.9766\ 10^{6}$ eV	$3.2637198\ 10^{22}$ Hz
strange	$0.0075\ 10^{9}$–$0.17\ 10^{9}$ eV	$1.934\ 10^{22}$–$3.143\ 10^{22}$ Hz
bottom	$4.1\ 10^{9}$–$4.4\ 10^{9}$ eV	$9.913\ 10^{23}$–$1.063\ 10^{24}$ Hz
tau^-	$1.77699\ 10^{9}$ eV	$4.296742\ 10^{23}$ Hz
$kaon^0$	$497.672\ 10^{6}$ eV	$1.2033656\ 10^{23}$ Hz
$kaon^+$	$493.677\ 10^{6}$ eV	$1.1937057\ 10^{23}$ Hz
charm	$1.15\ 10^{9}$–$1.35\ 10^{9}$ eV	$2.780\ 10^{23}$–$3.264\ 10^{23}$ Hz
proton	$9.38272029\ 10^{8}$ eV	$2.2687318\ 10^{23}$ Hz
neutron	$9.3956535\ 10^{8}$ eV	$2.2718590\ 10^{23}$ Hz

This table lists the constants evaluated, their classic unit values, and their frequency equivalents. The frequency equivalents are calculated as the annihilation frequencies of the masses or energies, and the frequencies associated with the wavelengths.

the plotted value plus one. Inspection shows that the x-axis ln-translated constant's values are empirically related solely to $\pm 1/n$ values, where $n = 1$ to $\pm\infty$ (Tables 1, 2, 3). The actual exponents of the known constants are related to $1\pm 1/n$. These are referred to as quantum fractions (qf), and the n is analogous to the principal quantum numbers of atomic spectra. For example, the known qfs for the gravitation binding energy of the electron in hydrogen, the ionization energy, the Bohr radius, and the mass of the electron are all nearly equal to -1, 2/3, 4/5, and 6/7, respectively.

A graphic translation the known exponents is plotted on a ln-ln plane, where the point (0, 0) is associated with the neutron. The x-axis is related to the qf-1 or $\pm 1/n$. The only possible x-axis values are $\pm 1/\pm n$, and are related to the qf values. The y-values represent the difference between the known exponents and the qf values similar to a split spectral property.[15] A total of four points for each known value are plotted, similar to imaginary number properties (complex conjugate and inverses) because the system is empirically symmetric.[16–18] The neutron is the only entity at the center, (0, 0), point.

The points associated with the properties of hydrogen (the Rydberg constant R, the Bohr radius a_0, and the mass of the electron *e*) represent the foundation for all other fundamental constants independent of force. By plotting a line related to the weak forces of hydrogen, the mass of the electron and the Bohr radius, all of the weak force constants can be derived, including nuclear ones such as tau, muon, Z and W. By plotting the line related to Planck's constant $(-1, 0)$ and the ionization energy of hydrogen, all of the electromagnetic force constants, such as the quarks, pions, and kaons of the electromagnetic force, can be derived in a similar fashion.

Table 2. Quantum fractions and δ values for the evaluated constants.

Constant	Abbrev.	n	± 1/n	qf, 1–1/n or (1 + 1/n)	n_H	exp_k # range	δ, ± (exp_k–qf) (calculated)
gravitational binding electron, H	Gbe			–1		–0.007757	–1.007757
Planck *s	h			0	1	0	0
neutrino, H	v_{ave}	2	–1/2	½ (3/2)	2	~0.5	(0.002162)
Rydberg, H	R	3	–1/3	2/3 (4/3)	3	0.66436554	–0.0023011223
Bohr radius, H	a_0	5	–1/5	4/5 (6/5)	5	0.80291631	0.0029163104
electron, H	*e*	7	–1/7	6/7 (8/7)	7	0.86023062	0.0030877599
up	*u*	10	–1/10	9/10 (11/10)	*	0.88025–90264#	(0.0024)
top	*t*	10	+1/10	11/10 (9/10)	*	1.09706–1.09795#	(0.0024)
down	*d*	11	–1/11	10/11 (12/11)	*	0.89314–0.91357#	(2.2 10^{-3})
Z	Z	12	+1/12	13/12 (11/12)	7	1.0850734	0.0017401528
W^+	W^+	12	+1/12	13/12 (11/12)	3	1.0827381	–5.9517108 10^{-4}
Muon	μ	24	–1/24	23/24 (25/24)	8	0.95936771	0.0010343838
$pion^+$	π^+	28	–1/28	27/28 (29/28)	3	0.96454355	2.57836 10^{-4}
$pion^0$	π^0	28	–1/28	27/28 (29/28)	4	0.96392127	–3.64441 10^{-4}
strange	*s*	30	–1/30	29/30 (31/30)	*	0.95299–0.96810#	(8.0 10^{-4})
bottom	*b*	36	+1/36	37/36 (35/36)	*	1.02693–1.02870#	(–3.8 10^{-4})
tau	T	83	+1/83	84/83 (82/83)	6	1.0118493	–1.9884066 10^{-4}
$kaon^0$	K^0	84	–1/84	83/84 (85/84)	3	0.98818379	–8.8556944 10^{-5}
$kaon^+$	K^+	85	–1/85	84/85 (86/85)	6	0.98803392	–2.01364 10^{-4}
charm	*c*	139	+1/139	140/139 (138/139)	*	1.00375–1.0067#	–4.5 10^{-4}
proton	*p*	39043	–1/39043	39043/39044	1	0.99997438	2.5613004 10^{-5}
neutron	n	±∞	0	1		1	0

This table lists the known constants evaluated, the abbreviations, the principal quantum number, 1/n, the hydrogen quantum number, the quantum fraction and their inverses, the known exponent (exp_k), and the δ values. The n_H notes that these are the hydrogen values. Note that all of the δ values are very small, but not zero as predicted. The* signifies that the quantum number values are not known since their masses are not accurately measurable. The values in parentheses are calculated. The values labeled with # are the published ranges.

Table 3. Coupling constant ratios and exponents for the evaluated constants.

Constant	Abbrev.	n	±1/n	v_k/v_ns (range calculated)	$v_ns^{(\pm 1/n)}$
gravitational binding electron, H	Gbe	–2	–2	$1.276\ 10^{-47}$	$1.937\ 10^{-47}$
Planck *s	h	–1	–1	$4.401681\ 10^{-24}$	$4.401681\ 10^{-24}$
neutrino, H	v	2	–1/2	$1.6\ 10^{-12}$	$2.1\ 10^{-12}$
Rydberg, H	R	3	–1/3	$1.448083\ 10^{-8}$	$1.638851\ 10^{-8}$
Bohr radius, H	a_0	5	–1/5	$2.493665\ 10^{-5}$	$2.131688\ 10^{-5}$
electron, H	*e*	7	–1/7	$5.438673\ 10^{-4}$	$4.606531\ 10^{-4}$
up	*u*	10	–1/10	$(1.596\ 10^{-3}$–$5.321\ 10^{-3})$	$4.617\ 10^{-3}$
top	*t*	10	+1/10	$1.855\ 10^{2}$	$2.165\ 10^{2}$
down	*d*	11	–1/11	$(3.192\ 10^{-3}$–$9.578\ 10^{-3})$	$7.528\ 10^{-3}$
Z	Z	12	+1/12	97.05359	88.3822
W^+	W^+	12	+1/12	85.591	88.3822
muon	μ	24	–1/24	$1.124545\ 10^{-1}$	$1.063695\ 10^{-1}$
$pion^+$	π^+	28	–1/28	$1.485476\ 10^{-1}$	$1.465019\ 10^{-1}$
$pion^0$	π^0	28	–1/28	$1.436585\ 10^{-1}$	$1.465019\ 10^{-1}$
strange	*s*	30	–1/30	$(7.982\ 10^{-2}$–$1.809\ 10^{-1})$	$1.665152\ 10^{-1}$
bottom	*b*	36	+1/36	(4.2572–4.6830)	4.45439
tau	T	83	+1/83	1.89128	1.91162
$kaon^0$	K^0	84	–1/84	$5.2965\ 10^{-1}$	$5.271665\ 10^{-1}$
$kaon^+$	K^+	85	–1/85	$5.2542\ 10^{-1}$	$5.311522\ 10^{-1}$
charm	*c*	139	+1/139	(1.223–1.436)	1.4724
neutron	n	±∞	0	1	1

This table lists the known coupling constant ratios evaluated, the abbreviations, the principal quantum number, ±1/n values, and the v_ns values raised to the ±1/n values. Note that the degenerate ratio values derived from integers only are quite close, but not exactly identical to the known values. This is supporting evidence of the hypothesis.

The harmonic number properties of logically associated entities lineage are also empirically demonstrated once each qf and principal quantum number are identified. For example, Z is associated with one of the ln-ln points of the electron. Another example is that the quantum number of the muon is associated with the quantum integer product of the neutrino and the W boson quantum numbers. The derivation of the actual nuclear frequency equivalents from hydrogen properties only is possible since all of the associated entities are linearly linked between the neutron and the hydrogen points only by logical harmonic numbers, and simultaneously they only exist on lines connecting the hydrogen points to the neutron.

This model is unequivocally supported by demonstration of multiple linear relationships on the ln-ln plane between logically associated physical constants, and is therefore tested and supported. There is no speculation in the calculations or results. It will be shown that this method displays ln-ln properties between logically associated constants, evaluated as frequency equivalents, such as symmetry points (i.e. the up quark, and top quark). An analysis of the constants as a ln-ln system can be utilized to make predictions of fundamental constant values beyond what can be experimentally made, including predictions of nuclear high energy physics constants from properties of hydrogen only (i.e. calculation of the mass of Z from the Bohr radius and the masses of the electron and neutron only).

