Electrons, Neutrinos, and Mesons

by w. t. gray

Abstract

This paper shows the origin of tau, pion and muon particles and their associated neutrinos. Exact energies for these particles were calculated by showing that they correspond to electron energy states and relativistic angular momentum energies in helion-triton electron orbital binding structures, developed in The Superposition States of Planck's Constant and Radioactive Decay papers, and occur on orbital decay. (These electron orbital binding structures, pp. 37-A and 49-A of Radioactive Decay, are included in the Appendix for reference.)

It is shown that a Negative Energy Well results during electron oscillation because its inertial mass vectors are equal and opposite so they cancel while the relativistic attraction gradients caused by the inertial motion result in a binding force that can absorb energy without mass increase. The paper then goes on to explain neutrinos, why they are difficult to detect, how matter forms by induction from existing particles, why antimatter doesn't form, and why Black Holes absorb light but emit low energy thermal waves. Finally, the paper explains how permeability and permittivity affect the 3-dimensional energy oscillation of The Superposition States of Planck's Constant to generate particle charge, magnetism and quark energy states.

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"To be or not to be, that is the question...." -- W. S.

"By their acts ye shall know them...." -- J. C.

"If it looks like a duck...." -- Anonymous

Einstein felt that "a human being is part of the whole, called by us 'Universe;' a part limited in time and space. He experiences himself, his thoughts and feelings, as something separated from the rest -- a kind of optical delusion of consciousness." The laws of nature, not being blessed with consciousness, and unable to see them selves, never make this mistake in application. And being the same here as well as there, must be possessed of a common origin, a denominator of continuity between their cause and effect.

I once knew a woman who lived all alone up in the mountains in harmony with nature. Her days were spent seeing nature's beauty and her evenings reading man's philosophies, not some, all of them, from Sidhartha and Christ to Freud and Jung, from Socrates and Sun Tzu to Redfield and Zukav, and all in between. We shared a common interest, wanting to know, and ironically the one philosopher she had never read was Einstein, but she understood that "our task must be to free ourselves from this prison by widening our circle of compassion to

embrace all living creatures and...nature in its beauty," because that was the way she lived life.

Never having had an interest in math or physics she was curious as to Einstein's insight and our discussions began. A concept I call Fractal Reality, dealing with that "something mysterious behind all things," captured our attention and down the path we went. It was really just Riemann's "unseen communications" through an eyepiece of Mendelbrot's fractals, with some Recursion, Regression, and Complex Variables thrown in, but she found it interesting and I enjoyed the sharing of it. Inevitably our path led to a discussion of god, consciousness, and the evolution of sentience, and I said that "God is the awe in the sunset." She quickly corrected me by saying that "God is that in us which recognizes itself in the sunset," and then we laughed at my chagrin over missing such a fundamental point.

The experience was a lesson in the value of independent review, but what really impressed me was the quick matter of fact insight by one trained in philosophy, not math and physics, into the concept of local and independent perspectives. There can be no awe without its recognition, and the denominator of a common cause, and since this concept is fundamental to Fractal Reality it evoked much thought.

Mendelbrot's fractals are irregular geometries whose behaviors exceed boundaries; Fractal Reality is the concept that the structure of matter derives from a denominator common to its behaviors and an understanding of one explains the other. A magnet is a good example.

It's a mass, attracting certain metals, with attraction, repulsion and neutrality to other magnets, depending on orientation, inducing current in wire by its motion, and conversely moved by current, and capable of having its field reoriented by an external field. These behaviors of course relate directly to the electrons that make the mass magnetic, and to its particle, nuclear, and atomic structures.

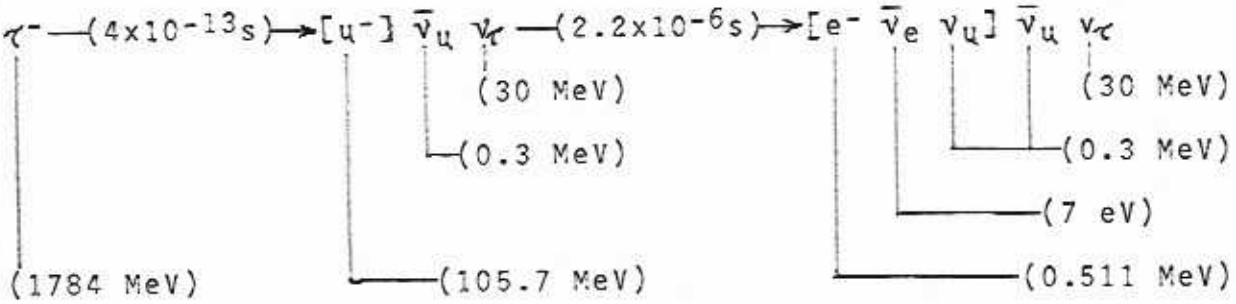
The analysis process, called Recursive Mathematical Modeling, consists of arranging the structures into a recursive pattern, such as photons, particles, atoms, molecules, giant molecular structures, polypeptides, nucleic acids, RNA/DNA, cells, cellular function, etc. In an a, b, c, d, ··· pattern it can easily be seen that sub-element behaviors are the constituents of their supra-elements and it's not possible for behaviors to spontaneously manifest higher up without being transmitted through lower elements in some way. The behaviors may be transformed by lower structures into forms not immediately recognizable as related, but they must be there.

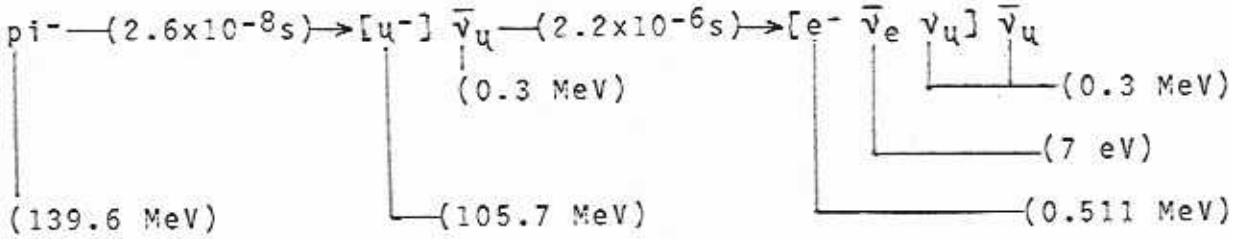
By an iterative process of mathematical Regression, the adding of dimensional perspectives, and the use of Complex Variables, where if $y = a + ib$, with y and a being real observed effects and causes, respectively, it is possible to derive and characterize the unknown imaginary domain causes, $ib = y/a$, and determine the behaviors of intermediate and sub-elements in the series. An important concept in this process is that behaviors are perspective dependent, local and independent, and this was used to derive nuclear binding forces in terms of coulomb and relativistic energies in Radioactive Decay.

The same process is readily applicable to deriving a pattern in electron, neutrino, and meson behaviors, since tau, pion, and muon particles ultimately decay to electrons and neutrinos:

Tau	Pion	Muon	Electron
4×10^{-13} s	2.6×10^{-8} s	2.2×10^{-6} s	stable
1784 MeV	139.6 MeV	105.7 MeV	0.510999 MeV
3491.2 m_e	273.19 m_e	206.85 m_e	m_e

Decay Modes





Neutrinos

$\nu_e < 7$eV $\qquad$ $\nu_\mu < 0.3$ MeV $\qquad$ $\nu_\tau < 30$ MeV

It is apparent that muons are common denominators to taus and pions and that electrons are common to all three. It can also be seen that their ½-life times vary inversely to their energies, that pions have no corresponding neutrino, and that ν_τ, ν_μ, ν_e energies parallel their seminal particle energies. From these patterns, the neutron electron orbital model developed in The Superposition States

of Planck's Constant, and the proton:electron:proton nuclear binding structural models developed in Radioactive Decay we will be able to show that taus, pions, and muons are electron energy states and that neutrinos conserve orbital angular momentum by representing a ½-spin relativistic effect. We will also show that up and down quarks are electron energy states in the nuclear binding models.

In Radioactive Decay it was shown that the general equation for Binding Energy (BE) in helion-triton nuclear structures is given by $3^{1/d}(p \times 2.224)^n$, where 3 is the available dimensions and d is the structural dimensions, p is the proton #, 1 or 2, in the structure, and n is the structure's neutron #, or available binding electrons. Thus, for He-4 the BE = $3^{1/3}(2x2.224)^2$ = 28.5344808 MeV, since He-4 is a 3-dimension tetrahedral structure. The 2.224 MeV energy value is the 1-dimensional BE in a deuterium proton:electron:proton model and is used as a reference base. In actual 3-dimensional structures particle geometries affect the energies and a value of 2.220 MeV was calculated for He-4 (pp. 49-50), which is only 0.2% off of an exact 2.21472 MeV required to yield an actual 28.29683 MeV BE for He-4.

The significance of these numbers is that the tau / pion energy ratio of 1784 MeV/139.6 MeV = 12.78 is also the energy ratio between He-4's 3- and 1-dimensional energies, 28.297 MeV/2.2147 MeV = 12.78, within 0.02%. The reason for this correlation immediately becomes apparent when Yukawa's tau, pion, and muon interaction distances are calculated and compared to the electron interaction distances in the proton:electron:proton nuclear model developed in Radioactive Decay.

