THE ENTROPIC ENERGY DENSITY PROGRESSION PRINCIPLE

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Introduction

In an ordered Universe there is no entropy because all energy is used for something. The distinction between usable and waste energy derives from the concept in Thermodynamics that only a specific percentage of the energy in a process can be transformed into work. However the progression of understanding improves process efficiency and renders waste into usable energy.

On a microscopic scale increased efforts are devoted to rendering diminishing portions of processes' unusable energy usable. However from a macroscopic perspective knowledge advances at increasing rates which discards obsolete processes in favor of more specific ones by transforming the entropies of energy into useful information.

In doing so the substance of energy becomes less significant and its information becomes the usable product. The progression of a camp fire into a nuclear reaction is a transformation of energy form by conversion of entropy into information. When Planck reduced the spectral distribution of black body radiation to a Boltzmann Distribution a very slight high end discrepancy prompted Einstein to show that light, a "continuous spatial function," exists as energy quanta and the black body's thermal energy results in electron resonances in addition to the previously recognized atomic resonances.

Bohr developed the energy quanta and electron resonance concepts into a quantum mechanical model that assigned integer multiples of Planck's constant to the angular momentum of a classical orbit. De Broglie then recognized that particles have a wave nature in addition to their particle nature and Schrodinger applied it to the atom to explain discrepancies that Bohr's model could not account for. Pauling extended the concept to the Chemical Bond, others extended it to nuclear physics and the camp fire became nuclear.

With the marriage of semiconductors and computers Information Technology became the sociological backbone of all human endeavors from commercial to military operations and from video games to internet access of a seemingly infinite information pool. However current technology is reaching its theoretical limits and the substance of energy is becoming more significant as resources diminish and ecotoxins increase. Ecological Impact and Carbon Footprint are the subject of increasing concern and development of energy resources are undergoing exponential commercialization.

While these efforts are valuable they proceed from a microscopic perspective, increasing efforts for diminishing returns. However technological systems, like computers, have "back doors" into their information that permit faster more significant results by bypassing the system's overhead. Fermi applied this concept to measuring the energy from an atomic bomb blast by weighing a piece of paper, tearing it into small pieces, dropping them at the moment of the shock wave, and calculating the blast energy from their displacement in a few hours to within 1% of the value derived by the computers in three days.

This conversion of entropic to usable information is the substance of a process that Planck, Einstein, Bohr, De Broglie, Schrodinger, Heisenberg, Dirac, Pauling and so many others used to transform 19th Century thermodynamics into today's technological society. They transformed entropy into function. This is not just a philosophical observation, there is a specific process to it - Discrepancies are observed, quantified, explained, and then utilized technologically.

The discrepancies are usually small, in the order of 10^{-5} times smaller than the dominant function of a process. However, as a system back door they are invaluable in finding the transform function from current to next generation technology. They permit

transformation of one energy form into another, converting entropy into order.

While Quantum Theory has been immensely successful it has one underlying problem, its wave functions, relying on a concept of integer increases in standing wave energies, do not permit prediction of future values, bringing into question the underlying premise of standing waves. This discrepancy however has a cause. When the wave nature of particles was discovered it was so successful that their particle nature was no longer needed, except to the define the wave function in terms of momentum.

It turns out however that the particle nature results in a 2.662674×10^{-5} wave behavior discrepancy that accounts for its discontinuity. It is a relativistic mass increase that alters the momentum relation, and thus the wavelength derived from it by de Broglie's $\lambda = h/mv$ relation. This value was first discovered by Sommerfeld and used to render Bohr's particle model more accurate but when the wave function nature of particles was recognized the particle model was discarded.

Every form of energy has a domain of dominance, but this does not negate the existence of recessive forms that are each dominant in their own respective domains. They may seem insignificant in a domain but they become a mechanism for transcending a domain's boundary conditions when its context changes. Wave functions dominate in atomic orbitals where the space to particle size ratio is in the order of 10^5 and EM fields can operate, but inertial mass dominates in particle accelerators or where the space to particle size ratios are fractional and reciprocal orbital momentums cancel, resulting in mass defect binding energies.

Einstein achieved historical notoriety by relating mechanical

and EM energy forms by Lorentz and $E = mc^2$ transformation functions.

Similarly, Bohr derived a transform function between quantum and classical behaviors in his Correspondence Principle. However these were narrowly defined microscopic applications that failed to result in a broader view which recognized that each energy from exists in a domain bounded by circumstances that create the entropies of that domain. Equilibrium states exist in each domain by the resonance of the domain's dominant energy form, and transform between domains requires a transform function that relates their different entropic degrees of freedom.

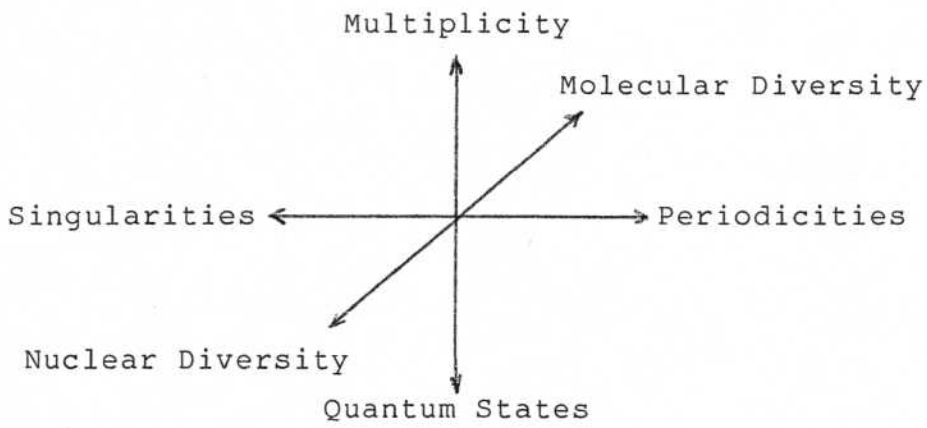
What Sommerfeld's number actually shows is a phenomenon by which the dominant wave function energy form in atoms becomes recessive in the nuclear domain where particle nature dominates. As the mv momentum of a particle increases to the speed of light the $\lambda = h/mv$ wavelength changes linearly but inertial mass increases geometrically to infinity, thus increasing the influence of the particle nature at a greater rate than the wave nature's linear progression.

This has resulted in an Entropic Energy Density Progression Principle that recognizes the importance of energy resonance as a stability function, while also recognizing that the entropic degrees of freedom of that energy also transform as recessive energy forms transform into dominant ones. This concept relies upon Sommerfeld's number to show a definitive relation between the EM wave, the orbital structure of the atom, and the size and mass of the electron.

The concept is then extended to derive the proton and neutron sizes, mass and magneton values, the deuteron, triton and helion mass defect binding energies and magneton values, and explain Weak force beta decay and decay path asymmetries. It also explains neutrinos' functions and structures and the concept of Strangeness as an entropy transformation function in the decay of nuclear particles.

This concept does not replace the concept of quarks as a tool in predicting particles. Their value in this area is well established. However, like all other energy forms, they have a domain of dominance. They are static steady state energy forms that have assigned parameters, like Bohr angular momentums in terms of Planck's constant. They establish what is, but they do not explain why it is or how energy transforms, as in Weak force decays.

The Entropic Energy Density Progression Principle provides an energy transform priciple that lends itself to dynamic analysis that ranges from Singularities (energy transform functions) to Periodicity (matter stable states), relates Nuclear and Molecular Diversity in terms of inertial and wave function resonances, and which ranges from Quantized to Multiplicity energy states that eventually manifest as continuous behavior.



EM waves exist as "continuous spatial functions" with quantized energies and entropic degrees of freedom transform dynamic energy behaviors into ordered quantum matter states which then behave continuously in an energy density progression that creates new domains of entropic freedoms dominated by four interrelated forces: (1) Strong force is the mechanism of mass and close interactions and is EM energy relativistically compounded in

angular momentum configurations; (2) EM energy is an oriented "continuous spatial function" with linear momentum and quantized by its periodicity; (3) Weak force is a quantized statistical energy transform mechanism between the entropic degrees of freedom of EM energy in atomic constructs and strong force constructs of nuclear configurations; and (4) inertial mass relates to EM energy by Einstein's Electrodynamics of Moving Bodies. They are operators and this paper derives the transform function that interrelates their domains.

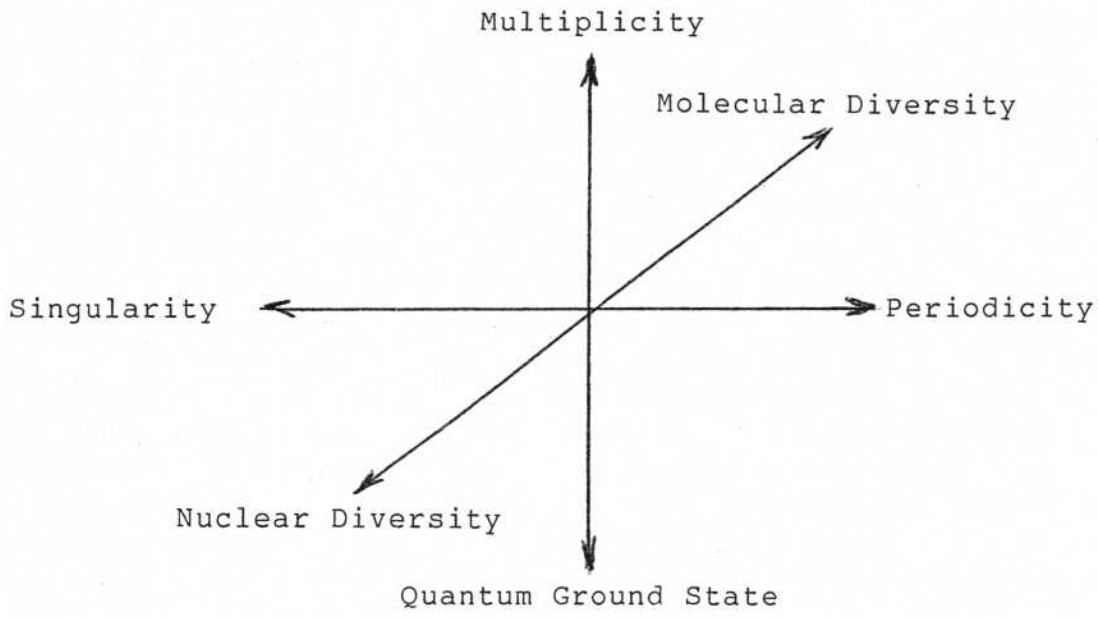
The Entropic Energy Density Progression Principle

by William Gray

A fundamental problem with Quantum Theory is that given a wave function, it is not possible to predict its value at some time t later. While Heisenberg's Uncertainty explains this, the theory's underlying premise is that higher energy states occur periodically as harmonic multiples of the ground state, and since atomic spectra don't exhibit the wave function discontinuity, the particles that generate them must be operating according to a continuous function.

Similarly, in the face of Strong force symmetry, Weak force decays yield asymmetric product formations with beta particles but not positrons, a charge asymmetry. A parallel exists in Chemistry, where product symmetry occurs with chiral centered molecular interactions except when living organisms' enzymes or differentiated chiral centered solvents introduce oriented charge dipole asymmetries.

And a fundamental inconsistency appears in our concept of time, where physics' laws are uniform over time but energy appears to only flow in one of its directions. A parallel exists in Relativity, where physics' law are uniform in all inertial reference frames, but given two reference frames, it's not possible to tell from either's perspective which is stationary and which is moving. Singular events occur as time flows forward with respect to Periodic functions, but within Periodic functions it's not possible to tell from either phase's perspective which occurs first or assign a direction of time flow.



Entropic Energy Density Progressions

Entropy measures unavailable disordered energy, and yet the Universe exhibits conservative energy form-function interactions. When Boltzmann introduced his $S = k \ln W$ entropy is a function of probability principle, where k equally partitions disordered thermal energy between all system parts and W is the probability or multiplicity of quantum states, Maxwell showed that molecular velocities distribute according to the $e^{-KE/kT}$ Boltzmann factor, where $KE = \frac{1}{2}mv^2$, and which conversely results in ordered velocities.

Since $S = k \ln W$ and $W = e^{S/k}$, multiplicity occurs according to $W = e^{S/k} = e^{(-E/T)/k}$, where entropy $S = -E/T$ is the ratio of average molecular energy to thermal energy T, the negative sign indicating a stable system. If the energy is a sum of kinetic and potential energies, $-E = KE + PE$, and $W = e^{-E/kT}$, it can be expressed as $W = (e^{-KE/kT})(e^{-PE/kT})$, where $KE = \frac{1}{2}mv^2$ and the potential energy factor can be expressed as an $\sum_i e^{-E_i/kT}$ "molecular partition function" sum over all possible states, so the W multiplicity occurs according to $W = (e^{-\frac{1}{2}mv^2/kT})(\sum_i e^{-E_i/kT})$.

This means that while appearing to be random energies, as a whole they constitute an ordered distribution. In the $P = nkT/V$ Gas Law, ordered pressure exists because the nkT random thermal energy is factored by the volume's degrees of freedom, and in the kinetic theory of gases each individual molecule's state is the thermal energy factored by all the other molecules' states. In other words, just as a volume's defined degrees of freedom filter disordered energy into an ordered pressure, the thermal energy factored by the sum of all states filters the randomness into ordered individual states, each existing to fit the distribution, and order resulting from disorder.

This concept of order as a function of entropy, where a distribution's energy states define individual energies, each molecule constituting an energy boundary condition that confines the other molecules to their individual states, can be extended to an Entropic Energy Density Progression that explicitly defines an absolute energy density relation extending from particles to electromagnetic waves and yields hydrogen's ground state energy, the electron, proton and neutron radii, masses and magnetons, and the deuteron, triton and helion binding energies.

1. Principle and Constructive Theories

As John Stachel pointed out in Einstein's Miraculous Year (2005, p. 19), Principle theories are "independent of the theories that [impel their] formulation." They are transform functions that permit "the reduction of certain laws to others," transforming one energy form-function to another, like $m = E/c^2$.

Constructive theories "summarize and generalize" empirical data by the use of principles. As such their results don't permit absolute accuracies, describing Effects in terms of data distributions that result from uncertainties imposed by

their boundary conditions. Quantum Theory is constructive, defining results in terms of wave constraints that don't permit resolution to less than half a wavelength.

Principle theories derive absolute relations from Causes, "elementary foundations." This is a Conservation of Energy principle requirement. Transforming from one energy form to another by approximation would yield non-conservative results, leaving energy unaccounted for. The Special Theory of Relativity principle defines absolute $m = E/c^2$ and Lorentz transformations of mass-energy, space and time in terms of the speed of light and inertial velocity.

Principle theories define energy operators, independent of application, and are "no substitute for a constructive theory." Constructive theories define a more "complete view," attempting to explain Effects in terms of Causes, ever increasing the ratio of understanding to the unknown. As such they are entropy reducing functions that find order in previously disordered energy. Technology advances by organizing or constructing principles into new understanding.

