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Particle Physics Insights

The Harmonic Neutron Hypothesis: Derivation of the Mass Equivalents of the Quarks from the Frequency Equivalents of the Ionization Energy of Hydrogen and the Annihilation Energy of the Neutron

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ABSTRACT: The harmonic neutron hypothesis states that all of the fundamental constants, when expressed as frequency equivalent coupling constant ratios, are related to the annihilation frequency of the neutron, v_n 2.271859 × 10^{23} Hz. The constants are interrelated by classic standing wave, harmonic number properties, and have classic quantum spectral characteristics. If $v_n s$ is raised by the exponents of a consecutive integer quantum fraction (qf) series ([$n \pm 1$]/n) for the principal quantum numbers, then $n = 1$ to ∞, representing many of the degenerate exponent values of the fundamental constants, including the quarks. The qf values have been shown to be symmetrically split by sign when plotted on an ln ln plane, similar to imaginary numbers. The hypothesis also states that, when plotted, the associated entities should align in linear patterns, and their principal quantum numbers should simultaneously be products of smaller harmonic numbers for higher hierarchical particle generations. The slopes and intercepts of the lines are derived solely from the properties of hydrogen, and the neutron have been published and used to derive other constants. It has been previously predicted that the quarks are associated with the slope, defined by the line connecting the points for Planck's constant (–1, 0) and (–1/3, known exponent of the ionization energy of hydrogen –2/3), which is referred to as the electromagnetic line, or em line, whose principal quantum number is 3. Assuming that the quarks fall on integer slope multiples of the line connect (1, 0), the inverse slope of the em line, the quark values can be derived and compared to the known values. The quarks, sign, principal quantum numbers, quantum fractions, and known and predicted eV values include: up (–10, 9/10, 1.7–3.1 MeV, 2.3 MeV); down (–11, 10/11, 4.1–5.7 MeV, 4.7 MeV); strange (–30, 29/30, 100; +30 or –20 MeV, 106.6 MeV); charm (109, 110/109, 1,290; +50 or –110 MeV, 1,280 MeV); bottom (32, 33/32, 4190 +180 or –60 MeV, 4,214 MeV); and top (10, 11/10, 172.9 ± 1.5 GeV, and 172.2 GeV). The three harmonic numbers associated with the quarks are 3, 10, and 11. The strange quark is related to the product of 3 and 10, the bottom quark 3 and 11, and the charm quark 10 and 11. The paper explains the origin and rationale for the mass equivalents of the quarks and makes predictions of more accurate values than are known.

KEYWORDS: quarks, neutron, harmonic neutron hypothesis, hydrogen ionization energy, fundamental constants

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Introduction

The harmonic neutron hypothesis[1–3] states that all of the fundamental constants as frequency equivalents are related to the annihilation frequency of the neutron, v_n, 2.2718591 × 10^{23} Hz. This paper focuses on evaluating the quarks using the standard methods of the hypothesis.[4–6] This is analogous to the chemical periodic chart, but each integer is associated with a different physical constant (rather than different atoms), independent of the unit. The neutron is the logical physical entity that is centered between the subatomic and nuclear entities. The neutron is related to all other physical entities. The other assumptions of the hypothesis include symmetry, which is similar to imaginary number plotting, standing wave relationships on an exponential scale, common products of harmonic number hierarchic relationships, linear relationships of related entities, and a spit spectral pattern. The physical constants, independent of unit when possible, are evaluated as coupling constant ratios, known as constant frequency (Hz/v_n Hz). The actual physical units are, therefore, irrelevant.

The harmonic neutron hypothesis assumes that the simple integer fraction exponents of v_n, the fundamental frequency, are the degenerate values of a system with classic standing wave scaling in a symmetric pattern, not the frequency values themselves. If v_ns is raised to exponents of a consecutive integer quantum fraction (*qf*) series ([$n \pm 1$]/n for the principal quantum numbers), then for $n = 1$ to ∞ represents many of the degenerate exponent values of the fundamental constants, including the quarks. The degenerate ratios of the known constant's frequencies and v_n represent v_ns raised to exponents of $1/\pm n$ for $n = 1$ to ∞. These values represent the only possible values that are identical to quantum spectra, where each integer is associated with specific spectral lines. Each line is symmetrically split, which is analogous to Zeeman's effect. The smallest principal quantum numbers represent the most fundamental entities, such as gravity, electromagnetic force, the electron, and the Bohr radius. Logically, related higher-generation physical entities should be products of the smaller common principal quantum numbers. This represents a classic harmonic numbers property. For example, the muon, kaon, and the strange quark are higher-order entities that are linked to simpler, smaller integers.[1]

