

# A Comprehensive Unification Theory

by William Gray

## Abstract

This is a theory of three forms of light: without momentum, with momentum, and with angular momentum. It is also a theory of Quantum, Classical and Relative Physics, and a theory of local, independent and gestalt perspectives.

The complete theory is presented in 11 papers:

- a) The Electron
- b) The Proton
- c) The Particle Effect
- d) Wave-Particle Duality
- e) Quantum Dynamic Relativity
  - Bohr's Correspondence and Heisenberg's Uncertainty
  - Neutron Spin
  - Nuclear Force
  - Quantum Behavior
- f) Nuclear Binding
- g) Neutrons
- h) Modulated Quantum Neutron Fusion
- i) Electrons, Neutrinos, and Mesons
- j) Radioactive Decay
- k) The Superposition States of Planck's Constant  
(Note: These papers are available at [www.mqnf.com](http://www.mqnf.com))

### I) Light

The initial premise is that light is a 3-dimensional energy oscillation. Its stationary form is the dark energy of space with the properties of charge permittivity, magnetic permeability, and non-linear density that permits the inertia and acceleration of Einstein's Euclidean and Riemannian space. Its momentum form is the Electromagnetic Wave (EM wave) with Maxwell's electric (E) and

magnetic (B) field oscillations. And its angular momentum form is the mass, radius, density, charge, spin, and magnetic moment of protons and electrons.

From this 3-d energy oscillation construct the properties of space, the forms of matter, and the gravitational, electromagnetic and nuclear forces are derived. The 3-d oscillation results from the 2nd Law of Thermodynamics (entropy increases in all natural processes) and Quantum Theory (all regions are equally accessible and all energy states are equally available). Energy oscillation in each dimension over time is the result of the Maxwell-Boltzmann Distribution Law as presented in "Gases: Quantum Mechanics and Statistical Mechanics," General Chemistry, Ch. 9 by Linus Pauling.

These oscillations conform to the  $d^2g/dx^2 = (1/v^2) d^2g/dt^2$  general wave equation that is the basis of Maxwell's EM waves and the  $e^{ix} = \cos x + i \sin x$  Euler Identity with real and imaginary parts that is the basis of Schroedinger's Wave Functions. As a result the construct of the Universe becomes a simple recursive pattern with the dark energy of space as a stationary oscillation providing the reciprocal properties of EM wave's E and B fields and the mass, charge and magnetic effects of particles.

Hydrogen's configuration of a proton and electron in harmonic equilibrium was shown to have two boundary condition states, its stable -13.605698 eV ground state and its unstable +0.78233 MeV maximum energy neutron state. The unstable neutron state was then shown to form stable harmonic equilibriums with protons resulting in nuclear force and also to interact with other neutrons which constitutes the fusion of hydrogen into helium.

The Universe thus becomes a simple construct of hydrogen in two quantum states, with or without the 0.78233 MeV energy of the neutron. The proton and electron components of hydrogen result from EM wave energy with angular momentum. Energy transfer occurs between these structures by EM waves with simple 1-d momentum. And the medium by which this occurs is EM wave energy without momentum but which appears to have momentum from the local perspective of light and angular momentum from the local perspective of an EM wave in a particle.

## II) Gestalt

This concept of the Universe derives from a gestalt view of form being function that exceeds the properties of its components because of the relativistic behaviors that organize the components into their specific forms. These behaviors are derived from local and independent perspectives. For instance, if an observer stands on earth and looks up to the stars he sees relativistic continuity and predictable behaviors and if he looks down to the electron he sees quantum discontinuity. However if he changes his perspective to the smallest, lightest and highest velocity particle (electron) he again sees relativistic continuity with predictable results.

Such a transposition is permitted by Bohr's Correspondence Principle that behavior becomes Classical when energy differences between adjacent quantum levels vanish. From the proton's vantage the electron has  $E_n = 13.6/n^2$  eV quantum energy states and its second state is  $13.6/2^2 = 3.4$  eV which is a  $13.6 - 3.4 = 10.2$  eV quantum level difference. However from the electron's vantage the proton appears to be a particle with an  $m_p = 938.2723$  MeV energy and only a  $10.2/m_p = 1 \times 10^{-8}$  quantum level difference,  $m_p/m_e = 1836$  times less than for the electron.

The proton's mass also has a 3-d inertial effect on space and the 10.2 eV is a 1-d radial energy. Thus the energy difference is entropically affected by the proton's 3-d structure resulting in a  $(m_p/m_e)^3 = 6 \times 10^9$  further reduction in the quantum energy's effect on the proton. This renders the energy effect virtually non-existent and therefore from the electron's perspective the proton appears to behave classically.