Yukawa predicted an interaction particle of $*E = \hbar c/2d$ energy, where d = the distance between interacting nucleons. Conversely, one may calculate an interaction distance, $d = \hbar c/2*E$, if an interaction particle energy is known. For a 1784 MeV tau, $d = (1.05457 \times 10^{-34} Js)(2.997 \times 10^{8} m/s)/2(1.602 \times 10^{-19} J/eV)(1784 \times 10^{6} eV) = 0.055$ fm, which is the contracted relativistic distance between the proton and orbital electron in the Radioactive Decay paper's neutron model (p. 13). This value was derived by including relativistic and magnetic energies in Bohr's analysis, so $E_{tot} = RE + U_B + KE + U_e = 0$. If relativistic energy equals the 0.78233 MeV difference between m_n and (m_p+m_e), and divides between the 3 energy forms so $U_B = U_e = KE = 0.78233$ MeV/3 = 0.260777 MeV = 4.17765×10^{-14} J, an $r = k_e e^2/2E_e = 2.76136$ fm Bohr radius results. The electron's added 0.78233 MeV relativistically reduces 2.76136 fm, $1/(0.78233+m_e)/m_e = 0.3951$, to a 1.091 fm radius for independent observers since they only see its surface, 0.055 fm greater than the proton's calculated 1.0355 fm radius (pp. 11-13).

Similarly the 105.66 MeV muon yields an $r = \hbar c/2*E = 0.93378$ fm interaction distance, the 139.6 MeV pion$^{+/-}$ yields r = 0.706759 fm, and the 135.0 MeV pion^{0} yields r = 0.730841 fm, each corresponding to a specific neutron orbital electron model's calculated distance. Since their decay path energies only exist for their ½-life times, and all decay to stable electrons and associated neutrinos, Yukawa's analysis indicates that they are formed from the relativistic energy contained in the contracted spatial gradients in this neutron model, and that their existence, decay sequence, and half-lives represent a specific decay sequence of these relativistic gradient energies.

The 1784 MeV tau represents the relativistic contraction energy of an orbital electron's 2.76136 fm radius to its observed 1.091 fm neutron radius, 0.055 fm from a proton's surface, and the 105.66 MeV muon represents an electron's transition energy from a neutron state with one proton to another, and correlates to the transformation of a Classical Bohr orbital, with $E = KE + U_e = 0$ and $KE = U_e = 0.78233$ MeV/2, to a relativistic Bohr orbital with $E = KE + U_e + U_B + RE = 0$ and $KE = U_e = U_B = RE/3 = 0.78233$ MeV/3, as the electron approaches a 2nd proton and forms a relativistic state. Magnetic energy depends on energy density and increases in its 1.091 fm radius (pp. 12-3).

In a Classical Bohr state $r = k_e e^2/2E = 0.92$ fm for $E = 0.78233$ MeV which correlates to a 107.20736 MeV Yukawa energy and equals the 105.66 MeV muon + (m_e + 0.78233 = 1.29333 MeV) neutron electron + 0.254034 MeV muon neutrino energies. The 107.20736 MeV Yukawa energy is the energy a 1.29333 MeV neutron electron acquires on approaching 0.92 fm inside a 2nd proton's 2.64586 fm nuclear interaction space, as will be shown, and is the energy acquired on transforming from a Classical to relativistic Bohr state. Tau energy corresponds to the electron's neutron state and muon energy is its transition energy in the H-2 (pp. 28-30), He-3 (pp. 37-9), H-3 (pp. 45-8, Figs. A, B, and C), and for He-4 (pp. 49-50, Fig. E) models in Radioactive Decay as it transforms from a neutron state with one proton to another.

In the model an electron attains a bound state by transforming coulomb energy it acquires on passing within 1 fm of a proton into a relativistic gradient that overcomes the proton coulomb repulsions.

At 1 fm coulomb energy is determined to a proton's surface charge so $E_c = k_e\ e/1\ fm = 1.44$ MeV and adds to the electron's 0.78233 MeV to form a 1-dimensional 2.224 MeV relativistic Binding Energy well for deuterium and $3^{1/d}(px2.224)^n$ 3-dimensional Binding Energies of 8.5, 7.7, and 28.5 MeV, respectively, for H-3, He-3, and He-4 (pp. 34-6).

This BE is a transform Yukawa interaction where proton coulomb energy transforms by electron interaction into relativistic spatial contraction, instead of the formation of an interaction particle by field gradients of 2 interacting particles. Also, when the electron passes within 1 fm of the 2nd proton its $m_e \div 0.78233 = 1.29333$ MeV neutron energy state from the 1st proton contracts space by 1/2.531 = 0.3951 to yield a 0.4 fm gap that independent observers see as the 0 MeV potential energy nuclear bond point in potential energy versus nucleon separation plots, but this is not the actual nuclear bond.

Bonding actually occurs as the electron traverses a clover-leaf orbital between the protons (Fig. B). On exiting a transition region the electron moves along a 2.76136 fm orbital path of one proton and approaches to within 2.64586 fm of the 2nd proton, initially head-on and then changing to a tangential path 2.76136 fm from the center of the 1st proton and 1 fm from the surface of the 2nd proton. From its local perspective the electron doesn't experience the 1 fm to 0.4 fm contraction that an independent observer sees. It then traverses the 0.72586 fm transition region at the clover-leaf's tip between the protons and enters a neutron radius 2.76136 fm from the 2nd proton's center and 1 fm from the 1st proton's surface.

When a 0.78233 MeV electron's 0.92 fm Classical Bohr radius is added to its 2.76136 fm neutron radius, as occurs in interaction of a neutron electron and 2nd proton, it yields a 3.68136 fm distance to the proton center. Subtracting its 1.0355 fm proton radius yields the 2.64586 fm non-relativistic coulomb interaction distance seen by independent observers as varying with energy by $1/r^2$ from 2.64586 fm to 1 fm in potential energy versus nucleon separation plots. At 1 fm an observer sees the particle interaction plot contract to 0.4 fm in a straight line relation to potential energy as relativistic effects compound the coulomb forces and the 2nd proton transforms from its Classical to a relativistic state with the neutron electron.

In its orbital path an electron moves from a 2.64586 fm initial interaction distance to its 1 fm distance, then through a 0.72586 fm transition region to a 3rd proton's 2.64586 fm interaction distance. So the electron-proton separation undergoes 2.64586 - 1 = 1.64586 fm contraction and 0.72586 fm expansion to 1.72585 fm The net change in electron-proton separation is 2.64586 - 1.72586 = 0.92 fm, which is the Yukawa 107.20736 MeV energy of a 105.66 MeV muon, 1.29333 MeV neutron electron, and 0.254034 MeV muon neutrino. Since the 1.29333 MeV neutron electron energy is orthogonal to its path and results in the 1 fm to 0.4 fm contraction, the 105.66 MeV muon and its neutrino energies are responsible for the proton to neutron state transition.

The electron traverses around the clover-leaf tip's 0.72586 fm transition region, rotating its vectors 180° so the 0.4 fm gap is in the 1st proton's direction and the contracted 0.92 fm Bohr distance

is in the 2nd proton's direction, with a 2.64586 - 0.92 = 1.72586 fm distance to its 1.0355 fm surface and 1.72586 + 1.0355 = 2.76136 fm neutron radius to its center. The 0.72586 fm transition region is exactly 1 fm to either proton's surface, forming a 2.76136 fm radius with one proton's center and a 1 fm gap to the other's surface from a local observer's perspective, with a relativistic 1.091 fm radius and 0.4 fm gap from an independent observer's perspective.

The 0.72586 fm transition region is a relativistic buffer where electron momentums rotate gradients between the protons to transpose their neutron states. The actual momentums are analyzed in detail in Radioactive Decay (pp. 37-50, Figs. A-E) but a brief description is included here. As an electron moves in a neutron orbital its 0.78233 MeV divides between kinetic orbital momentum coulomb, and magnetic forms, resulting in a 2.76136 fm radius. Since 0.78233 MeV increases electron relative mass 2.531 times it relativistically enhances the energies by that amount and reduces radius for independent observers to 1.091 fm, contracting space (2.76136-1.0355 = 1.72586) / (1.091-1.0355 = 0.055) = 31 times. But when the electron passes within 1 fm of another proton it contracts 2.531 times to 0.4 fm because effects on particles within 1 radius are to surfaces, not to centers, since an electron would see the effect over the proton's entire surface.

These effects are radial to the protons, orthogonal to the path of the electron. However, as the electron moves between the protons it also has an orbital angular momentum, orthogonal to its orbital plane at the neutron's center of mass, with a spin 1. 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 angular momentum is a radius-momentum cross product, observers can only see a surface, and relativistic contraction moves the mass center closer to the surface, not surface closer to center of mass, which means that the relativistic contraction has a ½-spin.

This is how a neutron, as a quantum-relative state of hydrogen (The Superposition States of Planck's Constant, p. 27, fn. 26, and Radioactive Decay, pp. 11-13), decays to a ½-spin proton, electron, and electron anti-neutrino, $\bar{\nu}_e$. A hydrogen atom's orbital electron has a spin-1 orbital angular momentum, but relativistic contraction in its neutron state moves its mass center toward the surface, which is the independent observer's reference point, to give the neutron a ½-spin. On decay the ½-spin neutron would decay to a ½-spin proton and electron moving in opposite directions to conserve the spin-1 orbital angular momentum, leaving the neutron's ½-spin unaccounted for unless a ½-spin neutrino representing relativistic contraction of the electron's orbital radius is also generated.