The actual values of the known constants should be slightly different from their associated specific degenerate values. For example, atomic masses are not equal to an integer product of the neutron, but they are very close. Quantum spectra manifest this property by symmetrically splitting when in the presence of an external force, such as occurs in Zeeman's effect. This is another very common spectral property that is part of the hypothesis. This splitting property is manifest as an important inverse sign symmetrical pattern that is similar to imaginary numbers when the exact exponent values are plotted on a ln ln plane. Each single entity has an analogous inverse and complex, conjugate pairs that are related to opposite signs. Therefore, there are only four possible associated points with mirror image positions across the x- and y-axes for each entity.[1] For example, the principal quantum number ±10 could have *qf* inverse pairs of 9/10 (1–1/10) or 11/10 (1 + 1/10). These two *qf* have been shown to represent an inverse pair associated with the quarks up and top.[1]

Each fundamental constant is plotted on an ln ln plane, so the distribution of energy/mass equivalents is similar to the distribution of energy over time, and it is exponential as well. On the ln ln plane, there can be physical entities associated with both the positive and negative signs of the same principal quantum numbers. This is equivalent to multiplying and dividing a degenerate frequency value by the same value, so as to generate two other actual relevant, measurable physical entities. On the ln ln plane, this involves adding or subtracting the same value to the *qf*. The most classic spectral example involves the ionization energies of hydrogen (ionization energy/n^2) and Mosley's series (ionization energy × n^2).

The hypothesis also states that when the exact known exponents are plotted on a ln ln plane, related physical entity values should align in a simple, logical, linear pattern. This implies that the related values are scaled by a constant common force slope. The slopes and intercepts of two lines have been published and are derived from the properties of hydrogen and the neutron alone.[1] These two lines are hypothesized to be related to all other entities. One line is related to weak kinetic entities, which are referred to as the wk line, and this is defined by the points for the mass of the electron (e) and the Bohr radius (α_0). The slope is awk, and the y-intercept is bwk. Their respective principal numbers are 7 and 5, and *qfs* 6/7, 4/5. Weak force particles are related to this line, and can include the muon and W boson.[1]

It has been previously predicted that the quarks are associated with the slope, which is defined by the line that connects the points for Planck's constant and the ionization energy of hydrogen.[1] This is the second line that was previously calculated. It is referred to as the electromagnetic em line. The slope is aem and the y-intercept is bem. This line is related to the principal quantum number 3, *qf*, 2/3. The quarks are associated with charges of 1/3 and 2/3, reflecting an identical number pattern. There are also three generations of quarks; the integer 3 is a recurring harmonic number in the products of associated quarks and mesons.[1]

At the time of a previous paper, the values for the quarks were less accurately experimentally known.[1] The present paper evaluates the more recent quark data and plots them on the ln ln plane utilizing a standard method to see whether the reported values are actually related to *qf*, the predicted em line, and have harmonic number properties. It was not possible to estimate a line or *qf* for all of the quarks using the prior data.

If all of the predicted harmonic neutron hypothesis properties are fulfilled, then these quark findings support the validity of the hypothesis. This paper explains and derives the mass equivalents of all of the quarks solely from the frequency equivalents of the neutron and the ionization energy of hydrogen using harmonic number properties. The quark values can be derived from high-accuracy values of the neutron and from the ionization energy of hydrogen; those are the only two experimental data points needed. These predicted values can be compared with future experimental data.

Methods and Results

The floating point (the number of accurate digits) is based on known experimental data. The up and down quarks have two-digit accuracy. The strange, charm, bottom, and top quarks have four-digit accuracy. The other constants related to the frequency equivalents of the neutron and ionization energy of hydrogen are seven digits.

All of the fundamental constants are converted to frequency equivalents, v_k (1, 2). The masses are converted by multiplying by c^2 (speed of light squared) then dividing by h (Planck's constant). The distances are converted by dividing the wavelength into c. Energies are converted by dividing by h. The *eV* value for the neutron is 939.565378(21) × 10^6. Then, v_n equals 2.271859 × 10^{23} Hz. *Hz* are converted to *eV* by multiplying by the constant, 4.135667 × 10^{-15} eV/Hz. Following that, *eV* were converted to *Hz* by multiplying by the constant 2.417989 × 10^{14} Hz/eV. All of the data for the fundamental constants were obtained from certain websites (http://physics.nist.gov/cuu/Constants/ and www.wikipedia.org).