In addition to Bohr's Correspondence Principle both Einstein and Schroedinger overlooked Conservation of Angular Momentum. To account for hydrogen's 0-spin Schroedinger differentiated Bohr's 2-d orbital angular momentum model to a 1-d wave equation with real and imaginary components and then integrated this to a 3-d wave function with no spin. This Calculus differentiation of the Bohr orbital lost the initial condition of the electron's angular momentum orientation and therefore rendered Schroedinger's Wave functions only statistically continuous.

Similarly, Einstein only solved for the relation between 1-d inertia and gravity. As a result his equation for Euclidean space had three spatial dimensions and one composite time flow dimension in terms of a photon travelling from one point to its neighbor at the speed of light. However, from orbital electrons at the atomic level to galaxies at the stellar level all matter statistically stabilizes in angular momentum equilibrium orbitals because energy distributes between all dimensions to increase entropy.

It would not be possible for these behaviors to occur at the atomic and stellar levels unless space had the ability to permit such behaviors. The presence of energy attenuates time flow (time dilation) and orbital angular momentum rotates energy between the dimensions, so to be complete Einstein's equation for space must accommodate different time flows for each dimension in the form of a phase shift between the energy in each dimension so that each is described as a simple  $x = A \cos (wt + \phi)$  harmonic oscillation with an A amplitude, w angular frequency, and  $\phi$  phase shift.

With angular momentum incorporated into Schroedinger's wave functions and Einstein's concept of space-time in conjunction with Bohr's Correspondence Principle, a resolution between Quantum and Relative Physics occurs in terms of the electron's relativistic effect on the proton by its orbital velocity. Furthermore, since the proton and electron form an electric dipole that rotates it constitutes an EM wave with angular momentum, with its own mass, charge and magnetic effects that equalize relativistic differences between the proton and electron. Relativity's inertia, Maxwell's EM waves, and nuclear force within and between nucleons then solve in terms of each other and the dark energy of space.

### III) Particles

In The Particle Effect it was shown that dark energy has the form of Einstein's Euclidean point with energy existing as a 3-d oscillation with angular momentum. Because this structure has an orientation it was related to charge polarity and each point in space was shown by the Pauli Exclusion Principle to exist in an equal and opposite state with its neighboring point. This is the neutral unexcited ground state of dark energy in space. However,

when subjected to an external EM field energy the field is stored in the dark energy by re-orienting its neutral energies to align with the EM field, constituting an excited dark energy state.

From this the 3-d energy oscillations' oriented inertias were shown to relate to charge permittivity and magnetic permeability in free space. These qualities were then related to the speed and wavelength of light in term's of Maxwell's Equations and angular momentum relativistic effects were incorporated to compress the excited dark energy in three dimensions and show that an EM wave with angular momentum results in charge and magnetic effects since the E- and B-field cancellations that occur in an EM wave with 1-d momentum do not occur when the EM wave traverses an orbital path.

In The Proton mass was shown to result from the relativistic compression of excited dark energy by the angular momentum of an EM wave. Since the EM wave between a hydrogen proton and electron is a naturally occurring ground state with minimal relativistic effects it was taken as the reference for an electric field energy based on the  $F_c = k_e e^2 / r^2$  coulomb force relation. The coulomb constant is  $k_e = 1 / (4 \pi \epsilon_0) = \mu_0 c^2 / 4 \pi$ , since  $c = 1 / \mu_0 \epsilon_0$  by Maxwell's Equations, and the electric field energy is  $E_c = F_c r = k_e e^2 / r = (\mu_0 c^2 / 4 \pi) e^2 / r$ . By  $E = mc^2$  mass-energy equivalence this becomes  $E = mc^2 = (\mu_0 c^2 / 4 \pi) e^2 / r$  and  $m = \mu_0 e^2 / (4 \pi r)$ .

At the proton's 1 fm radius this yields a  $2.5669722 \times 10^{-30}$  kg mass-energy of E-field excited dark energy without relativistic compression, as in hydrogen with an  $E_0 = 13.6 \text{ eV} = \frac{1}{2} m v^2$  classical  $v_0 = 2.187692 \times 10^6 \text{ m/s}$  orbital electron velocity. The mass of the proton is then this electric field energy density compounded by whatever relativistic compression occurs from the EM wave's angular momentum. Ground state hydrogen thus provided the frame of reference for classical electric field energy and the neutron provided the reference for calculating relativistic compression.