This means that as the electron traverses a transition region its electron orbital's ½-spin relativistic contraction must also be rotated if the two protons are to transpose the neutron state, and that means the ½-spin relativistic contraction also has an orbital angular momentum which must conserve during transition. This would manifest as a higher energy neutrino because its radius of curvature is only 0.72586/2 fm, specifically the 0.254034 MeV muon neutrino.

And, since the neutron state, including its 0.055 fm 1784 MeV tau and 0.92 fm 105.66 MeV muon states, rotates between the protons as an electron traverses the clover-leaf, a higher energy tau-neutrino with a helion orbital's 28 MeV energy also manifests.

So a 1784 MeV tau particle (corresponding to a 0.055 fm spatial contraction between the 1.0355 fm proton and 1.091 fm neutron radii) and the 105.66 MeV muon (corresponding to a 0.92 fm contraction of a 2.64586 fm interaction distance to 1.72586 fm neutron state) are the respective Yukawa neutron and interaction energies contained in the relativistic contractions created by an electron's absorbed coulomb energies as it interacts with its clover-leaf orbital protons. In a nuclear structure decay these relativistic contractions would decay in a neutron to interaction to non-relativistic state sequence, and their respective energies would manifest as a tau particle decaying to a muon and the muon decaying to a non-relativistic electron, with associated neutrinos, as shown in the decay sequence on page four.

The 0.92 fm Bohr radius forms by the 0.78233 MeV absorbed from the 2nd proton and occurs on transition of the neutron radius from the 1st to the 2nd proton. Since it occurs within the formation of the 2.76136 fm to 1.091 fm neutron radius, the 0.055 fm tau energy decay sequence would be reversed, first a tau particle as the 0.055 fm distance decays, followed by its decay to a muon, muon neutrino, and tau neutrino as the 0.92 fm radius decays, followed by formation of the electron with its neutrino. The electron always exists, but in tau and muon energy states with life-times proportionate to their

respective energy levels and time required for the contracted space to dilate to its next successive stable state in the structure (i.e. 0.055 fm neutron space to 0.92 fm interaction space to normal).

As validation of the muon's role in the 0.92 fm transition from a non-relativistic to relativistic state we will analyze the muonic hydrogen-deuterium molecular bond. In this case a 105.66 MeV muon bonds H and H-2 nuclei 0.003 Angstroms = 3×10^{-13} m apart until they react to form an He-3 nucleus with liberation of 5.4 MeV and a muon. In Radioactive Decay (p. 11) it was shown that a 1.29333 MeV neutron electron's orbital wavelength is 1.045×10^{-12} m, or 3.33×10^{-13} m dia. and 1.66×10^{-13} m radius. This orbital radius forms a $2 \times 1.66 \times 10^{-13}$ m = 0.0033 A molecular bond length, as in a H to H-2 muonic to neutron electron bond from a non-relativistic observer's perspective.

However in addition to the 1.29333 MeV to attain this state the 105.66 MeV muon provides the 0.92 fm Yukawa contraction energy that reduces the 2.64586 fm initial interaction space to 1.72586 fm, the 2.76136 fm non-relativistic Bohr neutron radius - 1.0355 fm proton radius. So the muon energy transforms the H^+ of the muonic molecule to 1 fm from the 0.72586 transition region, and a 1.72586 + 1.0355 = 2.76136 fm neutron radius from H-2's neutron, to form a clover-leaf He-3 bonding structure. The muon acts catalytically in forming the clover-leaf bond but is liberated with 5.4 MeV as He-3's 7.71836 MeV BE provides 1.29333 MeV for a H^+ to H-2 neutron electron bond, plus 0.25 MeV for a ν_u, and 0.78233 MeV to replace the muon's 0.78233 MeV orbital bond energy, roughly He-3's 7.718356 MeV - H-2's 2.224 MeV.

So the muonic electron's 0.782333 MeV energy vector in a H:H-2 molecule transforms from a non-relativistic 0.00166 A orbital bonded to H-2's neutron electron, also at 0.00166 A from a non-relativistic perspective, into a relativistic state with both H's muonic electron and H-2's neutron electron in a 0.78233 MeV 2.76136 fm orbital (i.e. Radioactive Decay's Bohr analysis, pp. 11-13), and the muon's 105.66 MeV contracts the nuclear interaction distance, 2.64586 fm - 0.92 fm = 1.72586 fm, to transpose H-2's neutron electron to a neutron state with H^+, forming an He-3 with a 7.7 MeV BE in a inverse muon decay reaction. However, since the 105.66 MeV muon energy exceeds He-3's BE it is emitted with 5.4 MeV of He-3's BE release after returning the 1.29 + 0.78 + 0.25 = 2.3 MEV the muon lent to the reaction.

So the tau - muon - electron decay path represents decay of the relativistic energy in the neutron state 0.055 gradient and 0.92 fm nuclear interaction gradient back to non-relativistic space, however another decay path also exists. Instead of decaying from the neutron state, a decay may also occur from the 0.72586 fm transition region an electron passes through during transition from a neutron state with one proton to another. Relativistic contraction of this 0.72582 transition region occurs from the coulomb energy a neutron electron from one proton in a nuclear structure absorbs on passing within 1 fm of another proton in the structure, as explained in Radioactive Decay's BE analysis for H-3, He-3, and He-4 (pp. 37-50, Figs. A-E).

In He-3 the BE for one electron in a 2-dimensional structure is 7.718 MEV. Subtracting the 0.782 MeV neutron energy yields a 6.936

MeV BE relativistic contraction in the 0.72586 fm transition region. Multiplying by $3^{2/3}$ to transform the effect from a 2-dimensional triton to 3-dimensional helion structure yields a 14.427 MeV BE, and subtracting the 0.254 MeV muon neutrino yields a 14.173 MeV BE / e, or a 28.346 MeV BE for He-4's 2-electron tetrahedral structure (only 0.17% from its actual 28.297 MeV BE). This 28 MeV 3-dimensional relativistic contraction energy releases as a tau neutrino in a τ - u - e decay because 28 MeV of proton mass was transformed into the gradients by coulomb transfer to the electron that created them. If this mass energy is restored to the protons, the -28 MeV BE well is overcome and the excess 28 MeV relativistic gradient releases as a ½-spin ν_τ, since a gradient contracts orbital radius as described.

However, in a 1-dimensional 0.72586 fm transition region decay the energy corresponds to Yukawa's 0.70676 fm 139.6 MeV pion energy. So if decay occurs in a 0.72586 fm transition region, instead of a 2.76136 fm neutron region, a pion - muon - electron decay occurs as shown on p. 4, instead of a τ - u - e decay and it works like this. In tau decay the distance between a relativistic neutron and proton radius is actually 1.091 - 1.0355 = 0.0555 fm, 0.0005 fm more than the 0.055 fm gradient that produces a tau. This is because 0.0555 fm is a stable gradient with only 1777 MeV available but a tau particle requires a 1784 MeV 0.0550 fm contraction, the 7 MeV 1-dimensional BE, so a high energy collision is required to initiate the decay.

In the case of pion generation the process reverses. A neutron is a positive energy state with +0.78233 MeV and compression of the

gradient past its 0.0555 fm stability point produces a tau emission, but the 0.72586 fm transition region is a negative energy BE well in which energy in the form of a contraction gradient holds the proton repulsion forces in equilibrium. So while compression of a positive energy gradient produces a tau particle, tension in the negative BE well produces a pion and results in the nuclear bond's linear nature about its 0.4 fm 0 MeV potential energy separation distance.

It is linear up to the [(2.76136 fm - 1.0355 fm = 1.72586 fm) / (1.091 fm - 1.0355 fm = 0.0555 fm)] = 31 times relative contraction ratio of a 1777 MeV gradient and results in a 28.3 MeV helion BE but when compression goes to 0.0550 fm it produces a 1784 MeV tau by the 7 MeV BE increase. This 2-dimensional clover-leaf energy transforms to a 14.56 MeV $3^{2/3}$ 3-dimensional equivalent that adds to the 28.3 MeV helion BE to yield the 42.82 MeV nuclear bond compression break down energy that results in a tau. Subtracting the original 1.29333 MeV electron energy yields an actual 41.56 MeV compression breakdown energy. Tension on the negative BE well releases a pion by a similar process but as separation increases from 0.4 fm to 1 fm relativistic energy releases and $1/r^2$ coulomb repulsion non-linearity manifests.

Positive and negative energy states reference to an independent observer's relative state and result from particle motion. In linear inertial motion particle energy increases mass and contracts space in the direction of motion according to Lorentz Transforms, but in oscillatory motion the bi-directional motion vectors are equal and opposite so no net mass increase results, and only a bi-directional

contraction gradient remains. So a neutron with only linear electron orbital motion exhibits mass increase and a radial contraction that independent observers see as a 1.091 fm particle radius, while H-2, H-3, He-3, and He-4 structures with oscillatory orbital motions have only contraction gradients that overcome the proton repulsions, a structural mass loss by the coulomb energy absorbed by the electron from the protons, but no net electron mass increase.

A neutron is positive energy with respect to an observer since its contraction gradient results from and exhibits a mass increase, but the nuclei have a negative energy with respect to the observer because the BE well contraction gradient results from net structural mass loss and appears to be a spatial gradient without an associated inertial mass, so it is a negative energy state that absorbs energy with no mass increase until the BE well threshold is exceeded. It is a Riemann space of Euclidean points, a $1/\mu\nu$ E uvg $dx^{\mu}\ dx^{\nu}$ non-linear summation of $ds^2 = dx_1^2 + dx_2^2 + dx_3^2 + dx_4^2 = 0$ linear spaces, but with a negative g factor since it results from mass loss instead of mass gain, hence a negative energy state.

