Radioactive Decay

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Thesis: Radioactive decay is a temporal domain equilibrium state between energy's Relative nature to attain the lowest stable energy state and its Quantum nature to statistically distribute. As such, the half-life Decay Constant, k_r , may be predicted from the energy, space, time parameters of the decay particles and their products.

Given: An equilibrium state in the dimension of time occurs when the number of decayed particles equals non-decayed particles, just as placing equal masses equal distances from a fulcrum in a balance creates an equilibrium. This process equilibrium state occurs when the number of non-decayed particles, N, equals ½ the initial number of particles, N_O, or $N = ½N_O$, and the length of time required to attain this state, $T½$, is given by $T½ = \ln 2 / k_r$, where k_r is a function of the specific circumstances of reactant and products.

If: Each element in an e^x expansion represents the calculus integral of its preceding element, $e^x = 1 + x + x^2/2! + x^3/3! +...$, and integration represents the state existing when an orthogonal, dimension is added. Therefore, e^x may be used to represent the sum of all states of added degrees of energy freedom, each referenced to its lower dimensional energy states by the factorialed energy window common denominators, and x represents the circumstances of the energy in space and time.

Factorialed energy windows are significant in referencing each element's degrees of energy freedom to those of preceding elements. This is seen graphically if the first element of e^x, 1, represents a normalized energy point. It's integral is x, a line representing the 1st degree of energy freedom. Since a point is the end, or residual, of a line the line's inertial energy, x, relates to the point by its 1! factorial. Physically, inertial mass is a relativistic transform, $m_i = m_O(1 - v^2/c^2)^{-1/2}$, where m_i depends on m_O. Acceleration, the 2nd degree of freedom is graphically a triangle, $x^2/2!$, bounded by x, an edge, with its energy averaged between the degrees of freedom and related to the lower degrees of freedom by 2!, and so forth.

Since the integral of e^x is e^x, all processes describable by an e^x energy transfer function are themselves relative elements in a greater e^x transfer function. That is, energy-space-time parameters can be initialized or a dimension or energy factor added or deleted and the process remains an e^x transfer. Since integration of the energy states of a process with respect to x is an energy state in a greater or lesser process, the e^x process of particle decay is a state and the half-life decay constant in x, k_r, may be determined.

The parameters of x are the energy forms (i.e. gravitational, electromagnetic, or nuclear) and spacetime dimensions (i.e. density, distance, attenuation, and duration or periodicity, since e^x may take an Euler $e^{ix} = \cos X + i \sin X$ oscillation form). This means k_r may be defined in terms of the energy-space-time parameters and the

reactant and product configurations.

Then: An e^x expansion contains all possible x^n energy states interrelated as a continuum by n! common energy denominators. It characterizes all energy transfers, statistical or continuous, since as Laplace pointed out "The theory of probabilities is at best nothing but possibilities reduced to calculus." And the conditions specified in x are the cause and effect of the e^x energy transfer. Because of this the equilibrium state of a transfer, of following an e^x curve with respect to a space-time reference dimension, can be predicted by the conditions, in this case the decay constant k_r.

Proof: Of the 3 natural radioactive decay paths, beta pertains to particle decay, alpha pertains to nuclei decay, and gamma decay is a nuclei de-excitation process. In beta decay a positron and neutrino are emitted by a proton to neutron transmutation or an electron and anti-neutrino are emitted by a neutron to proton transmutation. This process, being a fundamental natural decay path, serves as a model to determine the k_r decay constant parameters. Since the process varies significantly between nuclear configurations those conditions must also be incorporated into k_r. For instance, neutron half-life decay is 920 sec while carbon-14 to nitrogen-14 decay is 5,730 years and nitrogen-12 to carbon-12 decay is 0.011 sec.

Since bidirectional neutron-proton decays occur in nuclei, but only unidirectional neutron to proton decays appear to occur outside nuclei, developing a neutron-proton model would be the first step in deriving k_r's parameters. And since protons and neutrons differ in

mass, charge, and magneton those parameters will be the model basis. Detailed analyses of proton and neutron magnetons are presented in "The Superposition States of Planck's Constant" by W.T. Gray, fns. 25 and 26. Briefly, electron and proton charge and magnetons result from 3-dimensional rest mass oscillations with polarity dependent on oscillation orientations. Charge manifests as a radial gradient from a particle's center and magnetons manifest as axial fields. Because maximum stability occurs with least spatial distortion and magnetons are $3^{1\backslash 2}$ resultants of the three oscillations, moving particles orient with one oscillation on the propagation axis and magneton resultants 45° off the axis, or ½ spin. Magnetons are axial resultants with frequency and magnitude dependent on velocity while charge depends on the constant local oscillation frequency and remains constant.

With this concept of a particle, proton's can be thought of as spherical 1.672×10^{-27} kg masses of oscillating energy approximately 2×10^{-15} m in diameter, electrons being 9.109×10^{-31} kg and 1×10^{-16} m. If $e = mc^2$ and $c = E/B$, then $m = e/c^2 = e \cdot B^2/E^2$, or energy with a bipolar magnetic component bounded by two concentric electric fields as would result from a radial gradient of 0 at a particle center to 1.602×10^{-19} C at its surface. Coulomb binding forces, $F_C = k_e \cdot q^2/r^2$, for such a configuration would be approximately 9×10^4 N and 230 N, respectively, for electrons and protons. This comports with the 1961 Hofstadter high-speed electron scattering results since the electron magnetic fields would increase with energy by $u_B = 9.274 \times 10^{24}$ J/T, a charge gradient would scatter them accordingly, and the oscillating energy in protons would result in regional charge and mass density variations of quarks if they are viewed as mathematical resultants.

This model of a proton allows its correct magneton value to be calculated. Inductance, L, the ratio of magnetic flux linkage to current producing the flux, is a product of permeability and spatial geometry, and is magnetism's equivalent of mass since $E_m = ½mv^2$ and $E_B = ½LI^2$. Using the proton's and electron's diameters, their volumes, $V_P = 4.19x10^{-45}$ m and $V_e = 5.24x10^{-49}$ m^3, have a ratio of 8000, but mass ratio is only 1836, so protons are 4.36 times less dense. Since $L = 2 \cdot E_B / I^2 = \int_{vol} B \cdot H \, dv$, where $B = u_o u_r H$, a relative permeability, u_r, must be incorporated to calculate its magneton.

Protons and electrons in this model differ by mass and a 4.36 density ratio. The nuclear magneton, u_n, accounts for mass while density accounts for the 2.7928 difference between u_n and the actual magneton value if the fact that density is 3-dimensional and the $3^{1/2}$ magneton resultant in the model is only 1-dimensional so the density of 4.36 must be divided by $3^{1/2}$ to yield a permeability effect of u_r = 2.52, which is within 10% of 2.7928 and would result from a 3% error in particle diameter resolution since density is a cubic function.

A neutron magneton of -1.9135 u_n indicates a magnetic moment opposite the spin angular momentum, as would result from a negative orbital particle. A hydrogen atom is a proton-electron stable state with an electron magneton proportional to its spin angular momentum and velocity and orbital dependent on quantum energy and wavelength. If electrons may be excited to higher orbitals, a state constraining an electron to a proton's vicinity, in a neutron configuration with

electrical neutrality and unshared magnetic moment is also possible.

Normally addition of 13.6 eV a hydrogen ground state results in ionization. However, Schroedinger's probability density, $|\Psi|^2$, is actually $\Psi\Psi^*$ and the ground state is an energy well between boundary conditions of an ionization state (orbitals represented by Ψ) and a neutron state (orbitals represented by Ψ^*). When quantum theory was developed to explain discrepancies between Bohr's theory and complex atomic spectra or simple atom spectral subtleties, the perspective applied was Classical. In other words Bohr's theory is based on the concept that the total energy in an atom is the sum of its kinetic angular momentum and electrical potential energies and equilibrium occurs when $k_e e^2 / r^2 = m_e v^2 / r$ at -13.6 eV and r = 0.0529 nm.

From a Classical perspective, adding energy increases angular momentum and orbital size until ionization occurs at 13.6 eV of added energy and the equilibrium ground state was set at -13.6 eV. Because of this decision, when quantum theory was applied to explain the previously unexplained spectral data the issue was considered to be resolved and ionization at 13.6 eV added energy was accepted as the only real electron behavior. However, unknown at the time were the unexplained circumstances of the sun's fusion. An abundance of hydrogen and neutrons are present, and helium is formed, but the amounts of deuterium and tritium present are insufficient to explain the rate of fusion occurring or the quantity of neutrons present.

By some method neutrons must be forming and must be doing so from non-deuterium or tritium hydrogen atoms. In quantum theory the orbital wave function is a product of 3 polar coordinate functions

which characterize the 3 degrees of electron freedom, radius, theta, and phi. Both standard and conjugate forms are incorporated into the probability integration and it's normalized to 1 to signify presence of an electron in an orbital (i.e. §§§ Ψ* Ψ dØ dθ dr = 1) 100% of the time. Because of a Classical perspective the 3 degrees of freedom were specified spatially in terms of distances and degrees of arc (i.e. the orbital energy defines an average position or expectation value of (x) = § x $|\Psi|^2$ dx) but this is only half the picture.

Heisenberg's uncertainty principle states the impossibility of simultaneous position and momentum measurement and has spatial and temporal boundary constraints (i.e. dx·dp ≥ h/4·pi and dE·dt≥h/4·pi, where d's signify measurement uncertainties). One interpretation of this violates energy conservation by allowing energy change but this is not so, as long as it does not exceed dt ≥ h/4·pi·dE, as pointed out in the Feynman-Yukawa particle interaction theory. It is also substantiated by interpreting Planck's constant as a force-energy superposition state, h = 6.626×10^{-34} Joule·seconds = 6.626×10^{-34} Newton·meter·seconds, allowing for transformation of energy and force and providing a basis for e^x statistical energy distributions.

A Classical example is a pendulum where velocity is maximum and has direction but no acceleration at the bottom of its swing and has 0 velocity and maximum acceleration but no direction at the ends of its swing. Energy and direction transform to an equal and opposite force and does so by Euler's e^{ix} = cos x + i sin x identity if cos and sin represent energy and force and i signifies dimension. This

same energy-force transformation occurs in wave functions, where the orthogonal energy velocity is maximum crossing the propagation axis and zero at wave cycle peaks, and energy and force transform between velocity and acceleration in a plane orthogonal to propagation.

This agrees with de Broglie's e = hf equation if h defines the energy superposition state transform relation between Energy x Time and Force x Distance x Time, and energy quantity is proportional to its transformation rate since time is the parameter common to both states. In a quantum orbital the specific wave function reflects an electron's total energy but it also defines its spatial probability density distribution as a distance function (i.e. Schroedinger's time independent equation $d^2\Psi/dx^2 = -8 \cdot pi^2 \cdot m \cdot (E - U)/h^2$, where E is total and U is potential energy), and a spatial probability distribution distance function constitutes a periodicity or occurrence frequency in the hydrogen atom's radial coordinate represented by Ψ^*.

However an energy discrepancy occurs unless the probability density distribution is defined in terms of power, the time rate of energy transfer to and from a hydrogen atom's nuclear and ionization regions, because an electron of one orbital energy level is entering the spatial regions of higher energy orbitals and returning to its energy level's spatial region with a periodicity. This behavior is identical to that described in Feynman-Yukawa particle interactions, where a higher energy state is allowed within Heisenberg's $dE \cdot dt \geq h/4 \cdot pi$ constraint, and energy is conserved by the superposition state relation of h = Energy x Time = Force x Distance x Time.

This can be seen in a hydrogen atom's potential energy function determined by the coulomb force and distance between an electron and proton, where $U_e = -k_e e^2/r$. At a Bohr radius of 5.29×10^{-11} m, F = 8.245×10^{-8} N and $U_e = 4.36 \times 10^{-18}$ J = 2.72×10^{1} eV. Bohr analyzed that two degrees of freedom exist in addition to radius and an electron's motion in those dimensions generates a centripetal acceleration that balances the coulomb force to hold the electron in a stable orbit. So a kinetic and potential energy equilibrium occurs when forces are equal, $k_e e^2/r^2 = m_e v^2/r$, and since energy = force x distance, their energies equate as $k_e e^2/r = mv^2$, or $\frac{1}{2}mv^2 = \frac{1}{2}k_e e^2/r$. And since total energy is kinetic and potential, $E = KE + U_e = \frac{1}{2}m_e v2 - k_e e^2/r$ and $KE = \frac{1}{2}mv^2 = \frac{1}{2}k_e e^2/r$. So at equilibrium $E = -\frac{1}{2}k_e e^2/r = -2.185 \times 10^{-18}$J = -13.61 eV, matching the ionization energy and proving his logic.

Additional orbital energies, subject to a constraint of having integral angular momentum values, n, are determined by E/n^2 and at ionization $n = \infty$, $1/n^2 = 0$, and $U_e = O$. However at 1×10^{15} m from a proton's center, F = 2.3072×10^{2} N, E = 1.1536×10^{-13} J = 7.2×10^{5} eV, and at 0.92×10^{-15}m from a proton's center, F = 2.78×10^{2} N, and E = 1.2533×10^{-13} J = 0.78233 MeV, which is not allowed as a $-13.6/n^2$ eV stable orbital but is allowed by the probability density function, is allowed by Heisenberg's $dE \cdot dt \geq h/4 \cdot pi$ relation, and is equal to the difference between the mass of a neutron and a hydrogen atom.

This probability distribution reflects the average distance and energy and also allows an energy to time ratio which integrates to

the average energy over time, meaning that it is in the proximity of the nucleus (highest instantaneous energy) or ionized state for the least probable amount of time and at an average orbital vicinity and energy for the greatest portion of time. While its duration is short its transit rate through the nuclear region is high, yielding higher momentum, just as higher velocity orthogonal to a propagation axis constitutes an e = hf frequency to energy ratio which is a conjugate wave function Ψ^* that reflects the angular momentum information not included in a scalar E = KE $+U_e$ energy calculation.

This is a major discrepancy because it says energy can only be in $-13.6/n^2$ eV states and energy can go to other energy values for short periods of time. The quantum states are verified by spectral analysis and organic molecular structures that mirror the electron probability density distributions in bonding orbitals so the quantum mechanical interpretation is correct to that extent. But it would also violate Heisenberg's uncertainty principle to say energy cannot possess an average energy different from the $-13.6/n^2$ ratio. The principle states one can't simultaneously know momentum and position and disallowed energy states constitute knowing that information.

However this discrepancy only occurs in a classical E = KE + U_e energy interpretation excluding relativistic energy RE. If electrons can exist with any energy value for short periods of time then their state is a function of time and time is a relativistic variable. All higher energy quantum orbitals are time dependent states. The sun's gravitational field provides a background relativistic energy that dilates time and contracts space, which has the effect of moving a

hydrogen atom's -13.6 eV ground state electron radially closer to a neutron state. Kinetic energies are also high and not distributed uniformly, and since inertial energy is relativistic, a percentage of atoms with even greater relativistic energies would exist.