In hydrogen there is a 13.6 eV EM wave with angular momentum equalizing the proton-electron harmonic resonance with  $13.6 / m_e = 0.00266\%$  of the electron's mass in each dimension. However in a neutron the EM wave is  $(m_n - m_p - m_e = 0.78233 \text{ MeV}) / m_e = 1.531$  times the electron's mass so the electron's total mass-energy is

2.531  $m_e$ . By the  $m_0/m = (1 - v^2/c^2)^{\frac{1}{2}}$  Lorentz Transform this yields a  $2.754 \times 10^8$  m/s = 0.92c velocity and shows a 1.531 mass-energy in the EM wave by relativistic compression. To equal the  $m_p = 938.2723$  MeV proton mass the EM wave compression would need to be increased by  $m_p/0.78233$  MeV = 1199.33. By the  $m_0/m = (1 - v^2/c^2)^{\frac{1}{2}}$  Lorentz Transform this yields a  $v_p = 2.99792354 \times 10^8$  m/s = 0.999999653c EM wave velocity.

Comparing the Lorentz Transform for this EM wave velocity and hydrogen's classical velocity EM wave yields the compression ratio for the excited dark energy and results in the proton's mass. The ground state hydrogen radial compression is  $l_0 = a_0(1 - v_0^2/c^2)^{\frac{1}{2}} = 0.999973374$  and the proton's compression is  $l_p = a_0(1 - v_p^2/c^2)^{\frac{1}{2}} = 8.3295498 \times 10^{-4}$  so their compression ratio is  $l_0/l_p = 1200.513$ . Factoring this by the  $4/3 \pi r^3 / (2r)^3 = 0.5236$  spherical to cubic volume ratio and multiplying by the  $2.5669722 \times 10^{-30}$  kg excited dark energy's mass-energy equivalence yields a  $1.6135708 \times 10^{-27}$  kg mass, within 3.53% of the proton's actual  $1.672623 \times 10^{-27}$  kg. This is corrected to within 0.13% of  $m_p$  by factoring the proton's mass gyration effect into the hydrogen atom's EM wave.

In The Electron its mass was similarly calculated by showing that the proton and electron are opposing quantum states of equal and opposite charges and a small size, mass and large magneton or a large size, mass and small magneton. High energy EM waves can form stable quantum angular momentum states to yield electrons just as orbital electrons in short wavelength atomic orbitals are able to form high energy molecules with short bond lengths.

The electron was shown to result from wavelength compression of the  $E_0 = 13.605698$  eV  $v_0 = 2.1877 \times 10^6$  m/s hydrogen orbital EM wave by the  $v_0/c$  ratio of their relativistic energies where  $m_e = E_0(2\frac{1}{2}c/v_0)^2 = 0.51099906$  MeV. However the electron's lower mass-energy also results in a greater magnetic field energy. Both the electron and proton generate magnetons based on the  $B = \mu_0 I / 2 \pi r$  Biot-Savart Law, from which Ampere's  $\oint \vec{B} \cdot d\vec{s} = \mu_0 I$  Law and Maxwell's  $\oint \vec{B} \cdot d\vec{s} = \mu_0 I + \epsilon_0 \mu_0 d\phi_E/dt$  Equation derive. Since current depends on orbital frequency and  $f = c/\lambda$  a short wavelength yields greater magnetic field and captures less dark energy to capture the field.

In the  $\mu_B = \frac{1}{2}e\hbar/m_e$  Bohr magneton  $\hbar = h / 2\pi$  is the quantum angular momentum equal to the  $L = mvr$  Classical angular momentum so  $\mu_B = \frac{1}{2}e\hbar/m_e = \frac{1}{2}em_evr/m_e = \frac{1}{2}evr$ , the magnetic flux of a  $I = \frac{1}{2}evr$  current loop of radius  $r$ . However the field is factored by the  $\mu_0$  free space permeability, and since mass is compressed dark energy and the field is  $\oint \vec{B} \cdot d\vec{s} = 0$  through a closed surface by Maxwell's Equations, the field is captured by the increased permeability of the compressed dark energy according to the compression ratio.

Because the EM wave has three equal oscillations (the E- and B-field energies and the propagation axis) the magneton for the electron is  $\mu_B = \frac{1}{2}evr (3c/v_0)^2 / 2\pi r = 9.274 \times 10^{-24}$  J/T, where  $(3c/v_0)^2 / 2\pi$  is the compression ratio, the  $v$  EM wave charge velocity is the speed of light, and  $r$  is the calculated radius of the EM wave's propagation axis,  $r = 2\pi a_0 / (c/v_0)(3c/v_0)^2 = 0.014356$  fm. This radius was derived by showing that an  $m_e = 0.51099906$  MeV EM wave's wavelength is the Bohr orbital wavelength factored by the  $(c/v_0)$  relativistic energy increase and then compressed by  $(3c/v_0)^2$  because of its angular momentum.