In a tau decay the relativistic BE well energy releases as a 28 MeV ν_{τ} by compression when the electron is in its neutron state, but compression when an electron is in the transition region increases the coulomb repulsion field which creates a force opposite to the BE well gradient. This repulsion vector is opposite the BE gradient's attraction vector (i.e. a tensile) and adds energy opposite to the bi-directional oscillation attraction gradient, in effect cancelling

the electron's relativistic gradient and destabilizing its negative BE well. Similarly, tension from a tangential collision on a proton increases separation from the electron and reduces the relativistic magnification of its coulomb attraction by the contracted space, so bond tension or compression can disrupt the negative BE well effect.

In this case relativistic energy remains with the electron and no ν_τ forms so the ½-spin relativistic effect cancels the electron's ½-spin to yield a 0 spin pion, just as orbital electron spins cancel by Pauli Exclusion, only in this case it is the relativistic orbital angular momentum ½-spin and electron ½-spin, but as the pion decays to a muon and $\bar{\nu}_\mu$, and then to an electron with a $\bar{\nu}_e$ and ν_μ, 28 MeV is returned to the protons. A pion forms when the contracted BE well 0.72586 fm transition region is stretched. Normally the electron's $[m_n-(m_p+m_e)+m_e = 1.29333$ MeV$]/m_e = 2.531$ relativistic mass increase contracts its 2.76136 fm neutron orbital radius to the 2.76163 fm x (1/2.531 = 0.3951) = 1.091 fm an independent observer sees.

The 2.76136 fm radius is comprised of a 1.0355 fm proton radius + a 1 fm separation + a 0.72586 fm transition region. In Radioactive Decay's triangular and tetrahedral triton-helion structures, a 1 fm separation exists between each proton and its neutron's 2.76136 fm orbital electron radius so the 0.72586 fm transition region is 1 fm from all protons, including neutron protons, so they all have a 1 fm + 0.72586 fm + 1 fm separation from each other, 2.76136 fm from each proton's center to the far side of the 0.72586 fm transition region, as shown in Figs. A-C, in a scissor-jack configuration.

Electron energy contracts the 0.72586 fm region from opposite sides as a neutron with 1 proton and bonding electron to another, so structural tension compresses the region and structural compression dilates it in opposition to the relativistically magnified coulomb attraction in each proton's contracted 1 fm space. Neutron electrons absorb $E = k_e e^2/r = 1.442$ MeV in coulomb energy on passing 1 fm from a 2nd proton, which adds to its 0.78233 MeV neutron energy to become deuterium's 2.224 MeV BE (Radioactive Decay pp 29-33). Since proton centers in this configuration are 4.797 fm apart, $E = k_e e^2/r = 0.30$ MeV (the ν_u energy if the relativistic contraction decays) in radial coulomb repulsion and BE is 2.224/0.30 = 7.4 times greater but since the 0.78233 and 1.442 MeV energies are from opposing protons their opposite vectors affect the 1 fm and 0.72586 fm regions differently.

The m_e + 0.78233 MeV = 1.29333 MeV contracts the 2.76136 fm orbital by 1.29333 MeV/m_e = 2.531 to yield 1.091 fm so its 2.76136-1.0355 = 1.72586 fm space contracts 31 X to 1.091-1.0355 = 0.0555 fm = 0.032158 fm + 0.023442 fm for its 1 fm and 0.72586 fm regions, but the 2nd proton's 1.44 MeV divides into 2 components: 0.78233 MeV to its 1 fm gap because in a clover-leaf orbital an electron approaches the 2nd proton radially on exiting its prior transition region and then passes tangentially between the 1st and 2nd protons, orthogonal to each, so it has the same 0.78233 MeV energy in both directions, and 1.44 - 0.78233 = 0.65967 MeV directed into the 0.72586 fm region at a $\cos^{-1}$ 0.65967/0.78233 = 32.52° angle from the orthogonal axis between the the protons, exactly parallel to the electron's initial approach so it forms a radial acceleration at the clover-leaf's tip.

The radial acceleration rotates the electron's energy vectors about the tip, exchanging the protons' neutron and bonding states as previously described, while the 0.72586 fm to 0.023442 fm transition region contraction for the neutron state remains stable. The 0.72586 -0.02344 = 0.70242 fm contraction (real space-energy to local but not independent observers) is 0.70242/0.70676 = 0.99386 of Yukawa's 0.70676 fm pion formation distance and is a stable state since the BE well's energy vectors are in dynamic equilibrium so no energy is available to form the pion. However if a collision creates tension energy contrary to the BE well's vectors and increases the 0.70242 fm contraction to 0.70676 fm the BE would release as a pion. A tau forms by a 0.055 / 0.0555 = 0.991 compression and a pion forms by a 0.702418 / 0.70676 = 0.994 tension of the 0.3951 fm bond.

On decay of the BE well, the electron still has its 0.65967 MeV angular momentum energy component with a m_e / (0.65967+m_e) = 0.4365 relativistic contraction, constituting a 0.4365 shift of the 0.65967 MeV energy for independent observers, as described on pg. 11, and is a 0.4365 x 0.65967 MeV = 0.288 MeV ½-spin muon neutrino energy. This ν_u is different from the 0.255 MeV ν_u produced in tau decay because it occurs at the electron orbital's clover-leaf tip instead of its neutron state, with a different radius but equal velocity, so it has a 0.4365/0.3951 = 1.1047836 greater angular momentum and a 1.1047836 x 0.255 MeV = 0.282 MeV energy. On decay of the clover-leaf angular momentum the pion decays into a $\bar{\nu}_\mu$ and muon, which transforms over the 2.64586 fm interaction distance into a non-relativistic electron with decay of its neutron orbital angular momentum into a 2nd ν_μ.

It should also be mentioned that another possible muon neutrino energy may result if an electron decays to a non-relativistic 1.66 x 10^{-13} m muonic electron orbital radius (page 13). In this case the E = hc/2d Yukawa energy is 0.594 MeV, equally divided between radial and orbital momentum energies (Radioactive Decay, p 11), and yields a ½-spin radial relativistic decay muon neutrino value of 0.297 MeV. So 3 muon neutrino energy values are possible depending on whether a tau decay occurs from a neutron state (i.e. 0.254 MeV), a pion decay occurs from a transition region BE well (i.e. 0.282 MeV), or a decay occurs to the 1.29333 MeV non-relativistic muonic orbital instead of the 2.65 fm interaction distance (i.e. 0.297 MeV).

A pion is 0 spin because orbital electrons have neutron orbital and clover-leaf tip relativistic radial angular momentum components and the initial interaction distance relativistic energy on decay of the transition region's BE well so ½-spin ν_e, ν_u, and ν_u neutrinos result in a pion decay (page 4). The pion's 0 spin is conserved as a ½-spin muon cancelled by a ½-spin ν_u, and then as a ½-spin electron and ½-spin ν_e with a ½-spin ν_u and ν_u, as mentioned on page 18, so the net resultant is spin 0 in each decay stage since, as in Pauli's Exclusion Principle, opposing spins result in a stable energy state.

A final decay mode deserving of mention is that of the 0 charge pion and its gamma decay mode. The fundamental premise developed in The Superposition States of Planck's Constant was that h represents a relation between force (spatial gradients), space, and time. This concept was developed as an extension of Einstein's hypothesis that

while points in space are Euclidean a Riemannian metric exists such that energy in each point influences neighboring points non-linearly so space's "structure depends on physical influences." Conversely, the structure of space must also affect the physical influences.

Since $E = F \cdot d$, Planck's Constant defines this relation between spatial gradient energy and the physical influences creating it, and the energy exists in a superposition state 3-dimensional oscillation that forms matter or electromagnetic energy when sufficient quantity is present, with form determined by the physical influences. This concept was further developed to show that under the influence of an electromagnetic field this gradient energy will be induced to form inert matter with a charge and magnetic component, recognized as a particle, while gradient energy under the influence of gravitational fields will be induced to form an inert 3-dimensional energy wave oscillation, recognized as electromagnetic radiation.

The induction process occurs by a constructive interference of gradient energy under the influence of electromagnetic fields so as to result in energy form that manifests charge and magnetism while a gravitational field accelerates massless energy to light speed where the energy's 3-dimensional oscillating fields are inert since at the speed of light each field phase is cancelled by an opposite field phase along its propagation axis. In other words, as the oscillating energy moves forward the opposite phase cancels the effect of the preceeding phase. Oscillating energy is massless since the inertial components are equal and opposite so no net mass results.

In nuclear proton configurations there is a charge node exactly equidistant between protons where energy may manifest as a 0 charge unstable mass that decays to a stable electromagnetic wave. Charge forms by a circumferential oscillation on the particle's surface and holds its mass stable by coulomb attraction between its center and surface by a $e = mc^2 = mE^2/B^2$ relation. Without charge a particle is unstable and its energy will form into a linear electromagnetic wave in which one phase's field cancels its opposing phase's field as it moves at light speed, while in a spherical wave one field converges toward the center, its opposite field diverges to the surface, and its mass energy is contained by the charge gradient it creates.