The quantum fractions (*qf*), which are the degenerate exponents of $v_n s$, are defined in Equation 1. The degenerate frequency equivalents of the physical constants are related to $v_n s$, which was raised to the *qf* (Equation 2). The known exponent ($\exp_k$) values are calculated as the ratio of the ln of the known frequency equivalent, which is divided by the ln $v_n s$ (Equation 3). Equation 4 shows how the *Hz* equivalent is calculated from the exponent value. Equation 5 calculates the δ value, which is the difference between $\exp_k$ and the *qf*. This represents the symmetric splitting value and is used in the plotting and calculation of the known and predicted values. Equation 6 demonstrates the valid possible x-values that are plotted on the ln ln plane, and these are related to *qf* − 1. The constants are evaluated as dimensionless coupling constants (Equation 7). The integer exponent fractions of $v_n s$ are related to $1/\pm n$ values. The *qf* − 1 value is plotted as an x-axis value, with the neutron lying on the intersection of the x- and y-axes. This is equivalent to plotting the ratios that are seen in Equation 7. The exponent for the neutron is 0, which is the ln of 1. The possible y-axis values are ± δ for each entity. The natural $\log_{vns}$ value is 53.780066.

$$qf = \frac{n \pm 1}{n} \quad \text{for principal quantum number } n = 1 \text{ to } \infty \quad (1)$$

$$(v_n s)^{\left[\frac{n\pm 1}{n}\right]} Hz \quad \text{for principal quantum number } n = 1 \text{ to } \infty \quad (2)$$

$$\exp_k = \frac{\ln(v_k s)}{\ln(v_n s)} = \log_{vns}(v_k s) \quad (3)$$

$$v_k Hz = e^{\log_e(v_n s)\exp_k} Hz = v_n s^{\exp_k} Hz \quad (4)$$

$$\delta = \exp_k - qf \quad (5)$$

$$x = \pm\frac{1}{n} = qf - 1 \quad (6)$$

$$\frac{v_k}{v_n} \quad (7)$$

The ionization energy of hydrogen is related to the Rydberg constant, R. The frequency equivalent of the hydrogen ionization energy, v_R, is 3.289842 × 10^{15} Hz; $\exp_R$ is 0.6643655. The *qf* is 2/3 and its δ is −2.301122 × 10^{-3}. The line formed from the ln ln point for Planck's constant (h) is plotted at (−1, 0) by definition (Fig. 1). The slope of the em line defined by these two points is −3.451684 × 10^{-3}. The line from (+1, 0), the inverse point for Planck's constant, to (+1/3, −2.301122 × 10^{-3}), the inverse of the standard R point, is the line associated with the quarks. This line has a slope of 3.451684 × 10^{-3} and a y-intercept of −3.451684 × 10^{-3}. This line is used for the prediction values for the quarks (Equation 8; Figs. 1 and 2). Multiples of this slope are used in the calculations for some of the quarks. The $v_{predicted}$ is calculated from Equation 9.

$$\exp_{predicted} = qf + \frac{1}{n}\ (3.4516836 \times 10^{-3}) - 3.4516836 \times 10^{-3} \quad (8)$$

$$v_n s^{(\exp_{predicted})} Hz = v_n s^{\left(qf + \frac{1}{n}(3.4516836 \times 10^{-3}) - 3.4516836 \times 10^{-3}\right)} Hz \quad (9)$$

The known *eV* ranges, known frequency *Hz* ranges, *qf*, $\exp_k$, and predicted $\exp_{predicted}$ values for the six quarks are shown in Table 1. The *qf*, known *eV* ranges, predicted *eV* value, known δ ranges, and predicted δ values for the six quarks are shown in Table 2. All of the known quarks fall in linear patterns. The quark values fall on lines that are integer multiples of the em line slope all through the (1, 0) point. The top, bottom, and charm quarks all fall on the em line (Figs. 1–3). The strange and down quarks fall on the 2 × em slope line. The up quark falls on the 3 × em slope line.