This radius is the relativistic radius resulting from three equal orthogonal contractions so the local perspective radius is  $3^{\frac{1}{2}} r = 0.024865$  fm which is  $\frac{1}{2}$  of the electron's 0.5 fm radius, as if the particle results from an EM wave propagating on a path at  $\frac{1}{2}$  its radius. The proton's EM wave propagation axis was similarly shown to be at  $\frac{1}{2}(r_p = 1.0355 \text{ fm}) / 3^{\frac{1}{2}} = 0.2989$  fm and agrees with Hofstadter's 1961 SLAC electron scattering experiment which showed that charge distribution in a proton is  $\frac{1}{2}e^+$  at 0.3 fm and  $1e^+$  at its surface. The  $3^{\frac{1}{2}}$  relativistic contraction also results in a mass and magnetic field angular momentum offset that causes the observed  $\cos^{-1} 3^{-\frac{1}{2}} = 54.740^\circ$   $\frac{1}{2}$ -spin effect in particles.

Thus the radii,  $\frac{1}{2}$ -spins and masses of the proton and electron are derived from the relativistic compression effects of EM waves with angular momentum and the  $\mu_B = \frac{1}{2}e\hbar/m_e = \frac{1}{2}evr (3c/v_0)^2 / 2\pi$  electron magneton is shown to result from an actual orbital charge magnetic field attenuated by the increased permeability of the compressed space. This means that the mass and magnetic effects are reciprocal according to  $um = \frac{1}{2}eh$  so that as mass increases and

increases the relative permeability, capturing more of the  $\mu = \frac{1}{2}e\hbar$  current loop generated magneton, the observed external magneton decreases because flux follows the path of greatest permeability.

This is confirmed by the  $\mu_p = 2.7928 \frac{1}{2}e\hbar/m_p$  proton magneton, where the 2.7928 results because the proton is less dense relative to the electron. The proton has  $m_p/m_e = 1836.1527$  times more mass than an electron and a  $(r_p/r_e)^3 = (1.0355 / 0.05)^3 = 8882$  times greater volume so its density is  $(r_p/r_e)^3/(m_p/m_e) = 4.8373$  times less. With 4.8373 times less dark energy compression its relative permeability capturing the generated field is 4.8373 times less so its external magneton is 4.8373 times greater. This is its  $\frac{1}{2}$ -spin measured magneton value, with a  $4.8373 / 3^{\frac{1}{2}} = 2.7928$  component in the direction of the external magnetic field used to measure it so its magneton is  $\mu_p = (\frac{1}{2}e\hbar/m_p) (r_p/r_e)^3 / 3^{\frac{1}{2}}(m_p/m_e) = 2.7928 \mu_n$ .

#### IV) Charge and Gravity

In The Particle Effect, charge was shown to result from an EM wave's orientation,  $\begin{matrix} \uparrow E \\ \nearrow B \end{matrix} c$  or  $\begin{matrix} \nearrow E \\ \uparrow B \end{matrix} c$ . Dark energy was shown to exist as a 3-d energy oscillation with a phase shift between each orthogonal oscillation to yield maximum entropy. The adjacent neighboring point oscillations have opposite angular momentums so as to comply with the Pauli Exclusion Principle. This results in the  $\mu_0$  permeability and  $\epsilon_0$  permittivity which is excited by the E- and B-fields of EM waves to yield light's velocity and wavelength according to Maxwell's Equations. Since all the parameters define in terms of each other the proton and electron charges are equal but with opposite polarities because of EM wave orientation.

Thus the properties of space, the E- and B-fields of EM waves and the charge, mass, size, magneton and  $\frac{1}{2}$ -spin characteristics of protons and electrons inter-relate as EM waves without momentum, with momentum, and with angular momentum. Furthermore, since the particles are EM waves with angular momentum they also inductively interact with the dark energy and excite it just as EM waves with linear momentum.

EM wave's 3-d oscillations are inertial which Einstein showed to contract space according to the  $l = l_0(1 - v^2/c^2)^{\frac{1}{2}}$  Lorentz Transform so they transfer energy to the dark energy as an EM wave



traverses its path. This energy is returned over the  $\frac{1}{2}$ -wavelength of an EM wave because of the energy density gradient caused by the transfer of EM wave energy to the dark energy, which then repeats in the opposite direction to complete the wave cycle. Because a particle's EM wave traverses a spherical orbital path its energy oscillation results in an average Lorentz contraction effect in all three dimensions which is the basis of matter's gravitational acceleration gradient.