The sun to earth mass ratio is 3.33×10^5, with a proportionate spatial contraction, so neutron configuration conditions are greatly increased while still allowing $-13.6/n^2$ eV quantum excitation state behaviors which depend on angular momentum orthogonal to the axis of radial contraction that determines the electron-proton proximity. So incorporating relativistic energy into the quantum model can account for the 0.78233×10^6 eV neutron-hydrogen energy difference and such a configuration is supported 920 second neutron half-life decays to protons, electrons, and anti-neutrinos, with energy conserved in the particle momentums, and since gravitational field differences affect muon half-life decays, relativistic time dilation would similarly delay neutron quantum state decays back into protons and electrons.

The relativistic 0.78233 MeV neutron-hydrogen energy difference manifests in electron behavior as $m_{re} = RE + m_e = 0.78233 + 0.511$ MeV = 1.293 MeV = 2.531 M_e. By $m = m_o(1 - v^2/c^2)^{-1/2}$ velocity is, $v = c(1 - m_o^2/m_{re}^2)^{1/2} = 2.75 \times 10^8$ m/s, and wavelength is, $\lambda = h/mv = 6.626 \times 10^{-34}$ J·s / $2.531 m_e v = 1.0451 \times 10^{-12}$ m, or orbital diameter of 3.3267×10^{-13} m. With a relativistic spatial correction of 1/2.531 = 0.3951 the diameter is 1.3144×10^{-13} m, or 66 neutron diameters. And by Bohr's energy equation $E = k_e e^2/2r$, $r = k_e e^2/2E = 9.2 \times 10^{-16}$ m. So neither a totally relativistic or totally classical treatment of the

energy results in a correct neutron diameter calculation. However by incorporating relativistic energy into Bohr's concept the correct neutron diameter and its magneton may be obtained.

Bohr's $E = KE + U_e = -k_e e^2/2r$ energy relation included kinetic and potential energies but relativistic energy affects centripetal, coulomb, and magnetic energies, so $E = U_e + KE + U_B + RE = 0$. The Lorentz force, $F = qE + qvxB$, not just $F = qE$, defines the energies, orthogonal vector effects must he preserved, and all energies must be equal for stable neutron state to result. Under such conditions $U_e = KE = U_B = (0.782331\ MeV)/3 - 0.260777\ MeV = 4.17765x10^{-14}$ J. Because magnetic force is a cross product orthogonal to kinetic and coulomb forces, the $E = -k_e e^2/2r$ relation between them holds, so $r = k_e e^2/2E = 8.99x10^9 x(1.602x10^{-19})^2/2x4.17765x10^{-14} = 2.76136x10^{-15}$ m.

Incorporating the relativistic spatial contraction of $m_e/m_{re} = 1/2.531 = 0.3951$, yields a radius of $r = 0.3951 \times 2.76136x10^{-15}$ m = $1.091x10^{-15}$ m, or a $2.182x10^{-15}$ m neutron diameter. As mentioned, a detailed analysis of proton and neutron magnetons is given in "The Superposition States of Planck's Constant." Correct magneton values are obtained by showing an electron to proton density ratio relative permeability effect, divided by $3^{1/2}$ since the magneton is a single dimension resultant of three orthogonal energy oscillations, where u_p = [(proton volume / electron volume) / (m_p/m_e)] / $3^{1/2}$ = [8881.97 / 1836.153]/$3^{1/2}$ = 4.8373/$3^{1/2}$ = 2.7928, the discrepancy between a nuclear magneton, $U_n = 5.05x10^{-27}$J/T, and the measured proton value. For an electron radius of $0.5x10^{-16}$ m the proton radius is $1.0355x10^{-15}$ m.

A proton radius of 1.0355×10^{-15} m is only 5.55×10^{-17} m less than the calculated neutron radius of 1.091×10^{-15} m, an electron radius plus 11% difference, substantiating a relativistic quantum hydrogen structure. Both neutrons and hydrogen atoms are electrically neutral and a neutron magneton of $-1.1935\ u_n$ indicates a magnetic moment opposite spin angular momentum, as would result from the rotation of a negative charge. The electron orbital magneton at the surface of a proton would be identical to that of a negatively charged proton, with an equal and opposite value of $-4.8373/3^{1/2} = -2.7928$, and would exactly cancel the proton's +2.7928 magneton.

The electron spin magneton however is equivalent to the Bohr magneton, u_B, divided by the $1836.1527 m_e$ proton mass, times the 4.8373 electron to proton density ratio, divided by the electron's 2.531 increase in relative mass, or $u_N = -(4.837 / 2.531) \times (u_B / 1836.1527 m_e) = -1.9111\ u_n$. The error between this calculated and the actual measured value is $(1.9135 - 1.9111)/1.9135 = 0.1\%$, which is within physical measurement resolution errors. This quantum neutron model provides an explanation for a neutron's additional 0.78233 MeV by showing that it manifests in a hydrogen atom as a 4.85×10^4 radial and 1.143×10^{14} volumetric reduction, with neutral charge, and 191% increased magnetic moment, by equalized distribution of relativistic energy between the atom's kinetic, coulomb, and magnetic forces. However, proof of such a neutron model's correctness would he incomplete without also correctly explaining alpha and beta halflife decay in terms of the neutron model and its nuclear configuration.

A complete model must explain both structure and behavior, including neutron 920 s half-life decay, magic number configuration stability, and configuration dependent beta and alpha halflife decay constants. Since alpha particles are stable as decay products or helium nuclei their stability is a starting point in examining neutron behavior.

Alpha particles have a high binding energy per nucleon, 7.073 MeV, meaning that 28.294 MeV (2 x [m_p + m_n] - m_a = .030375 amu, 5.043948x10^{-29} kg, 4.5327x10^{-12} J, or 0.75% of particle mass) must be added to alpha particles to transform them back into protons and neutrons. It means that protons and neutrons exist in sub rest-mass states in alpha particle configurations, or energy wells, where four quantum particle structures combine to form a lower quantum energy state. Just as electrons occupy higher energy quantum orbitals and emit specific orbital energy quanta to attain their ground state, the particles in alpha nuclei must absorb a specific energy quantum in order to attain their ground state as individual particles.

The bound nucleon state behaves like a quantum subenergy state, not a force, in that it requires a precise energy quantity to change states, it requires a precise distance of 1.4x10^{-15} m, or $2^{1/2}$ times the 1x10^{-15} m nucleon radius, and it behaves like a "coupling" that resists compression or separation until threshold energy is attained instead of continuously diminishing by $1/r^2$. Its binding force is strong enough to overcome a 230 N coulomb repulsion force, and it has no magnetic moment, although its components, deuterium (0.8574), protons (2.7928), and neutrons (-1.9135) do have magnetic moments.

It's important to recognize that alpha particle nucleon binding is not just a 7 MeV force, the 28 MeV formation energy divided by 4. Alpha particles have only two possible single particle decay paths, tritium or helium-3, which have 3.17 MeV and 2.5 MeV nucleon binding energies respectively. And deuterium has a 1.1 MeV binding energy, so only 4.17 MeV or 3.7 MeV would be required to transmute an alpha particle back to hydrogen, or 16.7 MeV and 14.8 MeV respectively for four hydrogens. Since this is less than the 28 MeV mass difference between an alpha particle and its constituent hydrogens it means the energy difference results from the configuration, not the nucleon bonding energies, and the entire structure is a quantum energy state with a 28 MeV energy barrier to state change.

In benzene and certain other conjugated, alternating double and single carbon bonds in organic molecules the bonding electrons in double bonds attain a lower energy state by delocalizing from their contributing carbon atoms and resonating between all the carbons. In other words the structures attain a lower energy state by sharing the double bonds equally between all the atoms of the structure. In this configuration a more stable compound results since a threshold quantum energy is required to break the structure down to individual higher energy components, similar to the quantum threshold energy barrier in the dual proton-neutron configuration of alpha particles.

This concept is significant if neutrons consist of protons and electrons, and if electron delocalization resonance between protons results in proton:electron:proton neutron-proton bonding structures.

The concept is substantiated by the fact that neutron's have 0.78233 MeV greater mass than the proton and electron they decay to, while deuterium is stable with 2.22 MeV less mass than its proton-neutron constituents and 1.44 MeV less than the two protons and electron that compose a proton and neutron. A neutron's electron-proton pair has higher energy and is unstable and two protons and an electron in a deuterium nucleus have less energy and are stable.

This would imply that the constituents of a deuterium nucleus are no longer a proton and neutron, since by empirical definition 2.22 MeV must be added before they attain their correct masses. This is further substantiated by the fact that the sum of their magnetic moments (+2.7928 and is −1.9135) is 0.8793, which is 2.5% greater than the 0.8574 magnetic moment of a deuterium nucleus. It was previously shown that the correct magnetic moments of a proton and neutron can be calculated by taking into account their mass and energy density. Proton and electron energy density differences result in a relative permeability difference that gives the proton's magnetic moment a value 2.7928 times greater than a value based solely on its mass.

The density difference results from a proton volume 8882 times larger than an electron's with only 1836 times its mass. The density effect was arrived at by reasoning that protons and electrons have 1.602×10^{-19} C charge gradients from their center and protons with greater energy occupy larger volumes so their coulomb binding force would span a greater radial distance and hold the energy less densely. Deuterium's 0.118% less mass would similarly affect its magneton and

incorporation of the 0.118% mass reduction into the neutron magneton calculation (i.e. 4.8373 electron to proton density ratio / relative 2.531 electron mass x (1 - 0.00118 =) 0.99882 nuclear magneton mass reduction) does yield the exact measured magneton value of -1.9135.

Deviation between the calculated –1.9111 and measured -1.9135 values is expected since a neutron, with 0 charge, requires a bound charged proton for acceleration through measurement apparatus and a bound proton results in the mass loss. The O.9988 mass loss factored into the denominator reflects the proton mass loss in the nuclear magneton, $u_n = e \cdot h/4 \cdot pi \cdot m_p$. The 2.531 relative electron mass factor remains unchanged since the electron mass and added 0.78233 MeV are equally affected. The 4.8373 numerator density ratio is also unchanged since the effect to the electron and proton masses cancel.

In the proton magneton calculation there is no electron so the density ratio is affected. A 0.9988 proton mass loss reduces volume by 0.9988 and radius by $(0.9988)^{1/3} = 1.0004003$, increasing coulomb force, further reducing volume $1/r^2 = (0.9988)^{-2/3} = 1/1.0008008 = 0.999199839$, and the proton to electron volume ratio to 8874.86. Since proton mass is reduced by 0.9988 the density ratio is 4.8392, yielding a 2.7939 magneton. However, the nuclear magneton's proton mass is reduced by 0.9988 so the actual magneton is 2.7973, a 0.16% increase. These proton and neutron magneton values yield 0.8838, 3% greater than deuterium's 0.8574 value, and substantiates that its magneton can't result from simple proton-neutron mass loss and that a more complex proton-electron-proton resonance structure exists.

Correcting the calculated -1.9111 neutron magneton value to the exact -1.9135 value by incorporating the 0.118% mass loss strongly supports a proton-electron quantum neutron structure, and not being able to calculate deuterium's magneton in terms of a proton-neutron structure with 0.118% mass loss supports a proton:electron:proton (pep) structure with delocalized electron resonance as deuterium's actual structure. Since an electron would be equally attracted to both protons, and position and momentum cannot be absolutely known, it can't be assigned to either proton. And as with benzene and other conjugated carbon compounds, a significantly lower and more stable energy state is achieved by electron resonance delocalization.

In benzene a 6 carbon ring structure shares 3 electrons from 3 conjugated double bonds in delocalized resonance and attains a 151 kilo-Joule/mole resonance stabilization energy, meaning that much must be added to destabilize the structure. The following table of conjugated compounds illustrates the resonance stabilization effect:

Compound	Structure	Resonance Stabilization Energy
2-butene	C-C=C-C	4.2 kJ/mol (4.2/bond)
1,3-butadiene	C=C-C=C	8.5 kJ/mol (4.25/bond)
1,3-pentadiene	C=C-C=C-C	11.5 kJ/mol(5.75/bond)
1,4-pentadiene	C=C-C-C=C	4.8 kJ/mol (2.4/bond)
1,3,5-hexatriene	C=C-C=C-C=C	18 kJ/mol (6/bond)
benzene	┌C=C-C=C-C=C┐ ring :. . . . . .:	151 kJ/mol (50.3/bond)

The alternating double-single bond sequence significantly impacts degree of stabilization, as shown by the difference in stabilization between conjugated 1,3-pentadiene and non-conjugated 1,4-pentadiene. Benzene with all 6 carbons in a conjugated ring formation permits maximum delocalization resonance to occur equally between all atoms and has by far the greatest stabilization energy.

From the table it can be seen that the difference between the benzene stabilization energy (151 kJ/mol, 50/bond) is significantly greater (8.39 times) than its closest associated compound, 1,3,5--hexatriene, differing only by the fact that its terminal carbons are not bonded to yield a benzene ring structure. This slight structural difference has such an extraordinary stabilization effect because it opens up a degree of freedom to electron delocalization and allows a resonant equilibrium state which includes an additional dimension. A parallel to this is the electron stabilization energy difference between quantum orbitals. In s-orbitals the distribution probability is uniform in all dimensions and is a more stable lower energy state than p-orbitals with orthogonal single dimension lobe distributions.

Detailed treatment of single vs. relativistic energy storage is presented in "The Superposition States of Planck's Constant," pp. 5-7. Simply put, inertial energy contracts space by $1 = 1_0(1 - v^2/c^2)^{1/2}$ and $(1 - v^2/c^2)^{1/2} = E_0/E$, the ratio of energies, so $1 = 1_0E_0/E$. This means that the degree of spatial contraction depends on the energy in a dimension and if a quantity of energy is divided between n-dimensions, spatial contraction will be similarly divided. Since energy presence causes an opposing spatial gradient equilibrium occurs when energy distributes equally between available dimensions. Maximum energy storage with minimum spatial distortion, the most stable state, occurs when energy oscillates according to $E_n = h \cdot f$ since time is also an energy storage dimension and forms a temporal gradient. This resonant energy equilibrium state occurs when all forces, or boundary conditions of each dimension are equal.

Since energy equals force times distance, resonance is observed when the oscillation wavelength equals the distance between boundary conditions. In a proton:electron:proton deuterium model this would require that a 2.224 MeV nuclear binding force and 0.8574 magneton result from electron delocalization resonance and the coulomb forces resulting when its protons are approximately 0.4 fm apart. Atoms are electrically neutral because of the nucleus-electron electric field localization. A neutron, as a quantum hydrogen state, would also be neutral with an s-type electron orbital. Just as an atom's electrons magnetically bond with electrons of opposite spin from other atoms, and those bonds are affected by electric dipoles of other molecules, a neutron's electron would become delocalized by another proton.