Two of the R points for the ionization energy of hydrogen are plotted on the ln ln plane at the −1/3 and +1/3 x-axis values (Figs. 1 and 2). The points used to derive the two lines that should be related to all other physical entities are plotted on the ln ln plane in a similar fashion to the orientations outlined by previous publications (Figs. 1–3).[1] The two lines associated with the y-intercept for the em entities and b_{em} point are shown.

The known quark values are plotted on the ln ln plane. The x-values are related to the 1/n points. The y-axis is related to the difference of the *qf* minus the known exponent. The principal quantum numbers were chosen if they most closely fell on the em line. The small principal quantum numbers could only be those values, assuming that the δ follow a similar scale as those in previous publications. As the number increases, there are more possible n values, but this flexibility is eliminated by the goal to plot them on the em line. There are four different possible em lines, but the one associated with the known quarks is shown (Figs. 1–3). Figure 1 is from the prior publication outlining the neutron hypothesis.[1] Figures 2 and 3 illustrate more expanded views that focus on the quarks alone. The em line multiples are used to derive the predicted values for the quarks in Tables 1 and 2 and in Equations 8 and 9.

The three harmonic numbers for the first generation quarks are 3 (ionization energy), 10 (up and top quarks), and

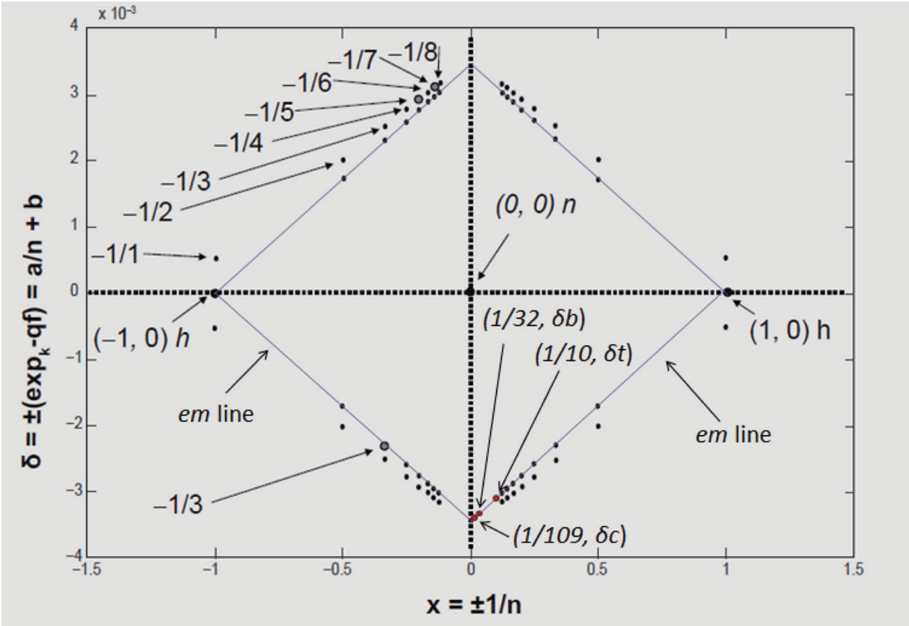

Figure 1. This figure is a standard neutron harmonic hypothesis ln ln plot.[1] The x-axis is related to ± 1/n, or *qf*–1. The y-axis equals δ, exp_k–*qf*. Plotted points include: h, (–1, 0); the neutron (0, 0); hydrogen ionization energy (–1/3, δ_R); (+1/3, δ_R); the Bohr radius (–1/5, $\delta_{\alpha 0}$); the electron (–1/7, δ_e); the y em intercept (0, b_{em}); and the wk line intercepts (0, b_{wk}; –1, b_{wk}–a_{wk}). This is a reproduction from Chakeres.[1] It shows all of the points for the weak kinetic and the electromagnetic lines from n = 1 to 8. These are plotted as black dots where hypothesized. The open blue circles are known points. The blue lines are the four possible em lines. These lines were hypothesized to be related to the quarks. Note that the points for the charm, bottom, and top quarks all fall accurately on this 1 × em line (red circles), as predicted.