Methods and Results

Annihilation frequency equivalents

All of the constants, independent of units, are converted to annihilation frequency equivalents (Table 1). This is a simple classic unit conversion, but it should not be confused with a kinetic energy process. This is not a typical method to compare fundamental constants of different units, but it is nonetheless completely valid. This is identical to the logical method used in Moseley's law.[8,9] It allows for a normalization of different entities, since they are all linked to the neutron, its beta decay products, and a single unit (expressed in Hz). Since the calculations are related to dimensionless ratios (coupling constants), the actual physical unit is not important since the ratios are independent of unit.

The data used for the calculations was acquired from http://physics.nist.gov/cuu/Constants/, and http://pdg.lbl.gov/2000/contents_tables.html.

Coupling constant annihilation frequency equivalents

All of the known fundamental constants, when expressed as frequency equivalents (v_k), are evaluated as dimensionless coupling constants spectra, where the numerator is related to each constant, and the denominator is related to the transitional annihilation frequency, v_n, 2.2718591 10^{23} Hz, frequency of the neutron (Equation 1). Coupling constants denote the strength of an interaction and are dimensionless. There are many other ratios that represent coupling, such as ratios related to the fine structure constant, α.[13,19]

$$\frac{v_k}{v_n} \quad \text{frequency coupling constant domain} \qquad (1)$$

Conversion of the coupling constant annihilation frequency equivalents to an exponent base of v_n

All of the fundamental constants are converted (transformed) to exponent equivalents with the dimensionless base equal to v_n Hz divided by one Hz, which equals $v_n s$. This is Equation 2. Equations 2 and 3 are inverse mathematical functions.[20] The known exponent value ($\exp_k$) is calculated as the ratio of the ln of each entity, divided by the ln of $v_n s$. Table 2 lists the constants' evaluated abbreviations, quantum fractions (qf), ±1/n, δ, principal quantum number (n), and $\exp_k$ values used in the calculations. Table 3 lists the ratio values of the coupling constants and the ±1/n exponent values plotted on the ln-ln plane (Equation 4).

$$\exp_k = \frac{\ln(v_k)}{\ln(v_n)} = \log_{vns}(v_k) \quad \text{exponent domain} \qquad (2)$$

$$v_k = e^{\log_e(v_n s)\exp_k} Hz = v_n s^{\exp_k} Hz \quad \text{frequency domain} \qquad (3)$$

$$\frac{v_k}{v_{vns}} = (v_n s)^{\exp_k - 1} \quad \text{ratio coupling constant domain} \qquad (4)$$

The fundamental constants evaluated as a unified spectrum of the neutron

The gravitational binding energy of the electron in hydrogen is assumed to be equally as important to the properties of kinetic forces (including gravity) as the ionization energy is to the spectral (Rydberg series) and chemical properties of the elements (Mosley's law), and atomic spectra. This paper focuses first on the relationship of the annihilation frequency of the neutron to the products of beta decay, including hydrogen. Next the relationship to the other particles and bosons is interrogated using similar methods.

Gravitational, electromagnetic, and strong energies as an integer series exponential function of the annihilation frequency of the neutron

The relative energy (or frequency) values of the neutron (spectral transitional, annihilation frequency, v_n, 2.2718591 10^{23} Hz, and Planck's constant times one second, s, (v_h = 1 Hz) equal the fundamental dimensionless coupling constants of this hypothesis, $v_n s$ (Equation 4).

The hypothesis is based on the empirical physical fact that the coupling constant ratio $v_n s$, the ratio of the neutron and Planck's time equivalent, is nearly equal to the ratio of the numerator, (product of Planck's constant (h) and 1 Hz) and the denominator (the gravitational binding energy of the electron in hydrogen).

This calculated value is 3.4480 10,[23] nearly equal to $v_n s$ (Equation 5; Tables 1, 2). The inverse of $v_n s$ Hz is 4.401681 10^{-24} Hz and the known calculated frequency equivalent of the gravitational binding energy of the electron is 2.9002 10^{-24} Hz. If the frequency equivalent of the gravitational binding energy of the electron is associated with the frequency of the neutron, it should logically be equal to approximately one half the inverse of $v_n s$, since it is a kinetic force, which is shown to be true. It is possible to even more accurately derive the gravitational binding energy of the electron in hydrogen using this model, but that is not the focus of this work and will not be further discussed.

The analysis above shows that there is a simple integer exponential relationship between the coupling constants $v_n s$ for the neutron, Planck's time, and the gravitational binding frequency of the electron. This is an exponential function (Equation 5), where 1 is associated with the neutron, 0 with Planck's time, and −1 with the binding gravitational energy. The neutron is the linear unit value for the elements. Planck's constant is the linear unit for electromagnetic properties. The gravitation binding energy in hydrogen follows the identical pattern, with a ratio spacing equal to nearly $v_n s$.

$$\left[\frac{v_n}{v_h}\right]^n Hz = (v_n s)^n Hz \quad \text{for} \quad n = -1, 0, 1 \quad (5)$$

In classic harmonic systems, the only possible steps are related to integer fractions (a standing wave pattern).[11,12,21] It is logical that the actual properties of hydrogen (ionization energy, Bohr radius, and the mass of the electron) and many of the fundamental particle rest masses and bosons should be associated with integer quantum fraction (1 ± 1/n) exponents as well. This is analogous to the orbital properties of hydrogen, where there is a series of four quantum factors that are predictive of the properties of the elemental orbitals (Tables 1, 2; Figs. 1–7; Equations 1–25). Four quantum numbers, including a principal quantum number, can be used to define all of the evaluated fundamental values in this mathematical system. These factors used in this hypothesis include: a hydrogen principal quantum number (1–8), a secondary (sec) quantum number (>9, for those entities that are not directly related to hydrogen, such as nuclear properties (nuc)), a factor related to whether the entity is associated to a kinetic or electromagnetic force, and the symmetry sign value (±) for the ln-ln plane. These signs define in which quadrant the translated points lie.

The degenerate frequency values of the fundamental constants are related to the exponents 1 ± 1/n (Equation 6). These values should be approximately equal to, but not identical to the known values of all fundamental constants, which is true (Tables 1, 2). The same is true for the ±1/n values and the known coupling constants (Table 3; Equation 14).

$$v_k \approx (v_n s)^{1\pm 1/n} Hz \quad \text{the only possible approximate degenerate frequency values} \quad (6)$$

Translations of the fundamental constants to a ±1/n exponential relationship plotted on a ln-ln plane

The ln-ln plane is associated with the exponential and quantum number domain of the constants. These points are described as z points, (x, y), that equal the total value ($\exp_k$ minus one values) (Equation 7–14). The minus one centers the neutron at the (0, 0) z point for symmetry. Therefore, the zero x-axis point is associated with n equaling both $-\infty$ and $+\infty$ (Fig. 1).

$$\exp_{kvns} = \log_{vns} v_k = 1 + z = 1 + x + y = 1 \pm \frac{1}{n} + y \quad (7)$$

z symmetry possibilities = the four symmetry points

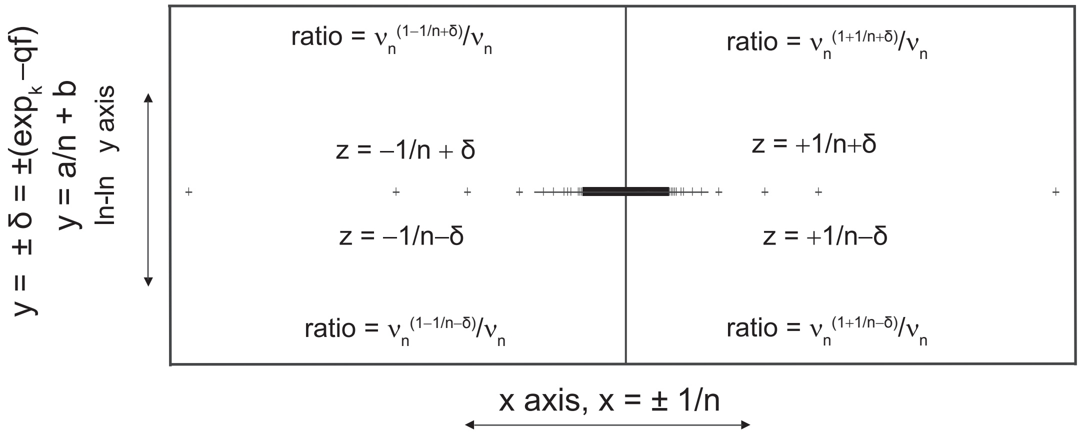
$$+\frac{1}{n} + y \text{ or } +\frac{1}{n} - y \text{ or } -\frac{1}{n} + y \text{ or } -\frac{1}{n} - y \quad \text{where } n \text{ equals integers 1 to } \pm\infty \quad (8)$$

$$\pm\delta = \pm\frac{1}{n} \pm z \quad \delta \text{ represents the difference between the degenerate } \pm 1/n \text{ values and the } (\exp_k - 1) \text{ values} \quad (9)$$

$$\pm\frac{1}{n} = x \text{ axis components} \quad (10)$$

$$qf = 1 \pm \frac{1}{n} \text{ quantum fractions} \quad (11)$$

$$z\ (\text{point}) = \exp_k - 1 = qf - 1 \pm \delta = x + y = \pm 1/n \pm \delta = \pm 1/n \pm a/n \pm b$$



x = 1/±n	–1	–1/2	–1/3	0	1/3	½	1
n	–1	–2	–3	±∞	3	2	1
1±1/n, (qf)	0	½	2/3	1	4/3	3/2	2
Hz	1		$\nu_n s^{(2/3)}/s$	$\nu_n s/s$	$\nu_n s^{(4/3)}/s$		$\nu_n s^{(2)}/s$
ν_n^{qf}/ν_n	$1/\nu_n s$		$\nu_n^{(2/3)}/\nu_n$	ν_n/ν_n	$\nu_n/\nu_n^{(2/3)}$		$\nu_n s/1$
constant	– *h*		–*R*	*neutron*	R		+ h