When the orbital electrons of individual atoms combine to form molecular orbitals they have a high probability of being located in the region between the nuclei. In a pep structure an electron would also be expected to occupy the region between the protons by virtue of the protons' charges. In this case the configuration could range from a minimum possible 0.4 fm proton-proton separation and maximum possible 0.4 fm proton-neutron separation, based on reasoning that a proton-proton repulsion force and proton-electron attraction force would result in a slight oblation of the protons so as to allow for maximum proton separation with minimum electron separation.
The centers of mass for the protons would be their geometric centers so deuterium's structure would e+fective1y range from center to center, or a distance of $d_{pn} = r_p + r_n + 0.4$ fm $= 1.0355 \times 10^{-15}$m +

$1.091x10^{-15}$ m + $0.4x10^{-15}$ m = $2.5265x10^{-15}$ m. Charge centers, however, being more strongly attracted to the closer proximity electron would have a separation of $d_{pep} = 2r_p$ + 0.4 fm = 2(1.0355x10^{-15} m) + 0.4 fm = $2.471x10^{-15}$ m. Similarly, the average electron resonance position between two protons would be at the center of the 0.4 fm separation, or proton-electron distance of $d_{pe} = r_p$ + 0.2 fm = 1.2355x^{-15} m.

Since a neutron is neutral, with the proton's positive charge completely shadowed by the electron's negative charge, it would be reasonable to expect that the proton charges would be half shadowed from each other by an electron resonating between them. From this reasoning an average proton repulsion force of $F_{pp} = k_e(½\ e)^2/(d_{pep})^2$ = $8.99x10^9$ N·m^2/C^2 x (½ x $1.602x10^{-19}$ C)^2 / ($2.471x10^{-15}$ m)^2 = 9.44668 N is calculated. No shadowing occurs between an electron and proton so the average attraction is $F_{pe} = k_e e^2/(d_{pe})^2$ = $8.99x10^9$ N·m^2/C^2 x ($1.602x10^{-19}$ C)^2 / ($1.2355x10^{-15}$ m)^2 = 151.14689 N. This results in a net binding force of $F_b = F_{pe} - F_{pp}$ = 141.7 N.

This binding force occurs between a proton and electron but its effect applies to the entire deuterium structure with an effective distance of d_{pn} = $2.5265x10^{-15}$ m. Since energy equals force times distance the nuclear binding energy for deuterium is given by F_b x d_{pn} =141.7 N x $2.5265x10^{-15}$ m = $3.580x10^{-13}$ J / $1.602x10^{-19}$ J /eV = 2.23474 MeV. The deviation between this calculated and the actual 2.224 MeV binding force is (2.23474 - 2.224) / 2.224 = 0.01074/2.224 = 0.004829 = 0.483% error, and shows a simple relation between the coulomb forces and the resultant deuterium nuclear binding energy.

It might be argued that the proton-electron binding force must be doubled since both protons attract the electron with equal force, as would occur under static conditions. However, under relativistic resonance conditions inertial motion contracts anterior and dilates posterior space so the anterior coulomb attraction geometrically increases as proton-electron distance decreases from the electron's motion and spatial contraction, while geometrically decreasing in its posterior region. The calculated binding force is an averaged ratio of the effects, like average power, between the electron and a proton for ½ of each cycle but manifests as the calculated binding energy between the electron and both protons over the entire cycle.

The resonance binding effect reflects deuterium's mass loss and can be understood by an analogy of two dams connect by a pipe. The dams represent the binding effect of each particle's radial zero to $+1.602 \times 10^{-19}$ C charge gradient on the energy they constrain as mass by $E=mc^2 = E^2 / B^2$. A better analogy would be two tsunamis in which liquid water (energy) contains its own dynamic forces that constrain it into the solid form of a tsunami with the effect of inertial mass but it's easier to visualize the dams with a pipe for the purposes of understanding the resonance force effect. The first thing to happen is equalization of the static water levels (mass) behind the dams.

This is equivalent to releasing a boundary constraint on the relativistic energy contained in the neutron's electron because the pipe represents a transform channel for the neutron's static mass into a dynamic (electromagnetic) form that can transfer from one dam

to the other. Particles constrained by an energy barrier may tunnel through it by $T = e^{-2KL}$, where T is the transmission coefficient, L is the barrier width, $K = (2m \cdot U-E))^{1/2}/2 \cdot pi \cdot h$, U is barrier height, and m and E are the particle mass and energy, since all regions are accessible by quantum theory. The barrier penetration equation only applies for small transmission coefficients since energy constrained by a particle's forces must transform to and from a barrier's forces at its boundaries and does so by an e^x transfer function containing all x^n degrees of energy freedom integrated by n! energy windows.

What this means is that a particle's kinetic or mass energy may transform through its coulomb or magnetic forces to electromagnetic forces in a barrier and back into particle kinetic and mass energy, although they are attenuated by losses dependent on barrier width L or relativistically increased if the energy base outside the barrier is lower than the inside base. This applies to small transmission coefficients because particle transfer is an energy transfer which must he small enough so as to only modulate a barrier's forces and not saturate them. And it means that a neutron's electron may tunnel through the relativistic energy barrier constraining it to a neutron quantum state and that a proton's mass energy may tunnel through the coulomb force gradient containing it.

Since a free electron is a lower energy state than a neutron's bound electron, the energy base outside a neutron is lower and it will decay. And since the delocalized resonant electron is a nuclear binding force energy well, the mass energy of a proton will transfer

through its coulomb force gradient to a lower deuterium energy state with an associated mass loss. As in Planck's resonators, oscillating charges, the delocalized electron resonance is a quantum state that requires addition of 2.224 MeV (minus the neutron's +0.78233 MeV) just to restore the protons to their rest mass. Returning to the analogy of the dams connected by a pipe will serve to exemplify.

As mentioned, the first effect would be to equalize the static water levels, specifically the neutron electron's 0.78233 MeV higher energy state. The second proton's charge creates an electric field dipole that provides a lower potential energy state for the electron and accelerates its decay just as the pressure difference from the second dam's lower level would accelerate water from the first dam. The delocalization force created by the second proton at 0.4 fm is $F_d = k_e(1.602x10^{-19})^2/(0.4x10^{-15})^2 = 1442$ N. The negative energy field created by this force at 0.4 fm is $-E = -F_d \cdot d_{pp} = -1442$ N x $0.4x10^{-15}$ m = $-5.768x10^{-13}$ J / $1.602x10^{-19}$ J/eV = −3.6 MeV, which is 4.6 times lower than the neutron electron's 0.78233 MeV energy level and 1.376 MeV below deuterium's 2.224 MeV negative energy state.

Deuterium's (1875.613 MeV) 0.118% less mass than a proton and Neutron (1877.837 MeV) results from loss of the neutron electron's 0.78233 MeV and 1.44167 MeV/2 = 0.7208 MeV from each proton but the potential energy from a −3.6 MeV field is 1.376/2 = 0.688 MeV below the 0.7208 MeV each proton must lose to form the deuterium state so the −3.6 MeV field provides a significant negative potential energy for both neutron electron delocalization and loss of proton mass.

This equates to two dams (one 0.78233 MeV greater) connected by a pipe that falls significantly lower (-3.6 MeV) in a U shape midway between the dams. Under these conditions water from the higher level dam reaches the midpoint sooner with a greater momentum and proceeds up the pipe to the second dam, impacting its water. The vector sum resultant of the two momentums will force water back into the second dam with a momentum that causes an overshoot, raising its level over the lowered equilibrium level (due to pipe volume) of the dams. The process then reverses and continues to oscillate, excluding losses.

Neutron's are unstable equilibrium states that decay as long as the equilibrium energy of their electrons, $E = U_e + KE + U_B + RE = 0$ or $U_e + KE + U_B = -RE = 0.78233$ MeV, can transfer through their boundary conditions in a way that unbalances the equilibrium of the electron's coulomb kinetic or magnetic forces. This three force equilibrium is an elevated energy well (+0.78233 MeV) resulting from three O.78233 MeV/3 = 0.260777 MeV dynamic forces that affect space and time orthogonally (i.e. Right Hand Rule) so as to maintain the electron's quantum neutron state.

Energy may transfer to or from a neutron through energy windows in the forces (i.e. alignment in space-time with other forces) and equilibrium is maintained as long as energy transfer occurs slowly enough to equalize between the forces and doesn't exceed the energy well capacity. This is exemplified by Land’s polarization effect of aligned long-chain hydrocarbons doped with iodine. Photons transfer their energy to “free” electrons in the iodine when their E-fields

align with electron motion degree of freedom along the chains but not when E-fields are orthogonal. It is also exemplified in wave superpositioning and in "red shift" when photon energy is lost to an orthogonal gravitational field at the E and B-field peaks when their time flow rate is the same as the gravitational fields, as described in The Superposition States of Planck's Constant, pg. 19 and fn. 16.

A 3.6 MeV electric field from a proton radially aligned at 0.4 fm from a neutron electron exceeds its 0.260777 MeV coulomb force and added 0.78233 MeV relativistic energy. This energy difference would be expected to destabilize the neutron electron but since the energy well is a relativistic state a more complex energy transfer occurs. The neutron state was calculated by showing that the coulomb and centripetal electron forces equalize at 2.76136×10^{15} m. When the O.3951 relativistic energy effect was incorporated it yielded a 1.091 fm neutron radius from the perspective of an independent observer, while the local observer's radius remains 2.76136 fm.

Since the 0.3951 relativistic energy effect originates from the electron's energy it affects both space between it, its neutron proton, and its surrounding space. So bonding occurs at 0.4 fm from a neutron from an independent observer's perspective, but to a local observer in Euclidean space bonding would occur at 0.4/0.3951 fm = 1.0124 fm from the electron's 2.76136 fm radius, at 3.77376 fm. Subtracting the 1.091×10^{-15} m neutron radius yields a 2.683×10^{-15} m separation, exactly the initial interaction distance occurring in a neutron-proton system's potential energy versus separation plot.

This means that to a local observer in Euclidean space at the neutron's center, the outside radius of its proton is 1.0355 fm, the average radius of its electron in an s-type orbital is 2.761 fm, due to its electromagnetic and kinetic energies, and it bonds with a 2nd proton at 3.774 fm, or a 2.7 fm separation distance from its outside radius. To a local observer bonding occurs 1 fm from its electron, which doesn't make sense to the observer since 1 fm is less than the 1.75 fm distance between its proton surface and the electron. And to independent observers bonding occurs at 0.4 fm from the neutron with no apparent reason for any interaction at 2.68 fm unless relativity is incorporated with the second proton as part of the local system.

From the neutron's Euclidean perspective its electron is 2.7 fm from its center and a bonded proton is 1.7 fm from its center, but from the neutron's 0.3951 relativistically corrected perspective its electron is about 0.3951 x 2.7 = 1 fm and its bonded proton is about 0.3951 x 3.7 = 1.4 fm. However, as the unbonded proton approaches the neutron it does not experience the relativistic correction of the electron's energy because it is becoming part of a local system from an independent observer's system. Because of this it will bond 3.7 fm from the neutron's center by what it sees from the neutron's Euclidean space. No relativistic effect occurs to the proton until entering the local relativistic region so an independent observer only sees the start of an interaction at 2.7 fm. However, upon bonding from the local space's perspective the proton is part of the local relativistic system which the independent observer sees as 0.4 fm. This results in a quantum relativistically latched state.

To understand how this constitutes a relativistic energy well it must be realized that given two identical systems with different velocities, the one with the greater velocity and contracted space has the greater energy. However, as Einstein pointed out, it's not possib1e for either systems to absolutely define which has greater velocity since each measures the other's in terms of its own relative position. To each system the other appears to be a higher velocity higher energy system with contracted space and equalization requires transfer of energy from it. Conversely, energy must be added to it to restore it to its original state and deuterium is the equilibrium state of a proton and neutron with our relative system.

From our perspective deuterium appears to be a neutron of 1.091 fm radius bonded by a "nuclear" force with a 0.4 fm separation from a 1.0355 fm radius proton, but from the neutron's perspective it's a proton in equilibrium with an electron at a 2.76136 fm coulomb force radius and another proton at a coulomb force distance of 1.0124 fm. Looking through these coulomb bonds into our domain it sees other states of itself as neutrons with 1.091 fm radius electrons and a proton 0.4 fm away so to deuterium's coulomb force world we are the higher energy contracted domain, meaning that energy must come from us to restore it to the state of hydrogen atom and a "free" proton or contract it by 0.3951 to form deuterium (i.e. an energy well).

The relativistic energy well concept is verified by calculation of deuterium's energies from both perspectives. If proton separation from a neutron's electron is 1.0124 fm its coulomb force energy is

$E = K_e e^2/1.0124$ fm = 2.279×10^{-13} J / 1.602×10^{-19} J/eV = 1.42256 MeV, or a total 3.64656 MeV when deuterium's 2.224 MeV (0.118%) mass loss is added. The energy difference between this neutron perspective and an independent observer's $E = K_e e^2/0.4$ fm/1.602×10^{19} J/eV = 3.6 MeV 0.4 fm nuclear bond perspective is 3.646 - 3.6 = 0.046 MeV/3.6 MeV = 1.28%, and if the neutron electron's 0.78233 MeV 0.3951 relativistic correction factor is used, instead of 0.4 fm, a 1 fm 1.44 MeV proton separation energy results from the neutron's perspective, or a total of 2.224 + 1.44 = 3.664 MeV, while an independent observer would see deuterium with a 0.3951 fm proton-electron separation and $E = k_e e^2/$ 0.3951 fm = 3.646 MeV , or only a 3.664-3.646/3.646 = 0.5% deviation.

This shows a definitive correlation between deuterium's 2.224 MeV nuclear binding force and it's particle's coulomb forces when the 0.3951 relativistic correction factor is incorporated. It is correct to use 0.3951 fm, instead of 0.3951 fm + the proton radius, for the calculations since a proton has a surface charge so any energy field calculation for distances less than its radius must be made to its surface. The 0.5% discrepancy results from parameter resolution errors and distance variations caused by the electron's resonance.

A neutron (a proton with a +0.78233 MeV electron) bonds with a proton to form a −2.224 MeV nuclear bond, and since an electron must maintain 0.78233 MeV to attain a neutron state with either proton, and deuterium's equilibrium state is −2.224 MeV below the reference based of 0 MeV, an electron's resonance energy may only reach 0.78233 MeV below 0 MeV, or 0.78233 − 2.224 − 1.44167 MeV above −2.224 MeV.

Subtracting this 1.441667 value from -2.224 MeV yields -3.66567 MeV, only 0.05% more than the calculated -3.664 MeV field. This means an electron resonates from a neutron state with one proton to the same state with the other proton by falling through a -3.66567 MeV field created by the 2nd proton's 1 fm proximity to the neutron's electron in a 2.75 fm coulomb force orbital, but relativistically observed as a 2.224 MeV energy 0.3951 fm separating cou1omb force nuclear bond.

In actuality the electron maintains its 0.78233 MeV energy by resonating +/-1.44167 MeV spatially about the −2.224 MeV equilibrium point midway between the protons, from -0.78233 MeV at one proton, passing through -2.224 MeV, and then rising to −0.78233 MeV at the other proton, like a pendulum, but is accelerates from each neutron state by a -3.66567 MeV field from the opposing proton’s proximity. Furthermore, a sub- resonance would occur as a result of the 1836.153 m_p to m_e mass ratio, since a 1/1836 = 0.0545% position deviation would occur to the proton in a coulomb oscillation, increasing the 3.654 MeV field calculation, accordingly, leaving only a 0.009% discrepancy from the -3.66567 MeV value required for equilibrium at -2.224 MeV, since (3.654 x 1.0005446 = 3.665996) − 3.66567 / 3.66567 = 0.0089%.

