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Introduction to the Harmonic Neutron Hypothesis and Mathephysics

The pure number/ physical entity duality paradox

This model is based on inherent pure number properties, and therefore mathematical to its most basic level. These number properties can have a mathematical and physical duality. For example, π is the penultimate physical constant, but its derivation and significance can be completely independent of any physical phenomena. It is dimensionless, and is a raw scaling factor. In physics this is described as a coupling constant, or scaling factor. There are multiple mathematical methods to derive π, none of them involve any physical measurements. Even and odd numbers are different based on their pure number properties, but atoms with even numbers of protons do not have magnetic resonance properties while odd do. Plus and minus signs are pure math concepts, but are associated with + and – charges, and matter and antimatter. There are many examples of these types of number/ physical phenomena duality. This physical model represents this duality to the extreme.

The hypothesis of the extreme case of number / physical duality

The most radical hypothesis imbedded in the Harmonic Neutron Hypothesis is that the all of the fundamental physical constants reflect this number physical duality in that all of them can be derived from no primary physical data just as π. This has been achieved yet, but that is the goal. All of the physical constants in this model are evaluated as dimensionless ratio scaling factors. This is a discrete number model so there are no 0 or ∞ ratios. For example there is no zero velocity, only the speed of light divided by a very large number that from a physical measurement standpoint seems to effectively be zero, but not truly zero. This may seem like a trivial advantage, but it profound. There are no singularities in this model and no mathematical impossibilities.

Just as π is defined by mathematical imperatives independent of anything inherently physical it is hypothesized so are the fundamental physical constants. π is the only constant in all of the possible circles, radii, frequencies, and sinusoidal waves. 2π can be thought of as the "fundamental frequency", v_f, of circle/ sinusoidal systems. The term fundamental frequency comes from a musical concept of the central note that all others are defined by. Unison is the other musical term. For example middle C on a piano. The annihilation frequency of the neutron is hypothesized to be the only constant fundamental frequency associated with all of the possible physical constants.

Mathephysics

Mathephysics is a term I have created to describe the implications and meaning of the number physical duality. In this setting the mathematics could completely drive the model totally independent of any physical reality. The paradox is that each mathematical facet represents a

physical reality, but each physical facet is independent of any specific physical explanation. This is a one way system in terms of the origin of the results. We literally "see" the mathematics as physical entities with their own units and properties, but these are defined completely independent of any physical relationship.

This is the inverse of the approach to physics where a physical phenomenon is interrogated secondarily searching for its mathematical explanation. In this case the mathematics could be known, but the physical manifestations need to be understood through the pure math and not the other way around. This is like the TV show Jeopardy where the answer is known, but the challenge is to know what is the question. This also totally changes the focus of physics from trying to better measure physic phenomena to better understand the math and secondarily the implications of the math translated into the physical domain. A good analogy is instead of investing your effort in trying to measure a banana you spend your time making banana splits.

2π discrete atolls

2π is a critical element of this model. All circle geometric systems simultaneously contain all of the other possible wave properties of frequency, resonance, phase, amplitude, interference, Euler's law, and wave velocity to name just a few. This is a sinusoidal periodic system. In physics there is a recurring situation where a physical constant is divided by a scaling factor and that represents another valid physical constant. That same physical constant multiplied by the same scaling factor that in turn also represents another valid physical entity. Moseley's law and the Rydberg series demonstrate this exact mathematical pattern. These are related to the hydrogen atom spectrum and the relationship of the maximum frequency of each atom's spectrum. They are both associated with the ionization energy of hydrogen, one divided, and one multiplied by the square of a consecutive integer series.

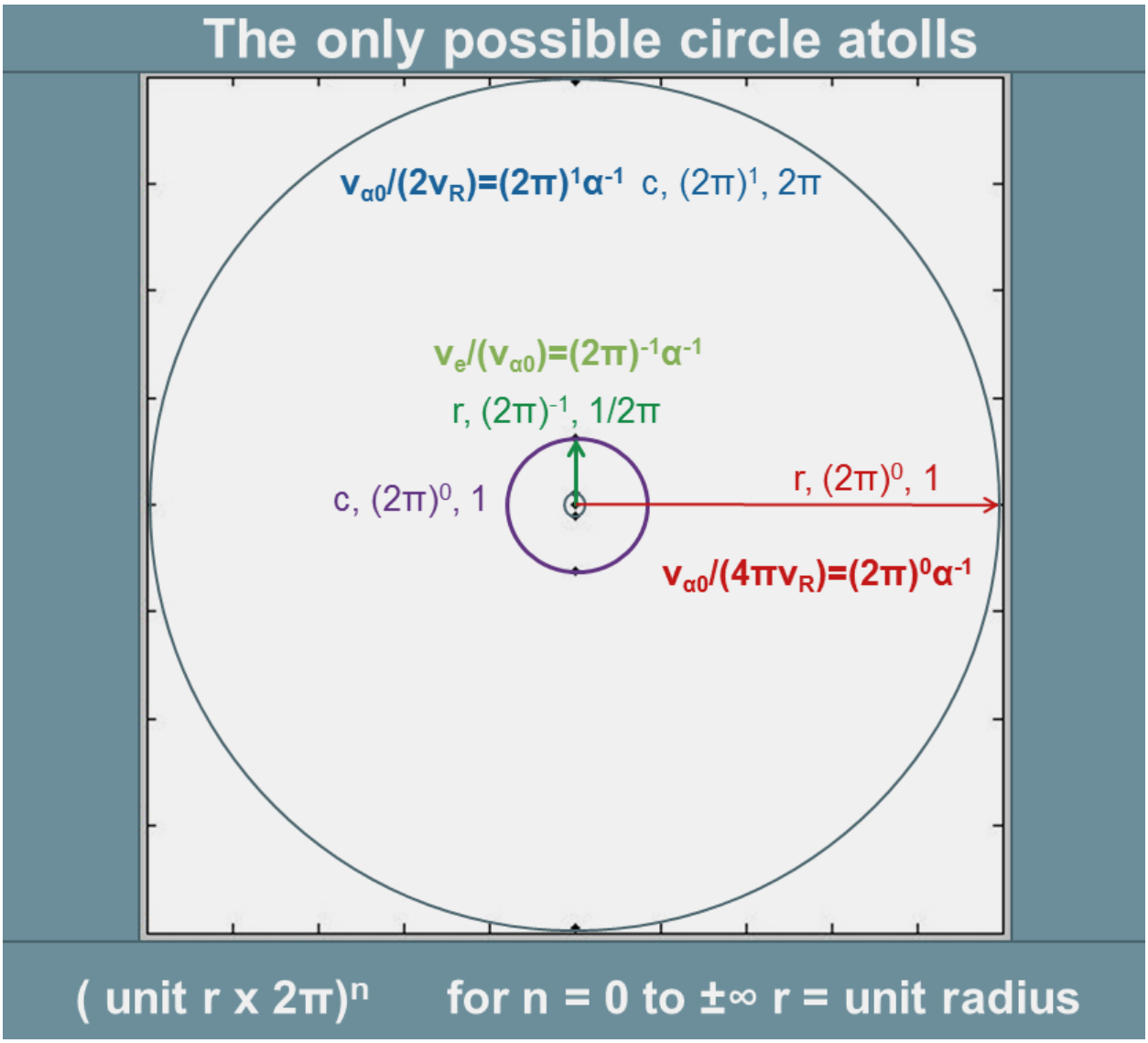
In this model the discrete geometry of circles and 2π are an example of this mathematical/ physical phenomenon. Starting with a unit radius of 1, 2π times that distance equals the circumference of a circle. 1 divided by 2π represents the radius of a circle with a circumference of 1. 1 is both a radius to one circle and the circumference to its neighbor. 2π is the only number that has this unique character of defining the next circumference and or radius.

This fractal series of circles is referred to as "2π atolls" with nothing in between, see figure below. A fractal is a system where it has the same appearance independent of scale. The blue circle has a circumference of $2\pi^1$. The red arrow is its radius of 1, $2\pi^0$. The purple circle has a circumference of 1. The radius of the purple circle is $(2\pi)^{-1}$. This is a graphic demonstration of this fractal system where each 2π in the exponential integer series is simultaneously the circumference of one circle and the radius of the next. This in part is the origin of the discrete nature of quantum physics. Specific physical quantum values must follow this identical geometry. This is property is described as "circle locked".