Figure 1. Translation of the frequency equivalent coupling constants to a ln-ln plane. This figure displays the ln-ln plane for the z point values for the known ν_k/ν_n ratio exponents ($\exp_k$–1). The unique neutron central symmetry point, (0, 0), (1/±∞) is related to $\nu_n s$ in the frequency domain. All points represent the exponents of $\nu_n s$ that are related to ratios. The only possible quantum (n) components of z, ±1/n, are plotted on the x-axis as small cross hairs (two for each ±n). This is similar to a classic standing wave pattern. As n approaches ±∞ there is confluence of points that cannot be displayed. The different mathematical unit values associated with the x-axis are listed below, including: x, (1/n), n, qf, Hz, frequency ratios, and the associated constants. This demonstrates that a single actual frequency associated with a specific constant can be related to different x-axis units. The four possible symmetry splitting components δ are plotted on the y-axis. The notation of each potential *z* point is related to its quadrant (top right +1/n+δ, bottom right +1/n–δ, top left –1/n+δ, and bottom left –1/n–δ). The neutron is associated with an *x*-value of 0, R with ±1/3, and h with ±1.

$$\delta = \pm(\exp_n - qf) \text{ y axis component known exponent splitting} \quad (12)$$

$$\exp_k = 1 \pm \frac{1}{n} \pm \delta = qf + \delta \quad \text{known exponent} \quad (13)$$

$$\frac{v_k}{v_{vns}} = (v_n s)^{\pm\frac{1}{n}\pm\delta} \quad \text{known ratio} \quad (14)$$

The known exponent value is usually translated to the nearest quantum integer fraction value and a δ. The y-axis values are then plotted on a ln-ln plane (Tables 2, 3). The associated integers and quantum fraction values are usually obvious. The distance from the (−1, 0) z point (Planck's constant) to the entities is identical to their known exponent value. This creates a symmetric standing wave pattern (Figs. 1–4). The only valid possible points are related to ±1/n x-axis values. The difference and its inverse (δ) between the known exponents and their quantum fraction are plotted on the y-axis for each constant at the x-value ±1/n. This represents the symmetric split spectrum property.

The sum of the orthogonal distances between two points on the ln-ln plane is related to the ratio of two frequencies in the frequency coupling constant domain (Table 3). The larger the sum of the distances from a z point to the neutron point (0, 0), the greater the ratios. Moving to the right and up is associated with multiplying $v_n s$ by each orthogonal factor. Moving to the left and down is associated with dividing $v_n s$ by each factor. For example, twice the orthogonal distance on the ln-ln plane is associated with the square of the factor in the frequency domain.

For each known ln-ln plane point there are three other associated z points, one in each quadrant. This is assumed to be related to the inherent symmetry of the system, and is supported by empirical findings. These are defined as symmetry points associated

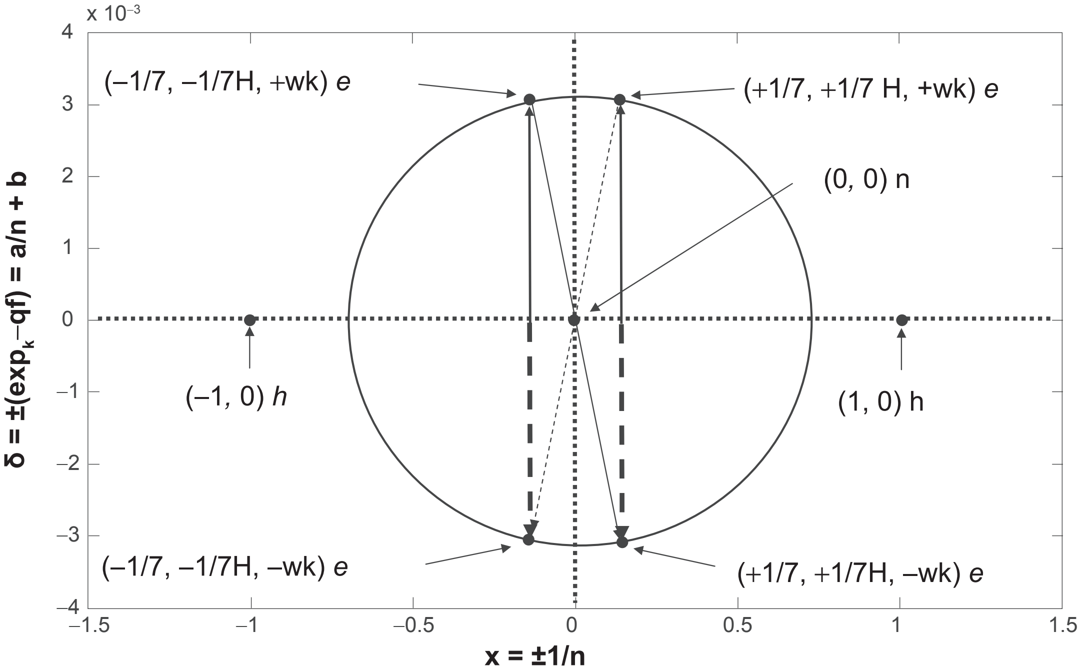


Figure 2. Translation of the electron to the ln-ln plane. This figure displays the ln-ln plane and the four translated symmetry points related to the electron. The neutron value is at the z point (0, 0). The quantum integer value of the electron is 7. The qf value of the electron is 6/7 or (1–1/7). These points are plotted at an x-axis value of ±1/7. The y-axis value is the difference between the $\exp_k$ of the electron and 6/7. Since this is a ln-ln plane system, there are three other associated symmetry values, one in each quadrant. These points must fall on a circle. The thick arrows show the symmetry points mirrored off the x-axis (dashed and solid). The thin arrows demonstrate the inverse symmetry points mirrored off the y-axis (dashed and solid). Any of these values are valid and may be associated with the electron directly or other logically associated lineage entities of the electron such as the Z boson (Fig. 6). Only one is the actual value associated with the electron though.

with the four possible sign combinations of the δ and the 1/n values (±1/n ± δ) (Equation 8). Each point must demonstrate mirror symmetry with the x- and y-axes (Figs. 1–4). The δ value is equivalent in the frequency domain to the factor that the degenerate quantum fraction frequency is multiplied or divided by to arrive at the known value (Equation 6).

A linear relationship on the ln-ln plane means that the coupling constant between entities is directly related to the quantum number fraction axis. In other words, the coupling constants of a force are equally scaled per 1/n change. The difference in the slopes defines the strength of the force.

This model represents a classic mathematical inverse function transformation from the frequency ratio coupling constant domain to the quantum fraction exponential domain. This is analogous to K space and real space in magnetic resonance imaging[22] or Fourier transform.[23,24] Both domains describe the same physical reality, but utilize completely different mathematical forms. The natural $\log_e v_n s$ value is 53.780055612.

To describe each specific constant's z point for each known physical constant, the following notation is used. This is analogous to the definition of the electron orbitals using quantum numbers.[6] This represents the translation of the known constants to the ln-ln plane. The notation includes three signs, two 1/n principal quantum number fractions (the first for hydrogen or non-hydrogen and the second for the associated hydrogen number), and whether the entities are associated with an electromagnetic or weak kinetic property of hydrogen. There are three signs to define the different possible quadrants in which the point falls. Directly following the associated constant value is an abbreviation (i.e. h for Planck's constant, a_0 for Bohr radius) (Tables 1, 2).