2. Informational Entropy

In his 1905 "Production and Transformation of Light" paper Einstein confirmed Planck's postulate that Maxwell's "continuous spatial function" electromagnetic energy occured as energy quanta by applying Boltzmann's entropy as a function of probability principle to a deviation in Planck's "black body radiation" distribution, recognizing that the thermal energy distribution in a black body included bound electrons as "resonators." He showed the kinetic energy of an electron ionized by "incident light" to be $KE = (RB/N)\nu - P$, his Photoelectric equation, where RB/N is Planck's constant and P is the ionization work function.

According to classical electromagnetic theory a charge oscillating at frequency ν and amplitude A loses energy by emitting light at a continuous $dE/dT = (2 \cdot pi \cdot \nu)^4 (e \cdot A)^2 / 3c^3$ rate, but Einstein showed that atom's electrons only emit light as discrete quanta, in agreement with observed spectra. Relying on Einstein's $h\nu = P + \frac{1}{2}mv^2$ photoelectric equation, Bohr theorized in 1913 that if an orbital electron's in an $E = KE + PE = \frac{1}{2}mv^2 - k_e e^2/r$ Centripetal - Coulomb force equilibrium, with its angular momentum confined to integer multiples of Planck's constant over $2 \cdot pi$, $mvr = nh/2 \cdot pi$, the emitted energy should be $h\nu = E_i - E_f$, where E_i and E_f are the initial and final orbital energy states (The Bohr Frequency Rule).

This constructive progression of information first constrained spectral emissions to a distribution, then to energy quanta bounded by atoms' ionization work function and electrons' $KE = \frac{1}{2}mv^2$ kinetic energies, and finally to specific energy differences between orbitals with angular momentums confined to multiples of Planck's constant. While this construct matched observed spectra, it could not account for hydrogen's spin 0 that changed to spin 1 under magnetic influence, spectral splittings with slightly higher and lower quantized energies, higher elements' spectra, or the observed probabilities (intensities) of quantum transitions.

In 1923 de Broglie postulated that if light is a wave and has momentum then perhaps particles with momentum have a wave behavior. He believed that if the E = hf "energy of a light corpuscle" contains a frequency and "a purely corpuscular theory contains nothing that enables us to define a frequency" then periodicity must be assigned to it. And since "the stable motion of electrons introduces integers," and "the only phenomena involving integers in physics [are] ... interference and ... normal modes of vibration," then "periodicity must be assigned to them also."

He reasoned that if $\lambda = hc / E$, and $E = mc^2$, it results in the $\lambda = hc / mc^2 = h / mc$ photon wavelength as a function of light's momentum, and a particle's momentum should yield a $\lambda = h / mv$ matter wave. In 1927 Davisson and Germer verified this by observing an electron scattering pattern with maxima and minima intensities at specific angles from a nickel surface that had accidentally been oxidized to a nickel oxide crystal that diffracted the electron matter waves.

A year prior Schrodinger had proposed a wave equation based on de Broglie's matter wave operating in 3-dimensional space and time. Since the de Broglie wavelength for an electron with hydrogen's ground state energy exactly matched the Bohr orbital circumference it substantiated de Broglie's wave particle duality concept and provided a basis for Standing Wave integer energy increases. The 3-dimensional wave function allowed three quantum numbers, Principal, Orbital and Orbital Magnetic, which along with electron spin states, explained the discrepancies of Bohr's model.

This constructive information progression resolved observed discrepancies by progressively transforming entropic degrees of freedom into ordered information that models observed empirical data, first Planck's black body spectral distribution exhibiting a discrepancy Einstein was able to assign to atoms' electrons and quantized light bounded by the ionization work function and inertial kinetic energy. Then Bohr confined it to quantized orbital energies bounded by a Coulomb - Centripetal force degree of freedom. And finally the dimensions of space and time bounded by a matter wave function of energy resolved the spin, spectral and probability discrepancies, transforming entropic into ordered energies, and leaving only the wave function discontinuity unresolved.

This therefore sets a clear pattern for the process of transforming entropic disorder into ordered information. On its most elementary level energy is defined in terms of substance and information, with substance defining its quantity and information determining its form, function and behavior. At the very least, no model can be considered complete therefore without considering all of its known aspects, including relativistic effects.

3. Relativistic Resonance

The wave function model clearly accounts for wave based observations, but as de Broglie and Einstein pointed out, light is corpuscular and periodic with quantum and "continuous spatial function" energy behaviors. In his wave particle duality concept de Broglie didn't replace particle with wave phenomena, he assigned periodicity to its particle nature, and a particle nature is subject to relativistic transforms to observed mass, position and rate of interaction. Any complete model must account for these effects.

Matter wave functions are assigned periodicity with 4-dimensional space time, normal mode of vibration, and particle momentum mathematical operator boundary conditions. This construct does not relate in a simple way to a $k_e e^2/\gamma r$ Coulomb energy and m/γ relativistic inertial mass increase equilibrium resonance degree of freedom, where $\gamma = (1 - v^2/c^2)^{\frac{1}{2}}$ is the mass, space and time Lorentz transformation which would interfere with the 4-dimensional standing wave function's boundary condition parameters.

At the $E = 13.605698$ eV ($2.179874089 \times 10^{-18}$J) hydrogen ground state energy the electron has a $v_o = (2E_o/m)^{\frac{1}{2}} = 2.187691411 \times 10^6$ m/s velocity with a $\gamma = (1 - v_o^2/c^2)^{\frac{1}{2}} = 0.999973374$ Lorentz transformation and $m/\gamma - m = 13.606239$ eV

(0.002662675%) mass increase. It also results in a $1 - 3^{1/3}(1/\gamma - 1) = 0.00384024\%$ contraction to the $a_o = 0.529177249 \times 10^{-10}$ m Bohr radius and $k_e e^2/r$ Coulomb energy increase to 13.606221 eV, equal to the relativistic mass increase.

This equivalence between relativistic mass and charge energy is simply Einstein's Electrodynamics of Moving Bodies applied to the particle nature of an orbital electron. Sommerfeld applied these principles in The Bohr-Sommerfeld Theory to explain discrepancies in the Bohr Model but it was subsequently abandoned in favor of the more successful wave theory model.

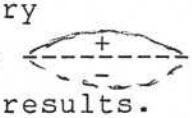
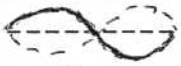
He did however derive the $c/v_o = 137.0359899$ Sommerfeld Number which partially serves to explain wave function discontinuity and provides a reasoned basis for particle wave behavior, Weak force assymetry, the Strong force in particles, and pure electromagnetic energy's quantum nature. It is partial only because the number also requires consideration of entropy to explain these phenomena. Sommerfeld was trying to derive a complete explanation based on Relativity, but as Einstein showed, electromagnetic energy has a dual "continuous spatial function" and quantum energy nature, as de Broglie showed, particles have a dual nature, and as Boltzmann and Maxwell showed, energy has a dual continuous and entropically statistical nature.

4. Wave Function Discontinuity

A wave interpretation eliminates the spin 1 and classical radiation problems of an orbiting electron because it has no oscillating mass or charge trajectory. And while Bohr imposed quantized energy and momentum requirements, standing waves intrinsically result in a spin 0 and quantized energy levels. Also, a rigid orbit with fixed distances does not permit neutron generation by Electron Capture, while a wave function probability distribution concentrates electrons at the nucleus where capture

occurs and explains the higher and lower quantized energies of spectral doublets by electron transition through the higher energy higher probability proximity at the nucleus. It is also confirmed in chemical bonding and multiple atomic electron behavior, but it can't explain the flaw in its own fabric: Given a wave function at some time t_o, it is not possible to determine its value at some time t later. This predictability discontinuity in light of the consistency of fixed line spectra is a discrepancy.

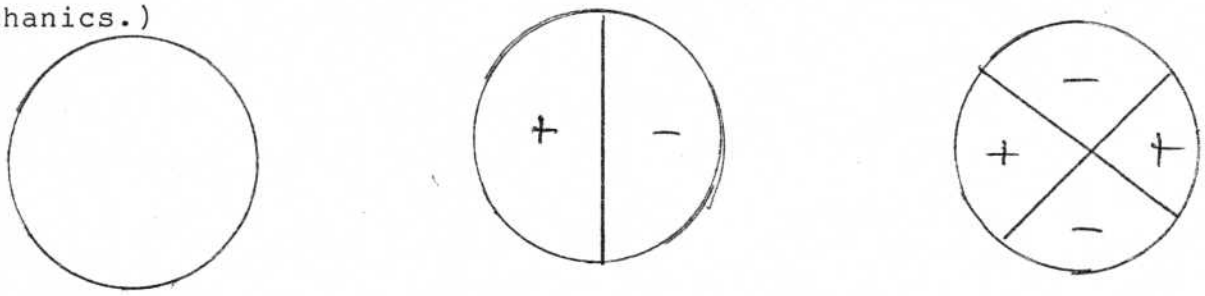
Realizing that electrons diffract, according to de Broglie's wave postulate, and that hydrogen exhibits line spectra, Schrodinger developed a wave equation based on a vibrating string model with fixed energy boundary conditions that result in n)/2 energy increases because the boundaries confine the frequencies to harmonics of the fundamental. It also explained why hydrogen's angular momenta increase as $p = [\ell(\ell + 1)]^{\frac{1}{2}}(h/2pi)$ radical resultants, where $\ell = 0, 1, 2, \ldots(n-1)$, instead of Bohr's postulated $p = n(h/2pi)$ integer increases.

For n=1 there are two wave nodes at the boundary conditions and one antinode potential energy disparity  , ↑ or ↓, in the plane of the wave so no angular moment results. Increasing frequency, n-2  or n=3  merely increases energy with no angular moment. However a 2-dimensional string model, like a drum head, results in radially concentric standing waves, like a $u(r, \theta, t) = J(rx_n^m) \cos m\theta \cos(ctx_n^m)$ Bessel function, shown with n=5 nodes and m=0 complete symmetry, as Constance Phillips and Michael Robinson used in "Quantum Riddles Part 1: Charge, a case for Causality," Galilean Electrodynamics, Nov/Dec 2004.

m=0 

m=1 

However a 2-dimensional string model also offers a standing wave with reciprocal symmetry through its center, in which the radially concentric antinodes are 180° out of phase between angular portions of the drum head, shown as m=1 in the Phillips-Robinson Bessel function model. This results in a potential energy polarity inversion ↑↓ that results in an angular moment. As George Pimentel and Richard Spratley showed in "Chemical Bonding Clarified Through Quantum Mechanics," 1970, p. 22, the angular nodes can incrementally increase the angular moment as l = 0, 1, 2, ...(n-1) allowed substates of the principal quantum number. (Note: The m and l variables are interchangeable, with m used in the Phillips - Robinson particle charge Bessel function and l being the conventional representation of the orbital angular number in quantum mechanics.)



l = 0 l = 1 l = 2

This model provided a basis for a wave function with n = 1, 2, 3, ... integral principal energy increases and $p = [l(l+1)]^{\frac{1}{2}}$ (h/2pi) angular moment increases from angular potential energy polarity oscillations, as in a cyclotron. And, as a charged particle, an electron subject to the angular potential energy oscillations would produce a magnetic moment orthogonal to the wave function plane. Since the electron motion could occur in either direction but results from standing wave oscillations of the angular potential energy the orbital magnetic quantum number occurs as m = l, l-1, ...1, 0, -1, ... -l.

As Pimentel and Spratley pointed out (pp. 23-4), Schrodinger took Bohr's p = mv momentum based $E = KE - PE = \frac{1}{2}p^2/m - e^2/r$

total energy equation and quantized it by transforming it into a $E\psi = (\frac{1}{2}p^2/m - e^2/r)\psi$ wave function mathematical operator form, where the energy form operates on the function ψ, "contains our knowledge of the whereabouts of the electron in the hydrogen atom," and "turns out to be exactly the hydrogen atom spectrum." However it only provides knowledge of the electron's whereabouts in terms of a ψ^2 probability function since waves oscillate, so it only represents the average energy as individual probabilities like a Boltzmann distribution provides probabilities of individual energies from an average total energy.

As John Stachel pointed out in "Einstein's Miraculous Year," pp. 170-1, "Planck interpreted W a proportional to the number of complexions of a state of the system," "equivalent to its definition as the average, over a long period of time, of the fraction of time that the system spends in this state only if all complexions of the total energy are equally probable." If "this is assumed to hold for an ensemble of oscillators in thermal equilibrium with radiation, the [$p_\nu = 8 \text{ pi } \nu^2 kT / c^3$] Rayleigh - Jeans law results," but "if the energies available to a canonical ensemble of oscillators are arbitrarily restricted to multiples of the energy element $h\nu$, [as in the case of a $\lambda = h/mv$ de Broglie wavelength,] then all possible complexions are not equally probable, and Planck's [$p_\nu = (8 \text{ pi } h\nu^3 / c^3)(1 / e^{h\nu/kT} - 1)$] law results," because "Planck calculated the entropy of the oscillations, using ... the Boltzmann [$S = k \ln W$] principle," "by dividing the total energy of the state into a finite number of elements of equal magnitude," "set equal to $h\nu$." (p. 169)

Thus the energy form, as a mathematical operator on a wave function ψ causes a result variance. For instance, quantized energy levels only occur in systems where energy is in equilibrium between two forms of energy, potential and kinetic in the case of Bohr's orbiting electron or Schrodinger's wave function. Light, as a "continuous spatial function" with

quantized energy, does not restrict light to quantized energy levels since the E = hf energy can vary continuously with respect to the frequency or wavelength functions. Similarly, de Broglie's $\lambda = h / mv$ matter wavelength can also vary continuously, except when it is confined to standing wave harmonic quantized energy levels by a system structure with an equilibrium between two energy forms.

In the kinetic theory of gases actual gas behavior differs from ideal gas behavior because gas molecules occupy space so the system volume is reduced, a concept relied upon by Einstein in his 1905 "Determination of Molecular Dimensions" paper. The proton's 1 fm and the electron's 0.05 fm radii represent a 10^{-5} effect on hydrogen's 10^{-10} m orbital and a 1/20 th effect on the proton's energy interactions, respectively. The 13.6 eV ground state energy is only a 10^{-5} effect on the electron's mass that operates to produce the observed quantized energy levels and line spectra, so a 10^{-5} energy form causes a significant effect on a functional constraint such as a wave function which operates within a 10^{-5} window of the electron's mass in an energy equilibrium.

Similarly, the 13.606239 eV relativistic mass increase is a 10^{-5} increase to the electron's mass and a 10^{-5} deviation from the 13.605698 eV ground state energy. It also causes a 10^{-5} contraction to the orbital wavelength and a 10^{-5} time dilation effect in the form of persistence of the electron's effects in available entropic degrees of freedom, or a 10^{-5} probability shift just as surely as a two molecule system would affect the available entropies and probabilities of a one molecule system (i.e. Pauli Exclusion Principle).

Furthermore, in an $h\nu$ wave based model the electron's motion would result in a Doppler Effect that would influence its behavior. If the electron actually moved in a rigid orbit it

would experience a higher energy state as it approached its own wave function because its velocity would increase the wave function frequency. This is just as valid as spectral splittings resulting from transition through the higher energy higher probability region. It would make no difference whether the electron transitioned laterally through the higher energy density region or approached its own wave function coincidently, it would affect its behavior, but instead of causing splittings by lateral transition through the region it would "steer" the electron unpredictably. (Splittings are energy probability distribution effects; Doublets are electron spin energy difference effects.)