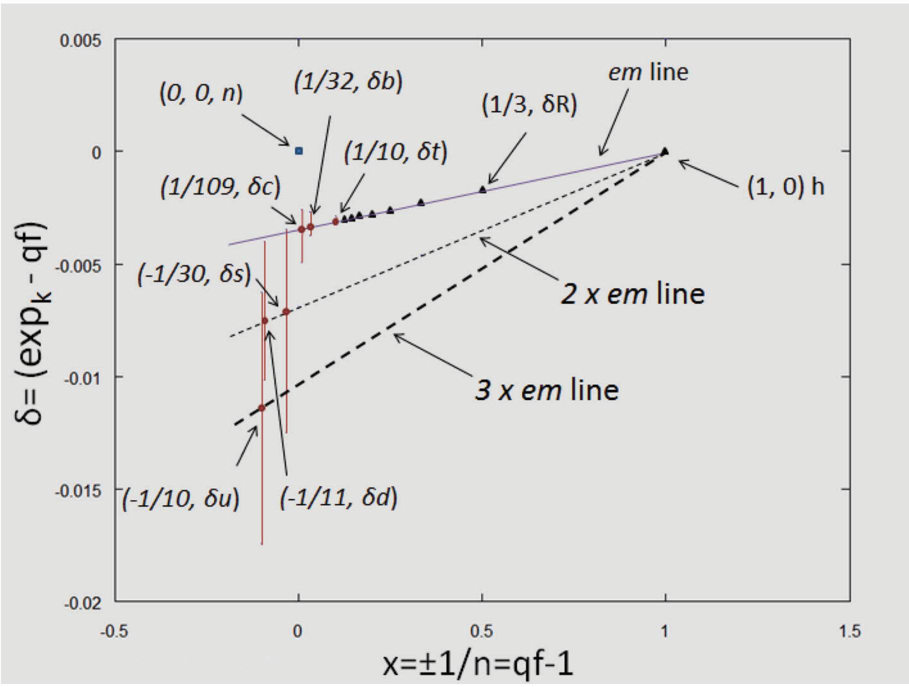

Figure 2. This is a blown up version of just the lower-left quadrant of the ln ln plot from Figure 1. A blue line connecting inverse h ([+1, 0], [+1/3, δ_R], and [0, b_{em}]) define the predictive line used in the quark prediction calculations. Three integer multiples of this slope are shown. The 1 × em line is the blue thin line. This is associated with the quarks that are more massive than the neutron, including the charm, bottom, and top quarks. The 2 × em line is the black, thin, dashed line; this is associated with the strange and down quarks. The 3 × em line is the black, thick, dashed line; this is associated with the up quark. The vertical red lines define the known range of the quark's upper and lower range values. The principal quantum numbers for each of the quarks include: up (–10), down (–11), strange (–30), charm (+109), bottom (+32), and top (+10). The intercepts of the em lines and the 1/n values are the derived predicted values of the quarks. Note that the predicted values are all within the known values.

Table 1. Quark known eV, predicted *eV*, known *Hz*, *qf*, known and predicted exponents.

	eV KNOWN	*eV* PREDICTED	v_k Hz KNOWN	*qf*	exp_k KNOWN	*exp* PREDICTED
up (u)	1.7 to 3.1 $\times 10^6$	2.35 $\times 10^6$	4.11×10^{20} to 7.49×10^{20}	9/10 0.9	0.883 to 0.894	0.886
down (d)	4.1 to 5.7 $\times 10^6$	4.70 $\times 10^6$	9.91×10^{20} to 13.8×10^{20}	10/11 0.9090909	0.898 to 0.905	0.901
strange (s)	100 (+30 or −20) $\times 10^6$	106.6 $\times 10^6$	1.93×10^{22} to 3.14×10^{22}	29/30 0.96666666	0.9542 to 0.9632	0.9595
charm (c)	1290 (+50 or −110) $\times 10^6$	1280 $\times 10^6$	2.85×10^{23} to 3.24×10^{23}	110/109 1.009	1.004 to 1.007	1.0057
bottom (b)	4190 (+180 or −60) $\times 10^6$	4214 $\times 10^6$	9.99×10^{23} to 10.6×10^{23}	33/32 1.03125	1.027 to 1.029	1.028
top (t)	172.9 (±1.5) $\times 10^9$	172.2 $\times 10^9$	4.14×10^{25} to 4.21×10^{25}	11/10 1.1	1.097 to 1.097	1.097

Table 1 shows the quark known *eV*, predicted *eV*, known *Hz*, *qf*, known and predicted exponents. Note that the exp_k are all very nearly equal the possible *qf* values.