In a nuclear configuration with a 0.72586 fm transition region exactly 1 fm from each proton's surface the electron is at a charge field node each time it passes through the transition region center. Normally a transition region contracts 0.70242 fm to form a BE well that decays to a charged pion if it contracts to 0.70676 fm however if this structure undergoes a particle collision that compresses the 2.72586 fm inter-proton region to a 0.73084 fm Yukawa distance while the electron is at the charge node a 135 MeV pion^0 would result with a net 0 charge field from the protons to induce charge and stabilize its mass energy so it decays into an electromagnetic wave.

However, compression of the 2.72586 fm inter-proton region will also increase the 0.70242 fm contraction of the BE well transition region to 0.70676 fm so both a pion^0 and BE well pion$^-$ will result. Also, since the 2.72596 fm to 0.73084 fm compression has a ratio of

3.73 a particle 3.73 x the pion^0 135 MeV energy, about 500 MeV, will initially form. In actuality the particle energy is modified by the the generation of the pion$^-$ in conjunction with the pion^0. The pion$^-$ is generated by the 0.70242 fm contraction of the BE well increasing to 0.70676 fm, a 0.00434 fm difference requiring addition of energy, and the pion^0 results from the 2.72586 fm to 0.73084 fm contraction.

This leaves a 0.73084 - 0.70676 = 0.02408 fm uncontracted space after the 2.72586 fm to 0.73084 fm contraction but since energy was used to contract 0.70242 fm to 0.70676 fm its 0.00434 fm difference effectively reduces the 0.02408 fm uncontracted space to yield a net energy adjusted 0.02408 - 0.00434 = 0.01974 fm uncontracted region. By adding this adjusted uncontracted space to the initial 2.72586 fm and contracted 0.73084 fm spaces as a relative reference the correct (2.72586 + 0.01974 = 2.7456) / (0.73084 + 0.01974 = 0.75078) = 3.658 pion^0 to seminal particle energy ratio is determined to be 3.658 x 135 = 493.8 MeV which is within 0.026% of a kaon$^-$'s 493.7 MeV value.

The kaon$^-$'s decay products are actually a pion$^-$ and pion^0 (or a u$^-$ and ν_u directly if decay occurs outside the transition region), with the 0 spin 0.83×10^{-16} s pion^0 representing the transition phase for de-excitation of the electron's collision energy component into two gamma rays, to conserve momentum and the pion$^-$ representing the electron's other muonic and neutrino energy components, with charge conserved as a kaon$^-$ - pion$^-$ - muon$^-$ - e$^-$ decay. Pion^0 generation by by this mechanism adds a significant ramification to the underlying concept developed in The Superposition States of Planck's Constant.

It was shown that maximum energy storage and minimum distortion of space occurs in a 3-dimensional orthogonal oscillation and if E = hf, E = Fd, and h = Et then energy has relativistic force·space·time continuity or quantum h/t discontinuity that depends on the relative time of the observer so it transforms from a particle to wave nature as the relative time difference increases (a particle on impact and a wave at light speed). Oscillating energy is massless because its opposing inertial mass vectors cancel but it also has dynamic field gradients that may interfere with other gradients, so 3-dimensional oscillating energy is a superposition state that may be periodically accelerated to a light speed electromagnetic wave by a gravitational field at oscillation peaks when relative times are equal or induced by similar dynamic electromagnetic fields into a charged particle.

As a particle the 3-dimensional oscillation circumferentially traverses a ½ radius path so oriented fields converge to the center, diverge from its surface, and create a polarized field observed as a radial charge with a resultant axial magneton according to a left or right hand rule configuration. In this arrangement field patterns at the center and surface are opposite so a charge gradient exists from 0 at its center to a + or - surface charge so the attraction force contains the energy but it is the oscillation's inertial mass effect converging on the center that holds the energy in a spherical form.

As inertial energy moves it creates an acceleration gradient in the motion's direction similar to a gravity field but stronger since strength is velocity dependent (i.e. $l = l_0(1 - v^2/c^2)^{\frac{1}{2}}$) and depends

on the E = hf oscillation frequency. In a spherical oscillation this energy aceleration vector is centripetal, holds the oscillation in a spherical form, and relativistically shifts the mass center toward the surface for independent observers, giving the particle a ½-spin effect. Electromagnetic wave fields are equal and opposite, 180° out of phase, and propagate at the same rate they move into each others region so they cancel, giving photons a spin 1.

Energy in a superposition state is induced by a charge field to become a charged particle with equal and opposite fields because the most stable state has minimum energy (constructive interference has a net energy increase; destructive interference has a net decrease). This is an extension of Einstein's Riemannian space concept, where a point's energy influences neighboring points, and also explains the lack of anti-matter formed in the Universe. If energy is induced to become a charged particle by effects from a neighboring particle the characteristics of that particle, including mass, charge, magnetic moment, and orientations will be conserved in the progeny particles.

This means that if a particle's magneton is a function of its energy density, orientation aligns by the Right Hand Rule in matter and Left Hand Rule in anti-matter (Superposition States of Planck's Constant, fns. 25, 26), and if the dominant particles are electrons and protons, then progeny particles must conform to their charge and magneton field strengths, a Right Hand orientation, and their masses and densities, with neutrons being proton-electron constructs. This phenomena is analogous to procreation of Levorotatory amino acids in

nature, where the first one formed determined the biological pathway by which subsequent amino acids formed, so the particle manifesting first would have set the charge-magneton interaction orientation and magneton mass-density criteria for the progeny particles.

This concept is significant because classical/electromagnetic charge-parity symmetry holds for strong interactions but appears to fail for weak interactions and the lack of anti-matter formed in the Universe. However symmetry is conserved by Einstein's relativistic gravity-inertia equivalence. He theorized that Euclidean points form a Riemannian metric because neighboring points influence each other since a 4-dimensional Euclidean point with constancy of light speed, $ds^2 = dx_1^2 + dx_2^2 + dx_3^2 + dx_4^2 = 0$, and a single direction inertia, ds, has an equivalence to a gravitational field determined by masses and their inertial position changes, $ds^2 = 1/\mu\nu \; \Sigma \; g\mu\nu \; dx^\mu dx^\nu$. This equivalence extends to 4-dimensional inertias since each dx element is a sub-relativistic inertial ds_x vector in its own right.

This means local observers perceive non-relativistic Euclidean space-time in each dimension but their space-time structure depends on external or internal physical factors that are relativistic to an independent observer. More specifically a particle is seen as having a mass, charge, magneton value, and orientation relation to a local observer that is consistent with characteristics of matter but to an independent observer energy has a quantity, density, and orientation of inertial motions that balance by equal and opposite conditions in their surroundings such that a net zero energy imbalance exists.

This is Pauli's Exclusion Principle and Hund's Rule extended to the fundamental properties that cause them. Electrons have equal and opposite spins in the atomic orbitals, with unpaired spins if equal energy orbitals are available, because the lowest most stable energy state occurs under these relative conditions. Their quantum numbers must differ but in a manner resulting in minimum net external energy difference. Physically this structure results in maximum like charge separation and opposite magnetic pole alignment (minimum unbalanced electromagnetic forces). These minimum unbalanced energy principles extend to electron:electron molecular, proton:electron atomic, and proton:electron:proton nuclear bonding in accordance with structural geometries, electromagnetic forces, and relativistic energy effects.

In molecules a 1-dimensional bond occurs between 3-dimensional structures, not just between two electrons with opposite spins. No electron:electron bonding occurs by itself because electrostatic and magnetic forces are coincidental and equal effects that derive from the same cause so no net bond occurs. However an orbital electron's negative charge forms a dipole with a positive nuclear charge so net charge is localized and only its magnetic force remains to bond with another atom's orbital electron. Because the bonded state results in no unbalanced electromagnetic forces the net field for the molecular structure is zero and the lowest energy most stable state results.

Since the electron's associated 3-dimensional atomic structure negates its charge repulsion and only a 1-dimensional magnetic force remains it may be described as a 3-dimensional array of forces and a

1-dimensional resultant specified by $ds^2 = dx_{1-4}^2 = 1$, indicating an available quantum bonding state, if Einstein's atom as a "portion of space (three-dimensional) at whose boundaries electrical density disappears everywhere,...contains a total electric charge whose size is represented by a whole number," and includes magnetic force with charge localization to form a bonding state (if added energy doesn't exceed 1, the quantum threshold electron magnetic or charge energy).

In fact destabilization occurs when external charge, magnetic, thermal, or photon energy equals electron ionization energy so this model is empirically correct. And if a second atomic structure in a quantum $ds^2 = 1$ bonding state joins this structure in an opposing direction a quantum 0 bonded state results, since equal and opposite magnetic vectors create a localized field, and the overall molecular structure is $ds^2 = 0$. An unbonded $ds^2 = 1$ magnetic field has dx_{1-4}^2 elements or latitude, longitude, and radial proximity criteria which must be met for a $ds^2 = 0$ bonded state to result, the magnetic spin orientations must oppose, and bonding electrons must be on matching ends of the atoms for a bond to form This extends to the dx_4 time domain since inertias must place atoms in the same place and time.

The significance of this concept is that 4-dimensional energy components, dx_{1-4}^2, transform through a single direction resultant, ds^2, to 4-dimensional components in the 2 atoms of a molecule. This means that a change to a dx element in one atomic representation has a counter reaction in the corresponding dx element in the 2nd atom exactly as Einstein determined for Euclidean inertial and Riemannian

spatial relations in his gravity-inertia equivalence analysis. This same concept applies to atomic and nuclear bonding and was the basis for incorporating magnetic and relativistic energy components in the Bohr model used in deriving neutron and nuclear bonding structures.