This would result in an entropic behavior as far as being able to predict its wave functions value over time. From its frame of reference the electron would not change energy but the information of its energy, its direction, would change for observers. This is an inverse Heisenberg Uncertainty, where instead of striking a particle with a photon, the particle is striking a standing wave of its own energy. The electron does not radiate EM energy according to classical EM theory because the 13.6 eV is an equilibrium energy resonance with the proton, but it does radiate quantized EM energy in excess of the equilibrium ground state energy. Shifting direction does not radiate because the quantity of energy is unaffected, so the wave function is discontinuous while the line spectra remain constant.

The premise of the wave function model is that all the electron's energy is contained in standing waves with fixed energy boundary conditions, but its boundary conditions are not fixed, they vary in 10^{-5} amounts. The electron's relative energy remains rigidly quantized from its perspective, but the form of the energy from the proton's or observer's perspective is not rigidly fixed. Thus spectral lines based on the electron's total energy remains fixed but the electron's behavior from a strict wave function perspective is discontinuous, although periodically repeatable from a probability standpoint because all forms of the

electron's energy (i.e. momentum, relativistic mass and coulomb potential energy, structural and volume deviation, and Doppler Effect) must be in equilibrium for the system to stay stable.

The point of Wave Function Discontinuity is that the energy form, as an operator on a mathematical function, affects the result. The form is important because it determines entropic degrees of freedom that are not available to the other forms. This means that Strong, EM, Weak, and Inertial energy forms are energy operators with different entropic degrees of freedom that alter the boundary condition on a mathematical function's domain, resulting in behavioral discontinuity from the mathematical function while retaining statistical continuity because a system equilibrium exists between the different forms.

5. Entropic Energy Operators

In a quantized system the entropic degrees of freedom range from the fundamental ground state equilibrium energy boundary condition, a relative zero, to the multiplicity limit imposed by the system's upper energy limit. It can range from zero to an infinite number of quantized states, but, as stated in Bohr's Correspondence Principle, when the distinction between quantized levels vanishes quantized behavior becomes continuous. Above n = 10,000 in an E/n^2 quantized equilibrium system, the behavior becomes classically continuous. Within the domain of these boundaries quantized behavior is controlling, but the dimensions of the system's components, relativistic effects on the system's dimensions and components' masses, and Doppler Effects are recessive energy forms with their own entropic degrees of freedom, and as such detract from the energy of the dominant quantized energy form's function.

In the dimension of time the domain ranges from a singularity (i.e. an energy transform function) to periodicity (i.e.

equilibrium states), with a statistical probability distribution of state energies within the boundary conditions of the space domain, resulting in periodicity interference. For example, Weak force Beta decay depends on interference from the number of remaining reactants, specifically the number of unreleased Beta particles in the excited Strong force state within the dimensions of space, the density of identical excited energy states, but not in a random way, in a polarized "charge" way, since positrons don't exhibit it.

Because there is such an immensely large amount of matter present, asymmetric positron decay would only occur if the antimatter density approaches 10^{-5} times that of matter, that is, similar conditions of antimatter with a density of excited Strong force positron energy states. This premise relies upon a requirement that neutrons which undergo Beta decay are proton - electron structures whose stability depends on energy equilibrium with protons in the nuclei, in deuteron, triton or helion configurations, with antimatter requiring similar antiproton - positron antineutron structures.

This neutron model is developed in terms of a c/v_o = 137.0359899 quantized energy level impeded by the physical limits of the particle sizes, resulting in an unstable state unless the energy difference is compensated for by the addition of other particles that result in an equilibrium state. In other words, c/v_o = 137.0359899 is a required energy boundary condition but it can be shared between other particles in two, three or four particle equilibriums, or multiples thereof.

This proliferation of stable neutron states with other particles results in a nuclear diversity and resultant electron configuration diversity, bounded by wave function constraints, yielding molecular diversity. Thus, nuclear and molecular diversity depend on the entropic degrees of freedom of an

unstable proton - electron configuration that attains stable equilibrium states with other particles in 1, 2 or 3-dimensional structures of 2, 3 and 4 particles. These entropic dimensions in space, time and structure result in a more "complete worldview" that intrinsically derives from the c/v_o relativistic effect ratio and electromagnetic energy bounded by the permeability - permittivity effects of space (EM waves), the inertial relativistic effects of particles, and by EM waves themselves in particle configurations.

In other words, an EM wave energy operating on space's $u_o \epsilon_o$ permeability - permittivity function results in a "continuous spatial function" with quantized E = hf energy, according to $\partial^2 E/\partial x^2 = u_o \epsilon_o \, \partial^2 E/\partial t^2$ and $\partial^2 B/\partial x^2 = u_o \epsilon_o \, \partial^2 B/\partial t^2$ electric and magnetic wave functions in terms of space x, time t, and $u_o \epsilon_o$ entropic degrees of freedom; an EM wave energy operating on a particle's charge and momentum results in a $E\Psi = (KE + PE)\Psi$ quantum mechanical wave function; and an EM wave energy operating upon itself through angular momentum and relativistic effects results in particle mass, size, charge, magnetic moment and spin. Since the choice of the energy form (i.e. Strong, EM, Weak or Inertial) operating on an energy function in terms of its available entropic degrees of freedom determines the energy's behavior and characteristics it should be possible to develop an energy transform relation between the energy forms.

6. Reciprocal Entropic Energy Density Progression

As previously shown in Relativistic Resonance, the electron's $v_o = 2.187691411 \times 10^6$ m/s velocity results in a 0.002662674% (13.606239 eV) mass increase, based on the $\lambda = [1 - (v_o/c)^2]^{\frac{1}{2}}$ Lorentz transformation of mass by $m = m_o/\lambda$. The c/v_o = 137.0359899 speed of light to ground state velocity ratio represents a boundary condition relativistic effects limit that relates pure electromagnetic energy, inertial mass and

EM energy interactions, and pure $m = E/c^2$ mass energy. It determines the size, structure, and energy density of all matter from particles to atoms to light waves.

For instance, an E_o = 13.605698 eV photon's $\lambda_o = hc/E_o$ = 911.2669951 Å wavelength is exactly $2(c/v_o)$ = 2(137.0359899) times greater than the $\lambda_B = h/mv_o$ = 3.324918498 Å de Broglie fundamental ground state wavelength of an electron with a v_o = 2.187691411×10^6 m/s velocity. Thus the size and fundamental energy of a pure electromagnetic wave and the electromagnetic interaction of a proton and electron are exactly related by a relativistic function.

Similarly, an electron traveling at light speed would have a $\lambda_c = h/m_e c$ = 0.02426310417 Å Compton - de Broglie wavelength exactly c/v_o = 137.0359899 times shorter than 3.324918498 Å ground state wavelength and Bohr orbital circumference, 2 pi times the a_o = 0.529177214 Å numerical average of the calculated $r = \frac{1}{2}k_e e^2/E_o$ = 0.529177249 Å classical mechanical and $r = h^2 / (2pi)^2 m_e k_e e^2$ quantum mechanical Bohr radii, thus extending the c/v_o relation from pure electromagnetic energy to periodic particle interaction to the upper limit of particle inertial momentum.

By extending the concept to angular momentum, with a simple $2^{\frac{1}{2}}$ Pythagorean resultant of an orbital with two equal orthogonal momentums, and a simple $3^{\frac{1}{2}}$ Pythagorean resultant for an orbital rotating in three degrees of freedom, factored by 2 pi to convert a circumferential to radial effect, the c/v_o relation transforms the Compton wavelength to the electron radius: $r_e = \lambda_c 2^{\frac{1}{2}} 3^{\frac{1}{2}} / 2pi (c/v_o)^2 = 6^{\frac{1}{2}}(0.02426310417 Å) / 2 pi (137.0359899)^2 = 5.037 \times 10^{-17}$ m = 0.05 fm. The c/v_o factor is squared because the relativistic effect from the two orthogonal momentums of an orbital is compounded.

Therefore the size of energy, from the Compton wavelength up to an electromagnetic wave and down to the smallest particle,

exhibits a reciprocal symmetry based on the c/v_o relativistic boundary condition of momentum:

E_o photon wavelength

$\uparrow$ $2(c/v_o)$

Bohr orbital circumference

$\uparrow$ (c/v_o)

Compton wvelength

$\downarrow$ $6^{\frac{1}{2}}/2pi(c/v_o)^2$

Electron radius

Similarly, the energy quantity of each of the matter forms relates by the same c/v_o relativistic boundary condition. In both Relativity and the $\lambda = h/mv$ de Broglie wavelength the observed object experiences classical Newtonian physics (i.e. all the laws of physics are the same in all inertial frames of reference). Thus an electron with an mv momentum in a hydrogen atom acquires an $m_e c$ momentum from its perspective if its velocity increases by $(c/v_o) = 137.0359899$. Under these inertial reference frame conditions its $\frac{1}{2}mv^2$ kinetic energy would be $\frac{1}{2}m_e c^2 = 0.2554995323$ MeV, so 2KE $= 0.51099906$ MeV $= m_e$.

The $E_e = 13.605698$ eV KE of the hydrogen atom, half its $k_e e^2/a = 27.21196$ eV Coulomb PE, results in the electron's $v_o = 2.187691411 \times 10^6$ m/s ground state velocity, which by increasing by c/v_o results in a KE equal to half the electron's mass from its perspective. Thus the mass of the electron is given by $m_e = 2E_e(c/v_o)^2 = 0.51099906$ MeV according to the $m = E/c^2$ mass energy equivalence of Einstein's "Inertia of a Body ... Energy Content" paper.

This is not to say that the mass is unaffected by the $\gamma = [1 - (v/c)^2]^{\frac{1}{2}}$ Lorentz transformation which would result in an infinite $m = m_o/\gamma$ mass increase by kinetic acceleration. This merely says that the mass of the electron equates to the 27.2 eV Coulomb energy by $(c/v_o)^2$. Actually accelerating an electron to the speed

of light would require infinite energy because each increase in velocity adds mass by a square function. It nevertheless does show an equivalence between Coulomb and inertial mass energy, the form mathematically operating on a function or principle in a defined way to achieve a transform result.

Einstein already showed equivalence between "an electric field with a definite energy value" and the quantum energy of light in Electrodynamics of Moving Bodies and that light carries mass energy in his Energy Content paper, but $m_e = 2E_o(c/v_o)^2$ shows a defined relationship between the stability of the proton - electron EM interaction and the specific mass of the smallest form of mass, the electron. The significance of this is that it relates in a very specific and defined way that pertains to the make up of particles and the interactive bonding by Coulomb potential energy which relates to the Strong nuclear force since the exact binding energy in deuteron, triton and helion structures equates to a mass defect.

Thus the fact that the $c/v_o = 137.0359899$ relativistic to inertial velocity ratio provides a specific relation between the size of the EM wave, hydrogen atom and electron, and between an "electric field with a definite energy value" and the electron's mass, also equates the structure of matter to the motion of the energy, since the hydrogen potential energy occurs as the result of an entropic energy equilibrium resonance between the charge field and the $p = mv$ momentum in both the Bohr particle and $\lambda = h/mv$ Schrodinger wave function models, and momentum invokes the Relativity principle.

7. Internal Particle Entropic Operators

There are three fundamental particles, the electron, proton and neutron, that comprise most matter configurations. The

electron's size and energy content clearly relate to the hydrogen atom and EM wave energies by the c/v_o quantum relativistic effect but the actual mechanism of the structure is unclear without further information. The proton similarly provides no avenue for investigation other than its $4.83722/3^{\frac{1}{2}}$ magneton deviation from the $u_n = \frac{1}{2}eh/2pi \cdot m_p$ Bohr magneton relation, in which the charge e with h/2pi angular momentum generates a magnetic field attenuated by the structure's mass energy.

From classical theory, the magnetic field magnitude of an angular momentum based generating structure depends on the $d\phi_E/dt$ rate of change (i.e. velocity) and relative permeability. Since the velocity of light depends on permeability by $c^2 = 1/u_o \epsilon_o$ and Relativity relates classical inertia and electromagnetics to the speed of light, the u_o permeability factor could be a common denominator in either a charge velocity dependent or relative permeability dependent cause of the proton's $4.83722/3^{\frac{1}{2}}$ greater magneton value. The fact that the magneton is factored by its mass ratio to the electron's mass by m_p/m_e = 1836 times to within 3 times the expected value indicates some relative correctness to a $u = \frac{1}{2}eh/2pi \cdot m$ Bohr magneton generator.

In both the $d\phi_E/dt$ rate and relative permeability scenarios the density of the proton's mass energy would be a factor. The electron has a radius of about 0.05 fm and the proton has a radius of about 1 fm, which by $V = 4/3 \text{ pi } r^3$ results in a density $(r_p{}^3/r_e{}^3) / (m_p/m_e) = 4.36$ times less than the electron's. The $3^{\frac{1}{2}}$ factor results because the magneton is measured in the direction of an external measuring field and the proton's magneton occurs in the direction of its ½ spin vector so it measure $3^{\frac{1}{2}}$ times less in the external field direction compared to the $3^{\frac{1}{2}}$ Pythagorean resultant in the ½ spin direction. The 4.36 value is within 10% of the actual 4.83722 value.

Since the density ratio directly results from the ratio of the radii cubed, only a $(1 + 10\%)^{1/3} = 1.0355$, or 3.55% radial deviation would explain the 10% deviation from the actual magneton value. Assuming a 0.05 fm electron radius and 1.0355 fm proton radius results in a $(r_p/r_e)^3/(m_p/m_e) = 4.8376$ lower density, indicating that the proton's 4.83722 greater magneton value results from the same generating structure of the proton factored by its volumetric size, or spatial entropic degrees of freedom difference.

This is not absolutely conclusive, but the obvious density difference as an entropy factor must be considered in characterizing an energy form's functions, as in $P = nRT/V$ or $m = m_o/\gamma$ Lorentz transformation of momentum to mass increase. However confirmation requires more information, such as is shown by the neutron, a nuclear Strong force particle that undergoes Weak force Beta decay to hydrogen, with a 0.78233 MeV mass energy conversion to γ-ray and kinetic energies when paired with other neutrons or an insufficient number of protons, and which has its own -1.9135 magneton deviation.

As first proposed by Haskins in 1913, and later shown by Electron Capture and Borghi's 1955 and Missfeldt's 1979 synthesis of neutrons from hydrogen, electrons form an $E_n = 0.78233$ MeV semistable neutron state with protons, just as they form a stable -13.605698 eV hydrogen state. Since protons and electrons do not decay, and they can both form and decay from a neutron by the addition of and release of $E_n = 0.78233$ MeV, it is reasonable to surmise that the neutron is a 0.78233 MeV Strong force proton - electron pair nuclear state. However this energy is only 57,500 times greater than the $E_o = 13.605698$ eV electron - proton ground state energy in hydrogen, much less than the typical Strong force million times greater than the EM energy of a chemical bond.

It can be shown that the neutron state constitutes an intermediate energy state between the Electromagnetic and Strong forces by considering the Bohr Correspondence Principle, that quantum behavior becomes classical when the difference between quantum levels vanishes, when the electron acquires 13.605698 eV over its E_o = -13.605698 eV ground state. Above this level the p = mv momentum and e^2/r Coulomb operators function according to a classical Coulomb - centripetal force equilibrium instead of the quantum wave function of Schrodinger's model. In other words, the particle nature dominates behavior when E exceeds $2E_o$, instead of its quantum wave nature dominating when E is less than $2E_o$.