In other words, the EM wave with angular momentum increases the dark energy's energy density according to  $E = hf$  and increases its 3-d oscillation frequency, thus contracting its wavelength and creating a spatial gradient. Since both the mass of particles and the gravitational acceleration gradient derive from the EM wave's effects on dark energy, Gravity derives from the 3-d oscillation of EM waves in a particle angular momentum configuration. Gravity co-relates to mass but both are derivative effects of EM waves.

#### V) Wave Behavior

In Wave-Particle Duality it was shown that wave behavior in particles derives from relativistic effects on space by harmonic resonances between the particles. This concept was derived from Linus Pauling's analysis of the quantum mechanics of diatomic gas molecules' harmonic oscillations in "Chemical Thermodynamics" and "Gases" (General Chemistry) and the Pauli Exclusion Principle.

In monatomic hydrogen the proton-electron bond energy is  $E_0 = 13.6$  eV and in diatomic hydrogen the valence electrons form a 4.53 eV bond exactly  $\frac{1}{3}$  the  $E_0$  orbital energy because valence electron charges repel while the proton-electron charges attract. Valence electrons only bond by the  $m_s \pm \frac{1}{2}$ -spin magnetic quantum numbers of Pauli's Exclusion Principle whereas the electron-proton bond has three quantum numbers (n-principal, l-orbital, and  $m_l$ -orbital magnetic) with three times the energy. However Pauling showed that in diatomic bonding the molecules undergo the same six degrees of freedom quantum harmonic oscillations as Schroedinger showed for monatomic hydrogen quantum harmonic oscillators.

This can only be possible if the valence electrons are able to transfer the six degrees of quantum harmonic oscillation energy

through Pauli's  $m_s \frac{1}{2}$ -spin quantum number parameter. In other words, valence electrons magnetically bond in pairs and resonate harmonically in all six degrees of freedom. This also means that ionized particles with the same relativistic energy and reference frame with respect to each other undergo Pauli Exclusion Principle pairing and six degrees of freedom harmonic resonance. However, because their motions are not inertially damped by the masses of their nuclei their resonant frequencies and associated wavelengths are the same as for orbital electrons in monatomic hydrogen.

That is, the  $\lambda = h/m$  de Broglie wavelength for diatomic gases reflect the masses of the atoms whereas the matter wavelength for valence electron pairs ionized from their nuclei only reflects the electrons' masses, just as in Schroedinger's orbital electron wave functions. In Quantum Dynamic Relativity (Quantum Behavior) it was shown that Schroedinger's orbital wave behavior derives from relativistic effects of the electron's  $E_0 = 13.6$  eV energy and  $v_0 = 2.1877 \times 10^6$  m/s velocity in the two dimensions of a Bohr orbital precessing in a 3rd dimension.

While this only represents a  $3^{1/3} E_0/m_e = 0.0000385$  change in electron mass and  $0.0000385 a_0 = 2$  fm change in orbital radius, it is a  $2 \text{ fm} / 28 \text{ fm} = 7.1\%$  change to the proton's 28 fm gyration, by Conservation of Angular Momentum, since relativistic effects only apply to independent observers (the proton), not a local observer (the electron in its own reference frame). Thus the proton sees the electron as having a 7.1% energy increase with respect to its 28 fm orbital energy frame of reference. Also, in addition to the spatial distortion, the proton sees a 7.1% time dilation of the electron's effect, by the  $t = t_0(1 - v^2/c^2)^{1/2}$  Lorentz Transform, so it actually only sees the electron where it used to be.

Thus the proton sees a compounded 7.1% spatial and 7.1% time dilation effect which, by Pauling's harmonic oscillator analysis, was shown to result in the  $\lambda = h/mv$  wavelength of Schroedinger's wave functions. Because relativistic space-time effects depend on momentum with respect to the speed of light and harmonic resonance wavelength depends on momentum it was possible to relate harmonic resonance energy to de Broglie's wavelength. Since Pauling showed

that diatomic molecules' kinetic energy determines their harmonic resonance frequency it was possible to relate the electron pairs' relativistic effects to their  $\lambda = h/mv$  de Broglie wavelength, thus showing that wave-particle duality arises from harmonic resonance relativistic effects between particle pairs.

#### VI) Neutrons

In Neutrons a 0.78233 MeV quantum state of hydrogen was shown to exist with the neutron's  $m_n = 939.56563$  MeV mass-energy,  $r_n = 1.091$  fm radius,  $-1.9135$  magneton, and  $\frac{1}{2}$ -spin characteristics and its associated  $\frac{1}{2}$ -life decay into a proton, electron, 0.78233 MeV and electron anti-neutrino. In this state the orbital electron has a  $m_n - m_p = 1.29333$  MeV =  $2.531 m_e$  mass-energy, 95,000 times greater than its  $E_0 = 13.605598$  eV ground state energy. Since the electron's state is high energy it may be analyzed as a Classical Bohr Model hydrogen atom by Bohr's Correspondence Principle.