In hydrogen Bohr derived an equivalence between orbital angular momentum and the proton:electron coulomb force. The electron angular momentum is a spin-1 radius-momentum cross product orthogonal to the orbital at the proton center of mass with a small orbital magneton. Since Einstein showed a Euclidean $ds^2 = dx_{1-4}^2$ inertial equivalence to the Riemannian $ds^2 = 1/\mu\nu \sum g_{\mu\nu}\, dx^{\mu}dx^{\nu}$ gravitational metric, and dx elements may represent relativistic energy, the relativistic and magnetic energies were incorporated into Bohr's analysis as elements in a $ds^2 = dx_{1-4}^2$ Right Hand Rule relation to yield the diameter and magneton of a neutron from hydrogen if its extra 0.78233 MeV mass is relativistic electron energy that contracts its orbital and proton energy density attenuates permeability of space, effectively moving the angular momentum vector from the mass center toward the observer to yield a relativistic ½-spin effect. (see Superposition States of Planck's Constant, fn. 26, and Radioactive Decay, pp 9-13).

This analysis led to the concept of a negative Binding Energy well that contracts space without apparent mass since the electron's inertial mass vectors are cancelled by its orbital oscillations and proton:electron:proton coulomb forces are multiplied by relativistic contraction to yield nuclear binding. Since the 1-dimensional forces incorporate into d-dimensional structures this force is factored by

$3^{1/d}(px2.224)^n$ to yield a structural nuclear BE that derived from Einstein's Euclidean:Riemannian inertia-gravity equivalence concept. So in all 3 matter levels (molecular, atomic, and nuclear) an energy transform occurs between 1-dimensional resultants and 4-dimensional oriented vectors and since external energies affect resultants there is also an oriented induction occurring to internal energy vectors.

Electrons and protons occur as stable nuclear and atomic states because their component dx energy vector orientations geometrically balance in distance and oscillation relative to each other (neutrons are semistable proton:electron pair quantum energy transition states between stable nuclear and atomic states). Electron mass, charge and magneton vectors form a dynamic equilibrium with proton vectors over a wide range of distances (10^{-16} to 10^{-10} m) and orbital oscillation configurations because component energy vectors symmetrically cancel to yield net 0 energy ($e^-:p^+$ and $e^+:p^-$ are stable equilibrium states while other $e^-:e^-$, $e^+:e^-$, $e^+:e^+$, $e^+:p^+$, $e^-:p^-$, $p^-:p^-$, $p^-:p^+$, and $p^+:p^+$ combinations form unstable states because their mass, charge and magneton component energy vectors don't cancel to net 0 energy.)

Vector orientation symmetry in matter reflects the Right Hand Rule and it must always be in inductive equilibrium with surrounding matter so energy in a superposition state will be influenced to form a matter (not anti-matter) particle by its surrounding matter. Since particle magneton values depend on particle energy density and their magneton energies must be in structural equilibrium with coulomb and kinetic orbital energies, electrons must induce proton formation and

protons must induce electron formation from superposition energy in order to conserve structural magneton equilibrium. In other words electron presence forms protons and proton presence forms electrons because an atomic matter structure is the lowest available energy equilibrium state that the superposition state energy can flow to.

However the form of the particle initially induced must reflect the ambient energy conditions. Since electrons and protons exist as atomic structures and superposition energy exists as dark background energy the particle form will depend on the electron nuclear orbital energy state and the back ground energy density. So tau, kaon, pion, or muon particles form depending on the electron orbital state, how much collision energy was imparted to initiate a decay, and what the background energy density level is. If it occurs at a charge node (clover-leaf tip) it will be a neutral kaon or pion, if it occurs in a neutron state it will be a tau$^-$ by proton induction, and if it occurs on entering or exiting a transition region from one proton's neutron state to another it will be a kaon$^-$ or pion$^-$.

Inductive influence by the energy orientations of neighboring points will cause matter, not anti-matter, to predominately form but since particle formation depletes the background superposition state energy density its transform into matter occurs radially outward at a rate proportionate to the existing matter's surface. However since Right Hand matter forms and momentum must be conserved an equal and opposite manifestation direction will result so it forms in a spiral which gives galaxies an angular momentum or rotation of formation.

Superposition states also provide explanation for black holes and gamma ray pulsars. The superposition states provide dark energy for the formation of matter but matter may also transform back into dark energy. Matter induces the 4-dimensional superposition state oscillation energy into matter by its electromagnetic fields but if the superposition state energy fields are stronger than the matter's the reverse occurs. A negative energy well forms when an orthogonal oscillation creates a field gradient towards its massless energy, since oscillating inertial vectors oppose and cancel, so energy will store by $E = hf$ and contract space by $l = l_0(1 - v^2/c^2)^{\frac{1}{2}}$, where v is the oscillating energy's velocity, without apparent limit or field discontinuity since time dilation integrates temporal discontinuity.

If the gravitational field of a star, with hydrogen fuel spent, is sufficient it will collapse particle structures. When the gravity field exceeds a particle's circumferential oscillation's centripetal field vector its energy, unbound, will constructively interfere with the superposition state oscillation energy because its 4-dimensional oscillation stores maximum energy in minimum space. This parallels Red Shift (Superposition States of Planck's Constant, fn. 16) where a gravitational field extracts photon energy at oscillation peaks in undilated time, only in this case the stronger superposition state's field gradient extracts particle energy from its centripetal field.

This process transforms static mass and electromagnetic field energy, $e = mc^2 = mE^2/B^2$, to superposition state oscillation energy and increases its negative energy well effect. Its field decreases

outward radially by $1/r^2$ and from the point where the gradient and centripetal fields equalize the particles will be stable but nuclei containing particles won't be until a radial point is reached where gradient and binding energy forces equalize. As nuclei destabilize the binding energies will release as decay particles and gamma rays, with particles masses pulled in and gamma rays radiated out.

So particles collapse and absorb in the 1st region while nuclei destabilize and emit gamma rays in the 2nd, with superposition state energy field strength increasing as particles absorb. In this case boundary conditions will exist at the absorbsion and destabilization radii, with different energy density and transmission coefficients in each region. Such an arrangement would require a periodicity in order to accommodate the different process rates, or a standing wave with absorbsion and destabilization phases, and the associated gamma ray bursts. Because field strength grows with the process the pulse rate will shift as it grows and surrounding matter is absorbed.

These concentric phases of conversion to particles, with gamma bursts, and absorbtion by the superposition state oscillation create a greater negative energy well that will collapse the star's matter in alternating stages of matter buildup and transform into negative energy well with a size reduction until matter is absorbed as fast as it falls into the star. At this point it would be considered a black hole, or high energy superposition oscillation, with a massive field strength and a matter absorbtion rate limited only by its time dilation, bringing us to its absorbtion of light and IR emissions.

Light traversing a gravitational field is bent by curvature of space but its Red Shift results from energy loss. As described in Superposition States of Planck's Constant, light is a 3-dimensional oscillation with its propagation axis oscillation contracted to zero for independent observers, since it moves at light speed, while the 2 orthogonal energy projections traverse sine waves with c velocity and 0 time flow on crossing the propagation axis and 0 velocity with normal time at amplitude peaks. So energy may transfer from the wave to a gravitational field at the peaks but interaction is impeded in other phases of the wave by a disparity in relative times.

Degree of interaction between points depends on their relative motions and distances. Two infinitely close points on parallel paths with equal velocities experience the same time with respect to each other and an observer at a 3rd point sees them as having identical space-time contraction-dilations as they move past him However if one point moves midway between the 1st and 3rd points it will appear faster to the observer even though both points still have the same velocity. And if the point moves infinitely close to the 3rd point it appears to have a velocity of c, even though no point's velocity has changed, so the degree of effect must be a Pythagorean resultant of the observed trajectory and radial distances.

Now if the mid-point follows a Pythagorean resultant trajectory as it moves between the 1st point and observer there is no apparent velocity difference between the 1st and mid points to the observer since its motion will be along a radial axis to the observer and its

motion will be cosine and sine functions from the observer's and 1st point's perspectives (i.e. if A is trajectory, B is orthogonal, and C is the vector resultant, then $A^2 + B^2 = C^2$; and if θ is the 3rd point's field of view angle, then $\sin \theta = A/C$ and $\cos \theta = B/C$). So if A and B are orthogonal inertial energy projections the resulting relativistic field gradient C would follow a sine trajectory to the observer and add to a radial gravitational field from the 3rd point.

If the two orthogonal inertial projections represent a photon's motion and its orthogonal oscillation the relativistic resultant and gravitational fields add to accelerate the photon to the observer as it moves into his field of view. However, after completing the 1st ½ of its trajectory the photon's sine wave resultant points away from the observer, since intertial motion entails anterior contraction and posterior dilation gradients (Superposition States... p. 15, and comets' tails point away from gravitational bodies, fn. 28), and its effect opposes the gravitational field during the 2nd ½ of the each sine wave. This gives an EM wave a centripetal acceleration toward the 3rd point that is only ½ the force that would result from its energy and a gravitational field so the wave has only ½ the force a mass does but its trajectory is still curved by the field.

Since the EM wave is accelerated toward the 3rd point it loses potential energy like a falling object, which means energy transfers from its wave structure to the gravitational field so its frequency red shifts downward. With Black Holes the gravitational field is so great the energy loss is much larger than for a normal star and the

Black Hole's larger time dilation permits energy extraction earlier in a sine wave's phase, closer to the propagation axis when its time is 0, so it loses more energy to the field. For higher frequency EM waves this cycle is repeated more often as they traverse the field of view whereas lower frequency waves only undergo one cycle or less as they traverse the field so high frequency photons are depleted of energy and only weak thermal waves radiate from around the Hole.