Physically this manifests as the electron being pulled from its higher energy neutron state, resulting in an energy density decrease to the space occupied by the neutron. Just as withdrawing a piston from an “ideal" gas cylinder results in a temperature drop, or water falling through a pipe creates a Bernoulli principle venturi vacuum, evacuation of an electron from a neutron will extract energy. Since

a proton is mass energy constrained by a coulomb gradient boundary condition its mass energy may tunnel through charge domain e^x energy windows. Evacuation of an electron will vacuum sufficient energy to attain equilibrium of all forces, -2.224 MeV or 0.118% in this case.

So the circumstances of physical proximity of two particles are statically creating a coulomb force arrangement that extracts enough energy to stabilize the configuration in a dynamic equilibrium state that appears to independent observers through a 0.3951 relativistic window as a 0.395 fm 2.224 MeV quantum nuclear bond. However it does not explain deuterium's 0.8574 magneton, tritium's 8.492 MeV nuclear bond, 2.9789 magneton, alpha particles' 28.297 MeV bond with no magneton, alpha and beta decay, or the half-life time decay factors in radioactive decay, so we are really only just getting started.

Since inertial objects create bipolar spatial gradients (The Superposition States of Planck's Constant, p. 15), and an electron has zero resonance translational velocity at its neutron state but maximum velocity at the –2.224 MeV midpoint, a resonant electron's posterior repulsion gradient will be zero at the neutron and maximum at –2.224 MeV. An electron attaining 1.44167 MeV of kinetic energy, (0.511 + 1.44167 = 1.95267 MeV)/0.511 MeV = 3.82128 time its rest mass, will achieve a 1/3.82128 = 0.26169 anterior contraction and 3.82128 posterior dilation. Although total net spatial distortion is 0.26169 x 3.82128 = 1 the posterior dilation has the effect of opposing mass energy flow from the proton and stabilizing its mass loss at 0.118%.

Mass loss is limited to 0.118% (0.78233 + 1.441667 = 2.224 MeV) because, although subject to a -3.66567 MeV field, the -1.44167 MeV gained on reaching 2.224 MeV transforms into the exact relativistic posterior dilation repulsion field necessary to oppose further mass loss from the proton that would result from the -1.44167 MeV gained between -2.224 MeV and -3.66567 MeV. Furthermore, in addition to limiting mass loss to 0.118% (2.224 MeV), the relativistic effect of the 1.44167 MeV also explains a 2.55% discrepancy between the vector sum of the proton and neutron magnetons and deuterium's 0.8574 value (i.e. 2.7928 – 1.9135 = 0.8793 – 0.8574 = 0.0219 / 0.8574 = 0.025542337).

As pointed out, the neutron electron's non-relativistic orbital radius is 2.76136 fm and 1.091 fm when relativistically adjusted by 0.3951 from the neutron's added 0.78233 MeV mass. And a 2nd proton 1 fm from the neutron's electron creates the 3.66567 MeV field that results in the +/- 1.44167 Mev electron resonance oscillation about deuterium's –2.224 MeV equilibrium state. The electron resonance is limited by neutron state boundary conditions, oscillating between a 2.76 fm radius from one proton's center and 1 fm separation from the other proton's surface and a 1 fm separation from the first proton's surface and a 2.76 fm radius from the other proton's center.

Since a proton radius is 1.0355 fm there is a non-relativistic separation of 2.76136 - 1.0355 = 1.72586 fm between a proton and its electron in a neutron state. And since a proton-electron separation is 1 fm in its non-neutron state there is a 1.72586 - 1 = 0.72586 fm resonance window, +/- 0.72586/2 = +/- 0.36293 fm, +/- 1.44167 MeV,

about the -2.224 MeV equilibrium midpoint. Since 1.44167 MeV causes a 0.510999 / (0.510999 + 1.444167) = 0.26169 relativistic correction, the relativistic oscillation is 0.26169 x 0.36293 fm = +/- 0.094976 fm peak-to-peak with a sine-wave average contraction of ($2^{-1/2}$ = 0.70710678) x 0.094976 fm = 0.067158 fm.

Since this relativistic contraction occurs within the neutron's 0.78233 MeV 0.3951 contraction, like the moon's gravitational field occurring within the earth's, or the earth's within the sun's, the neutron electron's 2.76136 fm radius reduces by 0.067158 fm to yield 2.694202 fm and is then adjusted by 0.3951 to yield 1.064479 fm. As shown in the Bohr analysis, where relativistic energy increased the coulomb, kinetic and magnetic energies, this 1.064479 fm /1.091 fm = 0.97569 relative energy factor would similarly affect all 3 energy forms except that it results from a +/- 0.094976 fm peak-to-peak oscillation on the pep structure's axis, negating any net affect to the coulomb and kinetic energies since they occur on the same axis.

However the added relative energy would manifest as magnetic energy since its domain is orthogonal to the pep axis and a moving charge manifests as an orthogonal magnetic field. It would also manifest as a magnetic field opposite to the vector sum resultant of the proton and neutron magnetons since it requires greater energy to increase magnetic flux and less energy to reduce it (i .e. Lenz's Law). This means the magnetic moment of deuterium is calculated by (2.7928 - 1.9135) x 0.97569 = 0.8579 with a (0.8579 - 0.8574 = 0.0005242) /0.8574 = 0.0006114 = 0.061% error.

While this error seems significant it must be remembered that the 1/1836 = 0.0005446 = 0.054% electron-proton mass ratio results in a sub-resonance oscillation that increases relative velocity and the 0.97569 relative correction factor by (1 - 0.0005446 = 0.999455) x 0.97569 = 0.9751586 which adjusts the 0.8793 resultant to 0.857457 with a 0.857457 - 0.8574 = 0.00005699 deviation and 0.0057% error, and is sufficiently accurate to proceed to an analysis of tritium.

Actually a comparative analysis of tritium, He-3, and He-4 best demonstrates the effect of structure on nuclear binding energy. It's been shown that in deuterium pep resonance structures coulomb forces result in a 2.224 MeV 0.3951 fm quantum nuclear bond, with 2.76 fm initial interaction and 0.8574 magneton, from independent observer's perspectives, if the relativisitic effects are incorporated into the local domain calculations of a neutron as a quantum hydrogen state. It can now be demonstrated that the same principles describe the binding forces of tritium, He-3, and He-4 in terms of coulomb forces resulting from the geometric arrangement of their particles.

The nuclear binding energy equation for tritium, He-3, and He-4 is $3^{1/d}(p \cdot 2.224)^{n}$, where 3 and d are the available and structural dimensions (d = 2 for planar tritium or He-3, 3 for volumetric He-4), p and n are protons and neutrons, and 2.224 is pep resonance binding energy. This equation yields an 8.567 MeV binding energy for tritium (1% greater than its 8.482 MeV), 7.704 MeV for He-3 (0.184% less than its 7.718 MeV), and 28.534 MeV for He-4 (0.84% greater than its 28.297 MeV), and if 2.21294, 2.2281, and 2.21472 MeV are substituted,

respectively, into the pep resonant binding energies for tritium, He-3, and He-4, their exact empirical binding energies are obtained.

The general equation was derived by reasoning that the elements of e^x describe a recursive pattern of the most stable configurations of matter and would therefore describe a recursive nuclei structural pattern up to the Helion-Triton and Shell model descriptions of the heavier nuclei. This means the first four elements, $1 + x + x^2/2! + x^3/3!$, geometrically define a point, line, triangle, and tetrahedron so a neutron's 0.78233 MeV binding energy should exhibit radially to form a point or particle structure, deuterium's binding energy would exhibit in 1 dimension as a line or pep structure, tritium or He-3's would exhibit as a $3^{1/2}$ resultant from a planar triangle's edges and, He-4's would exhibit as a $3^{1/3}$ resultant of a tetrahedron's edges.

Since the resultants depend on the pep structures present their magnitude may be defined in terms of the number of protons, neutrons and 2.224 MeV binding forces, adjusted for relativistic and coulomb force geometric variations. Pep bonds terminate on protons but they may form more than one bond (just as 1 electron bonds with 2 protons during resonance) so one determinant of a resultant's magnitude must be the product of the number of protons and 2.224 MeV. Furthermore, in relativistic systems forces are geometric products of the sources (not classical vector sums) so if pep bonds source from neutrons the magnitude also depends on the exponent of the number of neutrons, or Binding Energy = $f[(\text{sinks x bond energy})^{\text{sources}}] = 3^{1/d}(p \cdot 2.224)^n$, which is accurate to within 1% before including geometric variations.

Tritium's 2 neutrons and proton form a 2-electron 3-proton pep bond and He-3's neutron and 2 protons form a 1-electron 3-proton pep bond. It's expected that tritium's 2 electrons exert greater coulomb attraction on its protons than He-3's single electron, which is born out by tritium's 8.482047 versus He-3's 7.718356 MeV bonding energy, but this reasoning fails on considering that He-4 forms a 2-electron 4-proton 28.29683 MeV pep bond 300+% greater than tritium's and that every added nucleon above the neutron's 0.78233 MeV electron, from deuterium's 2.224 MeV to tritium's or He-3's 8 MeV to He-4's 28 MeV, follows a pattern of 300+% bond energy increase per added nucleon.

This is analogous to adding dams to the previous 2 dam U-pipe example, expecting the drop in water levels due to pipe volume to become less since there are more dams to fill the pipe, but seeing the levels drop by 300% of the pipe's volume for each added dam and another 300% for each dam that started with more water. It defies classical reasoning unless pipe volume stretches 300% for each added dam, plus plenums for each dam with more water to increase each 300% by 300%. Although complex, such an elastic structure is feasible and would explain the observed effects in terms of accepted principles.

Such a perspective parallels nuclear bonding if dams represent nucleons, each pipe a degree of freedom stretching a relativistic window between ours and the nuclei's relative system energies, with plenums as resonance secondary relativistic effects, and it permits resolution of the general equation's 1% discrepancy and explains the magnetons by known relativistic and electromagnetic principles.

Tritium and He-3 form planar equilateral triangles with protons at vertices A, B, and C (Fig. A). Different electron orbital paths were examined and it was found that a clover leaf orbital (Fig. B), with an electron traversing a neutron state 2.76136 fm radius from a proton center through the triangle, completing a deuterium 2.224 MeV relativistic pep bonding transition on the triangle's edge (Fig. C), thus transforming to a 2.76136 fm neutron state with a second proton and 1 fm gap from the first proton, and then traversing the triangle at a neutron state 2.76136 fm radius to repeat the process, provides the correct bond energy and magneton values to within a 0.1% error.

In tritium two neutron electrons must traverse the same clover leaf orbital but the electrons may have aligned or opposing magnetic moments (as in Pauli's Exclusion Principle). They may simultaneously occupy the same neutron radius for one proton, possibly appearing as two neutrons, or they might occupy different protons' neutron radii. They could also pass through transition regions on different axes of of the triangle simultaneously or they could be out of phase, either passing through the same transition region sequentially or different regions out of phase with 1 electron in transition and 1 in neutron phase. Two electrons offer a permutation of possible configurations.

Since He-3 has a single electron and follows the same path it will be analyzed first. In a 0.78233 MeV neutron state with proton A the electron is 2.76136 fm from its center (1.091 fm for independent observers by the 0.3951 relativistic energy correction factor) with a 1 fm gap (0.3951 fm for independent observers) from the surface of

proton B. As it traverses to within 1 fm of proton C's surface 2.224 MeV in mass energy transfers from C to the A-C pep transition bond, as described for deuterium. Additional energy results from coulomb attraction to proton B, $r_p + a + c = 1.0355 + 1.384732 + 2.769468 = 4.154200$ fm from the electron at its A-C pep equilibrium point, but the energy calculation must be made to its 2.76136 fm neutron radius since the electron is in sub-relativistic transition at equilibrium.

Proton B's distance from the electron at its neutron radius is offset from the equilibrium point by 0.36293 fm so the resultant is $R = (4.154200^2 + 0.36293^2)^{1/2} = 4.1700$ fm. The force from proton B is $F_B = k_e e^2/4.1700\ fm^2 = 13.268069$ N, the force from proton A is $F_A = k_e e^2/2.76136\ fm^2 = 30.25789115$ N, and proton C's 1 fm gap force is $F_C = k_e e2/1\ fm^2 = 230.7197196$ N. Since F_A and F_C oppose, $F_A - F_C = 230.7197196 - 30.25789115 = 200.4618285$ N, the resultant of $F_A + F_B + F_C = (200.4618^2 + 13.2681^2)^{1/2} = 200.90041$ N, and proton B increases the energy by (200.90041 - 200.46183)/200.46183 = 0.002188. This must be factored into the pep's 2.224 MeV bond energy to yield 1.002188 x 2.224 MeV = 2.22886578 MeV, with an error of (2.22886578-2.22809457) / 2.22809457 = 0.000346 = 0.035%.

When 2.2288658 MeV is factored into the $3^{1/2}(2n)$ general equation it yields a 7.721018 MeV binding energy with a (7.721018 - 7.718346) / 7.718346 = 0.000346188 = 0.035% error. The actual 7.718346 MeV mass loss is a cumulative of the 0.78233 MeV neutron electron energy and 7.718346 - 0.78233 = 6.936016 MeV, manifesting as the transition states' sub-relativistic pep bonding energies. This energy has the

effect of contracting the 0.72586 fm transition state between the 2.76136 fm neutron radius and its non-neutron 1 fm + r_p = 2.0355 fm region. The relativistic correction factor is 0.510999 / (0.510999 + 6.936016) = 0.068617963 and reduces the 0.72586 fm to a 0.049807 fm peak value which must be divided by $2^{1/2}$ to obtain the 0.035218891 fm average value. Since this transition region contraction is within the electron's 0.3951 relativistic contraction of 2.76136 fm radius to 1.091 fm it reduces the 1.091 fm radius to 1.0557811 fm.

The $(1.0557811 / 1.091)^3$ = 0.9062487 orbital volume reduction by electron transition from a proton A to a proton C neutron state effectively increases proton C's relative volume with respect to the electron's orbital volume by 1 / 0.9062487 = 1.10344986. This is a static analysis of a dynamic process in which the electron traverses its proton A neutron orbital while undergoing continual contraction of its neutron region, up to the 0.72596 fm transition region, from the absorbed coulomb energy as it passes to within 1 fm of proton C. As it becomes proton C's neutron electron the relative 1.10344986 proton C volume increase has the effect of reducing proton density, since proton mass now occupies a greater volume from the electron's perspective. And since the magneton depends on electron to proton density ratio, $u_N = p_e/p_p/2.531$, it increases by 1.10344986. The 7.718346 - 0.78233 = 6.936016 proton mass loss also increases the magneton by 938.2723 / (938.2723 - 6.936016) = 1.007447381, since it increased the electron density by this amount. Both factors together increase He-3's magneton to 1.111667666 x 1.9135 = 2.127176069, with a (2.127176079 - 2.1275) / 2.1275 = 0.00015225 = 0.0152254% error.