By the  $1/l_0 = m_0/m = (1 - v^2/c^2)^{\frac{1}{2}}$  Lorentz Transforms and Conservation of  $L = mvr$  Angular Momentum, at relativistic levels increasing electron energy proportionately reduces orbital radius.  $E_n = 0.78233$  MeV is the total 3-d orbital electron energy and  $E_0$  is a 1-d wave function energy so the radius reduction is  $(E_n/3)/E_0 = 19166.75$  to  $a_0/19166.75 = 2.761$  fm. This orbital radius is then relativistically contracted by the  $(E_n+m_e)/m_e = 2.531$  mass-energy increase to  $2.761$  fm /  $2.531 = 1.091$  fm. Since the  $r_p = 1.0355$  fm proton and  $r_e = 0.05$  fm electron radii sum to  $1.0855$  fm, the  $r_n = 1.091$  fm orbital is the smallest an electron may attain without colliding with the proton so the 0.78233 MeV neutron state is the maximum energy the ground state hydrogen electron may attain.

The neutron's magneton is the same  $\mu_B = \frac{1}{2}e\hbar/m_e$  Bohr magneton attenuated by the proton's mass to  $\mu_n = \frac{1}{2}e\hbar/m_p$ , mitigated by its 4.8373 times lower density to  $\mu_n(4.8373)$ , attenuated by the 2.531 relativistic contraction to its orbital radius, since  $\mu = IA = (ev / 2 \pi r)(\pi r^2) = \frac{1}{2}evr$ , to yield  $\mu_N = (\frac{1}{2}e\hbar/m_p)(4.8373/2.531) = 1.9111 \mu_n$ . It's polarity is negative since it is generated by an  $e^-$  and  $\mu_N = -1.9111 \mu_n$  is within 0.126% of the measured  $-1.9135 \mu_n$  neutron magneton. This discrepancy occurs because the neutron's magneton is measured in a deuterium nucleus which has a 0.12% mass

defect which results in less magnetic field absorption and a 0.12% greater magneton measurement than its actual  $-1.9111 \mu_n$  value.

The neutron's  $\frac{1}{2}$ -spin results from a spin 1 hydrogen orbital because of the 2.531 relativistic contraction on the proton which offsets the orbital center of mass. Without relativistic effects the electron has a 2.761 fm orbital radius, which 2.531 contracts to 1.091 fm in the electron's direction so there is a  $2.761 - 1.091 = 1.67$  fm mass center offset which results in a  $\cos^{-1}(1.67/2.761) = 52.8^\circ$  spin moment, within 3.57% of the  $\cos^{-1} 3^{-\frac{1}{2}} = 54.74^\circ$   $\frac{1}{2}$ -spin moment. This discrepancy was reduced to  $54.756^\circ$ , within 0.04% of the  $53.74^\circ$  value, by factoring in proton gyration effects as shown in Quantum Dynamic Relativity (Neutron Spin).

On decay an electron anti-neutrino is emitted to conserve the decay of the 2.531 relativistic effect on the orbital electron's angular momentum. From an electron's perspective it never "knows" it has undergone a 0.78233 MeV energy increase or a relativistic contraction. It is simply in its orbital with a 1-d  $E_0 = 13.6$  eV energy and 2-d  $E_r = (2 E_0^2)^{\frac{1}{2}} = 19.24$  eV radial resultant. However to the proton and outside observers it has a 3-d spherical orbital which is a  $= 4/3 \pi r^3$  volumetric energy density so the radial energy density vector is  $(19.24)^{1/3} = 2.68$  eV. This radial energy density was contracted by 2.531, a  $\frac{1}{2}$ -spin  $2.531(2.68 \text{ eV}) = 6.78$  eV relativistic energy increase to electron angular momentum, which is released as a 6.78 eV  $\frac{1}{2}$ -spin electron anti-neutrino on decay.

#### VII) Nuclear Force

In Nuclear Binding nuclear force was shown to result from the relativistic enhancement of electromagnetic force. To independent observers and other particles the neutron appears to have a 1.091 fm orbital radius because of the 2.531 relativistic contraction but to the electron the radius is 2.761 fm. As a reactant proton approaches a neutron its proton charge effect is shielded by its orbital electron. However at 2.761 fm the shielding becomes less than 100% effective because the electron is attracted to the other proton so its charge is shared between two protons and its neutron orbital becomes distorted.