This concept of energy as a 4-dimensional energy distribution provides a traceable path from providing for optimal storage of dark background spatial energy, to forming particles under condensation conditions of charge fields and contracted space or photons under neutral contracted conditions (Superposition States), to forming the negative binding energy wells of nuclei (Radioactive Decay), to the formation of neutrinos and lack of anti-matter in a matter Universe by inductive effects, to structure of Black Holes as a high density superposition states that absorb particle or photonic energy, to the radiation of weak thermal energy from Black Holes and the nature of gravity. It should also be mentioned that this concept answers some Standard Theory questions as to quark energies and leptons numbers.

Background energy is a 3-dimensional oscillation (4-dimensional energy distribution) that creates contraction gradients in 3 spatial dimensions (with equal and opposite internal repulsion gradients by oscillating inertial energy's effect on space, Superposition States, pp. 6-15). It exists this way because it stores maximum energy with minimum spatial distortion in the minimum energy stable energy state

because density distributes energy evenly in space, net gravity is 0 since external relativistic contraction equals internal repulsion in the outward phase of the inertial energy's 3-dimensional oscillation with a converse occurring in the inward phase while time dilation at each oscillation's maximum velocity point results in both conditions simultaneously existing as a superposition state, and the nature of energy to only cause as much contraction-dilation of space-time, no more or less, as there is energy present relative to surroundings.

The significance of this that nature does what is necessary but only what is necessary to achieve minimum average energy disparity. Two quantum states of high and low energy density (contraction and repulsion) simultaneously exist in dilated time as a superposition state because of the continuity relation between energy-space-time, called Planck's Constant, that equalizes energy density by equal and opposite dynamic effects. This 3-dimensional energy structure with two quantum states may then exist in four permutated quantum states, as photons with local Euclidean and Reimannian relativistic quantum states that depend on the observer's position or particles with two quantum states of complementary charge, mass, and magneton values.

Photons are 3-dimensional oscillations but appear 2-dimensional to independent observers because the propagation axis oscillation is contracted and they transfer continuously variable quantum amounts of energy that depend on oscillations per unit time. Particles exist as circular oscillations with two fields, charge and magnetism, that vary continuously with distance, have quantum mass energies, but may

store energy continuously as velocity (space/time) or by continuous structural expansion. These permutations of stable states exist in nature provided they maintain a criteria of having lower energy than their component parts and this is why only 3 leptons pairs exist.

Leptons are the structural bonding components, mortar to proton bricks, and only 3 pairs are required to form 3-dimensional stable particle structures. Seven fundamental structural states provide the basis for all other matter structures: 1) unpaired electron-proton, 2) hydrogen, 3) neutron, 4) H-2, 5) H-3, 6) He-3, and 7) He-4. These states are 1) potential, 2) stable paired p:e state, 3) unstable p:e state, 4) 1-dimensional p:e:p stable state, 5) 2-dimensional n:p:n unstable state, where n is the unstable p:e state, 6) 2-dimensional p:n:p stable state, and 7) 3-dimensional p:n:p:n stable state. The 1st lepton, an electron, is stable in hydrogen without its v_e pair because structural energy is less than component energies and 2 out of 3 fields (mass and charge) are balanced by equal opposite fields.

However when the v_e is added an unstable neutron state results because there is no equal and opposite energy to oppose the 0.78233 MeV in added energy. The neutrino represents a ½-spin relativistic angular momentum component of the electron's orbital that moves the electron closer to the proton center of mass. The 0.78233 MeV is the added electron mass that contracts the space between the particles but an observer only see the neutron's surface so it appears as if the proton is shifted toward the electron which gives the orbital a ½-spin instead of spin 1 angular momentum. On decay the 0.78233 MeV

releases as kinetic energy and the electron's ½-spin orbital angular momentum information releases as an electron anti-neutrino.

Neutrinos have only 2 orthogonal oscillations (defining orbital angular momentum's 2 degrees freedom) so no electromagnetic fields result to interact with matter. The 90^{o} out of phase oscillations (one peaks when the other is 0) yield a rotating resultant equal to an oscillation's peak energy amplitude. Since oscillation inertias cancel neutrinos would be massless and accelerate to c with a spin 1 moment at its center, orthogonal to the oscillation plane and on its propagation axis, like light, however a rotating resultant from out of phase oscillations creates centripetal acceleration to shift its moment outward, yielding a spin ½ in the direction of motion with an oscillation sequence that rotates like a propeller as it moves.

Since a $\bar{\nu}_e$ represents an electron's angular momentum its energy is determined as follows. A hydrogen electron is -13.6 eV at a 0.529 x 10^{-10} m Bohr radius. A neutron electron's extra 0.78233 MeV gives it a 2.76136 fm Bohr radius (Radioactive Decay, p. 12) but from its local perspective it is still at -13.6 eV while the 0.78233 MeV mass increase (2.531 times) contracts its radius by 1/2.531 = 0.3951 to 1.091 fm for independent observers. This relativistic shift changes the electron's perceived -13.6 eV orbital angular momentum but since it's a charge, magneton, and kinetic orthogonal resultant energy the contraction increases the -13.6 eV to $-13.6/(0.3951)^{1/3}$ = -18.534 eV with a kinetic or angular momentum energy of 18.534/3 = 6.178 eV for a $\bar{\nu}_e$ since it represents the electron's angular momentum component.

So hydrogen with a classical orbital angular moment of 1 has no extra energy to conserve as a tertiary particle, but a neutron with its ½-spin relativistic orbital moment must conserve this effect on decay. It does not exist as a neutrino per se in a neutron since it is an electron energy state but on decay this energy component forms as a neutrino. The first lepton pair is thus required for a neutron state of a hydrogen atom to exist. Similarly, tau and muon leptons and their neutrino pairs are needed for the nuclear binding electron orbital and transition region clover-leaf tip angular moments, and since no other relativistic orbital moments are necessary to form a stable nuclear structure only these three lepton pairs exist.

It should be noted that all leptons are electron energy states and their neutrinos represent the same relativistic orbital angular moment components as the electron neutrino except that their scalar energy values are specific to the orbital portion they derive from. When a proton is added to a neutron a 2.224 MeV negative BE well is created by the electron's relativistic resonance oscillation between two protons in a p:e:p deuterium structure. This configuration has 2 orbital states, the electron's +0.78233 MeV neutron orbital and a -3.66567 MeV relative energy transition to its +0.78233 MeV neutron state with the a 2nd proton (see Radioactive Decay, pp. 29-30).

The electron transitions +0.78233 - 3.66567 = -2.88334 MeV with respect to the 1st proton but it receives an average (2.88334 / 2 = 1.441667) + 0.78233 = 2.224 MeV energy gain as it oscillates between the protons. Independent observers see a 2.224 MeV proton mass loss

since the energy stores as 0 mass electron relativistic oscillation energy with equal and opposite inertias canceling. This negative BE well contracts the 2.76136 fm neutron orbit by 2.531 (1.67036 fm) to a 1.091 fm neutron radius and the 1 fm distance to the 2nd proton by 2.531 (0.6049 fm) to a 0.3951 fm neutron-proton separation gap shown in neutron-proton potential energy separation plots. The oscillating electron traverses a non-relativistic 1.67036 fm initial interaction distance to 1 fm from the 2nd proton which contracts to 0.3951 fm by absorbed energy and is rotated by coulomb force and electron inertia vectors so the 2nd proton becomes a neutron 0.3951 fm from the 1st.

The electron transition from a non-relativistic to relativistic neutron state with the 2nd proton is the muon energy state and the rotation of the 0.3951 fm gap from the 2nd to 1st proton is the muon neutrino orbital angular momentum component (pgs. 8-11). Similarly a tau energy state results when a deuterium bond is incorporated into 3 or 4 nucleon H-3, He-3, or He-4 structures. A tau is the overall electron energy state of the structure's nuclear orbital oscillation which includes the muon transition and neutron energy states and its neutrino is the overall orbital angular momentum relativistic effect exclusive of its individual muon and electron neutrino components.

From these concepts a correlation to the Standard Theory quark energies derives. In crystallization the electronegativities of the reactant atoms determine dipole moment polarity and strength that in turn determines the product crystal's composition. External factors such as reactant concentration, solvent structure and dipole moment,

thermal energy, and product crystal surface area determine crystal growth rate. And, prior events such as solvent selection and seminal crystal orientation determine lattice parameters (levero or dextero rotatory orientation, crystal structure type, and a radial helical or spatial 3-dimensional symmetry). All of these permutated effects trace back to internal:external electromagnetic field interactions.

Matter (and lack of anti-matter) formation may be thought of as crystallization of superposition state energy by neighboring points' static and dynamic field influences, where relativistic contraction is the dark energy condensation mechanism and field induction is the information transfer that determines the matter's structure. Instead of a quantum gas undergoing a Bose-Einstein condensation by phase transition of atomic wavefunctions to their lowest energy state when thermal wavelength exceeds inter-particle spacing this is a spatial contraction wavelength that condenses superposition state energy.

It's like corks floating on a choppy sea that calms to a long standing wave. Choppy waves distribute the corks over the sea since wavelengths are short compared to cork sizes but a long deep wave concentrates the corks at the bottom of its trough so they can phase shift wavelengths and condense into a low energy state wavefunction. In a deep enough trough side pressure will fuse the individual corks into a big one occupying less space than all the individual corks.