The 0.035% bonding and 0.015% magneton errors of He-3 exceed deuterium's respective 0.009% and 0.006% errors because they are based on static coulomb geometries in a system with relativistic pep transition regions, the electron has orbital angular momentum about the clover leaf, and the protons have an opposite angular momentum from electron attraction as it approaches them. Momentum energy is proportionate to twice the m_e / $3m_p$ = 0.00018154 mass ratio, since both electron and protons exhibit it, and reduces the 2.2288658 MeV coulomb energy by 1 – 2x0.00018154 = 0.999637 to yield 2.2280566 MeV with a (2.2280566 - 2.2280946)/2.2280946 = 0.0000171 = 0.0017% error.

Also, while electron and proton momentum energies won't affect density ratio in the u = P_e/P_p / 2.531 magneton calculation, the proton angular momentum energy will affect the 2.531 relativistic coefficient, based on the electron's 0.78233 MeV energy, since it is opposite electron momentum and therefore reduces its coefficient by 1-(m_e/m_p) = 0.99981846 and increases the magneton by 1/0.99981846 = 1.00018157. Multiplying this by the calculated 2.127176 value yields 2.127562 with a (2.127562-2.1275)/2.1275 = 0.0000293 = 0.00293% error.

Although tritium's electrons utilize the same He-3 clover leaf orbital several electron configurations are possible (i.e. they may occupy the same proton's orbital and sequentially pass through the same transition state, they may occupy different proton orbitals and pass through different transition regions, transition by electrons may be simultaneous or out of phase with one at the center while the other transitions, and their magnetons may be aligned or opposing).

Calculation of the resultant magneton provided insight into the most probable configuration. Tritium's 8.482047 MeV mass loss allows for 0.78233 MeV neutron states for each electron and 6.917387 MeV for the electrons' coulomb bonding, magnetic, and kinetic energies.

The 6.917387 MeV manifests as 3.458694 MeV in each electron and a [0.510999 / (0.510999 + 3.4586935) = 0.12872508] / $2^{1/2}$ = 0.09102238 relativistic correction to the 0.72586 fm transition region yielding 0.0660695 fm. Since the 2.76136 fm neutron radius transition regions face each other in the clover leaf configuration their relativistic correction is 2.76136-(2x0.0660695) = 2.629221 fm, or 1.038805214 fm with the 0.3951 correction factored in. The relativistic correction then for each neutron radius is 1.038805214 / 2.76136 = 0.37619333, which results in a 0.3761933/0.3951 = 0.95214713 correction factor. This correction factored into each (2.7928 - 1.9135 =) 0.8793 proton and neutron "deuterium-type" magneton yields a 0.837222969 magneton.

The cumulative magneton for tritium's proton and 2 neutrons is thus $(2.79282 + 2x(0.837222969)^2)^{1/2}$ = 3.033416628. However the 8.482047 MeV mass loss must be factored in since both the proton and neutron magnetons depend on the proton's mass, which results in an additional (938.2723 - 8.482047) / 938.2723 = 0.99095993 correction to the 3.033416628 magneton to yield 3.00599433. This magneton value is incorrect however since the nuclear magneton, $u_n = eh/4 \cdot pi \cdot m_p$, is dependent on proton mass and must also be corrected by 0.99095993 to yield a resultant tritium magneton of 2.97881993, with an error of (2.97881993 - 2.9788) / 2.9788 = 0.00000669 = 0.000669%.

Significant information is obtained from this calculation. In analyzing forces between particles one expects a 0% resolution error between the theoretical and empirical as refinement of principles produces irreducible elements, or the theory must be questioned (On The Method Of Theoretical Physics - Einstein). Errors of 1% strongly support the proton and neutron models used and that nuclear binding results from simple coulomb forces magnified by particle energies' relativistic corrections from an independent observer's perspective. As errors further reduce to 0.1%, 0.01.%, and 0.001.% details can be seen which incorporate refinements into energies complete behaviors and provide insight into specific individual structures.

As learned from Bohr's work, theories may accurately describe a specific situation and falter on further application. All theories eventually fall to future refinements but who can dispute the value of classical physicist's efforts to Einstein or of Bohr's efforts to Quantum Theory or Chemistry. This theory uses Relativity and Quantum Theory to explain nuclear forces in terms of electromagnetic forces, and while the errors seem inconsequential they do indicate anomalies that could point to subtle energy behaviors or disprove the theory entirely. As such they must be investigated.

The first thing noticed is that tritium's magneton error arises from calculation resolution greater than empirical resolution. This supports the model which uses vector treatment of empirical magneton values and a premise that the energy required to restore tritium to individual particles arises from proton mass loss which affects both

the nuclear magneton calculation and the proton's permeability value in the neutron magneton. This small error supports the relativistic quantum state of hydrogen neutron model and the clover leaf - triton nuclear structure with relativistic pep bonds but a question arises as to why helium-3's magneton has a 4 times greater error at 0.003%.

One discrepancy is that different structures require different analyses. He-3 can attain a lower energy state because it's 2 proton magnetons may align and cancel while the neutron electron's orbital magneton cancels its proton's magneton. This leaves only a neutron magneton for He-3 which results from the electron spin magneton and proton permeability effect. Proton mass loss manifests as electron relativistic contraction energy in the transition region and causes neutron orbital radius and volumetric reduction, thus increasing the proton permeability effect and the magneton from -1.9135 to -2.1275.

Tritium with 1 proton and 2 neutrons has 1 unaligned proton magneton, since the orbital magnetons cancel their proton magnetons, leaving 1 proton and 2 electron spin magnetons. By the 3-dimensional oscillation model developed in The Superposition States of Planck's Constant the spin magneton is the $3^{1/2}$ resu1tant of the 3 oscillations so least energy occurs on oscillation axes. The lowest energy state occurs with least relativistic spatial distortion so electrons will orient with an oscillation axis along the propagation path and its spin magneton freely rotating 54.7° from the path. In a clover leaf orbital the electron spin magnetons would align so as to cancel, by Pauli's Exclusion Principle, during their neutron orbital phases.

However during the radial transition phase spin magnetons can't align and electrons have no orbital magnetons so the spin and proton magnetons combine to yield (2.7928-1.9135) = 0.8793 factored by the cumulative 0.952147 relativistic contraction from both electrons to the neutron orbital radius resulting in an effective magnetic field opposite the proton-electron magneton vector sum due to proton mass loss and increased electron spin, as in deuterium, to yield 0.83722. Since electrons undergo transition by the coulomb energy absorbed by passing within 1 fm of a proton's surface this is a sine phenomena, where the -1.9135 value is a $2^{-1/2}$ average during its neutron orbital phase and the orbital and spin magnetons are out of phase with their respective peak values occurring during the maximum neutron phase at the clover leaf center and maximum transition phase at the edge.

This magnetic oscillation between orthogonal and spin magnetons allows tritium's magneton to be accurately calculated from neutron and proton empirical magneton values and a relativistic contraction based on the empirical mass loss energy transforming into relative electron energy via the coulomb forces. The final magneton value is determined by simple Pythagorean calculation of individual magneton values, adjusted for mass loss to the proton and nuclear magneton. He-3's magneton on the other depends on a volume calculation from a calculated radius to determine the proton's permeability effect so errors in its radius are cubed, resulting in a much greater error. Similarly, the binding energy calculations are based on the sums of electromagnetic forces involving the squares of calculated distances so errors are squared and summed, resulting in much larger errors.

As mentioned, He-3's electron traverses one proton's 2.76136 fm neutron orbital as it approaches to within 1 fm of a second proton's surface. In doing so the electron absorbs energy from the 2nd proton via coulomb force attraction. The absorbed energy flows opposite the coulomb attraction and has an equal and opposite relativistic effect of contracting space opposite the attraction vector and dilating it in the attraction direction. The concept of relativistic contraction in the direction of inertial energy and dilation in its wake was set forth in Superposition States of Planck's Constant (pp. 14-5) as the reason energy doesn't instantaneously accelerate mass to light speed {i.e. all forces have an equal and opposite effect; acceleration is opposed by space limiting contraction and time dilation in direction of motion (opposite effect in wake) by the finite energy relation of the Lorentz Transforms). This bipolar contraction-dilation gradient is the reason comet heads face gravitational bodies and tails point away (fn. 28). The electron's absorbed energy contracts the 0.72586 fm transition region and transforms the electron to a neutron state with the second proton that it received this coulomb energy from.

Tritium's 2 electrons similarly form bonds but have 2 possible orbital configurations, each resulting in less than a 1% deviation between calculated and empirical bonding energies. In the 1st case the 2 electrons simultaneously undergo transition but must pass thru the clover leaf center at the same time. In the 2nd case 1 electron undergoes transition while the other passes thru the center in such a manner as to maintain constant separation from from each other at all times. Both offer interesting perspectives and are presented.

Referring to Fig. B, in the first case 1 electron in proton C's neutron orbital enters B-C transition while a 2nd electron in proton A's orbital enters C-A transition. Since proton B is 4.1 fm from the C-A electron its coulomb effect is shadowed by the B-C electron 1 fm proximity to proton B, but the force between the electrons elongates the proton C to C-A electron distance and reduces its 2.224 MeV bond energy accordingly. The distance from C to B-C is 2.76136 fm and its distance to C-A is 2.0355 fm so the inter-electron distance is $r_{ee} = (2.76136^2 + 2.0355^2 - 2x2.76136x2.0355x\cos 60°)^{1/2}$ = 2.479439658 fm with a force of $F_{ee} = k_e e^2/r_{ee}^2$ = 37.52991912 N. The angles between the C-A and B-C electron force and their adjacent sides to C are 74.68651882° and 45.3134812° respectively, by the law of sines.

The orthogonal force on electron C-A is given by ½ the cosine of its complementary angle, or F_o = ½ x 37.52991912 cos 15.31348118° = 18.09871539 N, since total force divides between 2 electrons. The tangential force towards proton A instantaneously affects the 2.224 MeV bond but its average effect is zero over the entire clover leaf orbital since the electrons equally stretch and compress the lengths over the phases. The orthogonal force however always elongates the bond, and its specific effect depends on the angle between the 2.224 MeV bond and Fee so its effect must be calculated with respect to the specific tangential component. The tangential force on electron C-A is ½ the sine of the complementary angle, or F_t = ½ x 37.52991912 sin 15.31348118° = 4.955825714 N, which subtracts from the $F_A + F_C$ = 200.4618285 N resultant used in He-3 to yield a 195.506 N resultant, although this still represents a 2.224 MeV average tangential force.

With the 195.506 N resultant representing the average 2.224 MeV bond energy the orthogonal force's effect can be calculated from the resultant change in force, or $195.506 / (195.506^2 + 18.09871539^2)^{1/2} = 0.9957424$, which factors the 2.224 MeV to yield 2.2145311 MeV. This value is (2.2145311 - 2.21294196) / 2.21294196 = 0.000718, or 0.072% greater than the 2.21294196 empirical value, and can be explained by the requirement of both electrons simultaneously passing through the center region in this configuration. In this case the neutron state orbitals would have to diverge orthogonally from the triangle plane because of coulomb repulsion which would lengthen the orbital and reduce the electron's energies accordingly. Also an angular momentum factor of $1 - 2(2m_e/3m_p) = 0.999628934$ would reduce the calculated 2.2145311 MeV value to 2.213668279 with only a 0.0328% deviation.

In the second case one electron is in the center while the 2nd undergoes transition. Center electron position variations do yield slight energy value differences but they are small and the center calculation provides reasonable accuracy and simplifies presentation of the energy relations. Referring to Fig. A, the center electron to transition region distance along the center line is $(a + c) - r_n =$ 4.154203 fm - 2.76136 fm = 1.392843 fm. Since the C-A transition electron is 0.36293 fm from center line, the electron separation is $r = (1.39285^2 + 0.36293^2)^{1/2} = 1.43935$ fm, center line deviation angle is tan-1 0.36293/1.392843 = 14.604683°, and electron repulsion force is $F_{ee} = k_e e^2/1.43935\ fm^2 = 111.3658$ N. Dividing the force between the electrons yields 55.6829 N and subtracting proton B'S 30.25789 N attraction force yields a 25.425 N force on the transition electron.

The force's orthogonal component is F_o = 25.425 cos 14.604683 = 2.603488 N and its tangential component is F_t = 25.425 sin 14.604683 = 6.410878 N, which yields a 206.872706 N tangential resultant when added to the 200.4618285 N resultant from protons A and C. As with He-3's tangential force offset, this still represents a 2.224 MeV average energy since the electrons equally stretch and compress the bonds over the different phases, however its instantaneous value must be used in calculating the orthogonal force's effect. The cumulative resultant of the orthogonal and tangential forces is R = $(206.872706^2 + 24.603488^2)^{1/2}$ = 208.330622 N and represents a stretching of the bond thus reducing its energy to 206.872706 / 208.330622 = 0.993002 x 2.224 = 2.208436 Mev.

This value is only 2.212942 - 2.208436 / 2.212942 = 0.002036 = 0.2% less than the 2.212942 MeV actual energy but is much greater than the 0.0328% deviation that occurred with electrons undergoing simultaneous transitions. However, conceptually the electrons would seem more balanced if one underwent transition while the other was 180° out of phase at the center. The greater deviation can be reduced to about 0.1% if the center electron is offset from the center line by about 0.018 fm but the calculations are more complex and it must also be realized that the repulsion force between the electrons will have an effect of adding energy to its neutron state with proton B, so the calculations for this case yield a result comparable to the simultaneous transition case. It must also be remembered that tritium has an instability and electrons have a wave nature that makes it impossible to predict their exact positions.

Tritium's two orbital configurations deviate above or below the 2.21294 MeV equilibrium energy and require electrons to either pass over and under each other in a 3rd dimension through the center or deviate from their neutron equilibrium energy. In the neutron model, equilibrium requires equal magnetic, coulomb, and kinetic energies with a combined 0.78233 MeV relativistic value to maintain a stable neutron state so these deviations would result in unbalanced states unless they oscillate between the 2.208 and 2.214 MeV configurations with a 2.212942 MeV average value. The deviations also make tritium susceptible to external energy influence and provide a decay avenue.

The deviation is significant when we consider that in He-3 one electron results in a 7 MeV energy well, in He-4 two electrons have a combined 28 MeV energy well effect, but in tritium two electrons only result in an 8 MeV energy well so tritium's 2.208 MeV state in the 2.212 MeV bond makes it more sensitive to external influence. With 3 nucleons no magneton cancellation occurs because 1 proton is always unaligned so electron orbital and spin magnetons must undergo continual orientation change and can't align to cancel their effect, as shown by their inclusion in tritium's magneton calculation. This means external magnetic energy has access to tritium's energy well.

He-4, on the other hand, with 4 nucleons allows proton magneton alignment, resulting in aligned orbital and spin magnetons, no total nuclear magneton, and no readily available external energy access to its stability. It's nucleons arrange in a tetrahedral structure with protons at each apex (Fig. E) and results in 2 orbital configuration

possibilities, one with synchronous electron transition and neutron states and one with a-synchrounous states. Given dimensions for the tetrahedral faces are the same as for tritium and He-3 but electrons only reverse direction by 120° to change faces instead of the 180° change required for the 2-dimensional clover leaf configurations.