The possible radii and circumferences of such a simple system are shown in the equation below. This is an exponential system with the base equal to 2π and only integer possibilities. This

pattern is seen in classic harmonic systems where a base number raised to integer exponents represent the only possible resonant nodes. In concept this is identical. A two dimensional plot of this property is identical to the general configuration of the plotting used in this physical model with a exponent axes configuration, log log. This is the intersection of exponential relationships defined by integers and integer fractions, and harmonic frequencies.

$(2\pi)^n$ for n = 0 to ±∞



Circle locked hydrogen properties

In the physical domain this exact relationship is seen between the quantum properties of the electron, the Bohr radius, Rydberg constant, and α^{-1}. α is the fine structure constant. It is a dimensionless number that defines the relationship of the energy between two electrical charges at a specific distance. α is recurring value seen in a myriad of physical phenomena and is related

to the principal quantum number -11 in this model. The ratio of the Bohr radius frequency equivalent divided by 2 times the Rydberg constant frequency equivalent equals 2π times α^{-1}, blue equations. The ratio of the Bohr radius frequency equivalent divided by 4π times the Rydberg constant frequency equivalent equals α^{-1}, red equations. The ratio the frequency of the electron divided by the Bohr radius frequency equivalent equals α^{-1} divided by 2π, green equations. Therefore the quantum properties of hydrogen are "circle locked" by this identical 2π circle atoll geometry through α^{-1}. α^{-1} can be thought of as the unit radius. This is very important and represents the literal interface point of quantum physics and Euclid geometry of circles. This is a restriction in the relationship between physical constants not well known. A detailed description of these relationships is one of the reference links below. The implications of these simple relationships are profound. The origin of the 2 in the equation energy equals one half the product of the velocity squared times the mass is based on this relationship. The value of 4π in the electrical constants of permittivity, permeability and many others is from this specific relationship.

The frequency is inherently dimensionless by definition

Frequency is inherently dimensionless by definition. Frequency represents cycles per unit time in the time domain. Each cycle is a measure of the time it takes for one cycle of the reference. In the time domain frequency is a time divided by a time. In the distance domain frequency equals a sine wave with each distance of 2π defining a cycle. In the distance domain frequency equals the wave velocity times one unit time divided by the circumference of a circle (radius times 2π) defining each cycle. Therefore frequency is also a distance divided by a distance, and therefore dimensionless like π. Time and distance are proportional so any change of one is balanced by the other and the ratio does not change.

2π is the "frequency" of a circle

A circle with a circumference of a unit 1 has to cycle 2π times to equal the wave velocity distance 2π times one unit time. In the distance domain, 2π is the frequency of a circle. This is in part a sematic argument, but accurate in concept and definition.

The physical hypothesis

The physical hypothesis of the Harmonic Neutron Hypothesis is that the annihilation frequency of the neutron as a dimensionless number, $v_n s$, is the common resonance, fundamental frequency in physics, v_f, that all other physical constants are directly related to. v_n equals 2.2718591×10^{23} Hz. v is the notation for frequency used in physics. It is pronounced nu and is the Greek small letter for N. Hz is cycles per section or frequency. s is seconds.

Apples divided by apples

Many people believe there is an inherent error in the concept of the model since they question how can one convert all of the fundamental constants into dimensionless numbers and/or frequency equivalents. Planck in the early 1900s was the first to create a natural unit system of

just seconds, Hz, energy, length, or mass so this is not a new or radical idea. These are called Planck units. Einstein's famous E equals mc^2 equation converts mass into energy. Planck's equation converts energy into frequency. The speed of light equals to wavelength times the frequency. Therefore essentially any physical unit can be converted into any other including frequency. Since all of the calcualtions are done as ratios of identical units, any unit could be used, but frequency is a logical choice since it is a harmonic system. Here is another example, if a unit is a velocity it is divided by the speed of light to cancel out its units. The physical unit system is irrelavant for π just as it is in this model.

Derivation of physical fundamental constants

Another common misconception that makes the Harmonic Neutron Hypothesis invalid is that physical constants cannot be derived mathematically. Usually it is done utilizing other physical constants. Logical derivation of "physical" entities that cannot be directly measured are quite common. The best example is the radius of the hydrogen atom, the Bohr radius. There are multiple methods to derive the Bohr radius. All of the electrical constants such as permittivity and permeablity of free space are derived and not directly measured. The most famous derived constant is the electron G spin factor.

Why the neutron?

The choice of the neutron as the physical fundamental unit is logical since the neutron literally bridges the sub-atomic and the nuclear- atomic domains. The neutron can be thought of as the "mother" of all physical phenomena. All other constants are evaluated as frequency equivalent ratios with v_n Hz in the denominator so the model is dimensionless by definition. v_ns is a natural coupling constant unit system where the speed of light equals the Compton radius, the speed of light divided by its annihilation frequency, of the neutron times its annihilation frequency in one unit of time. Mass, annihilation electromagnetic energy, and frequency are equal. The unit of length is the Compton radius of the neutron. One unit of time equals to the time it takes light to travel v_ns Compton radii of the neutron. The speed of light is 1 since the frequency is v_n times the wavelength $1/v_n$. Electric charge has a unit of one. v_ns and the integer 1 are the only numerical values needed to define all of the units. Any unit of time can be utilized.

The first empiric observables

The single most fundamental empiric physical observation related to the Harmonic Neutron Hypothesis is that the relative scaling, ratio, between the unit values of the forces is v_ns. The neutron is the quantum unit value for the atoms and the strong force. The frequency of the neutron divided by v_ns equals 1 and equals Planck's constant frequency equivalent. Planck's constant is the unit value for electromagnetic energy. Planck's constant unit frequency of 1 divided by v_ns divided by 2 nearly equals the gravitational binding energy of the electron in hydrogen. The ½ factor is related to the fact this is a kinetic energy, and not an annihilation energy. The model assumes that the binding gravitational energy of the electron in hydrogen is just as important as the electromagnetic binding energy of the electron. See the reference below related to the derivation of Planck time. The hydrogen gravitational energy is the unit value for

gravitational energy, the graviton, E_{Gbe}. It is assumed that v_ns times the mass or energy of the neutron equals the minimum binding energy of a black hole. Using this assumption it is possible to derive the mass of the minimum black hole from v_n only. This is the next logical unit force. In summary the unit value ratio spacing between gravitational, electromagnetic, strong, and black hole forces are all related to v_ns between each progressively more powerful force.

This is an exponential system, but the exponents themselves are spaced in a linear pattern. This is very confusing for readers. If the exponents are integers then the axes are "linear". This is similar to music where the actual frequencies seem complex, but the integer exponents are a simple consecutive series. The forces are scaled by the following equation. The relative strengths as frequency equivalents are also shown.

$(v_n s)^n$ for n = -1, 0, 1, 2

$(v_n s)^{-1} / 2 = 4.40168146\text{x}10^{-24} / 2$, E_{Gbe}

$(v_n s)^0 = 1$, h

$(v_n s)^{+1} = 2.2718591 \text{ x } 10^{23}$, neutron

$(v_n s)^{+2} = 5.16134367 \text{ x } 10^{46}$, binding energy of a black hole

The relative force unit values equal v_ns raised to the consecutive integer series of n = -1 for gravity; 0 for Planck's time and electromagnetic energy; 1 for the strong force, and atoms; and 2 the binding energy of a black hole. This type of integer exponential consecutive series defines a classic harmonic system including music. In music the base equals 2 raised to integers for each octave.

Harmonic number properties

This model is based on harmonic number properties. Since music is related to these identical concepts and number system I will use music as an analogy to help explain this model. The entire mathematics of the two domains is not identical, but the general concepts are identical. In music the harmonic frequencies are called notes. They are discrete and can be thought of as quantum values since they are based on unit values. In other physical systems the terms quantum, nodes or modes carry the similar meaning. These terms will be used for their own physical context, but are all the same in concept. This type of scaling between frequencies is a classic harmonic mathematical integer system of music where the fundamental frequency, v^f, times 2 raised to integer powers define the next "octave". See equation below.

$v_f(2)^n$ for n consecutive integers 0 to $\pm\infty$ for each musical octave

In this physics model each "octave" is the scaling factor of a different force. In music as in this model in the frequency domain each note is always the ratio of two integers. All harmonic

systems are related to the integer ratios, and integer or integer fraction exponents. This is the origin of quantum phenomena. The denominator in music and this model is always the fundamental frequency, v_f. This is identical to the physical model.

In the physical domain this pattern is described as harmonic nodes or intervals. For example if there is string of length D then its wavelength is D. Its frequency when plucked is v_f. There is an inverse relationship of these two physical values. As the D becomes smaller, the frequency is greater. See equation below. D is in meters, m, and frequency in cycles per second, Hz.