For the hydrogen values, the two principal quantum values are degenerate. For the electron, the notation would be (−1/7, −1/7 *H*, +*wk*) *e* (Fig. 2). For the ionization energy, the notation would be (−1/3, −1/3 *H*, −*em*) *R* (Figs. 3, 4,). Using Z for example, the notation is (+1/12, +1/7 *H*, +*wk*) *Z.* Italics indicate this is the known value, not another

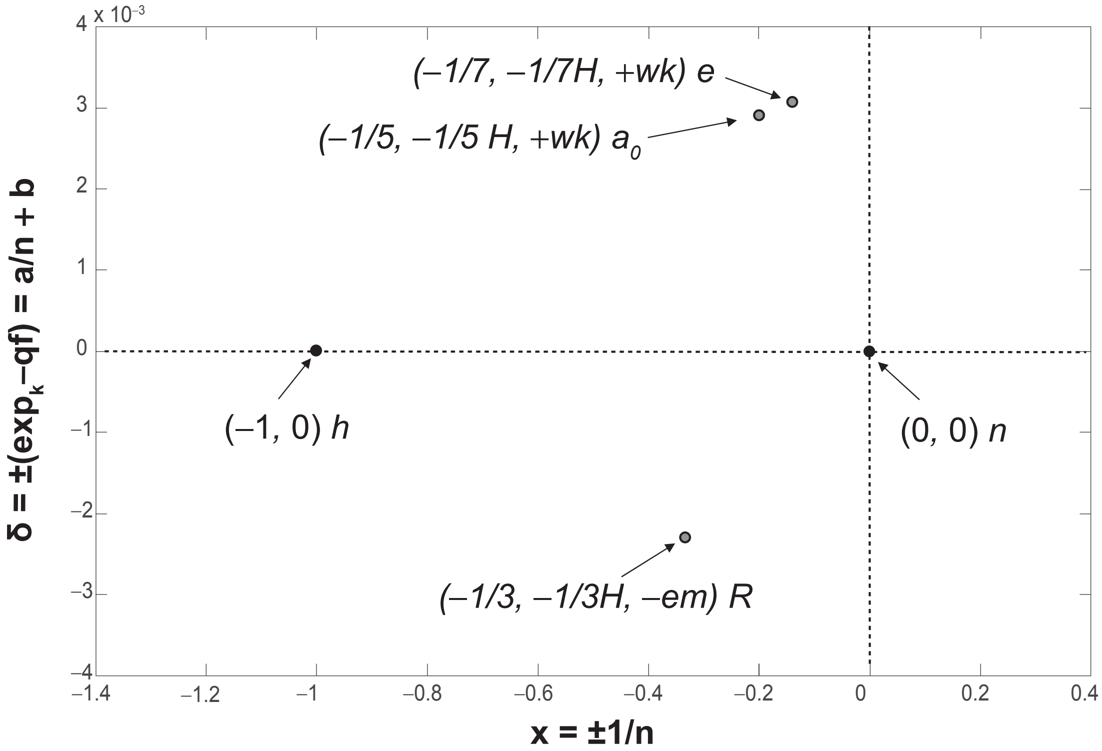


Figure 3. Translation of the electron (*e*), R (ionization energy), and Bohr radius (a_0) to the ln-ln plane. This figure displays the ln-ln plane and the three translated points related to the electron (*e*), ionization energy (R), and Bohr radius (a_0). The neutron value is at the z point (0, 0), and Planck's constant at z point (−1, 0) by definition. The associated quantum integer values are electron, 7 (6/7, 1−1/7), the Bohr radius, 5 (4/5, 1−1/5), and R, 3 (2/3, 1−1/3). These values are respectively plotted at x-axis values of −1/3, −1/5, and −1/7. Their associated δ y-axis values are related to the difference between the $\exp_k$, known exponent values and their qf values. All of the derivations are primarily related to these five points.

symmetry possibility (Fig. 6). Therefore, the quantum fraction value of Z is 1 + 1/12 or 13/12. Z is associated with the weak kinetic positive sign for the hydrogen point associated at the electron at the +1/7 x-axis point.

In most cases the 1/n value for the principal quantum number is an obvious translation. The $\exp_k$ and their corresponding $v_n s$ raised to a specific qf are nearly identical. The difference between the known and the qf is plotted as the δ directly above and below the 1/n value. Each point is listed in parentheses (Table 2). Each z point is first characterized by the 1/n value and its sign. Each 1/n value in the described ln-ln notation denotes its location on the ln-ln plane.

Hydrogen z point lines, weak kinetic and electromagnetic forces

The properties of hydrogen can be defined by two primary logical lines on the ln-ln plane. The possible quantum number points associated with these lines have been found to be associated with all other entities. There are three other symmetric lines associated with each primary line, just as there are three points associated with each known z point (Equation 8). The first line is called weak kinetic (wk), and is defined by the z points for the Bohr radius and the mass of the electron. These points are logically related to weak and kinetic entities, and will be shown to be related to the neutrino, tau, muon, Z, and W. The other line, electromagnetic (em), is defined by the z point for Planck's constant at (−1, 0) and the Rydberg constant point (ionization energy). These points will be shown to be related to the mesons and quarks. The slopes and y-intercepts of these two lines can be used to calculate all of the possible z points, and are important in the derivation process. For example, the weak kinetic point for −1/8 is linearly associated with the frequency equivalent of the muon, while −1/3 is linked to the pions and kaons.

The equations (15–22) used for the line calculations are shown. These equations are related to the linear relations of the two hydrogen lines and their nuclear entities. Equation 15 is derived from multiple points

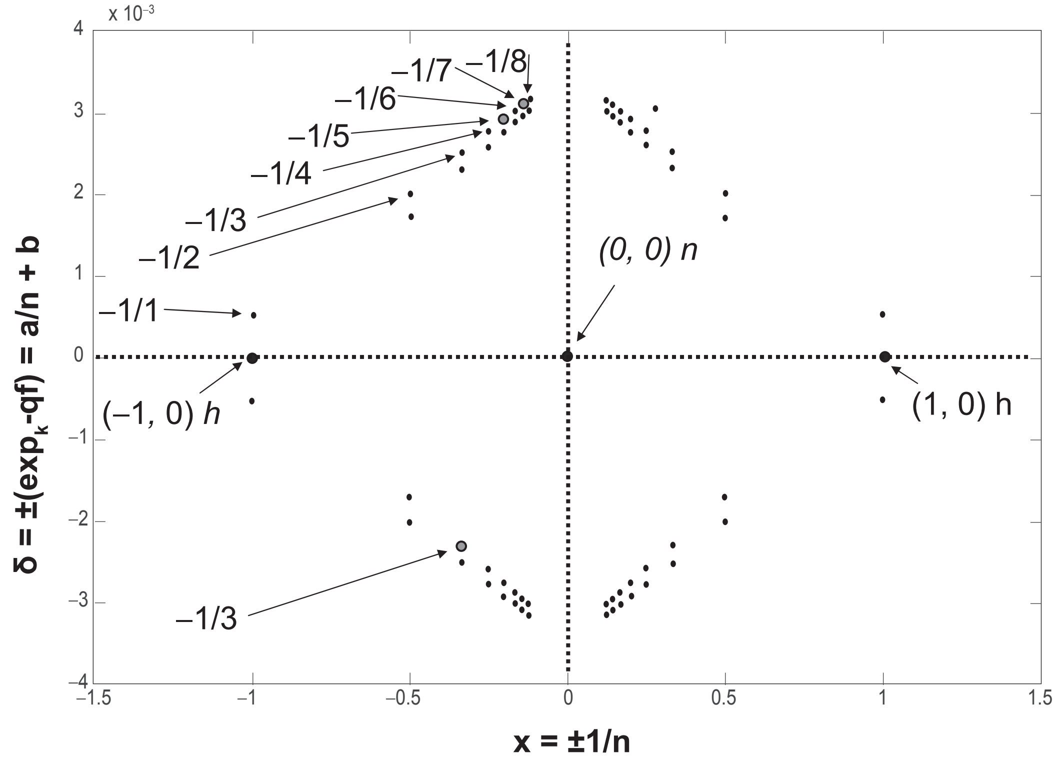


Figure 4. All of the translated possible integer z points of hydrogen to the ln-ln plane. This figure displays the ln-ln plane and all of the possible integer z points for hydrogen with n ranging from 1 to 8. The neutron value is at the z point (0, 0). The other possible z points are dots while the known values are black solid circles. These points fall on the lines connecting the Bohr radius and electron for one, and h, and R for the other. These points are in the identical pattern as those shown in Figure 3. From these limited hydrogen points all of the fundamental coupling constants will be derived. They have a diamond pattern because of the ln-ln dual axis mirror symmetry. The n values larger than 8 are not plotted, but are all valid.

on the hydrogen lines. Equation 16 is derived from the perspective of the slope from the neutron (0, 0) point to the hydrogen points. Equations 15 and 16 are equivalent. The exponent domain equations are shown, where v_k is the known frequency equivalent of a fundamental constant.

$$\delta = \pm\frac{n_H}{n_{\sec}}\left(\frac{a}{n_H} \pm b\right) = \pm\frac{n_H}{n_{\sec}}\left[a\left(1-\frac{1}{n_H}\right) \pm (b-a)\right] \quad (15)$$

$$\delta = \pm\frac{[(n_H-1)b \pm (b-a)]}{n_{\sec}}$$

or

$$\delta = \pm\frac{[(n_H-1)b \pm (b-a)]}{n_H} \quad (16)$$

where $a_{\text{em or wk}}$ (slope) and $b_{\text{em or wk}}$ (y-intercept) define a linear relationship between associated hydrogen fundamental constants and x (1/n) for hydrogen n_H,_em is related to electromagnetic properties, and wk is related to weak kinetic properties

$$\text{slope from (0, 0) to any z point} = n\delta \quad (17)$$

$$\text{slope from (0, 0) to any z point} = \pm (n_H-1)\, b \pm (b-a) \quad (18)$$

$$\text{slope from (0, 0) to any z point} = (n-1)-[n\,(\exp_k)] \quad \text{for } \exp_k < 1 \quad (19a)$$

or

$$\text{slope from (0, 0) to any z point} = [(n-1)\exp_k]-n \quad \text{for } \exp_k > 1 \quad (19b)$$

$$1+\frac{slope-(b-a)}{b} = n_H \text{ value associated with any z point entity} \quad (20)$$

an alternate form defining the linear relationship from the y values at x = 0 and x = −1 of the hydrogen factors related to specific quantum fractions

$$\frac{\left(1 \pm y_{intercept}\, at\ 0\right)\left(n-\frac{1}{n}\right) \pm \left(y_{intercept}\, at -1\right)}{n} = \exp_k \text{ for hydrogen} \quad (21)$$