As can be seen from the calculations the energy deviations from 2.21472 MeV are approximately 0.25%, with only a 0.02% difference between synchronous and a-synchronous energies, indicating that the electrons occupy both states equally. The 0.25% error is large when compared to tritium and He-3's errors however greater deviation must be expected between the theoretical and actual as the dimensions and size increase. Also, in the synchronous phase the contraction forces from the protons exceed the electron repulsion force so the increase in bond length (decrease in energy) results from contraction towards the tetrahedral center while in asynchronous mode electron repulsion force exceeds proton contractions so the bond length increase occurs from an outward expansion.

Since probability of either mode is equal (0.24% vs. 0.26%) and inward and outward forces are similar (24.00385/2 N vs. 11.2264 N) electrons would oscillate between modes with a bi-directional average of (12.001925 + 11.2264)/2 = 11.6142 N and an effective 2 x $2^{-1/2}$ x 11.6142 N = 16.42491 N orthogonal resultant and $(16.4249^2 + F_{AC}^2)^{1/2}$ = 201.1336 N net resultant. This would yield a binding energy of (F_{AC} / 201.1336 = 0.99666) x 2.224 = 2.21657 MeV with a deviation of only (2.216572 - 2.21472) / 2.21472 = 0.0008363 = 0.084%.

With magneton and binding energy values for protons, neutrons, deuterium, tritium, He-3, and He-4 characterized to within 0.1% by our quantum-relativistic model we may now proceed with investigating radioactive decay. As stated gamma decay is a nuclear de-excitation process. It may readily be seen that, as with quantum atomic models, nuclear orbitals have a fundamental oscillation wavelength dependent on orbital length. Since our nuclear model is based on the neutron as a quantum-relativistic state of hydrogen it follows that nuclear electrons may undergo similar quantum energy increases, even ionize as with hydrogen, by integral wavelength decreases, and associated frequency increases, consistent with the configuration geometries.

This means that orbital energies may undergo quantum increases and decays by photon absorption and emission. However absorption of sufficient quantum energy by photon is statistically improbable and an alternate method of energizing nuclei is more likely. Energy may transfer through boundary conditions if aligned with their internal energy structure. Coulomb energy, shielded from nuclear electrons by the protons, would merely move nuclei. However kinetic energy from a high energy particle would dislodge a nucleon or transfer inertial energy to it, which in turn would transfer via charge interaction to its electron, as long as transfer occurs in l/n integral wavelength multiples. And magnetic energy has direct access to both the protons and electrons through their nuclear and individual magnetons.

Magnetic energy may transfer continuously by transforming into proton mass energy, since its magneton is a function of its energy,

and then transfer to an orbital electron via charge interaction (as in electron relativistic transition state energy absorption). Since nuclear binding is a dynamic equilibrium of 3 orthogonal energies (kinetic, coulomb, and magnetic), and particle charge is constant, coulomb energy must vary by orbital to proton proximity variation, kinetic energy varies by velocity change, and magnetic energy varies by inertial energy change. The added energy, however, even though an equilibrium of the forms, is unstable and can only be maintained as long as energy from a greater source flows into the system.

So the system's elevated energy condition can't sustain itself because the orbital has been distended from its equilibrium position into a higher energy one with no mechanism to sustain the condition. However, when enough energy accumulates to attain a new equilibrium state with a 1/n wavelength quantum energy increase, where n = 1 for the fundamental orbital, the 3 static energy forms transform into a dynamic elevated orbital oscillation energy with 0 average deviation from the equilibrium condition. It constitutes a standing wave with boundary conditions to sustain the state and the 3 static orthogonal forms can return to their more stable equilibrium states.

In summary, magnetic or inertial energy transforms equally into 3 static orthogonal forms, causing spatial deviation as a temporary storage mechanism, and then transforms into a higher quantum orbital frequency energy state that is more stable because its net average spatial deviation is zero and, by de Broglie's equation, more energy can be stored as a stable state in the same space by E = hf.

A classical treatment of this non-classical event is permitted by Relativity's premise that all inertial reference frame's physics laws agree and Bohr's Correspondence Principle of classical-quantum physics agreement when energy differences between quantized levels vanish. To independent observers nuclear decay or binding appears a quantum statistical event, as in particle collisions, an interaction of independent inertial systems. However, to a local observer with dilated time and contracted space, energy transforms occur according to classical physics. The quantum event is the transfer of kinetic, magnetic, or coulomb energy to a system and resulting state change that appears instantaneous, and the relativistic occurrences are the equalizing energy transforms occurring within a systems local time.

As Feynman and Yukawa pointed out energy conservation violation is allowed in particle interactions for independent observer's time intervals of less than $h /4 \cdot pi \cdot mc^2$. If h is a force·distance·time relation no energy conservation violation exists if energy transform between forms occurs within that time interval in the dilated time and contracted space of a local domain. This understanding renders quantum states and events a perception of independent observers seen through a relativistic energy window, conserves energy, and allows a classical characterization of radioactive decay.

An earlier proton-electron nuclear model proposal was rejected because Nitrogen-14, with 7 protons and 7 neutrons, would have 21 ½-spin protons and electrons, or a ½-spin nuclear magneton, and N-14 has a spin of +1 and angular momentum would not have been conserved.

However, this discrepancy can be resolved by constructing N-14 from sub-structures such as 3 H-2's (spin +1) and 2 He-4's (spin 0), or 1 H-2 and 3 He-4's, instead of individual particles. And since the transmutations between N-14 and C-14 are well understood they serve as a good model for analyzing radioactive decay.

Formation of H-2 involves a nuclear bond between a neutron and proton, two ½-spin particles resulting in a +1 spin nucleus, with no clear explanation for a +1 spin and 0.8574 magneton, unless the pep model developed on pages 20-33 is used. A neutron quantum hydrogen state has 4 magnetons (electron, orbital, and protons). Its 0.78233 MeV electron energy relativistically contracts its 2.7614 fm orbital radius to 1.091 fm, from our perspective, and constitutes equal and opposite charges moving past each other at the same radial distance from the proton center. In this configuration the charges have equal and opposite spins that cancel, leaving only the ½-spin electron magneton factored by proton density to yield a -1.9135 magneton.

A proton bonding with the neutron in a pep structure will cause its electron's orbital angular momentum to transform into a circular resonance orbital between the protons. The electron traversing past each proton creates ½-orbitals with each and aligns their magnetons in parallel (opposite to the orbital magneton), in effect canceling 1 proton magneton. The electron’s ½-spin magneton aligns in parallel with the orbital magneton (opposite to the proton magneton) yielding a +1 spin nuclei and a (2.7928 - 1.9135) x 0.97569 (relative energy correction factor) x 0.99946 (mass loss) = 0.8574 magneton (p. 34).

From deuterium's pep structure it can be seen that a 3 particle configuration with 4 magnetons results in a +1 spin single magneton structure, indirectly dependent on its individual ½-spin particles. With a structural N-14 model its 21 ½-spin particles can be shown to have a +1 spin and since transmutation between N-14 and C-14 is well understood, (N-14 + n -- C-14 + H-1) & (C-14 -- N-14 + e + $\tilde{\nu}$), they serve as a basis for characterizing radioactive decay in terms of reactants, products, and structures. And, as previously mentioned, higher structures may be explained in terms of the helion-triton and shell models, with a slight modification to the Russell-Saunders and hybridized bond methods of determining magnetic moments.

A difference between molecular and nuclear quantum mechanics is that electron relativistic energy in pep structures contracts space, multiplying coulomb force effects, and gives nuclear bonds a quantum high energy coupling. A $1/r^2$ relation still exists but contraction masks it to independent observers and gives quantum nuclear bonds a more rigid Bohr type basis. Covalent molecular bonding is diverse because electron statistical energy distributions result in spatial deviations, and thus product distributions. Ionic bonds are stronger and more absolute because nuclear coulomb forces (electronegativity) enhance electron coulomb forces and supersede the statistical energy distribution effects. Nuclear bonds with relativistic multiplication of coulomb forces are stronger and more absolute, since relativistic energy wells exist and component particles or structures must reach threshold energy levels but gamma decay in excited nuclear orbitals acts as an upper level energy boundary condition to limit energies.

This means that as nuclei gain energy, as in particle collision kinetic energy, the electron's energy increases to an excited state that decays by gamma emission unless energy is continuously added so as to remove the electron from its relativistic energy well. It is still statistical but the distribution curve narrows to a steeper energy-distance relation seen as a quantum nuclear bond. In effect it multiplies coulomb bond strength to a quantum threshold level that is maintained because gamma decay bleeds off energy buildup.

This rigid Bohr type quantum model explains magnetic anomalies in the shell and helion-triton models. For instance, Li-7's 4.2039 moment doesn't directly relate to its 3.2563 field direction moment by the Russell-Saunders model, since a 1p3/2 orbital is 4.90, and it only approximately relates to a triton moving about a helion in the helion-triton model. However, by incorporating the proton-electron neutron model the exact magneton relation is calculated. A neutron electron has a 2.76136 fm local orbital radius and a 1.091 fm radius to independent observers from the 0.78233 MeV relativistic energy effects. Since the electron orbital is 1.091 fm and proton radius is 1.0355 fm its orbital angular momentum magneton effectively cancels proton spin magneton, except for a slight 1.0355/1.091 = 0.949129239 reduction to electron orbital magneton. Also, the effective mass for the electron charge is m_e + m_p while the proton's is only m_p so m_p / m_p + m_e = 0.999455679 factors the radius factor to yield 0.94861261.

Nuclear structure also plays a role. The helion's tetrahedron angle between a face and its opposing edge is 54.735610· (see /b, Fig. E)

which is $\sin^{-1}\{3/2)^{-1/2}$. Since Li-7 has a spin moment of -3/2 it suggests a spin moment structural dependence, and factoring the 0.948612608 radius and mass factor by sin 54.73561° yields a total 0.77454538951 factor, the exact ratio between Li-7's 3.2563 magnetic field direction moment and its 4.2039 magneton value, to within 0.007%.

Other 3/2 spin nuclei such as Be-9 (-1.1774/-1.520 = 0.774605), B-11 (2.6886/3.4710 = 0.77459), or Na-23 (2.2175/2.8628 = 0.77459) exhibit the same 0.774539 angle, radial, mass loss factor relation, to within 0.007%, between their magnetic moments and field direction values. Structure is expected to influence magneton orientation but the fact that 3/2 spin nuclei have an extra neutron, and that radial and mass loss components are factors, is significant since these are the elements of our derived neutron and nuclear binding structures. A brief review of the fundamental structural magnetons illustrates.

The proton magneton was shown (p. 12) to be the electron-proton energy density ratio/ $3^{1/2}$, $p_e/p_p/3^{1/2} = 4.8373/3^{1/2} = 2.2728$, based on a "Superposition States of Planck's Constant" concept of magnetism and charge arising from 3-dimensiona1 orthogonal oscillations and energy density determining permeability. Since magnetism is a 3-osci11ation resultant with a normalized value of $(1^2 + 1^2 + 1^2)^{1/2} = 3^{1/2}$, 54.73561° from each axis, or 45° off each axis, it has a $3^{-1/2}$ component along the propagation axis oscillation, or orthogonal axes, constituting a ½ spin, and in agreement with the $3^{1/2}$ factor between the proton's actual 4.87322 magneton and it 2.78277 field direction component, to within a 0.0017% error in proton volume calculation dimensions.

Neutron magneton (p. 13, 56) is electron-proton density ratio / electron relative mass, $(P_e/P_p)/[(m_e+0.78233\ MeV)/m_e] = 4.8373/2.531 = -1.9111$, -1.9134 if divided by deuterium's 2.224 MeV mass loss of $(m_D-m_e)/(m_n+m_p) = 0.99882$ (the carrier used in its measurement). The 3½ factor between its -3.31366 magneton and its -1.91314 field moment results from the electron spin $3^{1/2}$ factor. Electron orbital radius of 1.091 fm is an equal and opposite surface charge canceling the proton charge and magneton. Neutron spin magneton now becomes that of the ½-spin electron reduced by its relativistic mass (and proton mass when the nuclear magneton is factored in) and increased by the 4.8373 less energy density of the proton, or $1.9135 \times 3^{1/2}$.

Deuterium's magneton (pp. 32-34) is (proton - neutron magneton) factored by relativistic and mass resonance effects = $(u_p - u_n) \times CF_r \times CF_m = (2.7928 - 1.9135) \times 0.975691301 \times 0.999455383 = 0.8574$. The CF_r relativistic factor is electron sub-relativistic energy that decreases neutron radius and increases electron relative mass, thus reducing the neutron magneton. Also, in a neutron, orbital magneton cancels proton magneton by 1.0355/1.091 = 0.94912924 but deuterium's radius is 1.064479 fm, reducing it by 1.0355/1.064479 = 0.972776353, so proton magneton is reduced by 0.94912924/0.972776353 = 0.97569111 = CFr, since the orbital affects both protons. $CF_r = [r_n - (m_e / B.E.-0.78233\ MeV) \times (½\ peak\text{-}to\text{-}peak\ sub\text{-}resonance\ region \times 2^{-1/2})/2.531 = [[2.76136 -(0.261692585) \times (½ \times 2^{-1/2} \times 0.72586)]/2.531) = 1.06447921]/1.091 = 0.9756913$. Mass resonance factor, CF_m, is the sub-resonance loss from the electron-proton mass ratio, $(1 - m_e/m_p) = 0.999455383$, since proton motion towards the electron reduces its effect.

Tritium's magneton (pp. 40-41) is the pythagorean of its proton and 2 neutron magnetons, factored by the proton and nuclear magneton mass loss, $u_T = (up + 2\ (u_N)^2)^{1/2} x (\text{mass loss})^2 = 2.9788$, with neutron magnetons determined by sub-relativistic effect to neutron radius. Binding Energy / electron = (8.482047 - 2(0.78233)/2 = 3.458694 MeV. Sub-relativistic effect = $(m_e/(m_e+BE/e)/2^{1/2} = 0.0910224) \times 0.72596$ fm = 0.0660695 fm/e, (full 0.72586 fm, not ½, since electron traverses, not resonates, in transition region). Adjusted neutron radius and relativistic effect is (2.76136 - 2(0.0660695) = 2.629221)/2.76136 = 0.95214713 and net neutron magnetons are $(u_p-u_n = 2.7928-1.9135) \times 0.95214713 = 0.837223$. Resultant magneton is $[2.7928^2+2(0.837223)^2]^{1/2} = 3.03342$. Factoring in proton and nuclear magneton mass loss, $[(m_p- BE)/m_p]^2 = [(938.2723-8.482047)/938.2723]^2 = 0.982 \times 3.03342 = 2.9788$. Two proton and 2 orbital magnetons cancel, 2 electron spins cancel, and only 1 ½-spin proton with a $3^{1/2} \times 2.9788 = 5.1594$ magneton remains.