In this case the momentum is not constrained to nh/2pi integer multiples of Planck's constant, so $E = KE + PE = \frac{1}{2}mv^2 - k_e e^2/r$ and the $k_e e^2/r^2 = mv^2/r$ Coulomb and centripetal forces equate. Since the electron is not bound by initial and final quantum energy states, it simply decays by $E_i - E_f = hf + \frac{1}{2}mv^2$ so a neutron decay results in a conservative but undefined partition of electromagnetic and kinetic energy, as occurs in Beta decay. If the E_n = 0.78233 MeV equally distributes between the three dimensions of a spherical orbit and the E_o = 13.605698 eV of the electron is a 1-dimensional wave function energy, the E_n = 0.78233 MeV represents an $E_n/3 / E_o$ = 19166.7246 increase in 1-dimensional energy.

This would correspond to a 19166.7246 times contraction of the a_o = 0.529177249 A Bohr radius to yield $a_o/[E_n/3 / E_o]$ = 2.761 fm. However since the E_n = 0.78233 MeV constitutes an $(E_n + m_e)/m_e$ = 2.531 mass increase it also results in a γ = 2.531 Lorentz contraction of space to 2.761 fm / 2.531 = 1.09085 fm, correlating to the observed 1+ fm neutron radius and its $m_n = m_p + m_e + E_n$ = 939.56563 MeV neutron mass.

Since this structure results in a relativistic energy density mass increase it has an attenuation affect on the orbital

magneton generated by the electron, corresponding to mitigation of the proton's magneton by its 4.837 times lower density than the electron. Under this concept the electron would generate a $u_p = \frac{1}{2}eh/2pi \cdot m_p$ nuclear magneton, mitigated by the proton's 4.83722 lower density, attenuated by the 2.531 relativistic density increase, or $u_N = (\frac{1}{2}eh/2pi \cdot m_p)(\rho_e/\rho_p)/2.531 = 4.83722/2.531 = 1.9112\ u_n$. Since it is generated by a negative electron it would be in the direction opposite the angular moment with a $-1.9112\ u_n$ value corresponding to the measured $-1.9135\ u_n$ value.

This (1.9135 - 1.9112)/1.9135 = 0.12% discrepancy is attributed to the fact that the neutron's $1.9135\ u_n$ magneton is measured in a deuteron configuration, where the proton's charge can be used to direct the motion of the neutron. In this configuration the 1877.838 MeV proton - neutron mass has a 2.224 MeV mass defect, corresponding to a 2.224/1877.838 = 0.1185% mass loss. Since mass attenuates the $u = \frac{1}{2}eh/2pi \cdot m$ magneton generation, a 0.12% mass loss would result in a 0.12% higher 1.9135 measures value instead of the 1.9112 actual value.

The neutron's size, mass and magneton values are therefore exactly explained in terms of energy density resulting from a Coulomb - centripetal energy equilibrium's momentum operating on a relativistic transform function. Another unexplained aspect of the neutron is its ½ spin, since quarks can only account for 1.5% of its mass and 30% of its spin and magnetic moments. Fundamental to the relativity principle is that the laws of physics are the same in all inertial reference frames. This means that the relativistic effects operate on observations from other inertial reference frames. The electron's mass does not increase from its own perspective,it increases from the proton's.

In addition to seeing a 2.531 electron mass increase, the proton and other independent observers see the distance of the proton to the electron contracted by 2.531 while the electron

sees its distance to the proton uncontracted. In other words, the proton center of mass would be contracted 2.531 times toward the neutron's spherical surface created by the orbital electron. This results in a 2.761 fm - 1.091 fm = 1.67 fm offset to the neutron's center of mass, or 1.67 fm / 2.761 fm = 60.485%, the $\cos^{-1}$ 0.60485 arc cos of which is 52.78°, about 3.7% less than the $\cos^{-1} 1/3^{\frac{1}{2}}$ = 54.74° ½-spin value. This is reduced to 0.004% by incorporating proton gyration effects.

The fact that the proton and neutron magnetons and the neutron's size and ½-spin all derive from the same entropic and relativistic energy density effects substantiates the entropic energy density progression premise. The neutron's E_n = 0.78233 MeV value derives from the $r_p + r_e$ = 1.0355 + 0.05 = 1.0855 fm proton and electron radii, about 0.005 fm less than the 1.091 fm relativistically contracted neutron radius, 10% of the electron radius and a 10% margin of variation in its motion. This means the E_n energy is an entropic degree of freedom boundary condition created by the physical limitations of the proton and electron sizes.

8. External Entropic Operators: Nuclear Binding and Magnetons

The deuteron mass defect binding energy is 2.224 MeV, exactly equal to $2E_n + (E_n/3)(2.531)$ = 1.56466 + 0.660 = 2.224 MeV. If a neutron was in close proximity to a proton its electron would form an orbit between the protons in a plane orthogonal to the axis connecting them: ⊕-⊖-⊕ ⟶ u, creating a spin 1 magneton in the direction of the axis. However a simple orbit does not permit formation of a neutron state with either proton or utilize the entropic degree of freedom between the protons.

Instead, the electron would resonate between the protons as it traversed its orbit, alternately forming neutron states with each proton: ⊕ ⊖ ⊕. In this configuration the electron exists as a neutron state with the proton opposite its oscillation peak,

maintaining a 1 fm distance to the opposing proton and a 2.761 fm distance to neutron state proton's center. The 1 fm distance is contracted by 2.531 to yield the observed 0.4 fm deuteron bond distance and the 2.761 fm distance is contracted by 2.531 to the 1.091 neutron state radius. Thus the electron maintains an E_n = 0.78233 MeV neutron state energy with each proton and a 1-dimensional $E_n/3$ = 0.260777 MeV oscillation energy compounded by the 2.531 mass increase to 0.660 MeV with a 0.4 fm bond gap.

This orbital oscillation maintains a spin 1 angular moment along the axis connecting the protons and generates an opposite magnetic moment because it is generated by a negative electron. The proton and neutron have a combined 2.7928 - 1.9135 = 0.8793 magneton factored by 0.975 to yield the 0.8574 empirical value. Just as a mass increase or relativistic contraction attenuates a magneton, as in the 4.837/2.531 = 1.9112 neutron case, the 2.224 MeV bond energy attenuates the magneton.

The electron resonance between the protons constitutes a velocity increase over its E_n neutron state velocity and has a relativistic effect. In its resonance it alternately occupies a 2.761 fm neutron state with each proton and a 1 fm distance to the opposing proton, each contracted by 2.531 to the 1.091 fm neutron radius and 0.4 fm bond gap, respectively. Even though the electron changes states with each proton a constant 0.4 fm is always observed because both the neutron state radius and bond distance are always contracted by 2.531.

The 2.761 fm neutron state radius minus the 1.0355 fm proton radius and 1 fm gap results in a 0.7255 fm peak to peak resonance oscillation, or +/- 0.3627535 fm from the oscillation center. The relativistic effect on the oscillation is $m_e/(m_e + 2.224 \text{ MeV} - E_n)$ = 0.2616926 to yield 0.2616926 (+/- 0.3627085 fm) = 0.094929 fm / $2^{\frac{1}{2}}$ = 0.067125 fm average reduction to the 2.761 fm neutron state radius, or 2.761 - 0.067117 = 2.6938251 fm contracted by 2.531 to 1.0643521 fm, constituting a 1.0643521 / 1.091 = 0.976

relativistic attenuation of the 0.8793 composite magneton to 0.8578, within 0.05% of the 0.8574 empirical value. The 0.054% electron to proton mass ratio explains the 0.05% deviation.

By simple geometric comparison, the triton and helion mass defect binding energies are given by B.E. = $3^{1/d}(p \times 2.2147 \text{ MeV})^n$, where 3 is the available spatial degrees of freedom, d is the utilized degrees of freedom (i.e. 2 for a triton planar structure and 3 for a helion tetrahedron), p is the number of protons (i.e. 1 for tritium and 2 for He-3 or He-4 nuclei), n is the number of neutrons (i.e. 1 for He-3 and 2 for tritium and He-4), and 2.2147 MeV is the 2.224 MeV deuteron 1-D binding energy attenuated by interference effects, which yields 8.49553 MeV for tritium (0.16% greater than its actual 8.482 MeV), 7.672 MeV for He-3 (0.6% less than its actual 7.718 MeV), and 28.296 MeV for He-4 (equal to its actual 28.297 MeV).

Tritium's 2.9788 u_n and Helium-3's -2.1275 u_n magnetic moments are similarly accounted for. As with the proton and neutron, the magnetic moment in the spin resultant vector is factored by $2^{\frac{1}{2}}$ or $3^{\frac{1}{2}}$ depending on whether it is a two or three degree of freedom Pythagorean resultant, $2^{\frac{1}{2}}$ for deuterium and $3^{\frac{1}{2}}$ for the others. Helium-4 has no magneton because all individual components cancel.

In tritium the structural binding energy is its 8.482 MeV mass defect binding energy minus two E_n = 0.78233 MeV neutron state energies, or $8.482 - 2E_n = 6.91734$ MeV. This added relativistic mass increase to tritium's two neutron electrons results in an $m_e/(m_e + 6.91734/2) / 2^{\frac{1}{2}} = 0.12872586 / 2^{\frac{1}{2}} = 0.091022927$ relativistic correction to the 0.7255164 fm relativistic oscillation regions of its two n-p deuterium type bonds that exist at any given moment, yielding 0.091022927 x 0.7255164 fm = 0.066037124 fm resonance region.

In tritium's structure the two neutron states overlap each other so each 2.761 fm neutron radius is reduced by the 0.066037124 fm contracted resonance region from each electron, to 2.761 - 2(0.066037124) = 2.62893 fm, factored by the 2.531 contraction to 1.0386905 fm. This results in a 1.0386905 / 2.761 = 0.3762 compounded relativistic effect, which results in a 2.531 (0.3762) = 0.952164 correction to each n - p 2.7928 - 1.9135 = 0.8793 deuterium type magneton to 0.83724. For a single deuterium nucleus by itself the effect is $(0.952164)^{\frac{1}{2}}$ = 0.9758, as used above.

The cumulative tritium magneton will be a Pythagorean resultant of a proton and two deuterium magnetons, $[2.7928^2 + 2(0.83724)^2]^{\frac{1}{2}}$ = 3.0334286. The 8.482 MeV relativistic bond energy attenuates the resultant magnetic field like the 2.531 attenuation of the neutron magneton, affecting both the proton and deuterium bond magneton components with a $[(m_p - T_{BE})/m_p = 0.99095998]^2$ = 0.982 compounded factor, yielding a 0.982 x (3.0334286) = 2.97883 u_n tritium magneton, within 0.001% of the measured value.

In Helium-3 the 7.718 MeV binding energy is comprised of a E_n = 0.78233 MeV neutron state energy and 6.933 MeV electron structural resonance of its neutron state between the three protons. This results in a $m_e/(m_e$ + 6.933 MeV) = 0.068618 contraction of the (2.761 fm - r_p - 1 fm) = 0.7255 fm resonance oscillation region to 0.049785 fm peak oscillation, or 0.049782 / $2^{\frac{1}{2}}$ = 0.0352 fm average contraction of the neutrons 2.761 fm / $(m_e + E_n)/m_e$ =1.091 fm radius to 1.0558 fm.

This constitutes a $(1.0558/1.091)^3$ = 0.906297 neutron state volume reduction and 1/0.906297 = 1.1034 relative energy density increase caused by resonance of the neutron state between the protons. By Conservation of Energy, if the electron gains KE by "falling" through a proton's Coulomb force PE field, and total

energy is E = KE + PE, then increasing the neutron states energy density must correspondingly decrease the protons' energy densities, causing a 6.933 MeV proton mass energy loss and $m_p/(m_p - 6.933\ \text{MeV}) = 1.0075$ proton maneton increase.

The 1.1034 neutron energy density increase and 1.0075 proton energy density decrease has a compounded 1.1034 x 1.0075 = 1.11168 relative increase effect on the neutron electron generated 1.9135 magneton, or 1.11162 x 1.9135 = 2.1272, within 0.04% of the 2.2175 u_n actual He-3 magneton.

Thus the principle of relativity, operated upon by charge, bounded by the entropic degrees of freedom and particle size physical limits, provides an accurate calculation proton magneton, neutron state energy, magneton and ½-spin, and the deuteron, triton and helion mass defect binding energies and magnetons, with each correct calculation supporting the premise that relativistic, entropic, and EM effects, and the physical limits of particle sizes are the Strong force causalities.

9. Strong Force and the Proton

The contention of the Entropic Energy Density Progression Principle is that mathematical operators acting upon a function (i.e. priciple) provide a transform function that relates energy states (i.e. forms). Each energy state or form has significant parameters and boundary conditions that define its interactions. At the nuclear level the particle sizes play a defining role because of their close proximities while at the atomic level their role is insignificant but their interaction structure and inertias are the basis for a wave function that relates atomic and photonic energies. Since these operators constituted unknowns before their significance was derived they represent an entropic unknown to known information progression principle that relates the energy densities in different forms of matter.

As was shown, there is a precise relation between the sizes and energies of an EM wave, atom, Compton wave length, and he electron in terms of Electromagnetic energy and the principle of Relativity. Each of the different forms of energy exhibit entirely distinct functional behaviors and they all transform between each other by the $(c/v_o) = 137.0359899$ relation of the speed of light to classical velocity at the point of transforming to relativistic velocity, where $v_o = 2.18769411 \times 10^6$ m/s exhibits a $1 / [1 - (v_o/c)^2]^{\frac{1}{2}} = 1.00002662674$ relativistic effect.

This relation holds over such a broad range of energy forms, EM to particle interaction at atomic levels to the size and mass of the smallest particle, because the common denominator of momentum operates without interference from other operators like the physical sizes of the components. The momentum in each case related the wavelength of the energy form, from an EM wave to the hydrogen orbital to the Compton wavelength of the smallest particle at the speed of light to the physical size and mass energy of the electron.

In each case electromagnetic energy was the underlying common form that manifested in different physical forms that depended on the specific momentum and relativistic effects invoked. Since the physical form, or "complexion" to use Planck's and Einstein's term, was transformed by the momentum operating on the Relativity function while the underlying energy form remained in tact, it would be more correct to relate each of these forms in terms of EM energy captured by the constraints imposed by the circumstances (i.e. context of its interactions).

In the case of a photon a 13.605698 eV EM energy travels in a straight line and exhibits $\partial^2 E/\partial x^2 = u_o \epsilon_o \, \partial^2 E/\partial t^2$ and $\partial^2 B/\partial x^2 = u_o \epsilon_o \, d^2B/dt^2$ wave behavior on its electric and magnetic energies constrained only by the $u_o \epsilon_o$ permeability - permittivity of space. However, under the influence of a gravitational field it is

bent, and under the influence of inertial motion it exhibits Doppler "Red Shift" effects. Gravity and inertia both operate on space and time by the principle of Relativity, in three and one dimensions, respectively. Since both are transformed into an effect on space-time by the same principle it is reasonable to hypothesize that they represent different physical forms of the same underlying energy.