$v_f = \frac{1}{D}$ or $v_f D = 1 = \frac{dis\tan ce}{time} = wavevelocity$ where 1 is the distance unit D and v_f

There is a special case where for a distance D is divided by the consecutive integer series 1, 2, 3, 3, etcetera. n number sine waves can perfectly fit in that same distance D. These cases define the harmonics. These are the only possible lengths that can be the sum of complete sine waves in that distance, D. Therefore there are an infinite number of possible sine waves with wavelengths of D/n for n equals 1 to ∞. This is the origin of the fusion of the physics, music, and numbers linked by integers.

Only integer possibilities of D and v

This property creates spontaneous self-organization of this system into an integer based division of the length D, D/n. They represent the only valid nodes/ notes possibilities, n times v_f. This connection between integer and the only possibilities is very important to harmonic and physical systems. Any other number than an integer cannot define a full sine wave. Nature will spontaneously create all of these possibilities. Signs and integers in physics are "free" and they are all possible. This appears as a form of "intelligence" that is built into the system. It is intelligent since it is finding only what is possible. In physics and math, if it is possible it will exist. If one analyzes the sound of a real string it does contain these other higher frequencies, but they are increasingly faint. Computers can create pure single frequency tones, but nature in general is much richer and does not. This imperative creates a physical, mathematical, geometric, and frequency integer organization.

These different distances of a string are associated with specific harmonic "note/ node" frequencies. There are many examples of spontaneous harmonic nodes in physics. The most classic quantum example is Planck's energy frequency equation, see below. A vibrating surface like a drum head can spontaneously form different integer geometric subdivision patterns. The electron shells of chemicals are harmonic nodes. MRI coils have multiple modes and they are tuned to the Larmor frequency for imaging. Therefore this natural harmonic pattern can be seen in multi-dimensional physical systems.

$E = nh$ where E is the electromagnetic energy, n is the frequency as integer possibilities only, and h is Planck's constant

Integer fraction nodes, and quantum fractions, qf

The spontaneous wavelengths possibilities can only be D/n. Each wavelength is associated with frequency of the node equal to n times the v_f frequency. The harmonic fractional distances of D possibilities, nodes, are ½, 1/3, ¼… The lengths, nodes, from the one end to the last division equals ½, 2/3, ¾… These "residual" integer fractions are referred to as partials in music and this physics model. The equations below are the only possible integer fractions associated node pattern. With a guitar string if one gently touches the string at 1/3 of the distance and strikes it on the short end a harmonic note with a frequency three times the v_f will be heard. If the long end the string is struck then the fifth of the v_f is heard. This is an excellent physical example of this mathematical phenomena and identical to this physics model.

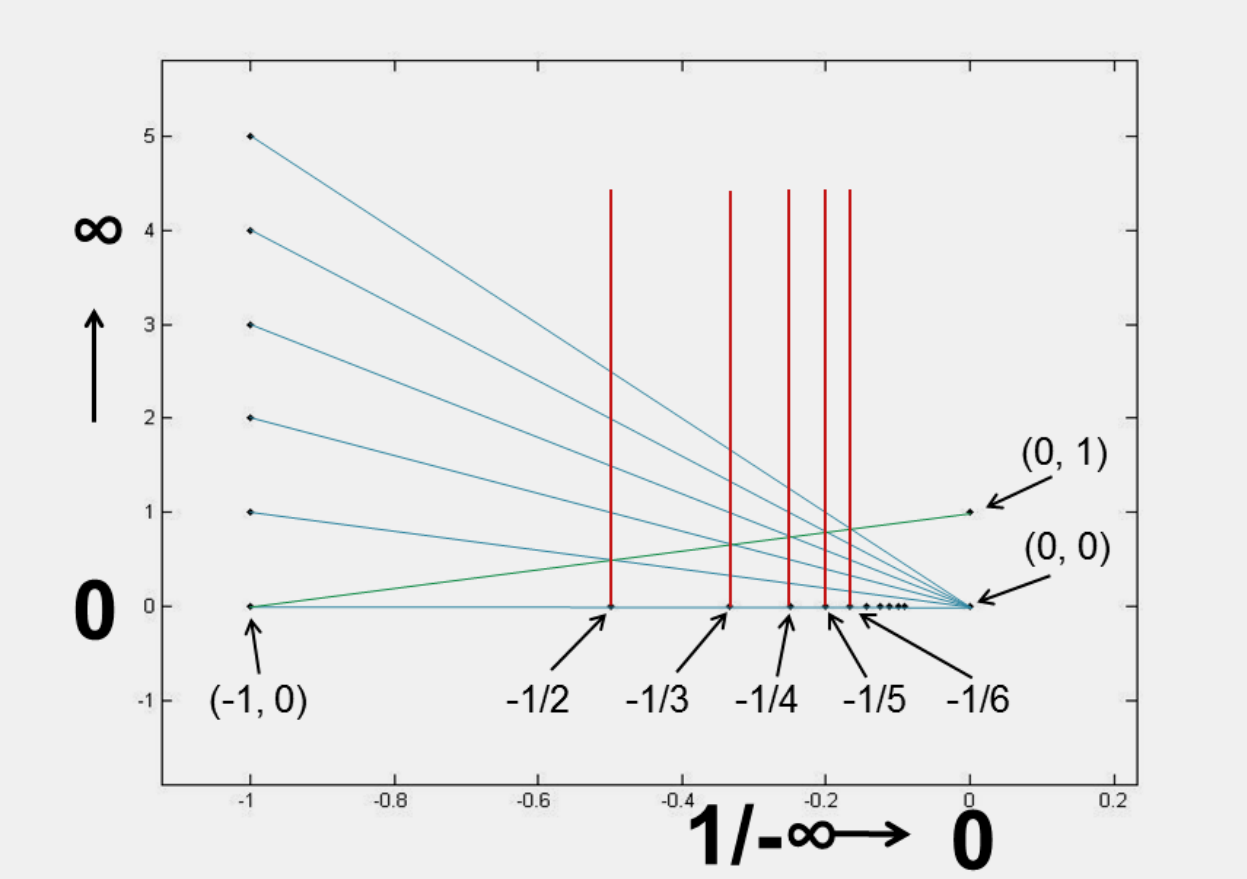
The term quantum fraction, qf, is used for these specific integer fractions of v_ns. The term quantum is used to signify that these are associated with the quantum physical constants and they are only integer fractions. Below is the most important equation of the Harmonic Neutron Hypothesis and is analogous to Einstein's $E=mc^2$ equation in significance and simplicity. v_k is the known frequency equivalent of the physical constant.

$$qf = \frac{n \pm 1}{n} = 1 \pm \frac{1}{n}$$ the parital node or $$qf = \frac{\pm 1}{n}$$ for the standard harmonic node for n = 1 to ∞

$$v_k = v_n s^{(\frac{n \pm 1}{n} + \delta)} = v_n s^{(qf + \delta)} = v_n s^{(\exp_k)}$$ for n = 1 to ∞