(Note: The electron is 2.761 fm from the neutron proton's center

because it does not "see" its own relativistic contraction and the reactant proton is 2.761 fm from the neutron's proton because the relativistic effect reduces the electron's orbital to the neutron proton's surface, so the electron is 2.761 fm from its own proton center and the reactant proton's surface.)

At 2.761 fm from the neutron's center the electron absorbs an  $E_n = 0.78233$  MeV neutron state energy component from the reactant proton so it has two equal and opposite  $E_n$  components. Because the electron is equidistant to two protons its orbital transforms to one between the protons and because it was in orbital resonance with one proton it has an  $E_n/3 = 0.260777$  MeV angular momentum component orthogonal to the axis between the protons. In addition the 2.531 relativistic contraction from the reactant proton energy magnifies this  $E_n/3$  angular momentum energy to  $2.531 E_n/3 = 0.66$  MeV, giving the electron a  $2E_n + 2.531E_n/3 = 2.224$  MeV energy equal to deuterium's mass defect binding energy.

However to form this orthogonal 0.66 MeV angular momentum the electron must acquire an actual 0.66 MeV energy, since the two  $E_n = 0.78233$  MeV energies form equal and opposite resonance vectors along the radial axis between the protons. This additional 0.66 MeV is acquired by the electron as the reactant proton proceeds to 1 fm from the neutron and enters into the electron's relativistic domain. The 1 fm is to the reactant proton's surface (not center) since, as Hofstadter's 1961 SLAC electron scattering experiments and The Particle Effect analysis both showed, the proton has a  $1e^+$  surface charge, a  $\frac{1}{2}e^+$  0.3 fm charge, and 0 charge at its center.

Thus the electron's  $1e^-$  charge 1 fm from the proton's surface forms a stronger gradient and absorbs proton mass energy.

At 1 fm from a proton's surface the electron will absorb  $E = k_e e^2 / 1 \text{ fm} = 1.44$  MeV. This 1.44 MeV value is composed of the  $E_n = 0.78233$  MeV it absorbed at 2.761 fm from the reactant proton center and the 0.66 MeV it absorbed as the proton proceeded to 1 fm from its surface,  $1 \text{ fm} + r_p = 2.0355$  fm from its center. At this point the electron has an  $E_n = 0.78233$  MeV energy vector towards its own neutron state proton and the  $E_n + 0.66$  MeV = 1.44 MeV energy from the reactant proton, with the  $E_n$  vector toward the reactant proton

and 0.66 MeV vector orthogonal to the axis between the protons.

The electron is 2.761 fm from its neutron state proton center and 1 fm from the reactant proton's surface from its own vantage and 1.091 fm from the neutron proton's center and 0.4 fm from the reactant proton's surface from an independent observer's vantage because the  $E_n$  energies from each proton relativistically contract the 2.761 fm and 1 fm distances to 1.091 fm and 0.4 fm. Thus the neutron and reactant proton transitioned from an interaction gap of 2.761 fm, to a 1 fm bond formation distance, to a 0.4 fm bond, exactly as shown in Nucleon-Potential Energy Separation Plots.

The 0.66 MeV orthogonal energy component forms the basis of an orbital angular momentum between the protons and the equal and opposite  $E_n$  energies form the basis of a neutron state resonance between the protons as the electron traverses its orbital. Energy transfer to the electron from each proton occurs as it accelerates toward each proton since acceleration in an electric field adds  $E = mc^2$  mass energy. The electron's energy derives from the protons as their charge repulsion decelerates them in the orbital electron relativistic acceleration field. (A detailed analysis is made in Quantum Dynamic Relativity (Nuclear Force) and Radioactive Decay.)

This 2.224 MeV deuterium bond from electron orbital resonance yields a spin 1 magneton that is the proton and neutron magnetons adjusted for the bond's relativistic effect on the neutron's 2.761 fm orbital radius. The electron's resonance orbital between the protons has a  $\frac{1}{2}(2.761 \text{ fm} - 1 \text{ fm} - r_p) = 0.363 \text{ fm}$  radius that its 1.44 MeV contracts by  $m_e / (m_e + 1.44 \text{ MeV}) = 0.262$  to a 0.0951 fm peak radius and  $0.0951 / 2^{\frac{1}{2}} = 0.06723 \text{ fm}$  average radius. This orbital resonance relativistic effect reduces the 2.761 fm neutron state radius to  $2.761 \text{ fm} - 0.06723 \text{ fm} = 2.69377 \text{ fm}$  which contracts by 2.531 from  $E_n$  to 1.0643 fm and yields a  $1.0643 / 1.091 = 0.9755$  compounded relativistic effect. Deuterium's magneton is thus  $(\mu_p - \mu_n) 0.9755 = (2.7928 - 1.9135) 0.9755 = 0.8578$ , within 0.045% of deuterium's actual 0.8574  $\mu_n$  value.