If the physical forms depend on the available entropic degrees of freedom then the underlying energy transforms between the physical forms must also consider them. In the case of gravity there is only mass without velocity, in the case of inertia there is both mass and velocity, in the case of light there is only velocity without mass, and, in the case of all three physical forms, they are capable of momentum that relates there effects by the principle of Relativity.

In his Electrodynamics of Moving Bodies paper Einstein related classical inertial and EM energies by the common denominator of the speed of light, eliminating the need for the infinite inertia of space as a point of reference for inertial behavior. In his Energy Content of Inertial Bodies paper he showed $m = E/c^2$ equivalence between mass and EM energies. And since the speed of light and the EM field energies both relate to the $\mu_0 \epsilon_0$ permeability - permittivity properties of space, by $1/c^2 = \mu_0 \epsilon_0 = \partial^2 E/\partial x^2 \ / \ \partial^2 E/\partial t^2 = \partial^2 B/\partial x^2 \ / \ \partial^2 B/dt^2$, and gravity and inertia alter space, in three and one dimensions respectively, and affect EM energy accordingly, it would seem reasonable to rely upon the $u_0 \epsilon_0$ of space as a more fundamental common denominator.

Einstein did not disprove a $\mu_0 \epsilon_0$ substantive nature of space, he simply transformed to the speed of light as a common point of reference between inertial an EM energy forms because both are velocity functions in order to eliminate the problems of relying on the infinite inertia of space in the classical inertial view

that seemed entirely unrelated to the "continuous spatial function" behavior of EM radiation. He related two domains of physical energy forms by a common absolute of the upper boundary condition of velocity, which does not relate to a concept of infinite inertia but does relate to the $u_o\epsilon_o$ property of space.

Similarly, in his Production and Transformation of Light paper he did not disprove light's "continuous spatial function" behavior, he simply proved an additional quantum energy content behavior. And since gravity and inertia both transform the dimensions of space-time, increasing its density, and alter the "continuous spatial function," the velocity and quantum energy of light accordingly, it would seem more reasonable to rely upon the $u_o\epsilon_o$ properties of space, the EM form of energy as fundamental form, and the entropic degree of freedom functions that relate all energy forms and functions by the principle of Relativity. Since $u_o\epsilon_o$ can vary continuously by relativistic effects on space and also provide an $E = hf = hc/\lambda = h/\lambda(u_o\epsilon_o)^{\frac{1}{2}}$ energy quanta basis, they relate continuity and discontinuity. (i.e. Periodicity).

In atomic orbitals EM energy provides the e^2/r PE basis for a structure that absorbs and emits EM energy. Normally this is interpreted in quantum theory as EM energy captured in an excited quantum state that emits all or quantum parts of the energy confined to integer standing wave function states. However there is no basis for the standing wave function without considering particle momentum, the basis of de Broglie's thesis, so it is really EM energy captured by inertial momentum. It could be said that EM energy is captured by the proton - electron charge dipole, but in both classical and quantum theory it is the momentum of the charges that relates energy interactions so momentum is the operator and charges are entropic boundary condition limits, like the dimensions of space-time, particle masses, and structure.

In each case, the EM wave, the atomic orbital, the Compton wavelength, and electron $m = E/c^2$ mass and size, can be viewed as EM wave energy bounded by different limits and transformed between domains by Relativity acting on the $u_o \epsilon_o$ permeability - permittivity of space. Simply stated, a magnet in motion results in "an electric field with a definite energy value," and a charge in motion results in a magnetic field with a definite energy value, according to Maxwell's $d\phi_B/dt = - \S E\, ds$ and $u_o \epsilon_o\, d\phi_B/dt = \S B\, ds$ relations, and relativistic momentum contracts space and thus increases these energy densities conservatively.

A 100 V/m field contracted to 1 cm by relativistic motion increases electric field intensity to 10,000 V/m, which according to Maxwell's $\S E\, dA = Q/\epsilon_o$ would be equivalent to a charge increase and/or a permittivity decrease. In other words, the charge function could be considered a derivative effect of the dimensions of space, permeability and motion of energy, in agreement with the $u=\frac{1}{2}eh/m \cdot 2pi$ Bohr magneton relation if e = 2um / h/2pi, if the density and Relativity effects shown in the proton and neutron magneton analyses are incorporated.

In addition, light as pure EM energy with "continuous spatial function" and quantum energy qualities existing at the speed of light is not just produced and transformed according to quantum theory's wave functions, it also exhibits "optical force" attraction and repulsion to other EM waves (Hong Tang, Yale University, 2008 and 2009 respectively) within the interatomic confines of semiconductors, constructive and destructive superposition and diffraction in optics, modulation and demodulation in radio waves, transform into inertial energy of electrons in Polaroid filters, and the annihilation of, interaction of, and decay of particles, all of which are charge based interactions.

In the $\lambda = h/mc$ Compton wavelength the local $\frac{1}{2}mv^2$ kinetic energy at the speed of light is $KE = \frac{1}{2}mc^2 = 4.09355584 \times 10^{-14}$J,

equivalent to 0.2554995323 MeV. This is motion in one dimension, in a straight line, and equal to a mass energy increase of $\frac{1}{2}m_e$. If this momentum occurred simultaneously in two dimensions, as in angular momentum, the mass energy would equal m_e, which is why the E_o = 13.605698 eV ground state energy relates to the electron's mass by $m_e = 2E_o(c/v_o)^2$, as if this EM energy was increased to the speed of light in an angular momentum configuration.

The $\lambda_c = h/m_e c$ = 0.02426310417 Å Compton wavelength also transforms to the $r_e = 6^{\frac{1}{2}}\lambda_c / 2pi(c/v_o)^2$ electron radius, as if a $3^{\frac{1}{2}}$ spherical resultant of a rotating $2^{\frac{1}{2}}$ orbital angular momentum resultant of the λ_c Compton wavelength was $(c/v_o)^2$ compounded by two orthogonal momentums. If light exhibits attraction at the interatomic spatial distances of silicon, but is imperceptible at the larger distances of classical phenomena, it is likely that this "optical force" correspondingly increases in strength at nucleonic interaction distances, like nucleonic interactions produce gamma ray EM energy levels corresponding to visible light EM energy levels at atomic level particle interactions.

If this reasoning was valid the optical force would correlate to an approximate 0.5 A / 1 fm = 5 x 10^4 energy increase, as in the case of the 5.75 x 10^4 increase from an E_o = 13.6 eV hydrogen ground state to E_n = 0.78 MeV neutron state, and similar deuteron, triton and helion configurations. Since both these energies derive from electron charge motion it shows a direct correlation between classical charge motion and the Strong force as an EM wave operating on the principle of Relativity as an energy transform. And if optical force increases as distance decreases it can be hypothesized that the electron mass energy derives from an EM wave function operated upon by angular momentum in which the wave's posterior and anterior regions confine themselves to the proximity of each other by the optical force.

Since light is polarized and the anterior and posterior regions are symmetrically reciprocal, with opposing charge and magnetic fields, it is a rational premise that the two half cycles' fields bend and attract each other. In other words, in a Cycloton the direction of the magnetic field causes a charged particle to curve in one direction while an alternating electric field accelerates it. The same effect would occur if the particle's charge oscillated while the electric fields of the Cyclotron's Dee's remained static. If a light wave creates a field in space and then reverses its polarity it would undergo angular acceleration bound in a standing wave resonance equilibrium between the fields it generates and creates in space.

In this case, angular momentum constitutes a velocity direction changes, and thus radial relativistic contraction, orthogonal to the curve of its trajectory. Since a field constitutes a definite energy in space, its contraction would constitute an energy density increase captured by the standing wave resonance between the EM wave and the fields it creates in space. A static high energy density field does not constitute radiant energy, a 1-dimensional momentum without mass, it would be inertial mass energy without momentum occupying three dimensions and offset from the EM wave field generator that created it in a ½-spin configuration like the proton mass offset in the neutron configuration.

In the electron the mass is $m_e = 2E_o(c/v_o)^2$, two orthogonal $c/v_o = 137.0359899$ contractions of an EM wave's fields, and its size is $r_e = 6^{\frac{1}{2}}\lambda_c / 2pi(c/v_o)^2$, or the $2^{\frac{1}{2}}$ angular momentum and $3^{\frac{1}{2}}$ spherical resultants of a 2pi orbital with two (c/v_o) compounded contractions of the Compton 1-D contracted wavelength. The electron constitutes a contraction of an EM field energy into a particle, exactly like the mass increase in a neutron by the relativistic effect on the EM field between the proton and electron in an atomic configuration. It increases the electron

mass $(m_e + E_n)/m_e$ =2.531 times to 1.29333 MeV, by the 2.531 $= 1 / [1 - (v_n/c)^2]$ Lorentz transformation, where the electron's neutron state velocity is $v_n = 0.918636537\ c = 2.754 \times 10^8$ m/s.

The velocity and energy of the proton-electron EM field in a neutron state are limited only by the physical constraints of the proton's radius and electron orbital radial contraction. If E_n = 0.78233 MeV is considered to be the nuclear energy ground state, compounding it by 1199.3306 results in the 938.2723 MeV proton mass, which occurs by a $E_n / [1 - (v_p/c)^2]$ Lorentz transformation at a $v_p = 0.9999996524\ c = 2.99792354 \times 10^8$ m/s velocity if the E_n = 0.78233 MeV neutron state is considered to have zero relative velocity. That is, its $v_n = 2.754 \times 10^8$ m/s is considered to be the ground state and $v_p = 0.9999996524$ c is a relative velocity with respect to it. This shows that increasing the relativistic effect on the fundamental E_n energy results in a manifestation of the Strong force energy of the proton's mass by the limit of the relativistic effect.

In actuality the proton's mass relates in a much more fundamental way to the electron and a relativistic EM wave effect that substantiates the concept that the proton and electron are an EM wave captured by itself, and that a neutron state is an EM wave captured by a proton - electron pair in a relativistic angular momentum configuration. Both the proton and electron rely on the $u = \frac{1}{2}eh/2pi \cdot m$, charge e with an h/2pi fundamental unit of angular momentum attenuated by mass Bohr magneton concept. And, as the previously presented proton and neutron magneton models showed, energy density and relativistic effects must be considered to be operators on the Maxwellian EM relations.

A more correct way to examine the phenomenon is to present the magneton and mass as a function of a charge with angular momentum, $um = f(\frac{1}{2}eh/2pi)$, in which the magneton and mass have

a reciprocal relation to each other, $u = f(\frac{1}{2}eh/2pi) / m$ and $m = f(\frac{1}{2}eh/2pi) / u$, and where lower density and relativistic contraction mitigate and attenuate the effects, respectively. In terms of physical manifestation this means that the electron and proton are reciprocally symmetrical boundary conditions: Low mass, small volume, minimum relativistic effect, and large magneton versus High mass, large volume, maximum relativistic effect, and small magneton.

This doesn't mean they can't exhibit the "multiplicity" of higher quantum energy states like Muon, Pion, Kaon and Tau or Lambda, Epsilon, and Xi, etc., it just means that they are fundamental particle states with Reciprocal Symmetry. In the case of the electron its mass results from a 1st order $(c/v)^2$ relativistic effect in which the $(c/v)^2$ component of the $\lambda = [1 - (v/c)^2]^{\frac{1}{2}}$ Lorentz transformation function is increased to its maximum limit of $v = c$ in an angular momentum structure that results in the $u_e = \frac{1}{2}eh/2pi \cdot m_e$ Bohr magneton. In the angular momentum configuration it is the $u_o \epsilon_o$ permeability - permittivity of free space that contains the defined electric and magnetic energy fields of the EM wave that are captured and relativistically compressed.

This would constitute a fundamental structural state of higher EM energy density proportionate to the increase in $u_o \epsilon_o$ density. If this object was subjected to motion the higher relative uc would impede inertia just as $u_o \epsilon_o = 1/c^2$ limits the speed of light because the defined EM energy field must transfer through space limited by the transform rate of free space $u_o \epsilon_o$ into relative $u\epsilon$, thus resulting in the phenomena of inertia mass with its $\frac{1}{2}mv^2$ kinetic energy and $m = E/c^2$ acceleration energy to mass conversion. It is a continuous second order relativistic Lorentz transformation function, as Einstein showed in Electrodynamics of Moving Bodies, but it explains the v^2 factor since it results from the angular momentum of EM field energies with equal orthogonal velocities.

Einstein quantified inertial energy in terms of mass and relativistic velocity. This simply extends the concept to quantifying mass in terms of EM energy and results in quantum particle energy states with form and function: size, mass, charge, magneton and ½-spin. With the um = f(½eh/2pi) concept in mind, if all the charge energy with h/2pi angular momentum manifested as mass, existing in three dimensions by equipartition, it would have three ½ integer components, as in Boltzmann's 3/2 kT average energy, with three orthogonal speed of light velocities relativisitcally compounding to c^3, with a $2^{\frac{1}{2}}$ orbit resultant and $3^{\frac{1}{2}}$ spherical resultant from the orbit's rotation, to yield $m_p = 3(\frac{1}{2}eh/2pi)6^{\frac{1}{2}}c^3 = 1.672693 \times 10^{-27}$kg mass, within 0.004185% of its actual 1.672623×10^{-27}kg value.

As with the electron, the proton radius depends on the λ = h/mc Compton - de Broglie wavelength of a speed of light momentum and $6^{\frac{1}{2}}$ spherical orbital resultant of a 2pi angular momentum effect: $(h/mc)(6^{\frac{1}{2}}/2pi)$. In the case of the electron this was further factored by the $(c/v_o)^2$ relativistic compounding effect that relates it to its physical interactions at the atomic level. Manifestation of electron radius is related by Reciprocal Symmetry to external physical interactions because Conservation of Energy requires equilibrium between its internal and external energies.

Thus the electron's E_o = 13.605698 eV orbital and EM wavelengths relate to its Compton speed of light momentum wavelength by the c/v_o relativistic compounding effect and its spherical radius similarly relates to its spherical orbital radius. The proton on the other hand has greater mass with near zero angular momentum and wave behavior manifestations. It is near zero in that $6^{\frac{1}{2}}/pi \cdot (c/v_o)^2$ = 0.00415% is the mass defect discrepancy between the calculated 1.672693×10^{-27}kg and measured 1.672623×10^{-27}kg mass energy values that would be expected from cancelation of momentums by its spherical orbital wave function.

Thus the electron radius is $r_e = 6^{\frac{1}{2}}h / m_e c(c/v_o)^2$ and the proton radius is $2(6^{\frac{1}{2}}h / m_p c)$. It's not that the proton doesn't exhibit the same $(c/v_o)^2$ relativistic compounding to its wave function energy, its that its wave nature is recessive because its greater mass renders its particle nature dominant, as exhibited by the fact that $(1 + 6^{\frac{1}{2}}/pi\cdot(c/v_o)^2)m = 1.6726925 \times 10^{-27}$ kg, the calculated value, where $6^{\frac{1}{2}}/pi\cdot(c/v_o)^2 = 0.000041519$ is the proton's recessive wave nature component.