Helium-3's magneton (p. 39), deriving from 1 electron binding 3 protons in an inverse neutron structure, is volumetrically affected by sub-relativistic transition region contraction since it affects effective proton density for the neutron electron. Thus $u_{He-3} = [r_n / (r_n - (0.72586\ \text{fm}) \times (m_e/BE+m_e) \times 2^{-1/2}]^3 \times m_p/(m_p - BE)$, where BE = 7.71835 - 0.78233 = 6.936016, so $u_{He-3} = [1.091/(1.091-(0.72586\ \text{fm}) \times (0.068617963) \times 2^{-1/2}]^3 \times (938.2723 / 931.3363) = 1.10345 \times 1.007448 = 1.111668 \times -1.9135 = -2.1272$, or -2.1275 when $(1 - m_e/3m_p)$ inertial effects are factored in. Two proton magnetons are cancelled by the orbital and 1 proton magneton, and only one ½-spin electron with a $3^{1/2} \times (-2.1275) = -3.6849$ magneton remains.

The models show a magneton dependence on particles, structure, and bonding energy. Proton magnitude is an energy density function and orientation is a ½-spin 3-dimensional oscillation $3^{1/2}$ resultant. Neutron magnitude is the electron relative mass to density ratio and orientation is electron spin. Deuterium magnitude is proton-neutron magneton sum reduced by relativistic effect of BE on neutron radius and orientation is spin 1 by proton spin alignment, cancellation of one by the orbital magneton, and addition of electron spin magneton. Tritium magnitude is a 2 deuterium - 1 proton pythagorean resultant magneton reduced by BE effects with a proton ½-spin orientation. In He-3 BE reduces electron orbital volume, increasing electron-proton energy density ratio and neutron magneton, and a ½-spin orientation.

This magneton progression parallels structural progression:
1) (electron, u_B, ½ : proton, 2.7928 x u_n, ½), a $3^{-1/2}$resultant of 3-dimensional oscillating energy structure mass and density ratios;
2) (neutron, -1.9135, ½), orbital particle's relative energy effect;
3) (proton - neutron, 0.8574, 1), a linear particle combination factored by BE relativistic effects;
4) (1-p + 2-n, 2.9788, ½) and (1-n + 2-p, -2.1275, ½), equilateral structures factored by BE relativistic effects and cancellation of equal components by equal and opposite particle spin effects; and
5) (2-p + 2-n, 0 magneton, 0 spin), a tetrahedral structure with complete magneton cancellation by equal and opposite spin effects.
And the magneton values show a pattern of approximately +3, -2, and +0.8 (factored by BE relativistic effects) for non-cancelled proton, neutron, and p-n effects, respectively, in the structural magnetons.

A pattern in this magneton and structural progression merits analysis since it forms the basis of the Helion-Triton, Shell, and Magic Number patterns. He-3's -2.1275 magneton is a -1.9135 neutron magneton enhanced by the BE's effect on the relative proton-electron region volumes. BE contracts the electron orbital radius from 1.091 to 1.056 fm, decreasing its orbital volume and increasing its energy density by $(1.091/1.056)^3$ = 1.10345. It's an inverted neutron where the electron orbits in a region between 3 protons, but at a 1.056 fm radius from each proton. The electron, unaware of its own relative energy effect, sees itself at 1.091 fm and a proton volume increase of 1.10345, decreasing its density, and increasing the electron's resultant neutron magneton by the (P_e/P_p)/ 2.531 relation.

Tritium's 2.9788 magneton is a 2.7928 proton magneton enhanced by a relative energy loss (density decrease) to its 2 deuterium type bonds. In He-3 one electron gains the relative energy and increases neutron character and in H-3 two electrons divide the energy, cancel each others net effect, and increase proton character. He-3 and H-3 may be thought of as enhanced neutrons and protons and since protons and neutrons form deuterium, it follows that He-3 and H-3 also form a deuterium type structure. Deuterium's ½-spin neutron and proton magnetons combine to a 1-spin 0.8793 magneton attenuated by a 0.975 relativistic binding energy effect to yield 0.8574, so if He-3 and H-3 bond one would expect their ½-spin -2.1275 and 2.9788 magnetons to form a 1-spin (2.9788-2.1275) x 0.975 = 0.8300 magneton, with a total structural BE of the (He-3 + H-3) BE's + 0.975 to form a bond between them, or 1.975 x (7.71835 MeV + 8.48205 MeV) = 31.99579 MeV.

In fact Li-6 has the same proton and neutron number as He-3 + H-3, has a 31.99574 MeV BE, and has a 0.8220 magneton, so logic and empirical data agree. And if electron-proton sub-resonance and mass loss are factored into the 0.8300 magneton it yields $(6m_p - BE)/6m_p$ $x(1 - 6(m_e/m_p)) = 0.99431655xO.9967323 = 0.9910674xO.8300 = 0.8226$, calculated magnetons and BE's to within 0.1%. However, while He-3's and H-3's BE's are close the sub-relativistic energy wells of H-3's electrons are ½ of He-3's electron, 8.482047-2(0.78233) = 6.917387/2 = 3.458694 versus 7.71836-0.78233 = 6.93603. The H-3 and He-3 BE's are unequal, 6.917387/6.93606 = 0.99731, since H-3's electrons lose energy in repulsion and transition phase a-synchronicity (pp 46-49).

This ½ energy relation between H-3's and He-3's electrons shows a gross quantum energy relation between electron states, similar to principle quantum number n, with high energy being a single electron He-3 configuration and low energy being a dual electron H-3 one, and is the basis of Magic Number 2 since one is 2 protons and the other is 2 neutrons. Orbital angular momentums align or cancel, 1 or 0, since two ½ energy electrons equal a high energy one, and orbital magnetic moments, 1 during orbit and 0 during transition, average to ½ and aligns with a proton spin. Remaining particle spins align so as to add or cancel and become the structural spin.

In Li-6, the energy difference between H-3 and He-3 electrons allows bond formation between the two npn and pnp Triton structures overlayed in a Star of David configuration from the top and circular $n_pP_nn_p$ pattern from the sides so the electrons may freely align with

any 3 proton combination to form opposing H-3 and He-3 structures in a deuterium type bond between their "proton" and "neutron" natures. The structure's 8 facets form equal angles such that each proton has equal probability of forming a H-3 or He-3 union, with deuterium's [1 - 3(m_e+0.78233) / (6m_p-16.200403) =] 0.9993088 sub-resonance and 0.9756913 relativistic BE effects combining with He-3's and H-3's BE's to yield a 1.975016905 (8.482047 + 7.718356) = 31.99607 MeV BE.

This establishes H-3 and He-3 Triton structures as one basis of nucleide structures and Magic Number 2-proton and 2-neutron pairs. The more prevalent Li-7 establishes a structural basis for Helions. Li-7 has a -39.2454734 MeV BE, a +3.2563 magneton, a -3/2 spin, and a neutron-proton complement of an (alpha + H-3) or (He-3 + H-3 + n) structure. A +3.2563 magneton indicates an enhanced proton magneton. Since an alpha structure is relatively inert and H-3 is an enhanced proton capable of bonding to neutrons, an H-3 bonded to two neutron structures, such as 1 neutron and an He-3, would enhance its 2.9788 magneton. The He-3 and neutron magneton would align so as to cancel, leaving (2.1275-1.9135) = 0.214 which added to 2.9788 yields 3.1928, within 2% of Li-7's 3.2563 value. Another reason for this structure is that the 3.2563 magneton is the maximum field direction value but its maximum spin direction value is 4.2039, which is exactly (3/2)½ x r_n/r_p x (m_e+m_p)/m_p = 1.224744871 x 1.091/1.0355 x 1.000544617 = 1.2911 x 3.2563. If neutron and He-3 ½ -spins aligned to cancel their combined spin effect would be 1, which added to H-3's ½-spin would be 3/2 with a (3/2)½ resultant attenuated by the orbital discrepancy between a neutron electron and its proton and the net mass ratios.

Alignment of He-3 and neutron ½-spins to a spin 1 configuration would occur in a tetrahedral structure. However this is not an alpha tetrahedron with 60^0 face angles, 54.7356^0 face-edge angles, and nucleon magneton cancellation (Fig. E). Otherwise the ratio between the 4.2039 spin magneton would be $(3/2)^{½}$ = 1.224745 x 3.2563 instead of 1.2911, 1/sin 50.76325^0, a steeper angle indicating an elongated tetrahedron from bonding between the apex neutron and H-3, and which adds the 0.214 He-3 + Neutron magneton difference to H-3's magneton.

In fact, simply adding an alpha 28.29683 MeV BE, a 8.482047 MeV H-3 BE, and a 2.224 MeV neutron-H-3 BE yields 39.00288 MeV, within 0.6% of Li-7's 39.24547 BE. And by incorporating energy stored in sub-resonances between protons and electrons if they have a relative mass equal to the 39.00288 MeV BE yields $7m_p/7m_p$-BE = 1.005939 x BE = 39.23452 MeV, within 0.03% on Li-7's 39.245473 MeV BE. It should also be noted that at this structural level the $(3)^{1/d}(px2.224)^n$ BE equation becomes more accurate as particle size effects become less of an influence in a purely mathematical structural model of point charges and masses held in a BE = (force x distance) equilibrium.

The alpha point structure BE = $(3)^{1/3}(2x2.224)^2$ = 28.5345 MeV, 0.84% greater than the actual alpha BE of 28.29683 MEV, and the H-3 point structure BE = $(3)^{½}(2.224)^2$ = 8.56703 MeV, 1% greater than the actual 8.482047 MeV BE, but when the point structure BE's are added to the 2.224 MeV BE that would occur between H-3 and the neutron, factored by the 0.975 coefficient for this type of structural bond, it yields 39.26993 MeV, within 0.06% of Li-7's actual BE.

This (He-3 + n) tetrahedral structure is a basis for the Helion pattern in nuclides and overcomes the problem of the alpha Helion's inert nature. It also comports with the Magic Number 2 pattern since H-3 (enhanced proton), He-3 (enhanced neutron), and a neutron form a proton and 2 neutron pair for Li-7. This unbalanced tetrahedron also provides insight into nuclide instability. For instance, an H-3 and 2 He-3's are a 1 "proton" and 2 "neutron" configuration of Boron-9's actual 5 protons and 4 neutrons. It is unstable because the He-3's 2 electrons can't form a stable bond with 6 protons if they occupy too great a volume for the electron's orbital and transition regions to extract proton energy and form a relativistic coulomb nuclear bond.

Conversely, too many neutrons are unstable, as in H-3, because the electrons have ½ the BE effect of a single electron, as in He-3. Structural instabilities from too many or too few neutrons differ, as indicated by the decay times. In Tritium the decay time is 12.26 years and in Boron-9 it is 10^{-19} seconds. This is because with too many neutrons, electrons form low energy bonds and are subject to a statistical probability of accumulating enough energy to break, but with too high a proton-neutron ratio bonds can't form, or maintain, as in the case of transmutation, and the structures disintegrate.

With this structural, bonding, and instability understanding it is now possible to analyze Nitrogen and Carbon-14 transmutation and decay. Nitrogen-14 has 7 protons and 7 neutrons, a 0.4036 magneton, a -104.6586095 MeV BE, and is stable, while Carbon-14 has 6 protons, 8 neutrons, 0 magneton, a -105.2844494 MeV BE, and 5730 year ½-life.

N-14's properties suggest a structural configuration of 2 Li-6's and deuterium, or 2 He-3's, 2 H-3's, and an H-2, while C-14's properties suggest a 2 Li-6 and 2-n, or 2 He-3, 2 H-3, and 2-n, configuration. C-14 forms when N-14 absorbs a neutron produced by solar high energy proton cosmic rays and transmutes to C-14 and a proton, N^{14} (n,p)C^{14}, and decays by neutron beta emission back to N-14, C^{14}(x,e)N^{14}, where x represents the factors precipitating the C-14 decay.

N-14 has a spin 1 while C-14 has a 0 spin which suggests a C-12 0 spin with a spin 1 deuterium for N-14 and 0 spin neutron pair for C-14. Hoyle analyzed that 3 He-4 == C-12 at 10^8 K° and 10^4 g cm^{-1}, however instability of Be-8 suggests that strict He-4 - He-4 bonding does not exist due to the inert and stable nature of He-4. But Li-7 (He-3 + H-3 + n) bonding does indicate existence of elongated alpha (He-3 + n) structure bonding to H-3. This type of bonding permits a C-12 structure of an H-3 center, with He-3's bonded to its neutrons and an H-3 bonded to its proton, or an He-3 center, with an He-3 bonded to its neutron and H-3's bonded to its protons.

This configuration would have 3 alpha type structures with a BE of $3x(3)^{1/3}(p\cdot 2.224)^n$ = 3x28.53448084 = 85.60344253 MeV + 3 H-2 type 2.224 MeV bonds x a $(0.975)^2$ relativistic correction for each apex neutron and $1/(0.975)^2$ for each apex proton (factors are squared since component nucleons are part of a helion so BE effect occurs within the helion and between its bonded helions, unlike Li-7's H-3 bond to an added neutron). This adds 2(2.11419)+2.3395 = 6.56789 MeV to the 85.60344253 MeV, yielding a total C-12 BE of 92.17133 MeV.

This calculated 92.17133 MeV BE value, within 0.01% of C-12's 92.161734 MeV BE, indicates an H-3 center. With C-12 cores for N-14 and C-14 it means the electron in N-14's added H-2 has a 104.65861 - 0.78233 - 92.161734 = 11.714546 MeV energy well and is stable, but 2 electrons in C-14's added n-n pair have (105.28445 - (2 x 0.78233) - 92.161734 = 11.55806)/2 = 5.77903 MeV energy wells, in between H-3's 3.458694 MeV and He-3's 6.93603 MeV electron energy wells. This is a significant pattern since H-3 with a 3.5 MeV energy well and 12.33 y ½-life, C-14 with a 5.8 MeV well and 5730 y ½-life, and He-3 with a 6.9 MeV well and stable, shows a energy well to decay rate relation.

In the actual structures electron energies exhibit dimensional equilibrium, meaning that 1-dimensional 2.224 MeV deuterium BE must equate to 2-dimensional H-3 and He-3 and 3-dimensional He-4 BE's. Otherwise structures would dimensionally imbalance and destabilize. In 3-dimensional space local energy is direction independent while independent energy is direction dependent, or Einstein's fundamental premise that "laws of nature [are] so constituted that they receive no real simplification through the choice of anyone particular set of co-ordinates" would be invalid and no gravity-inertia equivalence would exist (i .e. local observer Euclidean $ds^2 = dx_1^2 + dx_2^2 + dx_3^2 + dx_4^2$ metric could not equate to independent observer Riemannian $ds^2 = (1/\mu\nu)\ \Sigma\ (g\mu\nu\ dx^{\mu}dx^{\nu}$ metric) and his theory would be invalid.