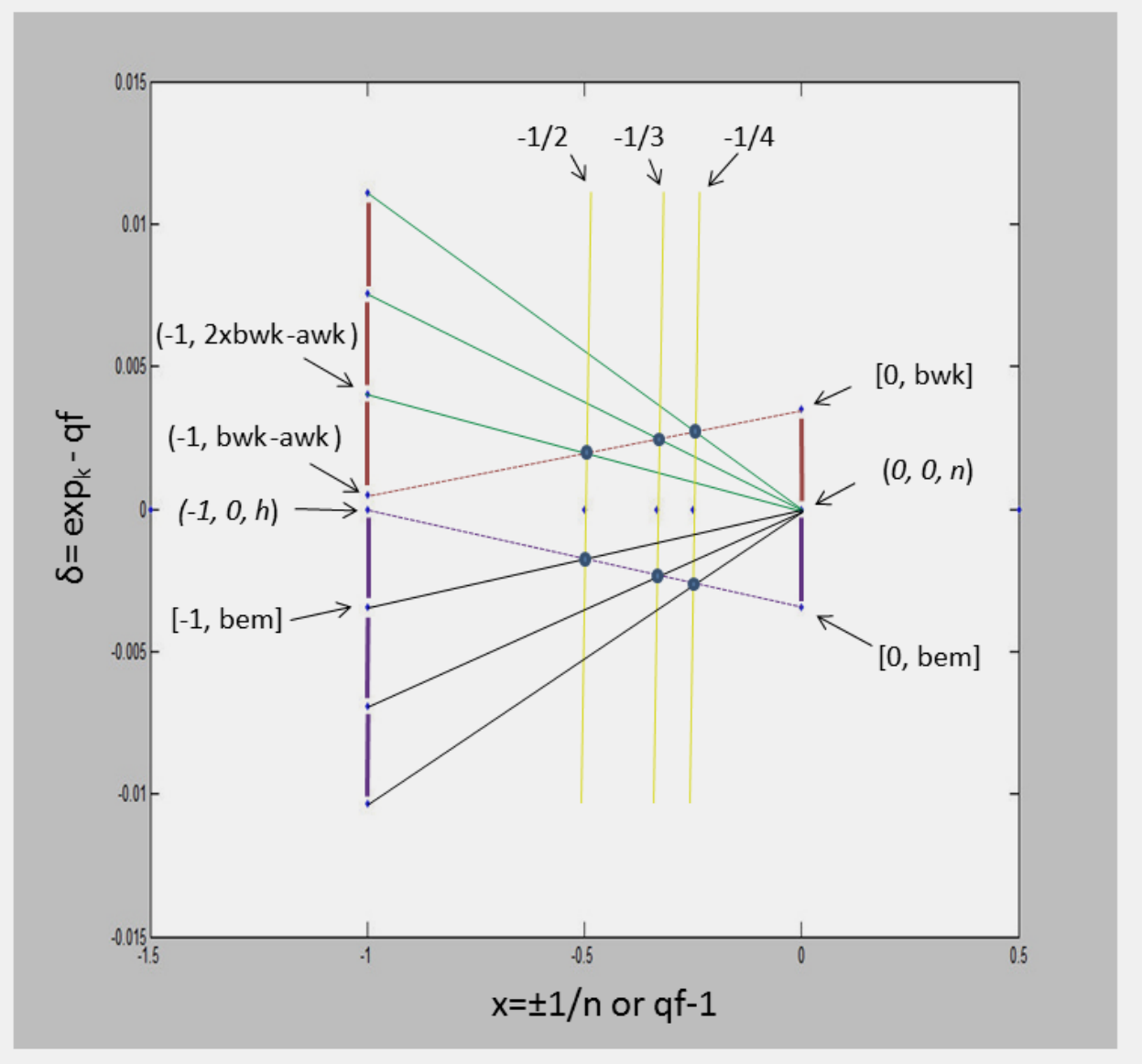
Graphical demonstration of the integer fraction harmonics

Below is a graphical representation of the integer fraction harmonics in a geometric pattern. This turns out to be identical to the physical model, but its axes are log log or exponent exponent. The x axis is from -1 to 0. A reference diagonal line is drawn from the points (0, 1) to (-1, 0). A series of lines are drawn from the (0, 0) point to points (-1, n) where n is from 1 to ∞. Note that each line from (0, 0) intercepts the diagonal reference line from points (0, 1) to (-1, 0) at each harmonic fraction x axis value. As n increases the distance towards the (0, 0) point decreases, -1/n. This graph demonstrates the mathematical imperative that the valid harmonics are only present at the intersection of three lines. This is a discrete. The valid harmonic points are defined by a vertical line at -1/n, the diagonal reference line from (0, 0) to (-1, 0) divided by 1/n divisions, and the line going from (0, 0) to an integer value of (-1, n). This discrete nature is followed exactly with the physical model. For example only where all three of those restrictions are fulfilled -1/n divisions on the reference diagonal line (0, 0) (-1, 0) are there actual possible physical entities.



The exponent exponent integer fraction plane and harmonic nodes

Below is a diagram of the actual nodes and lines associated with the physical model. This is a exponent exponent integer fraction domain. Note that the identical geometry of the standard harmonic numbers seen in the diagram above with linear axes, but the axes are log log or exponent exponent. The origin of this configuration is related to the fact that the forces are spaced by integer exponents. The only valid possibilities in the log log domain can be at intersections of two other valid points just like the linear system. The dotted red line is the weak kinetic lines, wk, and the dotted purple line is electromagnetic line, em. The wk line is related to the weak force, and the em line is related to electromagnetic force. These represent the two split forces to attain a common v_f. This will be explained below. The red vertical lines are the bwk values. bwk is the y intercept of the wk line. awk is the slope of the weak line. This scales the weak force split. The purple vertical lines are bem values. bem is the slope and y intercept of the em line. This scales the electromagnetic split. The vertical yellow lines are the qf intercepts. All of the fundamental constants can only occur at the intersection of three lines, big blue circles. The vertical unit dimensions are bwk and em.



The exponents, qfs, of the physical constants base v_ns

The calculation of an exponent of any physical constant with a base of v_ns is simple. See equation below. This is valid for any v_f value. The $\log_e$ of any frequency equivalent divided by the $\log_e$ of v_ns equals it exponent with a base of v_ns. This is logarithms 101, but hard to imagine when the base number is 2.2718591×10^{23}. Each known exponent, exp_k, in the exponent domain of a qf or a sum of qfs is paired with a frequency equivalent in the time domain. The known exponents are not exactly equal to the qf values and the δ represents that tiny difference. This will be explained in more detail below.

$$\exp_k = \frac{\log(v_k)}{\log(v_n s)} = \frac{n \pm 1}{n} + \delta = qf + \delta \qquad \text{or} \quad \exp_k - qf = \delta$$

The notes of music and nodes of the physical constants

In music each note is related to an integer or integer ratio of any harmonic note divided by v_f. Many of the standard note ratios are simple harmonic integer fractions. Below on the left are the integer ratios and the associated musical notes. Below on the right the integer fractions exponents of v_ns which are the inverses of the musical notes, but also have pairs that have physical constant manifestations. One can see that the physical constants follow the identical patterns of integer fractions as music do. This is the origin of the term harmonic in the title of the hypothesis.

Music integer fraction ratios		**Physic exponent integer fraction ratios**	
½	Octave below	0	h, Planck's constant, force below
1/1	Unison, v_f	1/1	v_ns, v_f
2/1	Octave above	½	cosmic microwave background radiation
3/2	Fifth	2/3	ionization energy of hydrogen
4/3	Fourth	¾	kinetic energy lost in neutron beta decay
5/4	Major third	4/5	Bohr radius

The harmonic fraction/ frequency node pairs in the routine frequency domain

There are pairs of qf (integer fraction, nodes), and their associated frequency equivalents. The concept of these integer fraction and frequency pairs is an essential element of the hypothesis. Music is identical in concept. One is in the frequency/ product/ ratio domain. These are described as the PR domain. The other is in the exponent exponent integer fraction domain. The product / ratios of the frequency of the fundamental constants are important relationships. These relate the properties of hydrogen described earlier in the "circle atoll" section. There is referenced paper detailing these below.

The shorter end of the string is associated with an octave change. The longer end of the same string is described as the partial note. Below is a table of the classic harmonic integer fraction nodes and frequencies of a string with a unit length D of 1 and fundamental frequency of 100 Hz. n is the integer related to the node, 1/n is the short distance and that distance's octave Hz values. The partial notes are the other length of the remaining string 1-(1/n), and their partial node Hz values of the longer lengths. Note that both the octave and partial nodes are simultaneously created from the same n value, and are valid harmonic possibilities. These nodes are linked by a common integer, but associated with different frequencies.

n	**length, 1/n octave nodes**	**Hz octave nodes**	**length, 1-1/n partial nodes**	**Hz partial nodes**
1	1	100/(1/1)=100	1	100/(1) = 100
2	1/2	100/(1/2)=200	1/2	100/(1/2) = 200
3	1/3	100/(1/3)=300	2/3	100/(2/3) = 150
4	1/4	100/(1/4)=400	3/4	100/(3/4) = 133

5	1/5	100/(1/5)=500	4/5	100/(4/5) = 125
6	1/6	100/(1/6)=600	5/6	100/(5/6) = 120

The harmonic qf / frequency pairs in the exponential domain

In the harmonic neutron hypothesis the main observation is that the physical constants are spaced by identical integer fraction nodes as other classic harmonic systems, but this is in the exponential domain with the base of v_ns. They also have the identical pattern for the partial node integer fractions. In this case to simplify the pattern a v_f of 100 is used as an example, see chart below. The origin of this harmonic number spacing is inherently different from that in the time domain, but the exact integer pattern is encountered. This is also logical since the distribution of energy over time is exponential. For example the rate of change in temperature of something hot to room temperature is exponential. The life times of radioactive particles, and the relaxation times in magnetic resonance imaging are also exponential. Below is an example where the "length" of the system is a unit of 1. That "unit length" is an exponent of 1. The fundamental frequency, v_f, is 100 Hz. Using the identical nodes as the musical system the exponential system has its own unique, though similar properties.