Similarly, as would be expected, the wave nature component accounts for the discrepancy between the calculated and actual proton to electron mass ratio. If $m_p/m_e = (\frac{1}{2}eh/2pi)6^{\frac{1}{2}}3c^3 / (m_e = 2E_o(c/v_o)^2) = 1836.228961$, where $1836.228961 / (1 + 6^{\frac{1}{2}}/pi\cdot(c/v_o)^2) = 1836.152724$, within 4×10^{-8} parts of the actual $m_p/m_e = 1836.152646$ value. In determining the mass ratio, the ratio of particle to particle natures, the $E_o = 13.605698$ eV ground state energy must first be converted to the same units of the proton's mass by the $E = mc^2$ relation and $1.60217733 \times 10^{-19}$J/eV conversion constant, so that $13.605698\ eV(1.60217733 \times 10^{-19} J/eV/c^2) = 2.425437028 \times 10^{-35}$kg and $2E_o(c/v_o)^2 = 9.1093897 \times 10^{-31}$ kg.

In the conversion the $1.60217733 \times 10^{-19}$J/eV factor equals the $1.60217733 \times 10^{-19}$C proton and electron charge values, and in both the Bohr and Schrodinger quantum mechanics models the $k_e e^2/a_o$ charge energy was the basis for determining the fundamental $E_o = \frac{1}{2}m_e v^2 - k_e e^2/a_o$ mechanical and $E_o = \frac{1}{2}m\ (k_e e^2/h/2pi)^2$ wave function energies. It constitutes an intersection of wave and particle natures and relativistic effects, since $v_o = 2.187691411 \times 10^6$m/s has a $(1 - 1/[1 - (v_o/c)^2]) = 2.662674 \times 10^{-5}$ relativistic effect with a $6^{\frac{1}{2}}/2pi(c/v_o)^2 = 4.152 \times 10^{-5}$ wave nature component, since $2.662674 \times 10^{-5} \times pi(c/v_o)^2 = \frac{1}{2}pi$ and $4.152 \times 10^{-5}/\frac{1}{2}pi = 2.643 \times 10^{-5} = 2.662674 \times 10^{-5}$.

The ground state energy was also previously shown to derive from ($\frac{1}{2}eh/2pi$) as $E_o = (\frac{1}{2}eh/2pi)6^{\frac{1}{2}}c / r_e e^2(c/v_o)^4$, where the electron radius is a function of the $\lambda_c = h/m_e c$ Compton / de Broglie wavelength in the form $r_e = (h/m_e c)(6^{\frac{1}{2}}/2pi(c/v_o)^2)$. Substituting this function for r_e results in $E_o = (\frac{1}{2}eh/2pi)6^{\frac{1}{2}}c / (6^{\frac{1}{2}}h / 2pi \cdot m_e c(c/v_o)^2)e^2(c/v_o)^2$ which simplifies to $E_o = m_e c^2 / 2e(c/v_o)^2$. Thus E_o equals half the electron's mass energy factored by $e(c/v_o)^2$, its charge relativistically compounded from v_o to the speed of light. Since $E_o/m_e = 2.662568 \times 10^{-5}$ and the inertial relativistic effect at v_o is 2.662674×10^{-5}, E_o is $2.662568 \times 10^{-5} / 2.662674 \times 10^{-5} = 99.996\%$ wave nature, since it derives from the Compton - de Broglie wavelength, and 0.004% particle nature.

This shows mass and wave boundary conditions exhibited in the proton and electron quantum wave functions, respectively, but both phenomena derive from the same energy relations, indicating that the Strong force constituting the proton's mass energy is also related to the electron's wave functions in terms of Relativity, angular momentum and pure EM energy. It is an energy density progression with boundary conditions that range from pure EM wave energy with momentum but no mass to pure rest mass with internal angular momentum.

10. Quarks, Weak Force and Neutrinos

This model neither supports nor disputes the existence of quarks. Their success in predicting the existence of particle states beyond the proton cannot be denied. However their usefulness, like Bohr's model, has severe limitations. They can only account for 1.5% of the proton's mass and about 30% of its spin and magnetic moments. They also do not account for the origin of mass, spin, charge or magnetic moment, or the interactions of protons, neutrons and electrons in terms of nuclear and atomic structures. And when the particles annihilate no quarks result, instead only EM waves result.

Quarks are named assignments of parameters, and like Bohr's assignment of angular momentum in integer units of Planck's constant and de Broglie's assignment of periodicity to particle behavior. They provide a constructive basis for ordered understanding but do not provide underlying principles that explain the transform of energy between the constructive energy states the quark model is limited to, a domain of specific steady state energies without any dynamic transform analysis capabilities.

For instance, all higher energy hadrons decay into a proton or electron. In this process quarks either transform into other quarks or leptons, or, conversely, in Electron Capture electron absorption transforms a proton's "up" quark into a neutron's "down" quark, from a 4 to 7 MeV higher energy state. This implies conservative interaction between the electron and the up quark, as with a photon and orbital electron or pion exchange between a proton and neutron, transforming each into the other's state. This is explained as an anti-up and down quark exchange mediated by gluons but no such Strong force mechanism is available for electron - quark interaction in the quark model, which is why quarks cannot explain Weak force decay.

Electron capture is the inverse of Weak force beta decay. This phenomena is unique because it transcends Strong and Electromagnetic domains in an apparently asymmetric "Strange" and un-conservative way with a periodicity function that statistically depends on reactant density. Electromagnetic force and angular momentum operating on the Relativity principle interrelates the proton, electron and neutron, and their resultant structures from nuclear to atomic energy states, everything from mass, size, spin, magneton and charge, by simple mathematical relations. Each state has an orbital electron with a specific resonance energy: H: -13.6 eV, n: +0.782 MeV, D: -2.224 MeV, T: -8.4 MeV, He-3: -7.5 MeV, and He-4: -28.3 MeV, etc., with one important distinction.

Neutrons decay because the orbital electron exists in a positive energy state. In the other configurations the orbital electron exists in a negative resonance energy in which the electron acquires its energy as it accelerates towards a proton. As the electron "falls" toward a proton it gains kinetic energy from the electric field, while the proton loses energy, constituting an inertial mass gain for the electron and equal loss for the proton. Since the proton is stationary and the electron's equal and opposite momentums of its resonance cancel the structure registers a net mass defect.

This inertial mass transfer occurs by the classical phenomenon of an oscillating electric charge emitting EM energy in reverse. As Land showed with polaroid filters, an EM wave causes electrons in cellulose chains doped with iodine to move, with EM energy transformed into inertial energy by $m = E/c^2$, the inverse example of Einstein's Inertial Energy Content paper. Similarly, interaction of nuclear particles can transform inertial energy into gamma ray EM energy or inertial mass by forming particles. And in neutron bonding its electron acquires energy from the proton. By Relativity both particles are in motion with respect to each other, and by equipartition of energy the proton's higher energy concentration transfers energy to the electron to achieve equilibrium between the inertial, EM force, and relativistic effects.

The electron, as with atomic quantum resonance states, can exist in nuclear quantum energy states, as exhibited by the specific energies associated with beta decays, in which gamma rays are emitted according to a quantum state change and beta particles share the decay energy with a neutrino production, as proposed by Pauli, developed by Fermi, and demonstrated by Lee and Yang. The EM energy is radiated by orbital decay, as predicted for an oscillating charge by classical theory, and the inertial kinetic energy of the electron is released as the linear

momentum kinetic energy of a beta particle minus the neutron's ½-spin and the relativistic energy from its angular momentum.

A neutrino is a ½-spin photon with a rest mass energy that conserves the relativistic distinction between a bosonic hydrogen ground state proton - electron pair and their fermionic neutron state. Just as the v_o ground state velocity results in a $m_e/(1-[1 - (v_o/c)^2]^{\frac{1}{2}})$ = 13.606239 eV relativistic particle effect mass increase from its $E_o = k_e e^2/r$ = 13.605698 eV bosonic ground state angular momentum energy, in a fermionic neutron state the electron has a $(m_e + E_n) / m_e$ = 2.531 relativistic mass increase and 2.531 orbital radius contraction that results in the previously shown ½-spin effect.

Upon decay the information of this neutron state energy must conserve as a minimum $2.531\cdot(2^{\frac{1}{2}}E_o)^{1/3}$ = 2.531·(2.679653) = 6.7822 eV ½-spin EM wave energy with rest mass resulting from the relativistic energy captured by its angular momentum. A neutrino must form upon formation of the neutron state, and its oppostie upon decay of the neutron state, to conserve the ½-spin relativistic transformation of linear momentum energy to angular momentum rest mass. Upon decay the beta particle may carry any portion of the orbital electron's kinetic energy as linear momentum as long as the neutrino carries the remainder as angular momentum energy.

This means that a beta particle could carry 0 to E_n = 0.78233 MeV and the neutrino would carry E_n minus the beta particle energy in the decay of a neutron state. In a nuclear configuration however the electron will have different mass defect and instantaneous angular momentum energies during different portions of its orbital interaction with a proton. The instantaneous state of the angular momentum energy determines the state of the released neutrino (electron, muon or tau) because the electron's instantaneous energy at the moment of decay must

be conserved. As with a photon - particle interaction, the Heisenberg Uncertainty makes the specific division of the beta particle - neutrino energy unpredictable.

The production of a beta particle and its associated neutrino is unpredictable except statistically according to the ½-life radioactive decay relation that depends on the number and proximity of identical unstable isotopes. It appears to be asymmetric (limited to beta decay and favoring specific decay products), but it is not because the symmetry occurs over time and depends upon the electron's excited state statistically linked by relativistic effects to its identical isotopes.

Specifically, Weak force beta decay is an apparent asymmetrical statistical phenomenon that depends on the physical proximity of neighboring identical nuclear configurations and temporal proximity of the decay event. In actuality it has specific causes that contribute to the observed effect and which also result in its reciprocal phenomenon, Electron Capture. These causes include electrons' dual wave -particle nature, Bohr's Correspondence Principle that quantum behavior becomes continuous when the distinction between energy states vanishes, and Quantum Tunneling.

First, as was shown for the wave function discontinuity in atomic configurations, the dual nature is the source of instability that provides entropic degrees of freedom for disorder to the dominant energy resonance that is responsible for the stability of the structural configuration. In hydrogen the wave function energy dominated, explaining inter alia the spin 0 ground state and spectral deviations, while its 2.662674×10^{-5} recessive particle nature relativistic effect resulted in wave function discontinuity. However in the neutron state the particle nature dominates because of increased inertial energy, particle sizes, and relativistic effects, while the recessive wave nature provides the avenue of energy transformation.

For energy states higher than n = 10,000 the E_o/n^2 distinction is only one part in 10^8, nearly continuous, and while the E = hf = $E_i - E_f$ emitted radiation is independent of particle effect orbital motion for lower values of n, the orbital and emitted radiation frequencies are within 0.015% for n = 10,000, $2^{\frac{1}{2}}/n$, in accordance with the Correspondence Principle.

This transformation of wave to particle nature at higher energy states is what permits the bi-directional Weak force phenomenon to occur, from wave to particle domain in Electron Capture and back to the wave nature domain in beta decay. In nuclear configurations the wave nature still exists but is masked by the much higher kinetic energies that control the electron's motion. The wave nature does however permit energy transfer in an entropic domain that relates the energies of identical nuclear configurations, a Quantum Tunneling of energy that results in a Boltzmann distribution of energies that provides a statistical ½-life basis for beta decay based on the density (proximity) of identical configurations.

Second, for the statistical distribution of energy to occur the nuclear configurations must constitute excited states. In He-3 the mass defect is -7.67 MeV, resulting from the resonance of a single electron between three protons. The defect results from cancelation of the electron's equal and opposite orbital momentums. The electron has a relativistic mass energy increase from its KE but orbital symmetries and time dilation permit its equal and opposite KE's to cancel the net mass increase, leaving only a resultant -2KE + KE = -KE mass defect.

The -7.67 MeV of He-3 constitutes the ground state for a triton nuclear configuration. However Tritium has two electrons and a $3^{\frac{1}{2}}$x $(2.2147)^2$ = -8.5 MeV defect which means each electron accounts for an average -8.5/2 = -4.25 MeV defect. Since each electron only provides a -4.25 MeV defect and the ground state defect for a

triton structure is -7.67 MeV, it means that each electron is in an excited -4.25 MeV -(-7.67 MeV) = +3.42 MeV state over the -7.67 MeV ground state.

Normally an excited charged particle would radiate energy as an EM wave (gamma ray), except that the excited state results from two electrons. A single electron in an excited quantum state would return to the ground state by such an emission but two electrons maintain a resonance symmetry by 180° out of phase energies thereby negating such an emission because it would disrupt the energy equilibrium of the symmetry, unless a Weak Force energy disrupts the equilibrium and causes a beta emission, in which case quantum gamma emission could occur in conjunction with the beta particle and neutrino emission.

Third, Weak force interaction is about 10^{-6} times that of the Strong force, corresponding both in function and strength to the recessive 2.662674×10^{-5} relative particle mass effect on the dominant wave function energy in hydrogen, which reverse roles in nuclear configurations where the particle nature dominates and wave nature energy is recessive. The entropic degree of energy freedom is resonance of relativistic energy in the form of a space - time contraction - dilation oscillation sympathetically linked to other identical configurations by virtue of the quantized frequencies of identical standing wave configuration dimensions.

Identical nuclear configurations will have identical excited state energies, orbital frequencies and physical dimensions. By virtue of the electron's momentum the effect on space - time provides an energy transform conduit between identical configurations, since their space - time resonances and physical constraints are identical or integer multiples. As with gas particles or orbital electrons statistically distributing particle energies, the effect on space - time between nuclei would statistically distribute the relativistic energy.

The brilliance of Einstein's Determination of Molecular Dimensions and Motion of Small Particles Suspended in Liquids papers rested on a premise that size affects energy behaviors. In the Kinetic Theory of Gases real gas behavior deviates from ideal gas mathematical predictions because molecular sizes affect the P = T/V relation. It was similarly shown that the proton's size has a 10^{-5} effect on the orbital wave function energy. Einstein simply reduced the inter-molecular space to that of a liquid so molecular sizes became a dominant factor and adjusted thermal energy affects accordingly. And in Production and Transformation of Light he showed that when the dominant atomic resonances could not account for the spectral distribution the recessive electron resonances became significant.