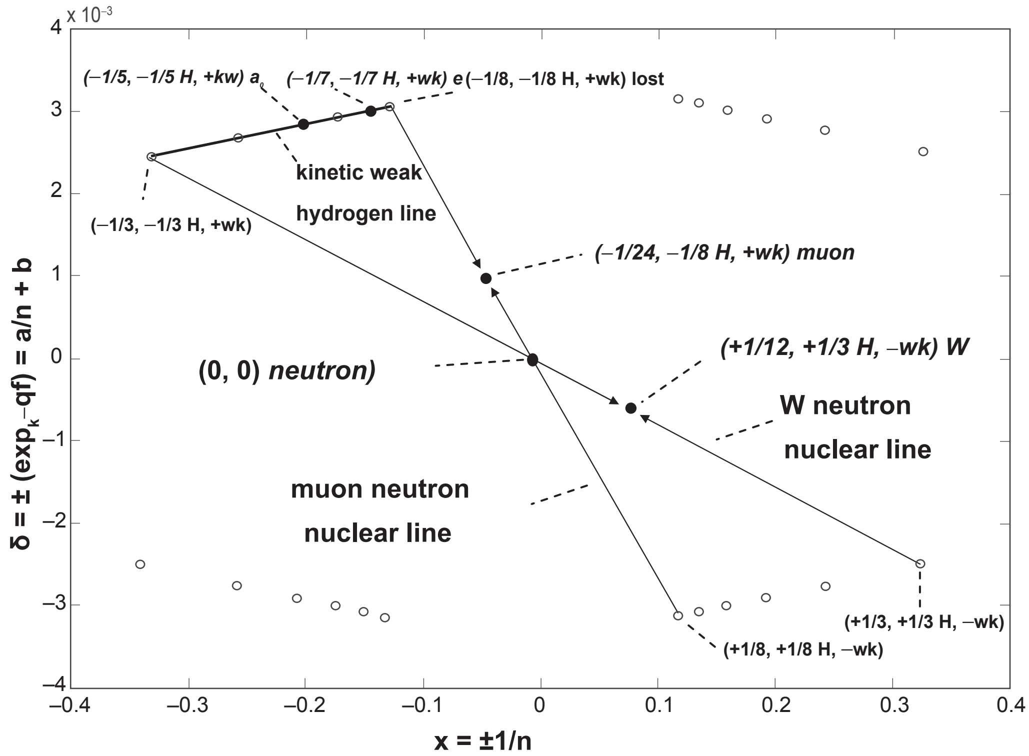


Figure 5. The known z points relating the muon and W with the neutron and hydrogen. This figure displays the ln-ln plane for the z values for the known values of the masses of the electron, Bohr radius, neutron, muon and W (solid black circles). The diamond pattern at the periphery is the linear relations of the 1/n values derived from the mass of the electron and the Bohr radius (wk H) (Fig. 4). The other white circle values are calculated. This linear arrangement of z values are logically assumed to be related to the kinetic weak forces. Note that the known z values of the muon and W are related to the intersection of radii of the inverses of –1/8 and –1/3 wk H points respectively and the vertical principal quantum number ±1/n line of –1/24, and +1/12, respectively. This demonstrates the geometric and quantum number lineage relationship between hydrogen and the nuclear properties. The quantum number of the muon is 2 times the quantum number of W. Two is the quantum number associated with the neutrino. W and Z are associated with the quantum number 12.

$$\frac{(\pm y_{intercept}\, at\, -1) \pm (n-1)(\pm y_{intercept}\, at\, 0)}{n} = \exp_k \text{ for the non-hydrogen factors} \quad (22)$$

Below are the frequency domain equations 23–25.

$$v_k = (v_n s^{\exp_k})Hz = (v_n s^{1+z})Hz \quad (23)$$

$$v_k = \left(v_n s^{1 \pm \frac{1}{n} \pm \delta} \right) Hz = \left(v_n s^{qf \pm \partial} \right) Hz \quad (24)$$

$$v_k = \left(v_n s^{1 \pm \frac{1}{n} \pm \left[\frac{n_H}{n_{nuc}} \left(\frac{a}{n_H} \pm b \right) \right]} \right) Hz \quad (25)$$

Nuclear z points and the weak kinetic and electromagnetic lines

The entities with quantum numbers larger than 8 are associated with two principal quantum numbers, one n related to hydrogen (n_H), and one secondary n_{sec} quantum number. The line splitting is linearly proportional to 1/n (x-axis). For the small values of n, the only possible qf values associated with each constant are those qf that are mathematically larger or smaller than the $\exp_k$, so there is no speculation in their assignment when they are accurately known. This is not true when n values are larger (greater than 40), since the 1/n differences become smaller than the δ values. Logical assignments are made (Table 2). More than one symmetry point can demonstrate a linear relationship to the other fundamental constant z values (Figs. 5–7). For example, the integer 12 is associated with both the W and Z bosons.

Harmonic linage relationship between hydrogen n values and their nuclear related entities

By empirical inspection there are only 16 possible individual symmetry points in each ln-ln plane quadrant associated with hydrogen that define all of the possible radii from the neutron (0, 0) point. Eight points are derived from the kinetic weak entities and eight from the electromagnetic entities. For the whole ln-ln plane, there are 64 possible hydrogen z points related to n values from 1 to 8. Every nuclear entity falls on one of these radii connecting the neutron and the other potential hydrogen points. These 64 points are based on only two lines for the lowest principal quantum number values only (n = 1–8) and properties of hydrogen (Fig. 4). There are eight z points per line for weak kinetic (wk) entities, or eight z points per line for electromagnetic (em) entities that are linearly related to each other on the ln-ln plane (Figs. 3–7). Therefore, the actual exponents of a group of associated hydrogen properties are all related to a specific line where a and b define each specific line slope (a wk), (a em) and y-intercept (b em), (b wk) (Equations 15–22).

The eight weak kinetic points are solely derived from two z points (the Bohr radius (n_H, 5) and the mass of the electron (n_H, 7)) (Figs. 3–7). These two points define the line slope: (a wk) 0.00300036680, y axis intercept: (b wk) 0.0035163838. All of the eight electromagnetic z points are defined solely by Planck's constant and the ionization energy (n_H 3) z points (Figs. 3–7). These two points define the line slope: (a em) −0.0034516834 and y-intercept: (b em) −0.0034516834.

Nuclear weak force entities' relationships between hydrogen z points and the neutron z point

The mass values for the three neutrinos are not accurately known, but are in the range utilized in the calculations. The reasonable, but not precisely known values of 7 10^{-6}, 0.1, and 0.5 eV were used as estimates for the calculations of the electron neutrino, the muon neutrino and the tau neutrino respectively. The approximate $\exp_k$ for the average value is 0.495. Therefore, the quantum fraction of ½ is assumed. It is not completely clear if this is a valid value based on experimental data, but it does appear to logically support the hypothesis.

Tau, muon, Z and W are all related to z inverses (radii) of the hydrogen weak kinetic line points (Figs. 5, 6). The predictions of tau, muon, Z and W are made from the calculated weak kinetic hydrogen line z (n = 2–8) inverse values and their nuclear 1/n (qf) only (Table 3; Equations 15–22). W is associated with the z point (+1/12, +1/3 H, −wk). The quantum number 3 is associated with currents, in this case neutral currents. Z is associated with the z point (+1/12, +1/7 H, +wk). The quantum number 7 is associated with the electron. The muon is associated with the z point (−1/24, −1/8 H, +wk). Tau is related to the z point (+1/83, +1/6 H, −wk). The quantum number for the muon is 24, and the associated harmonic product is 2 ∗ 12. Two is associated with the neutrino, and twelve is associated with Z and W. Tau is associated with the principal quantum number 84. It is also associated with the harmonic product 7 ∗ 12. These numbers are associated with the electron and Z or W. Therefore, the weak entities represent product harmonic numbers of the beta decay masses, 2 for the neutrino, and 7 for the electron with 12 for W and Z.

Electromagnetic entities relationship between hydrogen and the neutron z point

The z points associated with electromagnetic properties are derived from the em line (Figs. 4, 7; Table 4). All of the quarks and mesons are also related to a radius intersecting the neutron point and the electromagnetic points. This is identical in pattern to the weak force nuclear entities. The z points for the quarks include: up (−1/10, *H, *em), down (−1/11, *H, *em), strange (−1/30, *H, *em), charm (±1/139, *H, *em), bottom (+1/36, *H, *em), and top (+1/10, *H, *em). The *signifies that the values for the quarks are not defined well enough to associate them with specific values.