Conversely this means that to independent observers the neutron electron's BE must be dimensionally equivalent and orientation can't matter, while in the electron's subrelativistic local space it has a

directional component. Equivalence occurs for independent observers because the 1-dimensional force transforms to a 3-dimensional effect by the orbital motion. The $3^{1/d}(p \times 2.224)^n$ BE relation incorporates this in its $3^{1/d}$ component since there are 3 available dimensions and d orbital structural dimensions. To find the energy equivalence common denominator between 3-dimensional C-14/N-14 and 2-dimensional H-3/He-3 structures we transform to 1 dimension by $3^{1/3}$ and back to 2 dimensions by its square, or $3^{2/3}$ = 2.080083823.

So in C-14 and N-14 the electrons within each structure would have equal average energies so as to maintain structural equilibrium and integrity. N-14's 104.6586095 MeV BE would divide equally among 7 neutron electrons or 14.95122993 MeV/e and C-14's 105.2844494 MeV BE would divide equally between 8 electrons or 13.16055618 MeV/e in 3-dimensional structures and transform to 2-dimensional equivalents, to equate to H-3's and He-3's energies, by dividing by $3^{2/3}$ to yield 7.187801647 MeV/e for N-14 and 6.326935499 MeV/e for C-14. Since H-3 decays to He-3 and C-14 decays to N-14 the 7.718346 and 7.187802 MeV He-3 and N-14 electron energies would be stable energy states they decay to and the H-3 and C-14 8.482047 MeV/2e = 4.2410235 MeV/e and 6.3269355 MeV/e would be the electron energies they decay from.

Since the stable energy states are energy wells, H-3's electron may be thought of as having a 7.718346 - 4.2410235 = 3.4773225 MeV energy above its ground state and C-14's electron may be thought of as having a 7.187802 - 6.3269355 = 0.8608665 MeV energy above its ground state. These are relative energies since they both relate to

their ground states and the 3.4773225/0.8608665 = 4.039328398 ratio provides a relative decay time correlation factor. Also, as will be explained, since C-14 is 3-dimensional and H-3 is 2-dimensional a 3/2 dimension ratio increases H-3's electron energy decay effect.

This yields a 3/2 x 4.039328398 = 6.058992596 effective energy ratio which transforms by $e^{6.058992596}$ = 427.944107 to a time domain ratio. Since H-3 is the first radioactive isotope its 12.33 y ½-life serves as the reference decay rate and yields a 5276.55 y ½-half for C-14 when multiplied by the 427.944 time domain factor. This value has a (5730-5277) / 5730 = 8% discrepancy from C-14's actual 5730 y ½-life but is close enough to show the correlation between reactant and product structures and their BE's when the energy is represented in terms of the common denominators, their neutron electrons. The discrepancy is only ln (5730/12.33)= 6.1414355 - 6.058993 / 6.141435 = 1.35% when represented in terms of the average electron energies.

One source of error for consideration is the 0.975 coefficient in different types of bonds. The factor derives from the neutron to proton ratio in triton structures. In the $3^{1/d}(p \times 2.224)^n$ general equation the BE is 7.704162 MeV for 2-p and 1-n and 8.567028 MeV for 1-p and 2-n. This 0.89928 energy ratio is the (2 x 2.224) / $(2.224)^2$ deuterium bond ratio in He-3 and H-3 structures because in H-3 two electrons repel each other (high energy density) and thus contract their own neutron regions, while in He-3 only 1 electron (low energy density) contracts its non-neutron region, an effect which gives H-3 an overall 10% higher BE, but with lower individual electron BE's.

As mentioned, in He-3 a single electron contracts the electron orbital region which has the relative effect of enlarging the proton regions. This may be thought of as an inverted neutron structure in which the neutron forms in the electron orbital's center between the protons instead of around them, giving He-3 a neutron characteristic since its -7.718346 MeV BE has relatively greater energy than H-31s -8.482047 MeV BE (i.e. a neutron has 0."78233 MeV more energy than a proton + m_e and He-3 has 8.482047- 7.718346 = 0.763701 MeV greater energy than H-3, which is an He-3 structure + m_e). This structure has its BE contracted region in its center like a doughnut.

Similarly, since H-3's electrons repel they enlarge the orbital space and decrease the proton regions (i.e. relativistic contraction occurs within the proton's neutron radius and expands orbital space between the protons) so the BE energy well occurs around the protons and leaves its center orbital space with higher relative energy like a disc or inverted doughnut, compared to He-3's orbital space. Since H-3's center is like a proton that can transfer energy to He-3's energy well center they form a p-n deuterium type bond, as in Li-6.

In 3-dimensional structures these effects are compounded since bonding in tritons occurs in the area between their nucleons and the deuterium type bonding between triton structures is orthogonal to their bonding. So just as a common denominator energy equivalence must be derived to relate 2 and 3-dimensional structures, so to must a common denominator distance be derived to relate the orthogonal 2-dimensional forces generated by the sub-relativistic energy wells.

Since the BE ratio of He-3/H-3 is $(2x2.224)/(2.224)^2 = 0.899280575$, for their orbital area energies, the I-dimensional radial equivalent is (0.899280575)t = 0.948403052 for one triton, and then again to equate the second triton, yielding (0.948403052)t = 0.973809043.

This is the 0.975 factor of deuterium type bonds between H-3 and He-3 yielding Li-6's (He-3 BE + H-3 BE)xl.975 = 31.99579 MeV BE. The 0.975 factor, $(2x2.224/2.224^2)^{¼}$, occurs in Li-6 because parallel triton energies are bonding. However, in C-12 there is a core H-3 triton orthogonal to two He-3's with 2.224 x $(2x2.224/2.224^2)^{½}$ bonds to its neutrons and an H-3 with a 2.224 / $(2x2.224/2.224^2)^{½}$ bond to its proton. In this case the factors are 0.9752, not 0.975, and the energies are 2.224 MeV, not the core H-3's 8.482047 MeV BE, because the core H-3 is orthogonal and forms part of 3 alpha structures held by deuterium bonds from its individual particles to their tritons.

The proton bond is $2.224/(2x2.224/2.224^2 = 2.224x1.112 - 2.473$ because the He-3/H-3 BE ratio is $(2x2.224/2.224^2) = 0.899280575$ but the inverse H-3/He-3 BE ratio, a p/n ratio, is 1/0.899280575 = 1.112 which is H-3's relative p:H-3 BE compared to H-3's two n:He-3 BE's. This shows different electron energies in different structural parts and in C-14 two extra neutrons increase the BE to -105.2844494 MeV but reduce the electron energies to -6.326935496 MeV, compared to N-14's respective -104.6586095 MeV and -7 187801647 MeV energies. C-14's average electron energy is 0.8608665 MeV, over N-14's, but lower energies in the added neutron's vicinities would account for the 1.35% less energy that results in C-14's 5730 y ½-life.

This substantiates a relation between radioactive decay and our nuclear model electron energies but some aspects, such as why ½-life decay occurs or how reactant concentrations affects decay rate, need further clarification. Both C-14 and H-3 are formed from neutrons generated by solar cosmic rays so both generation rates and relative concentrations, about 1 in 10^{12}, are constant which simplifies our analysis. As artificial radioactivity experiments indicate, γ-rays and decay particles may initiate decays. For example, B-12 decay to C-12 generates 4.4 MeV γ-rays and Cl-38 beta decays emit 3.77, 2.17, and 1.6 MeV γ-rays but only 3.77 or 4.4 MeV γ-rays could initiate an H-3 3.5 MeV electron decay, and none can initiate C-14 decay, but since these are relatively rare they will be omitted from analysis.

Nuclear binding in our model consists of an energy well. created by relativistic contraction from the electron energy absorbed by its acceleration through a proton's coulomb field. Proton mass energy transfers through its coulomb field to an electron's orbital angular momentum. Its 14X energy increase creates a spatial gradient that bonds the protons by counteracting their coulomb repulsion forces. It is analogous to Yukawa's particle created by interacting charged particles, only it's a -7 MeV field gradient created from the 0.5 MeV electron's interaction with a proton and exactly parallels the quark-gluon exchange in a proton-neutron interchange.

An electron's transition state is a proton-neutron interchange and gluons are -7 MeV energy well gradients that counteract proton repulsions, massless because gradient energy has no mass. The gluon

energy well structure holds an electron in its nuclear orbit and up/down quark exchanges effecting proton-neutron interchange are change in direction energies that occur in clover-leaf orbital transition phases. The electron is Schroedinger's Particle in a Box and -7 MeV gradients are 7 MeV boundary condition threshold energies electrons must acquire to escape or tunnel through with $T = e^{-2KL}$ transmission coefficients, where $K = (2m(U-E))^{1/2}/(h/2 \cdot pi)$, L = energy barrier width, and U = 7 MEV energy barrier. To tunnel through a barrier an electron must have more energy than its -7 MeV energy well ground state and must have another -7 MeV energy well to transmit to.

In C-14 formation a neutron interacts with an N-14 nucleus and a proton is emitted. This decay mode is unusual since it does not involve alpha, beta, or gamma emission. However in our nuclear model if a neutron approaches to within 1 fm of a proton's surface its electron will absorb enough coulomb energy to initiate relativistic transition to a neutron state with that proton. This makes neutron capture by N-14 actually a neutron beta decay and N-14 transmutation to C-14 an electron capture, like $Ar^{37}(e,v)C1^{37}$, and thus a normal decay mode, not a proton emission. In this $N^{14}(n,p)C^{14}$ decomposition there will either be equal $\bar{\nu}_e$ and ν_e neutrinos produced or none, since neutron decay and electron capture produce $\bar{\nu}_e$ and ν_e neutrinos, respectively, or the neutron electron orbital angular momentum that produces $\bar{\nu}_e$'s is conserved on transfer to the N-14 proton orbital.

Orbital angular momentum has a vector orthogonal to the orbital plane at its mass center, equivalent to spin 1. However relativistic

contraction displaces the electron from its 2.76136 fm local orbital to a 1.091 fm independent observer radius. This effectively gives it a ½-spin since it radially displaces center of mass for independent observers. Since angular momentum is a radius-momentum cross product and independent observers only see a neutron's surface, relativistic contraction moves the mass center closer to the surface, not surface closer to mass center, just as inertial center of mass is shifted by anterior-posterior contraction-dilation for independent observers.

This offset gives the orbital magneton a ½-spin, which cancels the proton's ½-spin, and gives the relativistic contraction a ½-spin effect. When neutrons decay the ½-spin relativistic moment conserves as a ½-spin neutrino, with an angular moment and relativistic radial contraction so it has a rotation, offset center, and corkscrews like a propeller with spin oriented in propagation direction. So in C-14 decay to N-14 a $\overline{\nu}_e$ must be emitted to conserve angular momentum, and in Ar-37 beta capture a neutron orbital must form and the resulting relativistic ½-spin is conserved by a ν_e emission, but in N-14 beta capture the neutron orbital energy may transfer with the electron, so either a $\overline{\nu}_e$ is emitted by the neutron decay with a ν_e by the N-14 beta capture, or neither is produced because the energy transfers.

In C-14 an unstable condition exists because electrons exist in an energy well oscillating 0.861 MeV above their -7.718 MeV ground state and -6.327 MeV below their 0 energy non-bonded state. They may escape the well by addition of equal and opposite energy (magnitude and direction) that decelerates it back to the 0 MeV energy surface

or it may penetrate the gradient energy barrier as a particle-wave, compatible with the space-time transfer medium, until it penetrates another energy well. Tunneling from a relativistic energy well is an inverse Yukawa particle interaction; instead of particles produced by energy in gradients, they absorb by having more energy than the gradient, but must emerge in an energy well within dt = h/4·pi·dE, where dE is a particle's negative energy below its non-bonded state, since surrounding space has more energy than they do. Tritium with less negative energy would have more time (probability) than C-14.

The electron has two states: a neutron bonding electron in an energy well and a particle-wave outside the well. Transmission of the electron from the well also involves energy transfer back to the protons. Since the electron must return to its energy well if it can not find another energy well the transmission constitutes an oscillation. The energy transfer will be an average of its 0.860866 MeV peak energy~ or $0.860866/2^{1/2}$ = 0.6087245, which added to C-141s -105.2844494 MeV BE is -104.675725 MeV, 0.01635% below N-14's BE. This slightly negative energy state means that the electron is more stable oscillating than it is leaving its C-14 state since it still requires addition of 0.0171155 MeV to form a stable N-14 nucleus.

So the electron is still bound to its -7 MeV gluon energy well, its mass masked within its negative energy state but its charge only offset by its degree of proximity to a proton. Under such conditions the electron would exist in a (N-14) :[e]$^{-}$: :(C-14) resonance, where the brackets indicate a sub-relativistic negative energy state. This

is an e^{ix} = cos x + i sin x wave oscillation with its node at the energy well's boundary condition, with an equal probability of being within or outside the energy well, just as in a Schroedinger orbital electron radial oscillation. No decay occurs under such conditions and the angular momentum relativistic shift, its neutrino component, still resides in the electron's energy vector, rendering it a bonded energy state electron until a de-stabilization occurs.

However, if this electron encounters another C-14 nuclei with an oscillating electron a decay will occur. Since the electrons have identical energies and are interchangeable, one replaces the other nuclei's electron and its electron, unbound, is emitted with an $\bar{\nu}_e$ to conserve angular momentum. The 1st C-14 now becomes an N-14 and the 2nd C-14 remains a C-14 with its original electron emitted. The removal of the 1st C-14's electron leaves it in a slightly depleted energy state but the 2nd C-14's slightly enhanced energy state will oppose complete transfer of the electron energy so the 1st C-14 only loses enough to become a stable N-14 nuclei. Since this requires two C-14 nuclei and results in one, it constitutes a ½-life decay.

So the ½-life decay time is an electron BE function and occurs because decay is precipitated by substitution of an identical energy electron from a neighboring nuclei during an electron's oscillation from its bound state. The decay rate is a matter of probability and depends on the existing number available nuclei. Since the nuclear cross-section and volumetric density determines the probability of interaction, decay rate must depend on the number of nuclei present.

These relations are well established and the purpose of this paper was to develop the relation between reactant and decay product structures, energies, and ½-life. To do this it was necessary to develop a neutron model (pp. 11-13) which correctly calculates its magneton to within 0.1%. A deuterium model was then developed with calculation of its BE (pp. 20-30) and magneton (pp. 31-3); an He-3 model, BE (pp.37-9) and magneton (pp 39-40); an H-3 model, magneton (pp. 40-1) and BE (pp. 42-9); and an He-4 model and BE (pp. 49-50), with a 0 magneton. These structures provided the basis for the more complex helion-triton structures but since they are proton-electron based it was necessary to show how N-14 has a spin of 1 (pp 53-4).

It was then necessary to analyze this structural progression in terms of magnetons and BE's (pp. 56-61), develop models for Li-6 and Li-7 (pp. 62-5), and finally C-12, C-14, and N-14 (pp. 66-7). With these models it was possible to derive their electron BE's, compare them to their stable energy well BE, and calculate the t-life decay time for C-14 in terms of H-3's ½-life and electron BE (pp 68-71). Beta decay and the neutrino's ½-spin conclude the paper (pp.72-6). In the course of this paper a specific relation between the nuclear binding and electromagnetic forces was developed and presented in terms of particle coulomb forces and relativistic energy effects, thus providing a solution to Einstein's Unitary Field Theory.

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Respectfully submitted,

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