n	length, 1/n. qf nodes	Hz 1/n nodes	length 1-1/n, qf partial nodes	Hz partial nodes	log(Hz)/log(100)
1	1	$100^{(1)} = 100$	1	$100^{(1)} = 100$	1
2	1/2	$100^{(1/2)} = 14.142$	1/2	$100^{(1/2)} = 14.142$	1/2
3	1/3	$100^{(1/3)} = 4.6416$	2/3	$100^{(2/3)} = 21.544$	2/3
4	1/4	$100^{(1/4)} = 3.1622$	3/4	$100^{(3/4)} = 31.622$	3/4
5	1/5	$100^{(1/5)} = 2.5118$	4/5	$100^{(4/5)} = 39.811$	4/5
6	1/6	$100^{(1/6)} = 2.1544$	5/6	$100^{(5/6)} = 46.416$	5/6

Note that the ratios of log(node Hz)/log(v_f) equal the integer fractions nodes. Dividing the log of one number by the log of another converts the denominator's frequency values into the base of an exponential system. The sum of the 1/n nodes and the 1-(1/n) partial nodes always equals one. This is identical to the string analogy. There are many other important properties of this system that bridge between the frequency Hz domain and the exponent domain. The product of the Hz associated with the 1/n node times the Hz associated with the partial node 1-(1/n) always equals the v_f. The ratio of the Hz partial node divided into the v_f equals the Hz 1/n node. In the exponential domain the sum and difference equal products and divisions in the frequency domain. In this domain the 1/n values are associated with lower frequencies which is opposite of the musical analogy. In this domain the 1-(1/n) values are associated with higher frequencies which is opposite of the musical analogy. The frequency is always viewed from the perspective of v_f^0 or 1. In many respects this exponential mathematical system is much simpler and more integrated than the classic music harmonic system.

This exponential system has paired Hz values in the frequency domain to qf in the exponential domain. For example, ½ in the exponent domain is associated with 14.142 in the frequency domain. Each qf has an associated with a specific frequency value. They are directly related, but

represent different number valued completely dependent on the v_f value. The qf are fixed and discrete.

The concept of resonance

There is an important element of resonance in this mathematical/ physical system. Frequencies at which the response amplitude is a relative maximum are known as the system's resonant frequencies, or resonance frequencies. A musical instrument analogy is described. There are multiple tuning forks that vibrate at different frequencies placed in holes of a common solid piece of wood. None of them are ringing. If a tuning fork of the same frequency as one of them is struck then placed into a hole of the common wood, the two tuning rods with the same inherent vibration frequency will start to vibrate together. The most energy will be transferred to the tuning fork with the same natural vibration frequency. If there are two systems that have identical natural frequencies then there is the potential for maximum interaction of these two. They have the potential for synchronous vibration and exchange of energry.

Resonance is associated with the ability and propensity of two different entities to interact and share energy. Let us look at the frequency situation. If one entity is cycling at 3 cycles per unit time and another one is cycling at 5 cycles per unit time. If they start in phase the only time they will be in phase again is at the beginning of each unit time cycle. This means that they do not interact very much. This is a function of their specific n values. In this case the n values are primes. If the n values were 3 and 6 then every other cycle would be in unison and the total interaction, potential energy transfer, would be much greater.

This concept of resonance in the physical mode is reflected in this example. The electron neutrino is associated with the number 2, a prime. The nucleus is composed of an up quark, n equals 10, and the down quark, n equals 11. There is no "common resonance" of 2 and 11 as pure numbers and there is no interaction between neutrinos and down quarks. There is common resonance of 2 and 10. They are both even and 10 equals 2 times 5. The up quark can be thought of as a composite of both primes since 10 is a composite number. In the physical domain the only interaction and/ creation of neutrinos and the nucleus is through the up quark. An up quark and neutrino are created from the down quark in neutron beta decay. An up quark turns into back into a down quark only when it merges with a neutrino. This is an excellent example of where "resonance" of integers explains the physical properties and interaction between different entities that otherwise does not seem to have any logical explanation. In the exponent exponent domain multiplying exponents equals raising the frequency to that exponent.

Resonance in the exponential qf and frequency domains

In the exponential integer fraction system of 2 and π there is a common resonance, v_f. The frequency of any node raised to its inverse exponent equals v_f. For example $(14.142)^2$ equals 100, and $(21.544)^{(3/2)}$ also equals 100. Therefore once any v_f is defined all of the possible Hz frequencies can be derived since the integer fractions are fixed discrete values, qf. If this were the exact analogy for the physical constants the system would be very simple. Unfortunately the physical domain is more complicated, but in general follows very similar rules

Achievement of resonance of all of the physical constants with a common v_f

Below are two examples of physical domain. These are exactly like the prior example of paired qf and frequency values. Their pair derivations will be described later.

$$\frac{\log(2)}{\log(v_f)} = \frac{10}{1155} \quad \text{and} \quad v_f = 2^{\frac{1155}{10}} = 5.8744133 \text{ x } 10^{34}$$

$$\frac{\log(2\pi)}{\log(v_f)} = \frac{39}{1155} \quad \text{and} \quad v_f = (2\pi)^{\frac{1155}{39}} = 4.3491440 \text{ x } 10^{23}$$

Note that these two qf frequency/ qf pairs are not associated with a single resonant v_f. In fact they are hugely different. How is it possible to create a single harmonic resonant v_f system like music in the global domain of physics? One of nature's greatest attributes is its ability to "find" which possibilities actually work to solve this dilemma out of an infinite number of possibilities. A classic example of this in physics is Feymann's assumption that light going between two points could have taken any route. Mathematically it is possible bring the system into a single v_f resonance by adding or subtracting small δ values to the exponents, see equations below. These δs can be thought of small natural "shims" that bring the system into resonance.

$$\frac{\log(2)}{\log(v_f)} - \delta_2 = \frac{\log(2)}{\log(v_s s)} - 4.2305459 \text{ x } 10^{-3} = \frac{10}{1155}$$

$$\frac{\log(2\pi)}{\log(v_f)} - \delta_{2\pi} = \frac{\log(2\pi)}{\log(v_n s)} - 4.0771874 \text{ x } 10^{-4} = \frac{39}{1155}$$

The equations below are the inverse exponents of the qf, frequency value pairs. By adding or subtracting these tiny δs, "shims", to every physical constant's exponent values a common resonant v_f value is possible. In nature v_f is the annihilation frequency of the neutron. This "splitting" of the actual known experimental exponents slightly away from simple integer fractions, qfs, is an essential mathematical element that is necessary for resonance of the whole system. It also creates a "split" mathematical domain. This split in the physical domain represents the split between the weak and electromagnetic forces. Therefore the relationship between the weak and electromagnetic forces can be precisely mathematically defined. From an imaginary number perspective one could say the real components can only be harmonic integer fractions and the δs are the imaginary i components. This is in part accurate since the exponent exponent domain does represent a vector plane.

$$2^{\frac{1}{(\frac{10}{1155}+\delta_2)}} = 2.2718591\text{x}10^{23} = v_n sHz = v_f$$

$$(2\pi)^{\frac{1}{(\frac{39}{1155}+\delta_{2\pi})}} = 2.2718591\text{x}10^{23} = v_n sHz = v_f$$

Empiric qf frequency pair quantum observables of the physical constants

The empiric observables are that the fundamental constants represent classic 1±(1/n) exponents of v_ns. Below is chart showing the known exponents of many of the fundamental constants and the qf values. It is obvious that there is a direct relationship between these two. Every physical constant has qf value that is slightly "split" from the known value by a small δ. The actual exponent values should not be identical to the qf exponents, see above. This is similar in concept that the masses of the atoms do not exactly equal an equal number of neutrons, but slightly different. There are no physical constants where there are no qfs. The integer hydrogen, n_H integers refer to the nodes on the wk or em lines that other constants are related to. All of the quarks are associated with the (1, 0) point so that is listed and not a n_H node. NA refers to not applicable. Some of this data is old and it have not been updated since 2009.