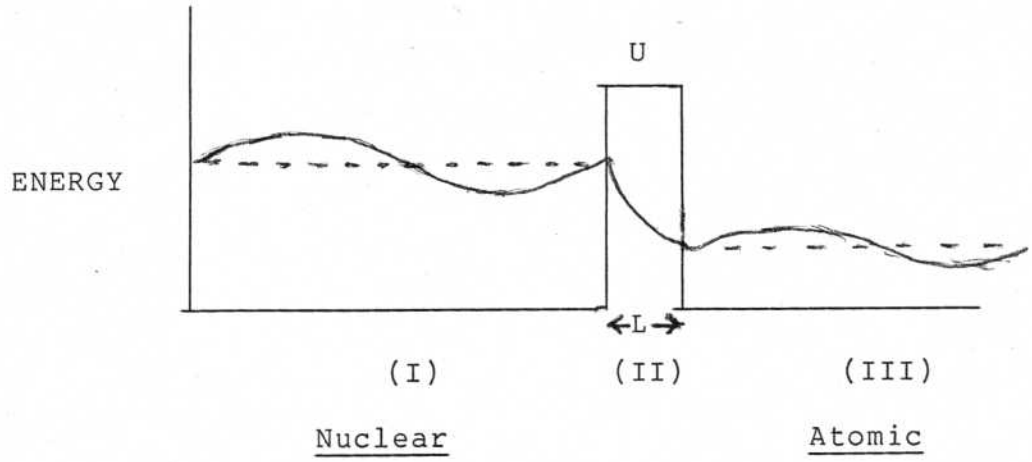
The concept of a neutron as an excited state of hydrogen relies on the same reasoning, incorporating the physical limits of the particle sizes and relativistic effects to account for the neutron's characteristics. This resulted in an E_n = 0.78233 MeV quantum Strong force energy unit that served as the basis of the $E_D = 2E_n + E_n/3$ = 2.224 MeV deuteron and $BE = 3^{1/2}(p \times E_n)^n$ triton and helion energies, thus showing the Strong force to result from EM energy compounded by relativistic effects and the physical particle size limitations. As with electron resonance effects on the statistical distribution of spectral energies, it is similarly reasoned that the relativistic resonance energy of electrons in nuclear binding configurations offers an avenue for statistical energy distribution between nuclei.

In a Maxwell - Boltzmann Probability = $C\ e^{(-E/kT)} dx\ dy\ dz\ dp_x\ dp_y\ dp_z$ distribution it makes no difference whether the PE position or KE momentum changes result from gas molecule motions or relativistic effects on nuclei from binding electron resonance energies. If relativistic contraction of space from binding electron momentums align for an instant the effect compounds, as in constructive superposition of waves, and when the momentums

un-align because of the physical configuration that constrains their motions, the compounded relativistic energy transfers according to the same Heisenberg Uncertainty as in a photon - particle interaction, thereby statistically distributing quantum energies defined by the physical standing wave limitation of the nuclear structures on the binding electrons' momentums.

In beta decay the relativistic wave effect operates on the bond between nucleons, from binding electron motions, typically in the order of 0.001 times the Strong force mass energy of nucleons (i.e. $E_n = m_p/1200$). Since the effect only occurs during the compounding of relativistic effects from alignment of binding electron momentums, the influence is a 0.001 effect on a 0.001 effect, or 10^{-6} of the Strong force mass energy, consistent with Weak force strength and the expected 10^{-5} influence of a recessive energy on a dominant energy's domain. And since the effect results from energy transfer between nuclei, while Strong interactions depend on distance changes, analogous to energy transfer through a pipe as opposed energy transfer by bumping the pipe, Weak interactions are in the order of $(10^{-20}s)^{\frac{1}{2}} = 10^{-10}s$ while Strong interactions are $10^{-20}s$.

Fourth, Weak force energy transfer is a $T = e^{-2KL}$ Quantum Tunneling transmission, where $K = [2m_e(PE - KE)]^{\frac{1}{2}} / h/2pi$ is a potential to kinetic energy barrier relation with respect to particle mass and L is the barrier width distance to neighboring identical nuclear configurations, and therefore a $N_o/2 = N_o e^{-\lambda T_{\frac{1}{2}}}$ statistical phenomenon dependent on distance between identical neighboring configurations. It is bi-directional (i.e. beta decay and electron capture) and occurs when the electron's entropic degrees of freedom information of one domain (i.e. nuclear) matches the entropic degrees of freedom energy information in another (i.e. atomic), similar to a 2-3-4-5-6 "straight"—"5 cards and under" hands in Poker and Black Jack. The same statistical information event can win in either domain, although arrived at by different configuration functions.



Typically Quantum Tunneling refers to transfer of an electron through an energy barrier (II) from a higher (I) to lower (III) energy state. It is however a statistical event in which the electron has some probability of being everywhere, in both the nuclear (I) and atomic (III) domains. The probability is a function of the difference between the barrier PE and particle KE with respect to its mass energy m, compounded by the spatial width of the barrier L, and is thus bi-directional.

An electron in an atomic orbital entropic degree of freedom domain can transcend the apparent energy barrier by a simple change in the relative information of the energy to the nuclear orbital entropic degree of freedom domain, and vice versa, by the same information. In an atomic orbital configuration the proximity of occupied quantum energy states constitutes the physical distance distance from the atomic domain side of the boundary condition to the nuclear domain side because the density of occupied quantum states constitutes a higher entropic energy density region. Similarly the proximity of identical nuclear configurations also represents higher entropic energy density region and the distance L on the nuclear side of the boundary condition to the atomic side.

The distance and relative energies determine the probability function but alignment of energy information is required for transform between nuclear and atomic energy form functions, hence

the 2-3-4-5-6 "straight"-"5 cards and under" statistical event analogy. Specifically this involves the proximity of the electron to the proton, its instantaneous momentum energy value, and its insertion angle. Only the direction vectors are reciprocal, depending on whether the neutron state is being formed or decaying, since the Probability = $e^{(-E/kT)}dx\ dy\ dz\ dp_x\ dp_y dp_z$ function is the same in both cases, irrespective of polarity sign.

In both cases, in a system of N identical nuclear configurations or N atomic orbital electrons, there are $E_t = E_1 + E_2 + \cdots + E_n = \sum_{i=1}^{n} E_i$ possible energy states, all of which are equally possible, and occur in an $N_i = Ne^{-E_n/kT}$ Boltzmann distribution. Since the sea of atomic orbital electrons of identical nuclear configurations involve electrons, not positrons, there will exist an asymmetry between beta and positron decay. As with gas molecules, it is the interaction of a particular form function that results in the statistical distribution of quantum energy states. To be of a particular form function they must derive from the same configuration, having the same relative ground state energy as the basis for the energy distribution.

In Electron Capture an atomic wave function electron is tunneling into an electron particle domain and in beta decay it is tunneling from a particle domain to a wave function domain. In each case the recessive energy form became the dominant energy form with statistically identical characteristics that transcend the boundary condition. Accordingly, a dN/dt decay rate that is a $r = (dN/dt) / N$ function of N identical parts appears as an $N = N_o e^{-rT_{\frac{1}{2}}}$ function of time that can be expressed as the familiar $N_o/2 = N_o e^{-rT_{\frac{1}{2}}}$ ½-life function. As shown, it appears asymmetric in that it only occurs as a beta decay, but only because it is a phenomenon dependent on "N identical parts" so it can't manifest as a positron decay because even if a significant amount of

antimatter was present the overwhelming presence of electron based matter negates the positrons' statistical interactions.

It also manifests asymmetrically in decay paths like $pi^- + p \longrightarrow K^\circ + \Lambda^\circ$ while $pi^- + p \not\longrightarrow K^\circ + n$ doesn't occur even though no current conservation principle prohibits it. This is because decay reactions don't just depend on "N identical parts" operating on an $N_o/2 = N_o e^{-rT_{1/2}}$ decay function. That's the apparent behavior, but interactions occur according to a reactant - product equilibrium in which reactant interactions are interfered with by products, just as gas molecule sizes interfere with ideal gas behavior. By the Entropic Energy Density Progression Principle each form function domain has a dominant energy form which stablizes by resonance within the entropic degrees of freedom of that domain, and a recessive energy form that transcends the boundary condition to the next domain where it is the dominant energy resonance form.

Thus the reactant form transforms into the product energy form and vice versa under the right conditions to maintain a reactant - product energy resonance equilibrium. The reactant domain transforms into a reactant - product domain. In Chemical Thermodynamics a product is stable if the $dG = dH - TdS$ change in free energy is negative, if energy must be added to destabilize it, and the change in dG free energy equals the dH change in bond energy minus the average energy T times the dS entropy increase. Thus if energy is given up by a reaction and product entropy exceeds reactant entropy the product is stable.

However this can occur bi-directionally because products fill available entropic degrees of freedom and interfere to form reactants according to $dG = -RT \ln [Products]/[Reactants]$, since all interactions are reversible under the right conditions, as in the case of Electron Capture, where R is the Gas Constant, or Boltzmann Constant for a mole. In an atomic configuration the electron falls toward the proton and

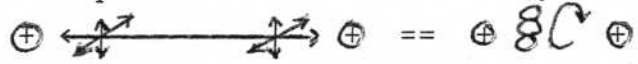
the dH energy distributes from the one degree of the fall into the six degrees of space and two degrees of time as a wave function with periodicity.

Thus instead of colliding the entropy increase distributes the fall's energy as the energy density decrease of a ground state orbital. The particle interaction energy transformed into a more stable wave function energy resonance. Wave function periodicity is an equilibrium between reactant and product energy states with perfect symmetry. EM wave energy transfers to the $u_o e_o$ permeability - permittivity of space and back again. It renders time flow symmetrical because from the perspective of the resonance the identical reciprocally symmetric reactant and product energy states cannot be distinguished in time, energy resonating back and forth between past and future states equally, hence a net zero time flow for an EM wave at light speed even though reactant to product and product to reactant transition times exist.

However a particle with a rest mass cannot travel at light speed so there is a hysteresis between its electromagnetic and inertial functions, thus creating a PE difference between the EM forces and inertial KE content according to the Lorents transformation. This difference increases the available entropies, permitting energy to resonate between inertial and EM wave forms, creating a wave - particle duality equilibrium between reactant (particle) and product (wave) energy states. And when more then one electron is present these energies have additional entropic degrees of freedom that distribute between Probability = $C\ e^{-E/kT}\ dx\ dy\ dz\ dp_x\, dp_y\, dp_z$ classical particle positions and momentums and quantized $N = N_o e^{-E/kT}$ states, as seen by the difference between EM wave and orbital frequencies.

These can statistically result in a higher energy quantized neutron state, unstable because the dG change in free energy is positive because the one degree of freedom fall to the proton

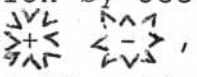
produces more energy than the six relativistically contracted degrees of freedom can sustain in a resonance between inertial and wave function energies diminished by the contracted period and time dilated frequency reduction. Stability returns when a second proton is introduced and all positive inertial momentum energies are negated by a symmetrically reciprocal entropic degrees of freedom and the wave function's two periodicity degrees of freedom in time are replaced by a doubling of spatial entropic degrees of freedom of inertial energy resonance periodicity



with energy storage capacity increased by the $E/E_o = 1 / [1 - (v/c)^2]^{\frac{1}{2}}$ relativistic effects of inertial momentum increase. So although time slows down, attenuating wave energy storage, the inertial entropic degrees of freedom are increased and the continuous ability of spatial contraction to store energy makes $dG = dH - TdS$ negative and stable. Relativistic continuity is thus the mechanism of E/n^2 quantized energy storage in a spatial resonance between the two protons.

However extra electrons negate the relativistic resonance energy storage by occupying the available entropic degrees of freedom, reducing dS. Thus bonded n:n pairs are unstable, n:p:n configurations are semistable, p:n:p configurations are more stable than p:n configurations because of the increased entropy of the triton geometry, and p:n:p:n helion configurations are even more stable. In Weak force decay, just as reciprocal reactant and product states were needed for a $dG = -RT \ln [P]/[R]$ equilibrium, the decay function can only achieve a stable $dG = -RT \ln [P]/[R]$ decay equilibrium by energy resonance between similar available entropic degrees of freedom, if reactants and products are similar.

In Chemistry the P:R equilibrium only occurs for covalent, not ionis, participants because if the product precipitates out of solution the reaction goes to completion, unless a solvent is

used which buffers the ionic nature. Salt is a precipitate in oil but an ionic equilibrium results with water molecules because they have a charge dipole moment and keep the Na^+ and Cl^- ions in solution by occupying each available degree of freedom around the ions  , decreasing their ionic strengths by increasing the field radius, forming an equilibrium between ions and solvent.

In Weak force decay the reactant isotopes exhibit an equilibrium with product isotopes that manifests as a ½-life decay. Mathematically an equilibrium is represented by an $e^{ix} = \cos x + i \sin x$ resonance between orthogonal real and imaginary domains. However as the distinction between the real and imaginary domains approaches zero, $r - i \rightarrow 0$, then $e^{ix} \rightarrow e^{x}$ and a decay function results because the phase shift between the cosine and sine energies approaches zero, so $\cos x + i \sin (x + 90°) = 0$. As the relative concentration of products increases the transition from reactant to product states becomes statistically less likely because all of the possible N product states become occupied, just as filling the ideal gas' volume with molecular sizes shifts the statistical curve until a liquid occurs and only diffusion is possible that depends on the relative molecular sizes, or an emission of a secondary quantized energy form results as in the conversion of a black body's thermal energy to electron resonance uv emissions.

The interaction of reactants is thus controlled by available entropic degrees of freedom. Orbital equilibrium occurs because 6 degrees of spatial and 2 degrees of temporal freedom allow energy storage as stable periodic wave functions until inertial energy storage contraction of space and dilation of time decays the wave functions into inertial relativistic resonances between particles, replacing temporal periodicity with space-time contraction-dilation periodicity. The transform between wave function periodicity and relativistic periodicity is an energy transform between atomic and nuclear densities, a discontinuity.

When a pi° neutral pion decays it results in two opposing gamma rays, as would occur by the release of opposing angular momentum energies, $\overleftarrow{\underrightarrow{Q}}$ $\longrightarrow$ $\longleftarrow$ + $\longrightarrow$, like an unraveling of charge and magnetic moment rotational energies into single degree of freedom EM wave momentums with orthogonal two degree of freedom electric and magnetic oscillations. Symmetry is preserved by eliminating the spatial distinction of an energy phase shift in one dimension thereby resulting in a transform of angular to linear momentum, as would occur if the orthogonal degree of freedom in an $e^{ix} = \cos x + i \sin (x + \phi)$ resonance as $\phi \to 90°$. Opposing momentums conserve the symmetry of the angular momentum.

In a $pi^- + p \to K° + \Lambda°$ decay strangeness conserves, but in $pi^- + p \to K° + n$ decay it does not, since K° = ds, $\Lambda°$ = uds, pi^- = ud, and p = uud quark energy states. Strangeness describes the need for transition states that permit interaction of entropic degrees of freedom that cannot occur absent the transition state. In a pendulum two reciprocally symmetrical PE states resonate $\downarrow\!\!\rightarrow$ <==> $\leftarrow\!\!\downarrow$ by way of $\xrightarrow{Q}$ <==> $\xleftarrow{Q}$ equal and opposite KE momentum transition regions. It would be a strange universe if potential energies could resonate polarity without transition region mediators. It is therefore not strange if Strong force energy states transform by asymmetric transitions that conserve symmetry over time.

Because these decay path transition states occured for no obviously apparent reason they were referred to as strange energy states, with a conservation of strangeness over the dimension of time requirement. By recognizing that these states permit the transition from one set of entropic degrees of freedom to another it provides a rational explanation for permitted pathways in terms of neutrino relativistic angular momentum release, transforming apparent entropies into ordered transitions. The $\Lambda°$ can transition to a n + pi° neutron plus neutral pion, which decays into two gamma rays, or it can transition back into a p + pi proton plus negative pion.