The experimental accuracy for the actual quark masses is poor, so the exact calculations are not possible. The top quark is best known. All of the quark predictions from this model are consistent with the known estimated values. The quarks' quantum numbers follow harmonic number properties as well, with the up quark number 10, down 11, strange 30 (3 ∗ 10), charm 140 (2 ∗ 7 ∗ 10), bottom 36 (3 ∗ 12) and top 10. Therefore the harmonic product for strange is related to 3 for R and 10 for up quark. Charm is associated with the harmonic product of 2 for the neutrino, 7 for electron, and 10 for the up quark. Bottom is associated with the harmonic product of 3 for R, and 12 for the W or Z. All of the hydrogen

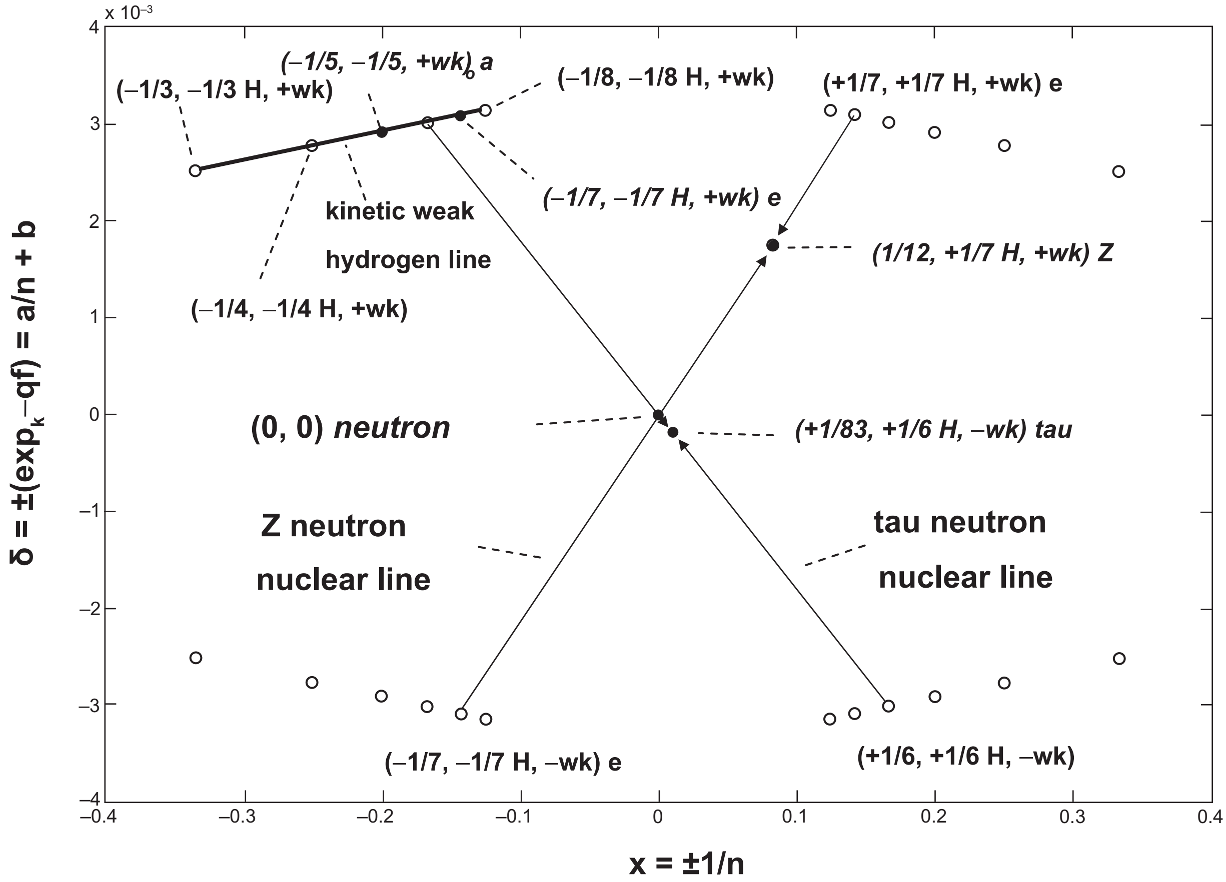


Figure 6. The known z points relating the tau and Z with the neutron and hydrogen on the ln-ln plane. This figure displays the ln-ln plane for the z values for the known values of the masses of the electron, Bohr radius, neutron, tau and Z (solid black circles). The diamond pattern at the periphery is the linear relations of the 1/n values defined by the mass of the electron and the Bohr radius (wk H line) (Fig. 4). The other white circle values are calculated. Note that the known z values of the tau and Z particles are related to the radii of the $1/n_H$ values 1/6 and 1/7 points respectively. The actual exponent known value is at the intersection of the neutron radii and their associated vertical $1/n_{nuc}$ intersection lines of +1/83, and +1/12, respectively. The predicted values of the tau and Z are within the maximum experimental measurable uncertainty. This demonstrates the geometric and quantum number lineage relationship between hydrogen and the nuclear properties. The quantum number of the tau is 7 times the quantum number of Z (12) or 84, 84/83.

quantum numbers are associated with the harmonics of these entities.

The pion and kaon values are more accurately known and also only occur at the intersection of electromagnetic hydrogen z point δ_H radii and their principal quantum number values (Table 5). Each kaon and pion value also falls on radii from the neutron z point to em δ_H points. The pion$^+$ is related to the z point (−1/28, −1/3 H, +em). The pion^0 is associated with the z point (−1/28, −1/4 H, −em). The kaon^0 is associated with the z point (−1/84, −1/3 H, +em). The kaon$^+$ is associated with the z point (−1/85, −1/6 H, −em). There is a product harmonic number property between the pion and kaon as well. The product of 3 for R and 28 for the pion is 84, the quantum number of the kaon. All of the nuclear entities in this paper demonstrate logical simultaneous associations of the hydrogen z point to nuclear values using harmonic number properties and linear relationships on the ln-ln plane.

Discussion

"A preposterous hypothesis"

This paper presents a "preposterous" hypothesis that the fundamental physical constants of hydrogen and the fundamental rest masses (bosons) plotted in their actual frequency equivalent coupling constant exponential values are similar to a classic quantum standing wave spectrum. This model in no way follows the mainstream thoughts related to sophisticated unified theories presently circulating today.[25] On the other hand, this model in no way represents the slightest departure from classic quantum mechanics and harmonic systems.[11,12] The validity of this model

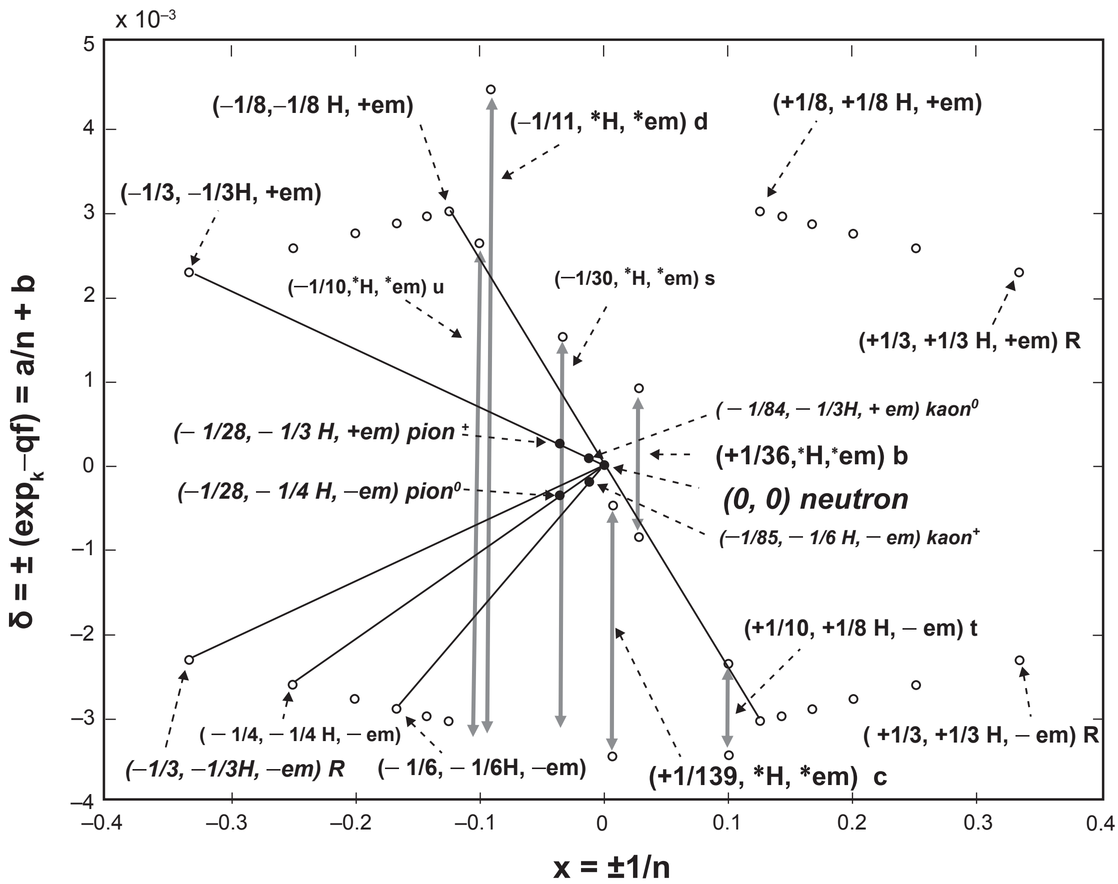


Figure 7. Plot of the quarks' and mesons' z points and their relationship to the hydrogen z em points. This figure displays the ln-ln plane for the z values for the known electromagnetic n_H points, kaons, pions, and the quarks. The * represent the fact that these values are not accurately known, and cannot be assigned. The solid black lines are the radii from the neutron to the electromagnetic hydrogen points (open circles) associated with the quarks and mesons. The solid black circles are the known values for the pions, kaons and the neutron. The open circles and range gray arrows are related to the estimated known values for the quarks. The solid gray lines are range of the calculated values for the quarks using the n values of 10 up-top, 11 down, 30 strange, 36 bottom, 140 charm. Note that all of the pions fall on electromagnetic radii similarly to the weak force factors. The six quarks known ranges fall within the predicted possible ranges between the n 1–8 δ ranges. This demonstrates the geometric and quantum number lineage relationship between hydrogen and the nuclear properties. Note that one each of the pions and kaons falls on the line connecting the nucleus and the R z point. The lineage quantum number is 3. The quantum number of the pion is 28. Three times that value is the quantum number of the kaon, 84.

needs to be systematically evaluated to be proven wrong (because it does not work to generate accurate predictions), or proven correct (because it does).