11 (down quark). The other quarks are related to products of these numbers (30, 3 × 10, strange; 33, 3 × 11, bottom; and 110, 10 × 11, charm; and the inverse sign for the up, 1–1/10, and top, 1 + 1/10 quarks). These results support the hypothesis by simultaneously fulfilling all of the assumptions of the harmonic neutron hypothesis.

Discussion

The harmonic neutron hypothesis has demonstrated that many of the most important fundamental constants are related to the integer fractions exponents of the neutron by classic quantum integer steps in a symmetrically standing wave scaling. In this case, the principal quantum integer (10) is associated with both the smallest and largest quarks, up and top. The symmetric splitting manifested as opposite signs (–1/10 and +1/10) is another one of the most fundamental assumptions of the hypothesis. This is identical to the spectral relationship between the frequency equivalents of the ionization of hydrogen and the values for the highest possible frequency of the elements, as outlined by Moseley's law. Inverse values across each ln ln axis represent multiplying and dividing a degenerate value by the same number, and both still represent relevant physical entities, where $v_n s^{(1/10)}$ is 216.5899. The ratio of the v_t/v_n is 184. The inverse of $v_n s^{(1/10)}$ is 4.617021×10^{-3}. The ratio of the u_u/v_n is between 1.8×10^{-3} and 3.3×10^{-3}. Another classic example is the product of a

Table 2. Quark *qf*, known *eV*, predicted *eV*, known δ, and predicted δ values.

	qf	*eV* KNOWN	*eV* PREDICTED	δ KNOWN	δ PREDICTED
up (u)	9/10	1.7 to 3.1 $\times 10^6$	2.35 $\times 10^6$	−6.248 to −17.42 $\times 10^{-3}$	−1.14 $\times 10^{-2}$
down (d)	10/11	4.1 to 5.7 $\times 10^6$	4.70 $\times 10^6$	−4.01 to −10.0 $\times 10^{-3}$	−7.53 $\times 10^{-3}$
strange (s)	29/30	100 (+30 or −20) $\times 10^6$	106.6 $\times 10^6$	−12.47 to −3.443 $\times 10^{-3}$	−7.133 $\times 10^{-3}$
charm (c)	110/109	1290 (+50 or −110) $\times 10^6$	1280 $\times 10^6$	−4.938 to −2.573 $\times 10^{-3}$	−3.420 $\times 10^{-3}$
bottom (b)	33/32	4190 (+180 or −60) $\times 10^6$	4214 $\times 10^6$	−3.720 to −2.669 $\times 10^{-3}$	−3.344 $\times 10^{-3}$
top (t)	11/10	172.9 (±1.5) $\times 10^9$	172.2 $\times 10^9$	−3.192 to −2.869 $\times 10^{-3}$	−3.106 $\times 10^{-3}$

Table 2 shows the quark known *qf*, known *eV*, predicted *eV*, known δ, and predicted δ values. Note that the known and predicted *eV* and δ values are all very nearly equal.