The specific 8.4 MeV, 7.72 MeV and 28.3 MeV binding energies for Tritium, Helium-3, and Helium-4 triton and helion structures of higher mass nuclei were calculated in Radioactive Decay. These

values are given to within 1% by  $B.E. = 3^{1/d}(p \times 2.2147)^n$ , where 2.2147 is deuterium's 2.224 MeV 1-d B. E. adjusted for resonance distortion, p and n are the protons and neutrons in the triton or helion structure, and  $3^{1/d}$  is the relativistic compounding effect of the structure's dimensions, 2 for tritons and 3 for helions.

These structures' magneton and spin values were derived in Quantum Dynamic Relativity (Nuclear Force) and Radioactive Decay, completing the explanation of Nuclear Force in terms of an orbital electron and relativistic effects caused by its orbital velocity. (Note: Early on in Nuclear Physics the concept of neutrons being comprised of protons and electrons was rejected since Nitrogen-14 with 7 protons and 7 neutrons would have 21  $\frac{1}{2}$ -spin particles,  $7p + 7n = 14p + 7e$ , which could not be reconciled with N-14's actual integer spin 1. This however is not the case since the neutron's orbital electron 2.531 relativistic mass increase causes a  $\frac{1}{2}$ -spin orbital contraction. Therefore each  $\frac{1}{2}$ -spin electron also has an orbital  $\frac{1}{2}$ -spin which allows an integer spin 1 for Nitrogen-14.)

Thus the forces (gravity, electromagnetic and nuclear), the properties of electrons, protons and neutrons (mass, size, charge, magneton and spin), nuclei's properties (structure, mass defect, magneton and spin) and the properties of space are shown to derive from light as a 3-d energy oscillation with three forms, without momentum (dark energy), with 1-d momentum (EM waves), and with angular momentum (particles).

#### VIII) Neutron Fusion

Because the structure of neutrons was shown to be an excited state of hydrogen it was possible to verify this theory by neutron synthesis as described in Modulated Quantum Neutron Fusion. By ionizing hydrogen to protons and accelerating them to 0.78233 MeV in a Cyclotron and then deflecting 426 eV electrons into them at a 35° angle the electrons absorb the 0.78233 MeV energy from the protons by coulomb force acceleration and enter into a neutron state orbital with the protons.

The electrons were given a 426 eV energy to give them the same inertial velocity as the 0.78233 MeV protons since  $(426 \text{ eV}) \times (m_p/m_e) = 0.78233 \text{ MeV}$ . The 35° orbital insertion angle is the

reciprocal of the neutron's  $\cos^{-1} 3^{-\frac{1}{2}} = 55^\circ$   $\frac{1}{2}$ -spin magneton moment and equals the orbital electron insertion angle in triton nuclear structures as it forms an neutron state with a proton. In actual practice any insertion angle between  $35^\circ$  and  $55^\circ$  may be used.

As the neutrons are formed their  $\frac{1}{2}$ -spin magnetons align them into a tetrahedral structure in which they undergo a  $\frac{1}{2}$ -life decay to a 2-proton::2-neutron helion structure with the release of two 14 MeV Beta particles. This is an  $H_4$  nuclear molecular structure, the stereochemistry of which is allowed because the neutron's size and the resultant 14 MeV electron energies allow stable resonance bonds to form between two electrons and four protons as described for Helium-4 in Radioactive Decay, like benzene resonance bonds.

The  $\frac{1}{2}$ -life decay of two of the neutrons occurs by means of a Bronsted-Lowry acid-base interaction between the electrons of two neutrons and the protons of two neighboring neutrons. Because of their charges the orbital electrons synchronize with opposite spin moments, according to Pauli's Exclusion Principle, so two orbit in toward the tetrahedron's center while the opposite spin electrons orbit away from the center. This occurs because  $\frac{1}{2}$ -spin neutrons, fermions, form integer spin bosons which undergo Bose-Einstein matter-wave superposition. As the inner electrons form resonance bonds the protons contract inward to form the helion structure and the outer electrons are emitted as Beta particles.

The neutron fusion reaction verifies the neutron as a 0.78233 MeV hydrogen state and the relativistic enhancement of the orbital electron's charge field as the mechanism of nuclear bonding. The fusion reaction's energy is of significant magnitude and disperses neighboring neutrons, quenching the process. No attempt should be made to confine these neutrons without understanding the risks and principles involved since energy releases many orders of magnitude greater than normal nuclear reactions can occur.

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