The power of the hypothesis

The power of a hypothesis is its ability to predict known physical facts that presently cannot be derived, or to logically explain unifying relationships of phenomena utilizing a simple method presently not understood. A few of these unresolved fundamental issues in physics include: the logical origins for the values for the fine structure contstant, α,[14,19] running α, electron spin g factor, g_e, Newton's gravitational force constant G,[14,26,27] the other force constants, and the masses of the fundamental particles (bosons).[2,27–33] This model can derive all of these constants, but this paper focuses solely on the values for the quarks, Z, W, the leptons, and some of the mesons. This hypothesis generates a simple supportable quantum rationale for the actual values of the fundamental constants across all of the forces with no mathematical impossibilities or unsolvable singularities. It does not require advanced math calculations, hypotheses that cannot be proved, or the necessity to define extra physical dimensions.

Properties of classic harmonic systems and the relationship to music

There are a number of classic mathematic properties that are expressed in physical harmonic phenomena.[11,12] These are commonly seen in musical systems and will be used as prototype models that

Table 4. Predicted-calculated exponent values for the muon, tau, W, and Z from hydrogen z points.

Weak force entities and qf (n_H, n_{nuc})	**Predicted exponent *(known)***	**Relative error predicted *(known)***
2/3 and W (13/12)	1.0827042	3.1 10^{-5}
(4, 12)	*(1.0827381)*	*(4.5 10^{-4})*
5/6 and tau (84/83)	1.0118301	1.9 10^{-5}
(6, 83)	*(1.0118493)*	*(1.6 10^{-4})*
6/7 (electron) and Z (13/12)	1.0851345	5.6 10^{-5}
(7, 12)	*(1.0850734)*	*(3.4 10^{-4})*
7/8 and muon (23/24)	0.95938044	1.3 10^{-5}
(8, 24)	*(0.95936771)*	*(8.9 10^{-8})*

The predicted-calculated values of W, tau, Z, and the muon from the intersection points of the radii of the z values associated with the kinetic weak hydrogen line (n = 2–8 points) and the vertical principal quantum number line ±1/n are listed (Figs. 5, 6). This is identical to the calculation using equations 15–22. The neutron point was assumed to be linearly related to the inverse of the properties of hydrogen and the high-energy weak forces' exponents. The weak kinetic hydrogen values were used. Note that predicted values are in excellent agreement with known exponent values and are nearly all within the relative measurable uncertainty ranges. The known values are in italics and the predicted values are not.

have identical properties to this paper's hypothesis. For example, when a string is plucked, it generates one dominant fundamental frequency. Simultaneous tones of integer multiple frequencies are also produced. This is a form of a spontaneous quantum phenomenon. This is associated with a standing wave geometric pattern, such as that seen in this model, and is analogous to Planck's law (Figs. 1–3). It was discovered even in ancient times that harmonic tones were related by integer fractional relationships of the fundamental frequency. For example, humans recognize harmony between two musical tones at integer fraction steps identical in character to the quantum fraction series in this model, where repeating product numbers are seen with the integer values. Our standard Western harmonic tone system is largely based on the frequency tone ratio of 3/2 and a series of $(3/2)^n$ times a frequency. These include the series 9/8, 27/16, and 81/64. The denominator changes to maintain each tone in the same octave. This is related to the Pythagorean harmonic scale. Therefore harmonic tones are related to common integer products of two numbers. In this model, this pattern is seen in the integer product relationships of the integer values for hydrogen that are related to nuclear properties. These modes are analogous to the physical distribution of electrons around the atom and their associated quantum numbers. Despite the fact that this is a model focusing on quantum phenomena, essentially all of the basic mathematical properties are well-known to occur in all periodic physical systems.

Confirmation of the hypothesis

This paper unequivocally confirms the hypothesis that the fundamental constants evaluated follow classic quantum spectral characteristics. Though this is a classic experimental spectral analysis method, it represents a totally new perspective on the previously unsuspected quantum relationships between the fundamental physical constants. This model is not in conflict with any existing physics values or "laws", but only plots the known values by first normalizing them to frequency units characterizing hydrogen, then translating them to a log unit system on a ln-ln plane. This makes the linear and quantum integer fraction relationships obvious.

Almost all of the predictions are within the range of measurable relative uncertainty. One outlier is the muon, but this may be due to its g-spin factor. The minor differences of predictions for a few of the known values (i.e. the muon) may reflect classic minor high-resolution spectral shifts similar to the Lamb shift. For example, it is possible to calculate the exp_k of the Z particle using only the principal quantum numbers 7 and 12 and the exp_k of the electron (Equations 15–22). The same is true for the $pion^+$ using only the principal quantum numbers 3 and 24 and the exp_k of

Table 5. The known and predicted values of the quarks, pions and kaons.

Constant	±1/n	qf, 1–1/n or 1+1/n	n_H values	exp_k# range	qf ± δ (predicted) # range
up	–1/10	9/10	*	0.88025–90264#	0.89758–0.90241#
top	+1/10	11/10	*	1.09706–1.09795#	1.0976–1.1024#
down	–1/11	10/11	*	0.89314–0.91357#	0.90689–0.91128#
strange	–1/30	29/30	*	0.95299–0.96810#	0.96586–0.96747#
bottom	+1/36	37/36	*	1.02693–1.02870#	1.0325–1.0341#
charm	+1/139	140/139	*	1.00375–1.0067#	1.0108–1.0114#
$pion^0$	–1/28	27/28	4	0.96454355	0.96453226
$pion^+$	–1/28	27/28	3	0.96392127	0.96391589
$kaon^0$	–1/84	83/84	3	0.98818379	0.98817645
$kaon^+$	–1/85	84/85	6	0.98803392	0.98803225

The known and range of predicted values of the quarks (Fig. 7) are listed. The values for the pions and kaons are predicted using the same linear relationship as well as those related to em hydrogen z points (n = 2–8 points) (Fig. 7). The hydrogen n values for the calculations are listed. These calculations were derived using equations 15–22 which is equivalent to the intersection of the z hydrogen electromagnetic points and the nuclear principal quantum number. The neutron singularity point was assumed to be the center of the quark values similar to the kinetic weak factors (Table 3). The associated 1/n vales are listed for each entity. Note that predicted values are in excellent agreement with known exponent values. Note that the top quark is equivalent to the inverse of the up quark, 10 and 11. The bottom quark is the inverse of the strange quark. The down quark is the next consecutive integer after the up value. The up, top, down, strange, bottom, and charm quarks are related to n equals 10, 10, 11, 30, 36, 140. The pion and kaon values follow similar patterns to the weak force factors (Figs. 5, 6) except they are related to the em hydrogen line-derived z points not the weak kinetic hydrogen z values. The *signifies that the hydrogen quantum number values are not known since their masses are not accurately measurable.

the Rydberg constant. This would be impossible using any other existing model.

The calculated exponent differences from the known values are well within the range of subtle differences seen in other quantum spectral patterns. Some of the known values are simply not accurately known, including the quarks. The value for the top quark is most accurately known and does follow a predicted hydrogen and qf value (Fig. 7). The other quarks fall within the predicted values. All of the particles should be associated with an integer n_H value that can be easily calculated (Equation 20).

Physical manifestations of symmetry properties on the ln-ln plane

The hypothesis is supported by documentation of many accurate linear calculations, predictions following classic symmetry properties on the ln-ln plane. In fact, every value plotted represents a symmetric point centered on the neutron. A symmetry point represents a value of identical scale, but opposite sign. This is analogous to complex number properties. Other physical examples include positive and negative charges, matter and antimatter, attractive and repulsive forces. There should be examples of symmetric points representing actual physical entities. The quarks top and up represent symmetric inverses (Fig. 7). The nuclear non-hydrogen entities fall on inverse lines connecting the hydrogen qf values.

Similarities of quantum spectra characteristics, atomic model analogy, and this hypothesis

This model is also based on the classic mathematical format defining atomic spectral series. In these series the energy values are related to the product of h, a fundamental frequency, and a function based on dimensionless quantum integers. The only substantive difference is that the equation used in this model represents an exponential integer relationship. Many physical phenomena (magnetic resonance relaxation times, radioactive half lives) are related to exponential relationships. This property can only be true if the ratios of the actual values for the primary linear force equivalents are equal (Equation 5). Therefore, this model represents a classic quantum system based on exponents and standing wave patterns (1/n).

There are multiple repeating line patterns seen in this model, similar to those seen in all classic quantum spectra. In the Rydberg series, each group is based on a quantum number, and each group has the same repeating geometric relationship, but is just scaled differently. In this model, the quantum number for the ionization energy of the electron of hydrogen (R) is 3, and 1/3, 2/3 patterns are seen. The quantum number 3 defines a harmonic lineage of other possible quantum numbers of associated values in a similar repeating geometric pattern. The product of the hydrogen quantum number predicts the lineage of its associated values as a product with the next possibility.