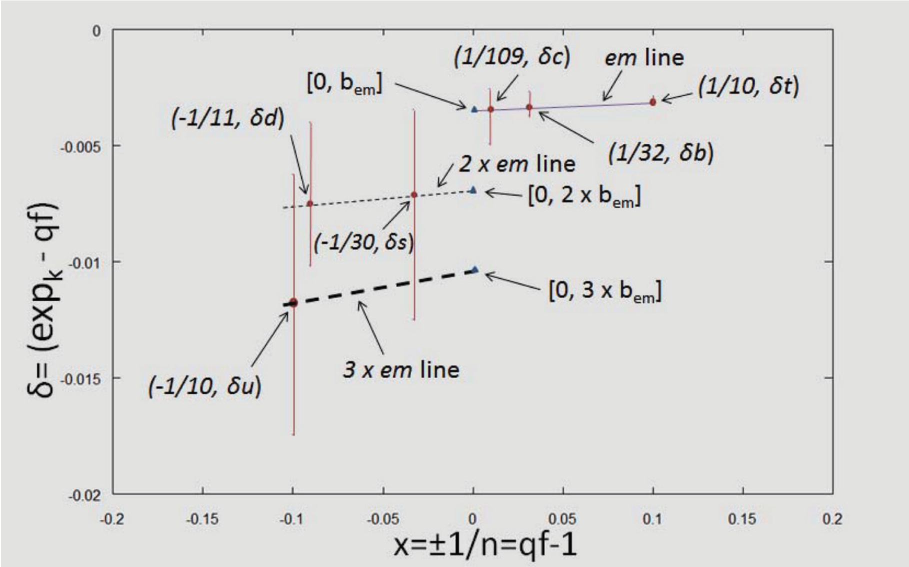

Figure 3. This is an even larger, blown up version of the ln ln plot of the six quarks from Figure 2. A blue line connecting inverse h ([+1, 0], [+1/3, δ_R], and [0, multiples of b_{em}]) define the predictive line used in the quark prediction calculations. Three-integer multiples of this slope are shown. The 1 × em line is the blue thin line; this is associated with the quarks that are more massive than the neutron, including the charm, bottom, and top quarks. The 2 × em line is the black, thin, dashed line; this is associated with the strange and down quarks. The 3 × em line is the black, thick, dashed line; this is associated with the up quark. The vertical red lines define the known range of the upper and lower range values for the quarks that fall. The principal quantum numbers for each of the quarks include: up (–10), down (–11), strange (–30), charm (+109), bottom (+32), and top (+10). The intercepts of the em lines and the 1/n values are the derived predicted values of the quarks. Note that the predicted values are all within the known values.

distance, and π is the diameter of a circle. Dividing a distance by π is the diameter of a circle, with that distance as its circumference.

The harmonic neutron hypothesis has shown that there are recurring integers (common factors) in the hierarchy of particles and bosons.[1] This is a manifestation of classic harmonic number properties of various harmonic systems, including musical harmony. For example, the number three is the common factor that relates integers associated with the *qfs* of the pions (27/28) and kaons (83/84); the product of three and 28 is 84. There are many other examples described using weak force particles and bosons.[1] In addition, two, seven, and 12 are the principal quantum numbers for the weak force entities, the neutrino, electron, and the Z or W bosons. The product of two and 12 is 24, and it is the principal quantum number of the muon *qf* (23/24). The product of seven and 12 is 84, and this is the tau particle principal quantum number *qf* (85/84).

The products of harmonic integer patterns are repeated with quarks. The integer, 3, is the principal quantum number that defines the mirror em lines across the y-axis, which are the quark lines (Fig. 1). The other common harmonic numbers should be 10 and 11 for the up and down quarks. If the hypothesis is correct, then the other quarks should be related to products of these three numbers (3, 10, and 11). The *qf* for the strange quark is 29/30, and is related to the product of 3 (em) and 10 (up quark). The *qf* for the bottom quark is 33/32 and related to the product of 3 (em) and 11 (the down quark). To complete this harmonic number pattern of the quarks, the *qf* of the charm quark is 110/109 and is related to the product of 10 (up quark) and 11 (down quark). These harmonic number properties support another basic tenet of the hypothesis.

The harmonic neutron hypothesis has shown that there are simple linear relationships when plotted on the ln ln plan between physically related entities. This represents a common force scaling factor for those associated entities that are related to the neutron. For example, the weak force entities are related to a line defined by the Bohr radius and the mass of the electron, the wk line.[1] The mass of the proton and the mass lost in the beta decay process are related to this same line.[2] Planck's time and gravity are related solely to the slopes and intercepts of both the wk and em lines,[3] and this is similar to the quark line. If the hypothesis is valid, then the quarks should be simultaneously related to the classic harmonic integer number patterns, and a linear pattern should be evident on the ln ln plane. Figures 1–3 demonstrate that all of the quarks fall on, or very near, the predicted inverse em lines. Using these lines to calculate the masses of the quarks based on logical harmonic integer numbers accurately predicts known values (Tables 1 and 2).