Table 1: quantum fraction and δ values for the evaluated fundamental 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		-1.007757	-0. 007757
Planck *s	h			0	1	0	0
lost beta, H	lb2	2	-1/2	½ (3/2)	2	0.50201620	2.0162007 x 10^{-3}
Rydberg, H	R	3	-1/3	2/3 (4/3)	3	0.66436554	-2.3011223 x 10^{-3}
lost beta, H	lb4	4	-1/4	3/4 (5/4)	4	0.75276629	2.76629212 x 10^{-3}
Bohr radius,H	Br	5	-1/5	4/5 (6/5)	5	0.80291631	2.9163104 x 10^{-3}
lost beta, H	lb6	6	-1/6	5/6 (7/6)	6	0.83634965	3.01632258 x 10^{-3}
electron, H	*e*	7	-1/7	6/7 (8/7)	7	0.86023062	3.0877599 x 10^{-3}
lost beta, H	lb8	8	-1/8	7/8 (9/8)	8	0.87814134	3.1413378 x 10^{-3}
up	*u*	10	-1/10	9/10 (11/10)	(1, 0)	≈ 0.88975	≈-1.0247 x 10^{-2}
top	*t*	10	+1/10	11/10 (9/10)	(1, 0)	≈1.0969	≈-3.030 x 10^{-3}
Higg's	H^0 11	11	+1/ 11	12/11 (10/11)	(1, 0)	≈1.0910	≈1.47 x 10^{-4}
down	*d*	11	-1/11	10/11 (12/11)	(1, 0)	≈0.90245	≈-6.63 x 10^{-3}
Z	Z	12	+1/12	13/12 (11/12)	7	1.0850734	1.7401528 x 10^{-3}
W^+	W^+	12	+1/12	13/12 (11/12)	3	1.0827381	-5.9517108 x 10^{-4}
muon	μ	24	-1/24	23/24 (25/24)	8	0.95936771	1.0343838 x 10^{-3}
$pion^+$	π^+	28	-1/28	27/28 (29/28)	3	0.96454355	2.57836 x 10^{-4}
$pion^0$	π^0	28	-1/28	27/28 (29/28)	4	0.96392127	-3.64441 x 10^{-4}
strange	*s*	30	-1/30	29/30 (31/30)	(1, 0)	≈0. 95852929 #	≈-8.137 x 10^{-3}
bottom	*b*	32	+1/32	33/33 (31/30)	(1, 0)	≈1.0277	≈ -3.4508 x 10^{-3}
tau	T	83	+1/83	84/83 (82/83)	6	1.0118493	-1.9884 10^{-4}
$kaon^0$	K^0	84	-1/84	83/84 (85/84)	3	0.98818379	-8.8556 10^{-5}

kaon$^+$	K^+	85	-1/85	84/85 (86/85)	6	0.98803392	-2.01364 10^{-4}
charm	*c*	109	+1/109	110/109 (108/109)		≈1.00560	≈-0.00357
proton	*p*	39048	-1/39048	39047/39048	1	0.99997438	-2.5619999 x 10^{-5}
neutron	*n*	± ∞	0	1		1	0
$\log_{vns}(1/2)$							-0.012888554
Planck's time^2, t_P^2				-128/35	NA	-3.6708789	-0.0137365140
α^{-1}		11	-1/11		NA	0.0914882590	5.7916811 x 10^{-4}

The split harmonic node lines of the weak kinetic force and the electromagnetic force

Each individual physical constant is plotted on a two dimensional exponent exponent integer fraction plane. If the system were not split then an single linear line could define each physical constant at each qf, 1±(1/n) node x axis location. The x axis is defined as qf-1 location since each entity is divided by v_ns. The x axis is related to ±1/n values. The y axis is the δ value. Since all of the constants are evaluated as ratios of v_ns divided into all others the neutron is plotted at (0. 0) since the log of 1 is 0. This is confusing, but accurate. For example the qf for the electron is 6/7, but it is plotted at the -1/7 point. The pattern of physical constants is symmetric around the neutron point. The pattern is diamond centered at (0, 0). The distance from point (-1, 0) is the exact exponent of any physical constant minus its qf, pair. That point is related to h and a frequency of 1. These points are plotted in a similar geometric configuration identical to imaginary numbers, but the math need not be completed with imaginary numbers. There are many similar vector properties though.

$$\exp_k = \frac{\log(v_k)}{\log(v_n s)} = \frac{n \pm 1}{n} + \delta = qf + \delta$$

$qf - 1 =$ x axis location and $\delta = \exp_k - qf$ = the y axis

For example the ionization energy is plotted at (2/3-1, $\exp_R$-2/3), (-1/3, δ_R). Some of the points represent products or divisions of other entities. These are the sums and differences of the qfs and δs on the qf-1, δ exponent plane. Planck time is an example of that type of a compound qf, see reference below.

The weak kinetic force line, wk line

There are two lines that define all of the possible nodes of the fundamental constants. One is the weak kinetic line and it is defined by the points related to the Bohr radius (-1/5, $\delta_{\alpha 0}$) and the electron (-1/7, δ_e). This is logical since the weak force is related to mass, the leptons, and kinetic energy of neutron beta decay. The electron is the primary lepton, a mass, and associated with beta decay and neutrinos. Distance defines velocity and therefore the Bohr radius. The other possible nodes on this line are directly or indirectly related to all of the weak force entities. This line has a slope of awk and a y intercept of bwk, see Table below.

The electromagnetic strong force line, em line

The other line is the electromagnetic strong force line. This is defined by the points for Planck's constant (-1, 0) and the ionization energy of hydrogen, the Rydberg constant, R, (-1/3, δ_R). This is logical since Planck's constant is the unit for the electromagnetic force. The ionization energy is the unit electromagnetic energy for the atomic system. The quarks are related to electromagnetic charges of 1/3 and 2/3 and held together by forces related to charge. This line has a slope of bem and a y intercept of bem since they are both the same value.

bwk: y intercept weak force 3.5163835×10^{-3}

awk: slope weak force 3.0003655×10^{-3}

bem: y intercept electromagnetic $-3.4516836 \times 10^{-3}$

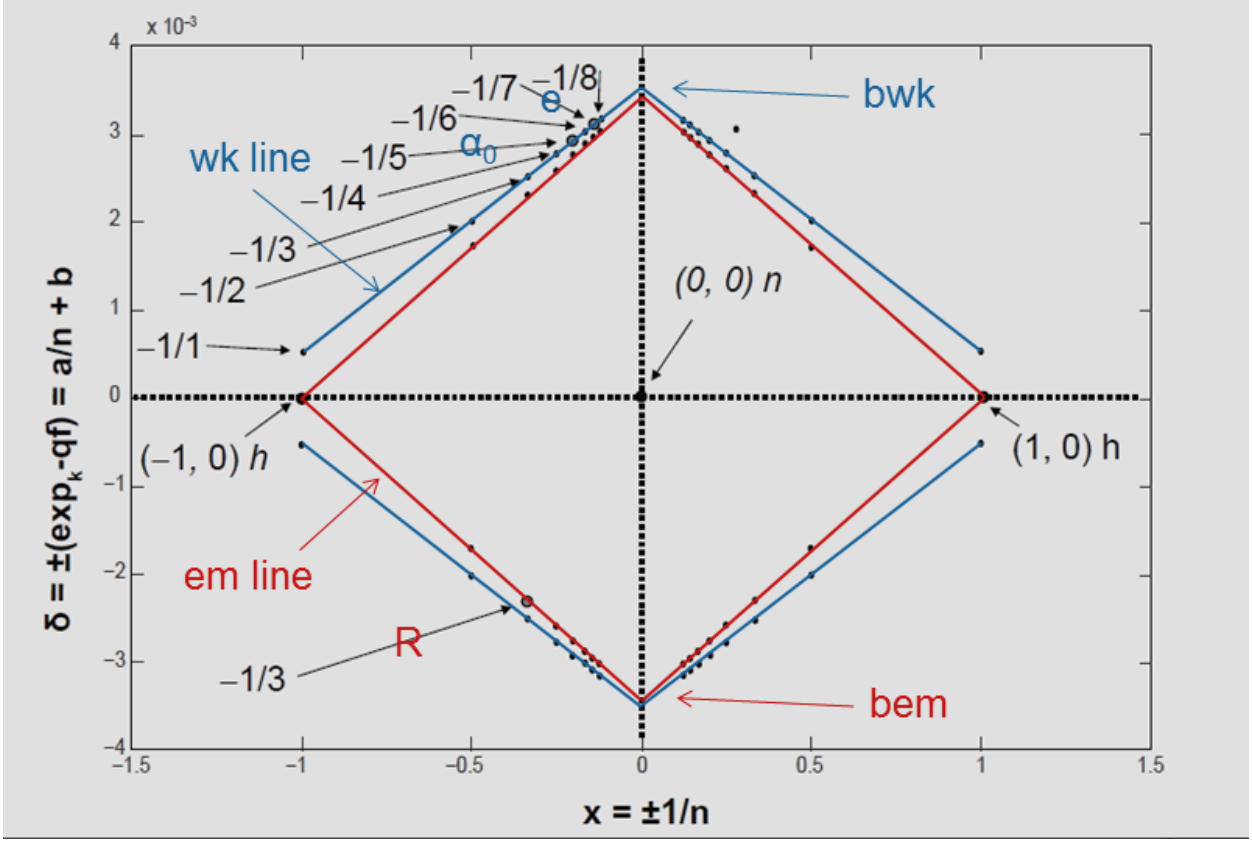
aem: slope electromagnetic $-3.4516836 \times 10^{-3-3}$

annihilation frequency of the neutron, v_n: 2.2718591×10^{23} Hz relative error 2.5×10^{-8}