This is a totally new method of prediction unifying hydrogen to nuclear properties. This principal quantum number, three, is associated with the properties of interactions of charges. A 1/3, 2/3 pattern is anticipated for the quarks, and indeed, the quarks are associated with 1/3, 2/3 charge properties. If the distance between z points (−1, 0) and (0, 0) is divided in thirds (n = 3), then the 1/3 value falls on the R qf (2/3). The quantum number 10 is associated with the up (9/10) and top (11/10) quarks. If one divides the x-axis distance between (0, 0) and the up or top quarks ($1/n = \pm 1/10$) into thirds, the associated $1/(3 * n)$ values are 1/±30. This is the qf value associated with the strange quark (Tables 2, 4) repeating the same pattern. The bottom quark is associated with the product of 3 and 12, 36. 12 is the quantum number associated with Z and W. The charm quark associated with the 1 + 1/139 1/n (Tables 2, 4). 140 is the product of 2, 7 and 10. 2 and 7 are the mass quantum numbers of the beta decay products. Both the bottom and charm quarks are composite harmonics of the weak and strong harmonic numbers. Below is the mathematical harmonic number pattern for the quarks.

$$-1, -1/3, -1/10, -1/11, -1/(3^*10), 0$$
$$0, +1/(2^*7^*10), +1/(3^*12), +1/10, +1/3, +1$$

There is a pattern related to the hydrogen fundamental n value that repeats in the nuclear quantum fractions. This is a form of unification by numerical lineage of the charged entities. The same pattern must be true for the mesons. It is seen with the quantum fraction relationship of the pion (27/28) and kaon (83/84). The denominator of the kaon is three times that of the pion, $1/(3 * 28)$.

This pattern of repeating hydrogen quantum numbers reflected in the associated nuclear strong quark entities is similar for the weak force leptons as well. Therefore, this model generates the first quantum rationale for a linkage between the masses of the massive leptons and the quarks. For the leptons, the two hydrogen masses are related to quantum numbers 2 (neutrino) and 7 (electron). Following is the same hydrogen number progression, listed below for the leptons.

$$-1, -1/2, -1/7, -1/12, -1/(2^*12), -1/(7^*12), 0$$
$$0, +1/(7^*12), +1/(2^*12), +1/12, +1/7, +1/2, +1$$

The quark pattern predicts that the massive leptons should be related to −1/24 (muon) and +1/84 (tau), which is true.

Significance of the model and other potential applications

The model is the first to demonstrate a simple quantum number system that can be used to define physical constants across a wide range of physical entities. If the method is valid, it generates unique new insights into the unifying relationships between these entities. There are many unknowns in physics, and this model may provide insight to clarify a few of them. For example, this model explains the reason for the mass relationships between the particles and bosons utilizing a totally new approach. It is extremely accurate as well. One could state that these findings are purely incidental, but there are many findings supporting the hypothesis.

Though not described in the work in detail, it is possible to derive many other important physical constants utilizing only the same data z points from hydrogen. If one assumes that all of the fundamental constants are related to extremely simple relationships defined solely by the slopes and intercepts demonstrated in this paper, it is possible to make many other accurate predictions. For example, Planck's time can be accurately derived by a calculation based on the gravitation binding energy of the electron in hydrogen. It is associated with the sum of the quantum fractions of 1 for the proton, −1 for the binding energy, 4/5 for the Bohr radius and 6/7 for the mass of the electron (−1−(+1)−4/5 −6/7). The line connecting the points related to the inverse sum of the y-intercepts for (b em) and (b wk), (0, −b em −b wk) and the other point at (−a wk) at −1 x-axis, (−1, −a wk) crosses exactly at the value for Planck's time for the appropriate quantum fraction

(−128/35), equal to the sum of the quantum fractions of the four entities described above. The slope of this line is equal to (a wk) minus the sum of (b wk) and (b em).

Another prediction and derivation is for running alpha at Z. If one plots a line with a slope equal to (a wk) plus the sum of (b wk) and (b em) starting at the R z point and calculates the intercept point at the x-axis 1/12 distance, the Z running alpha value can be derived and is equal to the known value. Therefore, gravity is associated with the slope (a wk) minus the sum of (b wk) and (b em). Running alpha is associated with the slope of (a wk) plus the sum of (b wk) and (b em). This represents an elegant and logical example of unification of the forces. This can be viewed as another example of symmetric splitting of forces.

If one examines the other possible quantum number entities that are larger than the top quark, insights can be gained. The frequency value for the point along the weak kinetic line at the x-axis position of 1/10 is essentially equal to the presently measured upper limit of the Higg's boson. There are only a few other values for +1/n with values above this. These are related to huge energy levels, but could logically be related to the forces within black holes or other extremely high energy entities.

Conclusions

This paper presents a new mathematical model for physics that hypothesizes that the fundamental constants represent a typical quantum number system similar to many discrete split line spectra. All of the values are normalized and transformed into exponents of a dimensionless frequency related to the neutron. These specific values are associated with a classic standing wave pattern. By plotting these values on a ln-ln plane, the quantum number and linear relationships between individual logically associated constants are obvious. This potentially represents a new means of analyzing and unifying many fundamental physical processes previously unsuspected.

Acknowledgements

I would like to thank Robert Scherer PhD for initially reviewing my early documents many years ago, and for not totally disregarding the model as invalid. I would also like to thank Stephen Sammet PhD, MD for reviewing my more recent calculations. I would like to thank my wife, Linda, and daughter, Alexandra, for helping edit the paper.

Disclosure

The author reports no conflicts of interest.

References

1. Ford KW. The Quantum World. Harvard University Press, Cambridge Massachusetts; 2005.
2. Griffiths DJ. Introduction to Quantum Mechanics (2nd ed), Prentice Hall; 2004.
3. Mackey G. The mathematical foundations of quantum mechanics, Courier Dover Publications; 2004.
4. Bohr N. On the Constitution of Atoms and Molecules, Part I. *Philosophical Magazine*. 1913;26:1–25.
5. Bohr N. On the Constitution of Atoms and Molecules, Part II Systems Containing Only a Single Nucleus. *Philosophical Magazine*. 1913; 26:476–502.
6. Schrödinger E. An Undulatory Theory of the Mechanics of Atoms and Molecules. *Phys Rev*. 1926;28(6):1049–70.
7. Kalckar J ed. Foundations of Quantum Physics I (1926–1932) Collected works: Foundations of Quantum Physics Vol 6 (Niels Bohr- Collected Works). Elsevier Science Publisher B.V. P.O. Box 103: 100 AC Amsterdam, The Netherlands; 1985;10:373–9.
8. Mehra J, Rechenberg H. The historical development of quantum theory Vol 1 Part 1. Springer-Verlag: New York; 1982;1:193–6.
9. Whitaker MAB. The Bohr–Moseley synthesis and a simple model for atomic x-ray energies. *European Journal of Physics*. 1999;20:213–20.
10. Eisberg R, Resnick R. Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles (2nd ed.). *John Wiley & Sons*. 1985;59–60.
11. Thompson WF. Music, Thought, and Feeling: Understanding the Psychology of Music, Oxford University Press; 2008.
12. Benson DJ. Music: a mathematical offering. Cambridge University Press. The Edinburgh Building: Cambridge CB2 2RU United Kingdom; 2007.
13. Peskin ME, Schroeder HD. An introduction to quantum field theory. *Basic Books*. 1995.
14. Barrow JD. The Constants of Nature: From Alpha to Omega—the Numbers That Encode the Deepest Secrets of the Universe. London: Great Britain, Vintage; 2002.
15. Zeeman P, On the influence of Magnetism on the Nature of the Light emitted by a Substance. *Phil Mag*. 1897;43:226.
16. Brading K, Castellani E, eds. Symmetries in Physics: Philosophical Reflections, Cambridge University Press; 2003.
17. Mainzer K. Symmetries of nature. De Gruyter: Berlin, Germany; 1996.
18. Birss RR. Symmetry and Magnetism, John Wiley & Sons; 1964.
19. Kragh H. Magic Number: A Partial History of the Fine-Structure Constant. *Archive for History of Exact Sciences*. 2003;57(5):395.
20. Smith WK. Inverse Functions, MacMillan; 1966:60.
21. Blackstock DT. Fundamentals of Physical Acoustics. *Wiley–IEEE*. 2000; 114:568.
22. Twieg D. The k-trajectory formulation of the NMR imaging process with applications in analysis and synthesis of imaging methods. *Medical Physics*. 1983;10(5):610–21.
23. Bracewell RN. The Fourier Transform and Its Applications (3rd ed.), McGraw-Hill: Boston, Massachusetts; 2000.
24. Grafakos L. Classical and Modern Fourier Analysis, Prentice-Hall; 2004.
25. Greene B. The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory. Vintage Series, Random House Inc; 2000.
26. Smolin L. Three roads to quantum gravity. *Basic Books*. 2001:20–5.

27. Ashtekar A. New variables for classical and quantum gravity. *Phys Rev Lett*. 1986;57:2244–7.
28. Carlip S. Quantum Gravity: a Progress Report. *Rept Prog Phys*. 2001;64:885.
29. Ho-Kim Q, Phạm XY. Elementary Particles and Their Interactions: Concepts and Phenomena. Springer; 1998:169.
30. Gell-Mann M. A Schematic of Baryons and Mesons. *Physics Letters*. 1964;8:214–5.
31. Amsler C, et al. Review of Particle Physics: Quarks, Physics Letters (Particle Data Group); 2008.
32. Povh B. Particles and Nuclei: An Introduction to the Physical Concepts, Springer-Verlag; 1995.
33. Halzen FM, Alan D. Quarks and Leptons: An Introductory Course in Modern Particle Physics, John Wiley and Sons; 1984.