The quarks follow patterns of 3/6, 1/3, 2/3, and 1/6. This may explain the multiple slope patterns that were seen. For example, the quarks have charges of +2/3 or –1/3. One-half of the quarks are larger than the neutron, and half are smaller than the neutron. One of six quarks have properties of strangeness, charm, bottomness, or topness. Two out of six have I_3. This pattern is repeated in the fact there are three different

Table 3. Harmonic number patterns for principal quantum numbers and different generations.

u −1/**10** 9/**10**	*c* +1/109 **110**/109 (**10** × **11**)/109	*t* +1/**10** 11/**10**	photon −1/**3** 2/**3** hydrogen ionization energy
d −1/11 10/**11**	*s* −1/30 29/30 29/(**3** × **10**)	*b* +1/32 **33**/32 (**3** × **11**)/32	gluon
v_e −1/**2** ½ beta decay and v_e	v_μ −1/4 ¾ beta decay and v_μ	v_T −1/6 5/6 beta decay and v_T	Z +1/**12** 13/**12**
e −1/**7** 6/**7**	*μ* −1/**24** 23/**24** 23/(**2** × **12**)	*T* +1/**84** 85/**84** 85/(**7** × **12**)	W$^\pm$ +1/**12** 13/**12**

Table 3 is in the classic format of the principal entities of the standard model. Each box lists the entity, sign, 1/n, *qf*, and the *qf* in the second row as a product of harmonic numbers, when applicable. The harmonic numbers are in bold. The photon in this case is associated with the ionization energy of hydrogen and the number 3. The gluon does not yet have a specific, defined principal quantum number. The principal quantum harmonic numbers associated with the weak force entities are 2 (neutrino/beta decay), 7 (electron), and 12 (W and Z). The denominators of the muon and tau are products of these three harmonic numbers. The three principal quantum numbers for the quarks are 3 (ionization energy of hydrogen), 10 (up quark), and 11 (down quark). A similar pattern is seen for the higher-order quarks, which represent the product possibilities of these three numbers, 3, 10, and 11.

multiples of the em slopes. One-half of the quarks fall on the 1 × em slope, top, bottom, and charm. Two of six quarks fall on the 2 × em slope line, strange, and down. One of six quarks falls on the 3 × em slope line, up.

Table 3 is presented in the standard format of the principal entities of the Standard Model. Both the weak force and quarks demonstrate similar harmonic number properties. Here is a brief review of the principal quantum numbers and their associated physical entities. Specifically, 2, 4, 6, and 8 have been shown to be related to the kinetic energy lost in the neutron beta decay process.[2] In addition, 3 is associated with the ionization energy of hydrogen, while 5 is associated with the Bohr radius,[1] and lost energy of the beta process.[2] Seven is associated with the electron. Nine is related to the lifetime of the neutron; this is unreported data. Ten and 11 are related to the up, top, and down quarks. Eleven is also related to the Higg's boson (not published). Twelve is related to W and Z. Therefore, all of the integers of 12 have been associated with actual physical entities.

Starting with only the physical data of the annihilation frequency of the neutron and the frequency equivalent of the ionization energy of hydrogen, it is possible to accurately derive all of the quark frequency equivalents (Figs. 1–3). This is an example of the power of the hypothesis examined in the present study. The predicted values for the quarks are more accurate than those possible by experimental data. These predictions can be confirmed or refuted in the future. This paper generates a clear harmonic number rationale for the masses of the quarks. More exact values can be explained by their linear relationship to the ionization properties of hydrogen.

Conclusion

The frequency equivalents of the quarks are evaluated using standard methods of the harmonic neutron hypothesis and are plotted on a ln ln plane. The quarks are simultaneously associated with integer fraction exponents (logical harmonic number products with different hierarchies), and all of these fall on the slopes of lines that were previously predicted. This line slope is related to the ionization energy of hydrogen and the principal quantum number 3. Fractional charges of the quarks are based on thirds. This is a fundamental property of quarks. It is possible to start with only the frequency equivalents of the neutron and the ionization energy to derive all of the quark masses accurately. These findings support the harmonic neutron hypothesis. This is a new perspective on the interrelationship of the quarks based on sign, quantum numbers, harmonics, and ratios. It demonstrates a common, repetitive pattern that holds true for both weak and strong forces, which is logical. These predictions can be supported or refuted in the future with better experimental data.

Author Contributions

Conceived the concept: DWC. Analyzed the data: DWC. Wrote the first draft of the manuscript: DWC. Made critical revisions and approved final version: DWC.

DISCLOSURES AND ETHICS

As a requirement of publication the author has provided signed confirmation of compliance with ethical and legal obligations including but not limited to compliance with ICMJE authorship and competing interests guidelines, that the article is neither under consideration for publication nor published elsewhere, of their compliance with legal and ethical guidelines concerning human and animal research participants (if applicable), and that permission has been obtained for reproduction of any copyrighted material. This article was subject to blind, independent, expert peer review. The reviewers reported no competing interests.

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