$\log(v_n s)$: 53.7800556

neutron eV/c^2 9.39565379×10^6 eV/c^2

In the graph below the blue lines are related to the weak kinetic, wk, lines. The red lines are related to the electromagnetic strong, em, lines. The dots with the solid circles are related to known entities. The other dots are "theoretical" nodes were hypothesized in 2009 that these nodes must be related to other physical entities. Frequently there is criticism when the term "must" be is utilized in this model. This is not an "opinion" it is a mathematical imperative. These are the only possible mathematical nodes. In the interval this has been documented to be true. The pattern is symmetric forming a diamond configuration centered on the neutron.



Why is the pattern a diamond?

The reason why the general pattern is a diamond is that it is an exponent exponent plane. On this plane a constant total sum orthogonal distance equals a constant ratio. On the qf-1, δ exponent plane distances are added or subtracted not multiple and divided. The distance from point (0, 0) to (0, 1) is one. That same unit distance can fall on line forming a diamond connecting the points (0, 1), (1, 0), (0, -1) and (-1, 0). This is a diamond. On the linear plane an equal distance from a point is defined as a circle. On the qf-1, δ exponent plane an equal product is a diamond pattern. In the physical case the y axis values are defined by awk, bwk and bem. See diagram above. The values bem and bwk represent the "unit" values of the split δs. These three values define all of the possible slopes of other forces by their sums and differences. This is shown in the derivation of Planck time, see reference.

Derivation of all physical constants from the Big Four

From the initial 2006 and 2009 papers it was hypothesized that fundamental physical constants can be derived from v_ns, bwk, awk, and bem. These are the Big Four fundamental constants of the model. By utilizing these four values and appropriate integer fractions the fundamental constants can be derived. v_ns scales the whole system. Sums and differences of bwk, awk, and bem define all of the lines related to specific forces. For example, the slope of the Planck time line from (-1, 0) out equals awk-bwk-bem. The slope of the Higg's boson line is 2xbwk-awk+bem. The only other variables are signs, integers, and integer fractions. In math and physics these values are "free" possibilities. Each qf can be associated with one or more physical

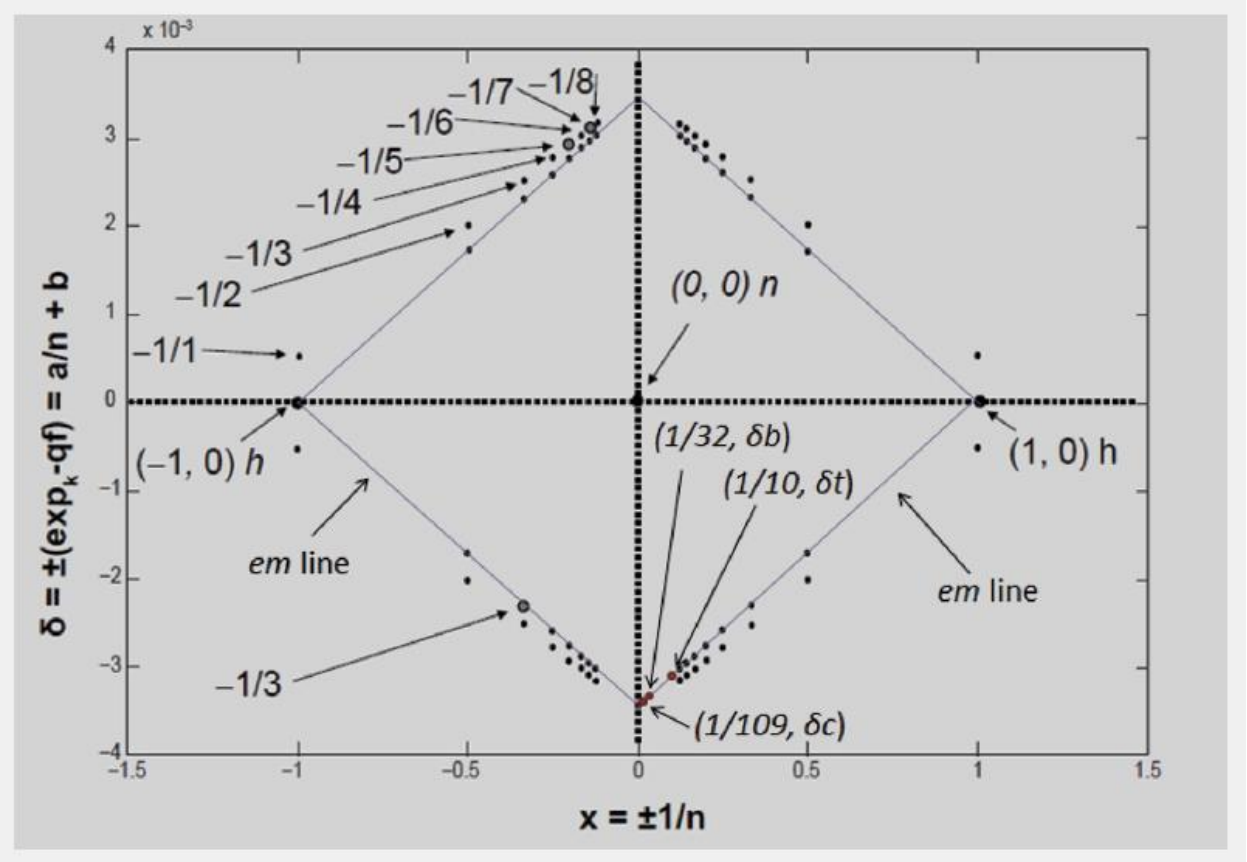
constants. For example, the qf ½ is related to the energy lost in beta decay of the neutron, the expectations mass of the electron neutrino, and the cosmic microwave background radiation. Note that this is an even number and all of these are kinetic. Also 2 is the most common prime associated with all even numbers. It is the most ubiquitous integer, and in the physical domain the cosmic background radiation is as well ubiquitous.

This is concept is exactly analogous to music where if one knows the fundamental frequency and the organization of the integer fraction nodes all of the notes can be derived. This is also similar in concept to chemistry where each integer is related to a different atom. There are three extra values, bwk, awk, and bem, needed in the physical domain to characterize the splitting. Physically related constants all fall on a common logical line since they are scaled by the same force. There are different lines for different forces. The sum of the difference between to qf and the slope equals a classic physical constant that is used in a product or ratio relationship. The qf values approximately scale the interactions. The δ values "shim" the qfs to the exact exponent.

A total of 23 fundamental physical constants can now be derived to their experimental accuracy starting with this very limited data set. Related physical constants all fall on a common logical line. For example, Planck time squared, t_P^2, the Hubble constant, H^0, and cosmic background microwave cosmic radiation, CMB, are all related to δ values that fall on the t_P^2 line.