It therefore truly is a transition region region energy form that can attain either product or reactant states. This Λ° lambda transition state is only needed if the pi^- negative pion and proton interact to form a K° neutral kaon state because a negative pion decays to a negative muon and antimuon neutrino, pi^- --> $u^- + \bar{\nu}_u$, and the neutral kaon can decay to neutral pions, oppositely charged pions which decay to muons and neutrinos, or a charged pion with an oppositely charged electron or muon and their associated neutrino. The neutron can only decay to a proton, electron and its neutrino, which leaves out the transition region decay of the charged pion's angular momentum energy, so a direct decay to a neutron does not conserve an angular momentum transition state decay.

With regard to charge asymmetry, K° --> $pi^- + e^+ + \bar{\nu}_e$ is statistically more probable than K° --> $pi^+ + e^- + \bar{\nu}_e$ because the e^+ positron's energy has infinite entropic degrees of freedom available to it since $e^+ + e^-$ --> 2γ will be instantaneous and it frees up a place for the for the pi^- decay e^- electron after it undergoes the K° angular momentum decay transitions. When $pi^+ + e^- + \bar{\nu}_e$ occurs the e^- electron must have an entropic degree of freedom available to it in a universe populated with electrons and the e^+ positron from the pi^+ must await the transition of angular momentum states to be annihilated. Thus the charge decay path asymmetry is entropically determined.

Transition regions are Quantum Tunneling events through a boundary condition between two domains by statistical alignment of entropic degrees of freedom. It's not adequate to simple require that nature observe man's conservation laws in a single transaction. That arbitrarily declares the temporal entropic degrees of freedom inaccessible and negates reactant - product transition region transformation equilibriums. In going from a Strong force particle domain to an Electromagnetic wave state domain all particle momentums must be conserved, including angular momentums either as opposing gamma ray linear momentums or as neutrino angular momentums from the transition states.

Weak force decay of Strong to EM domains accounts for transition state events that appear to be individually asymmetric but which are symmetric over time, like the distinction between an e^x singular energy transform and an e^{ix} energy equilibrium resonance that relies on the four e^x, $e^{1/x}$, e^{-x}, $e^{-1/x}$ reciprocally symmetric transitions. The apparent asymmetry only appears in beta particle specific pathways since the bound beta particle is the mechanism of Strong force binding between nucleons. They always involve a neutron or high energy electron meson state that transitions back to an electron in the atomic energy domain.

In other words, in neutron - proton bonding, in deuteron, triton or helion configurations, the electron undergoes additional degrees of entropic freedom beyond the simple orbital angular momentums of a neutron's spherical orbital. In a deuteron structure it resonates neutron states between two protons in addition to its orbital angular momentum, in a triton structure it undergoes a planar clover leaf orbital that resonates the neutron states between three protons, and in a helion structure the clover leaf is distorted into a transition between four proton, on the faces of a tetrahedron.

Each additional geometry incurs an angular momentum component that must be conserved as a tau, kaon, pion or muon decay with their associated neutrino relativistic angular momentum releases. Each of these constitute a transition region energy state corresponding to a specific instantaneous energy and composite angular momentum state that releases as a neutrino and lower energy state particle on the decay path to a beta particle release. For instance, the tau particle corresponds to a 1778 MeV instantaneous relativistic energy at the tip of a clover leaf between two protons that is released if a 6 MeV addition occurs. The others correspond to lesser energy instantaneous states along the orbital trajectories. (For additional details refer to Radioactive Decay and Electrons, Mesons and Neutrinos at mqnf.com)

All decay to a beta particle linear momentum state by a succession of neutrino releases from lesser intermediate energy state transitions, so all momentums are conserved over the entire decay path from the Strong force particle behavior domain to the EM force de Broglie $\lambda = h/mv$ wave behavior domain of a beta particle with linear momentum moving through space. The result is a progression of decreasing entropic energy densities with intermediate transition states mediating the transformation of Strong to EM force entropic degrees of freedom.

CONCLUSION

Heisenberg's Uncertainty is universally accepted because his logic is irrefutable. It is impossible to simultaneously measure a particle's position and momentum with infinite accuracy because the dx and dp uncertainties arise from the quantum structure of matter, such as the unpredictable recoil of an electron struck by an indivisible photon. Alternatively, it is not possible to measure continuous functions, position or momentum with a discontinuous quantized matter yard stick.

And yet these discontinuities in energy measurement do not aggregate to disrupt the continuity of matter. As Einstein pointed out while proving that light exists as energy quanta, it also exists as a "continuous spatial function," and continuous functions do interact continuously in a way that yields quantum results, such as superposition of integer wave function multiples, "multiplicity."

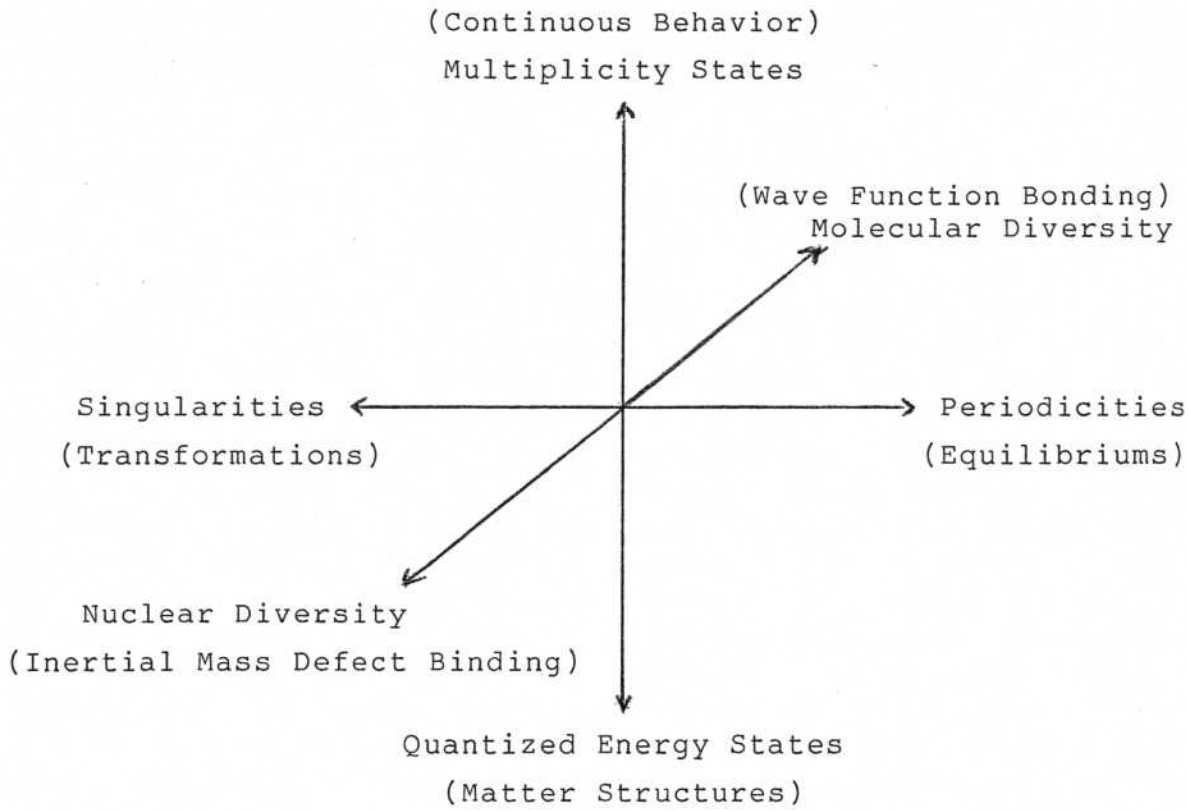
Continuous functions can measure continuous functions with infinite accuracy since superposition of irregular photons can completely resolve their energy by constructive addition of their continuous spatial functions. By the Bohr Correspondence Principle

quantum behavior becomes continuous when the distinction between adjacent states vanishes, and photons resolve photons with infinite accuracy because they have identical energy forms, functions and available entropies, but can only resolve particles down to the quantized discrepancies between theirs and the particles characteristics.

Even though the energy exists as a quantum state the difference between two quantum states can achieve zero distinction if their characteristics match and can never achieve zero distinction if they don't. The resolution is thus achieved by the added degree of freedom of the distinction between their characteristics. Conversely, this exercise becomes the means by which irreducible differences become reduced, transforming entropy into ordered logic. Similarly, in defining a rational connection the quantized distinctions in logic are refined until the logic explains the phenomenon.

Historically this process progressed from a matching of black body spectral emissions to a Boltzmann Distribution, to resolution of light as energy quanta by matching uv emissions to electron resonances, to resolution of hydrogen spectra to integer orbital momentums, to resolution of spin and higher atomic spectra to wave functions, and finally to resolution of wave function discontinuity to the recessive phenomenon of inertial effects on a wave function. This progression of entropic degrees of freedom was then resolved into an energy density progression principle that permitted calculation of the masses, sizes and magnetic moments of the electron, proton and neutron, the hydrogen atom ground state energy, and the nuclear mass defect binding energies and magnetons of the deuteron, triton and helion energy structures based on entropic interactions, similar to Einstein's molecular size calculations based on energy behavior and removing the space between them.

The principle was then extended to explain the asymmetry of Weak force transformations of Strong and EM force matter states by a progression entropic transition states. Thus beta decay, decay pathways, longer decay times, ½-life behavior, strangeness and charge asymmetries can be explained. This Entropic Energy Density Progression Principle is a dynamic model that offers distinct advantages over the static perspective of the quark model because it permits a more complete view of matter in terms of its form, functions and entropic degrees of freedom of its structures that result in Nuclear and Molecular Diversities, Quantum and "Multiplicity" states that become continuous when quantized distinctions vanish, and Singular energy transform events that become stable Periodic equilibrium states. In the final analysis, when words fail equations speak (see Appendix).



Entropic Energy Density Progressions

Appendix

A. Electron, Proton and Neutron Masses

$$m_e = 2E_o(c / \frac{k_e e^2}{h/2pi})^2 = 2E_o(\frac{c}{v_o})^2 = 0.510999 \text{ MeV}$$

$$m_p = (\tfrac{1}{2}eh/2pi)\cdot 6^{\frac{1}{2}}\cdot 3c^3 = 1.672692 \times 10^{-27} \text{ kg (see Section 9)}$$

(factored to 1.672623×10^{-27} kg by $(1 - 6^{\frac{1}{2}}/pi(c/v_o)^2)$, the mass defect from the proton's wave nature)

$$m_n = m_p + m_e + E_n = 0.78233 \text{ MeV}$$

The $E_n = 0.78233$ MeV value is determined by the physical constraints of the $r_p = 1.03$ fm and $r_e = 0.05037$ fm proton and electron radii, which result in a 1.08 fm limitation on their proximity. Since $E_n = 0.78233$ MeV constitutes a 3-D spherical orbit energy and $E_o = 13.605698$ eV 1-D hydrogen ground state energy, $a_o / (E_n/3 / E_o) = 0.529177249$ A/19166.723 = 2.761 fm, which is further reduced by the $(m_e + E_n) / m_e =$ 2.531 relativistic contraction effect to 1.09 fm. This allows a 1.09 fm - 1.08 fm = 0.01 fm margin, 20% of r_e.

$$m_p/m_e = 3/2 \cdot 6^{\frac{1}{2}}\cdot c^3(k_e e^2)^2 / 2E_o h/2pi = 1836.229$$

(factored by $(1 - 6^{\frac{1}{2}}/pi(c/v_o)^2)$ to 1836.153)

B. Electron, Proton and Neutron Radii

$$r_e = (h/m_e c)(6^{\frac{1}{2}}/2pi(c/v_o)^2) = 5.037 \times 10^{-17} \text{m}$$

where $h/m_e c$ is the Compton wavelength and $6^{\frac{1}{2}}/2pi(c/v_o)^2$ is the radial resultant of the relativistic contraction

$$r_p = (h/m_e c)\cdot(6^{\frac{1}{2}}/pi) = 1.03 \text{ fm}$$

$$r_n = a_o / (E_n/3 / E_o)\cdot(m_e + E_n)/m_e = 3a_o E_o m_e / E_n(m_e + E_n)$$
$$= 1.091 \text{ fm}$$

It is a proton - electron composite, where particle nature dominates, in an orbital configuration with the Bohr radius ao reduced by the ratio of the added neutron energy to the

hydrogen ground state energy relativistically contracted by the electron's inertial mass increase.

C. Hydrogen Ground State Energy

$E_o = m_e c^2 / 2e(c/v_o)^2 = 13.605698$ eV

D. Neutron ½-spin (see Section 7)

$\cos^{-1} = 1 / (m_e + E_n)/m_e = 52.8°$, within 4% of $\cos^{-1} 1/3^{\frac{1}{2}}$ corrected to the actual $\cos^{-1} 3^{-\frac{1}{2}} = 54.73°$ when the proton's angular momentum is factored in

E. Proton and Neutron Magnetons (See Section 7)

The electron magneton is $u_e = \frac{1}{2}eh/2pim_e$

The nuclear magneton is $u_n = \frac{1}{2}eh/2pi \cdot m_p$

The proton magneton is the nuclear magneton factored by its lower density: $u_p = u_n(r_p/r_e)^3 / m_p/m_e = 4.837$ in the ½-spin direction and $4.837/3^{\frac{1}{2}} = 2.7928\ u_n$ in the direction of the external measuring field, where $r_p = 1.0355$ fm and $r_e = 0.05$ fm

The mass attenuates the magneton, the proton's lower density mitigates it, and the neutron's $(m_e + E_n)/m_e = 2.531$ relativistic compression attenuates it, so $u_N = u_n(4.837/2.531) = 1.9112\ u_n$, with a negative sign, opposite to the angular moment, since it is generated by an electron

F. Deuteron, Triton and Helion Mass Defect Binding Energies (See Section 8)

$D_{BE} = 2E_n + (E_n/3)(m_e + E_n)/m_e = 2.224$ MeV

$H\text{-}3_{BW} = 3^{\frac{1}{2}}(P \times D_{BE})^n = 3^{\frac{1}{2}}(D_{BE})^2 = 8.5$ MeV

$$He\text{-}3_{BE} = 3^{\frac{1}{2}}(p \times D_{BE})^n = 3^{\frac{1}{2}}(2 \times D_{BE}) = 7.67 \text{ MeV}$$

$$He\text{-}4_{BE} = 3^{1/3}(p \times D_{BE})^n = 3^{1/3}(2 \times D_{BE})^2 = 28.3 \text{ MeV}$$

D_{BE} = 2.2147 MeV in triton and helion configurations

G. Deuterium, Tritium and Helium-3 Magnetons
(see Section 8)

$$u_D = (u_p - u_N)0.976 = (2.7928 - 1.9135)0.976 = 0.858\ u_n$$

$$u_T = [u_p^2 + 2((u_p - u_N)(0.976)^2)^2]^{\frac{1}{2}}[(m_p - T_{BE})/m_p]^2 = 2.9788\ u_n$$

$$u_{He\text{-}3} = \frac{u_N(m_p / (m_p - He\text{-}3_{BE} + E_n))}{[(r_n - (2.761\text{-}r_p\text{-}1 \text{ fm})(m_e/(m_e + He\text{-}3_{BE} - E_n)/2^{\frac{1}{2}})/r_n]^3}$$

$= 2.1277\ u_n$, within 4% of the actual 2.2175 u_n value