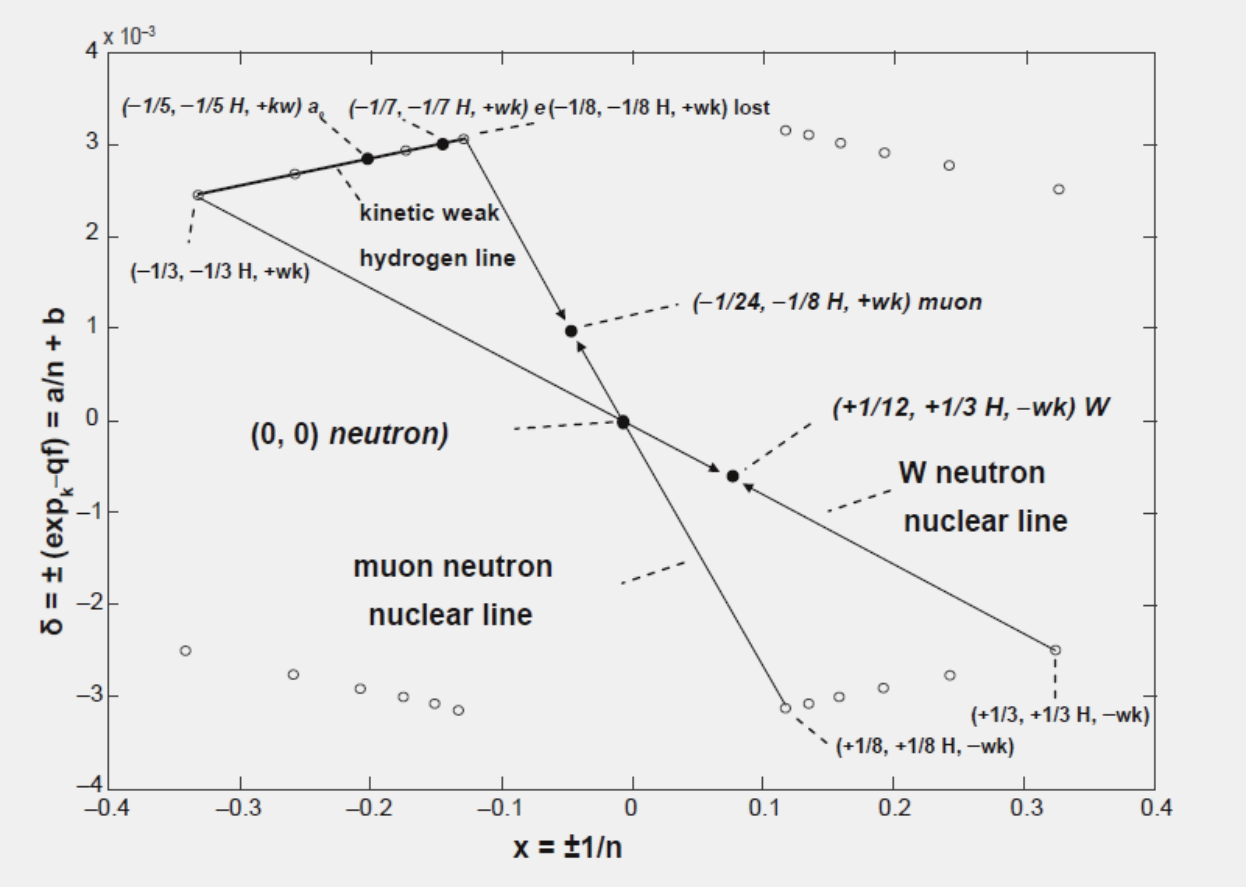
The quarks all fall on the predicted electromagnetic strong, em lines

Two examples of how other fundamental constants can be derived/ predicted from the Big Four are demonstrated below. The diagram below plots the qf-1, δ exponent points for the charm, bottom, and top quarks from a 2009 diagram, see reference below. All of these known exponents fall on the em line that connects with the (+1, 0). This is point is hypothesized to be associated with the minimum binding energy of the black hole. This is logical since matter cannot be extracted from a black hole and individual quarks cannot be extracted from hadrons. The nuclei represent "baby black holes" in this respect. The strange, and down quarks fall on the line with a slopes equal to 2xbem. The up quark falls on the line with a slope of 3xbem, see the quark paper referenced below. This pattern is identical to the harmonic graphical plot previously demonstrated.



W and Z fall on lines connecting the neutron and weak kinetic line nodes

The diagram below is another example demonstrating weak force entities, but associated with the wk line. This is from the 2009 paper, see reference and link below. The muon falls on a line between the wk node at qf, 7/8 and the neutron. 7/8 is associated with the kinetic energy lost in beta decay. The muon point is at the qf value of 23/24 which is the product of 2 and 12 the principal quantum numbers for the neutrino and the W boson. The W boson is related to the wk node of +1/3. This is logical since the electron is associated with its charge and electromagnetic of the ionization energy. Similar relationships are seen with Z and Tau. The mass of the proton and the kinetic energy lost in the beta decay process can be derived by adding up the lost kinetic energy related to the points that all fall on the wk for the even number points of ½, ¾, 5/6 and 7/8, see paper reference below.



Powerful prime numbers

Prime numbers should be extremely important in this model. The harmonics of prime numbers are reviewed here. The primes must play a critical role since they define the discrete harmonic possibilities. Just as there are only specific 2π "atolls", the harmonic numbers define prime product harmonic "atolls" as well. They also define the next possible generation and the degree of possible resonance. The smallest prime numbers must be associated with the most important entities. Since 2 is even it has an infinite number of harmonic pairs so it does not have the same properties as the other non-even primes. 2 is logically associated in the physical domain with the cosmic background radiation which is true.

The four critical odd prime numbers of the physics model are related to 3, the ionization energy, 5, the Bohr radius, 7, the electron, and 11 the fine structure constant. These all represent fixed entities and should not be "resonant". One could reason that the hydrogen atom does not collapse since none of the components can resonant or share energy with the other.

These primes also explain the hierarchy of generations of similar physical entities. The quarks are a good example. The three primary numbers of the quark system is 3 for the ionization energy, 10, the up quark, and 11, the down quark. The only possible harmonic combinations are 3 times 10, 30. That is the strange quark qf, 29/30. 3 times 11 is 33. That is the bottom quark's qf, 33/32. 10 times 11 is110. 110/109 is the qf for the charm quark. The top quark is 11/10 and

the up quark is 9/10. These are example of classic harmonic number properties are linked to the physical constants.

The fine structure constant, α, is the common resonance qf of components of hydrogen

Earlier the "circle" locked relationships of the hydrogen properties and α were discussed and demonstrated with a diagram. The origin of those complicated product/ ratios of the ionization energy, 2/3, 770/1155, Bohr radius, 4/5, 924/1155, electron, 6/7, 990/1155and α 1/11, 105/1155 are linked to the concept of how to bring resonance between the qfs of these prime number fractions. These qf relationships are therefore the foundation for many of the most important physical interaction's scaling linked through 2 and π.

The common denominator product of the primes 3, 5, 7, and 11 is 1155. The qf of α^{-1} is 105/1155. The difference between the ionization energy and the Bohr radius qfs is 154/1155. The difference between the electron and the Bohr radius qfs is 66/1155. How is it possible to bring these four different prime based qfs into a qf common resonance in the exponential domain, and resonance in the frequency domain? This is a classic "Goldie locks" problem. One difference is too big and one difference is too small. The solution is achieved in a clever fashion nearly identical to that the variable v_f problem of the qf described earlier, but even more inventive. How do you also insert 2π into the quantum values so they are "circle locked" and qf locked?

66 plus 39 equals 105. 154minus 49 (10+39) equals 105. Nature's solution is a brilliant integer fraction "shim". It is actually very simple. The qf of 2π must be related to 39/1155. This also means that the qf of 2 must be related to 10/1155. The qf for 4π must be related to 49/1155. The literal differences between the prime based qfs of the ionization energy, the Bohr radius, electron, and α are shimmed with the qfs for 2, 2π and 4π to bring them all into a common resonance with the qf of $\alpha^{-1}$with the differences of the qfs of the ionization energy, the Bohr radius, and the electron. It is an amazing beautiful solution to bring qf and 2π harmony to a system.

Conclusion

This model is based on a few classic first principles of mathematics not physics. Integer number properties have meaning and power including: π, odd, even, positive, negative, prime, prime products, sums, difference, ratios, and products. What is possible is defined by sign and a consecutive integer series. There is magic in the circle geometry and all of the associated properties that are inherent in sinusoidal wave systems. This is a very restrictive system though on the surface it seems very simple. The circle is both a discrete fractal system and a continuous one. Resonance is the mathematical and physical means of interaction between different discrete possibilities. The harmonic number properties of integers create an "intelligent" system which is highly structured with only specific possible integer and harmonic fractions. The harmonic number properties are true in both the frequency and exponential domains. The prime numbers limit the possible harmonic possibilities and interactions. There is a brilliant shimming strategy to bring a common resonance in the qf-1, δ exponent domain, and a fundamental frequency in the PR domain, to the whole system. There is an even more extraordinary shim that links the

harmonic fraction domain and the 2π circle domain bringing resonance to four prime numbers. If one searches for the only mathematical system that can fulfill all of these different restrictions in these different domains simultaneously you find our beautifully harmonic world as the only brilliant solution. Our world is beautiful for the identical reasons that music is beautiful, harmony.

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