This is Yukawa's theory from a perspective of an inter-particle contraction gradient being a wavelength, where shorter wavelength is

higher frequency and energy by e = hf (Superposition, fn. 3). This seems contrary to Bose-Einstein's thermal wavelength premise but it is just a flip side of the same coin. Individual superposition state 3-dimensional energy oscillations concentrate at the peak of a short wavelength high energy density ½-cycle compression wave and condense by a phase transition into a matter state in the long wavelength low energy density ½-cycle trough of neighboring space instead of atomic wavefunctions overlapping in a low energy state thermal trough.

Dark background energy sits in a high energy density state with no opposition to transform into matter except for boundary condition threshold requirements, the 1st of which is that dark energy must be bosonic like Bose-Einstein atoms with integral spins and symmetric wavefunctions, since ½-spin asymmetric wavefunction fermions cannot constructively superimpose. Superposition state 3-dimensional energy oscillations are spatially symmetric in all dimensions, are radially symmetric to the resultant and its orthogonal, have 0 spin, and will thus superimpose with a frequency increase that condenses energy. So in a inter-particle relativistic contraction the high energy density bosonic superposition state wavefunctions are at a short wavelength peak and neighboring space is a low energy long wavelength trough.

The 2nd requirement is that conditions must exist to induce the energy into photonic or particle matter. If they aren't present the energy may produce virtual particles such as occurs in a high vacuum or at particle surfaces when gravitational or charge field gradients are sufficient to condense the dark energy but neighboring space is

a 0 energy infinite wavelength trough (without induction fields) so the virtual particles are unstable high energy states that oscillate between their form and the concentrated dark energy field gradient.

If wavelength increases to infinity condensates decompose back into individual components; if the sea calms to "glass" with no wave troughs the corks disperse. This is supported empirically when light slows under some Bose-Einstein condensate conditions and speeds up under others. At local levels atoms are Euclidean and atomic size is fixed so light transit time is always the same from its perspective, whether it's 10^{-20} or 10^{20} m to independent observers, but observers see light speed according to observed size so light slows (refracts) if condensation dilates space by increasing atom size and it speeds up if condensed atoms differentiate (diffract) into smaller ones.

If a thermal wavelength is infinite no energy is present, as when lasers cancel thermal effects. A condensed atom would decompose since no specific lowest energy state exists and no potential energy to cause phase transition exists. Instead, potential energy exists in a condensed atom to un-condense and since it is a wavefunction it has potential energy to un-condense by an e = hf frequency reduction until density of un-condensed atoms and relative background energy density opposes the action. If Bose-Einstein conditions condense atoms that de-condense when conditions are removed then conditions may occur such that normal atoms phase transition into smaller ones. Atomic structure size depends on the relative energy of the space it occupies, and light traverse time depends on relative observer size.

These results simply confirm neighboring point energy influence principles. Light passing a gravitational body red shifts, similarly light passing a mass repulsion source would blue shift although such entities don't exist except from a viewpoint of relative movements. Stars moving away red shift, those moving closer blue shift, which compares to regional relative attraction and repulsion fields. Since dimensions are relative, atomic wavefunction sizes must transform to maintain energy density continuity, which correlates to condensation of lower into higher frequency wavefunctions by phase translation.

In inter-particle gradients bosonic superposition wavefunctions concentrate in a short wavelength relative high energy density peak. If atomic wavefunctions phase translate to maintain energy density then superposition state wavefunctions would also phase translate by transforming relativistic gradient energy into a higher frequency superposition state and resonating to and from virtual matter states via the energy density disparity created when the gradient energy is transformed. Particles may be bosonic or fermion matter:anti-matter pairs to conserve spin, and photons may form, but stable matter is improbable without induction to transform the dark energy into light by gravitational field acceleration to c or into particle matter by mass, charge, and magnetic fields from proximate co-particles.

Superposition state wavefunctions are 3-dimensional orthogonal oscillations with axial resultants and are massless since inertial oscillation vectors cancel. In a gravitational field a wavefunction can't know if it's moving relative to neighboring points or they are

moving relative to it. Using Einstein's $ds^2 = dx_{1-4}^2 = 0$ Euclidean point to represent a wavefunction (by substituting Euler's Identity $e^{ix} = \cos x + i \sin x$ for each dx_n, where $\cos x$ = kinetic energy and $i \sin x$ = relativistic energy, such that E = KE + RE = 0), and his Riemannian metric $ds^2 = 1/\mu\nu \; \Sigma \; g\mu\nu \; dx^{\mu} \; dx^{\nu}$ to represent points along a propagation axis we can derive a wavefunction acceleration effect, where $g\mu\nu$ are x_1 to x_4 coordinate functions that specify the laws governing space, with g representing static gravitational field and μ & ν representing dynamic electromagnetic field effects.

Strictly speaking Einstein was solving for the equality between gravity and inertia of gravitational bodies, where $g\mu\nu$ coefficients refer to gravitational field and position variables. However nothing in his reasoning precludes use of $\mu\nu$ in referring to electromagnetic fields since they represent gradients affecting spatial coordinates. Since electromagnetic fields E and B relate to the speed of light by $c = E/B$ and c is defined in terms of permitivity and permeability by $c = (\mu\nu)^{-\frac{1}{2}}$, $1/\mu\nu$ may be replaced by c^2 so $ds^2 = c^2 \; \Sigma \; g/c^2 \; dx^{\mu} \; dx^{\nu}$, and in the absence of electromagnetic fields $dx^{\mu} = dx^{\nu} = dx^0 = 1$ so $ds^2 = c^2 \; \Sigma \; g/c^2 = g$, since the c^2 constants cancel.

This means the wavefunction's $ds^2 = 0$ Euclidean space undergoes energy transfer to the g-field, with its local observer experiencing acceleration, such that $ds^2 = g$ and its energy decreases by $E = g \cdot d$. To independent observers in the local Euclidean space of the g-field source this energy transfer appears as a relativistic contraction of the propagation axis oscillation as the ds^2 wavefunction resultant

points toward the g-field source and the contracted propagation axis oscillation, mass-less, follows a g-field spatial gradient contour. As the wavefunction accelerates, its propagation axis oscillation is contracted to 0 and its ds^2 resultant rotates orientation to 90° off the propagation axis and radial to the g-field, with a spin of 1.

Spin is an angular momentum resultant. It's 0 for a non-orbital structure if the mass center and inertial moments coincide. It is 1 if an orbital structure's plane is orthogonal to its inertial moment so its mass center and angular moment vectors add without an offset. And it is ½-spin if its orbital angular and inertial moments yield a resultant 45° off the propagation axis. This occurs if inertial and orthogonal orbital moments equalize or if relativistic contraction of orbital radii moves mass centers toward observers as in neutrons. However since orbital and inertial moments must be equal it would be unusual for circumstances to consistently result in ½-spin vectors, unless the energy structure inherently equalizes these moments.

A 3-dimensional oscillation's resultant is 54.7° from each axis and appears 45° off the propagation axis oscillation for independent observers. At rest it has 0 spin since, with no motion, there is no inertial moment to reference the spin to. At non-relativistic speeds it is ½-spin since orthogonal oscillations constitute an orbital and the resultant is 45° off the propagation axis oscillation. At light speed it's spin 1 since the projection axis oscillation contracts to 0 and the resultant orients 90° from the axis and appears to rotate to an orthogonal observer as the orthogonal projections oscillate.

So a wavefunction is a 3-dimensional oscillation with a spin 0 resultant to a local observer, a ½-spin if it has a non-relativistic velocity, and a 1-spin 90° rotated resultant to observers at light speed. In a g-field the propagation axis oscillation is contracted by the field gradient and as the wavefunction accelerates through a field the propagation axis oscillation contraction accelerates to 0. The oscillations orient with one oscillation on the propagation axis because least spatial distortion occurs when 1 oscillation contracts to 0 at light speed ($3^{\frac{1}{2}}$ times as much energy is needed to contract a resultant). So at light speed the propagation axis oscillation isn't apparent to observers, its contraction orients the resultant 90° to the axis, and its oscillation forms a spin 1 spiral as it moves.

Propagation axis oscillation contraction and orientation of the resultant to 90° is the basis of wave:particle duality. In a charge field a wavefunction doesn't accelerate as in a g-field. Instead it rotates with centripetal acceleration about its mass center. This is the seminal root of Faraday's and Lenz's Laws, which state that time rate of change of magnetic flux induces an electromotive force of a polarity that opposes change in magnetic flux. It is also the basis of the Right Hand Rule, which states that magnetic force is a cross-product of charge velocity and magnetic field strength, $F = q\mathbf{v} \times B$.

Neighboring points influence each other in energy magnitude and orientation, which means the energy's inertial information transfers from one point to a 2nd point. From the 2nd point's perspective the 1st point's energy moved toward it while its energy moved away from

the 1st point, so it has exactly equal and opposite information with respect to the 1st point and means the 1st point induced an opposite effect in the 2nd one. Similarly if inertial energies oscillate with respect to each other they will be 180° out of phase because as one's energy moves toward the other the other's energy moves away. And if the oscillations are 3-dimensional the created dynamic fields will be equal and opposite, and that includes rotating oscillations.

A 3-dimensional orthogonal oscillation generates an oscillation resultant 54.7° off each oscillation axis and 45° off a plane formed by any 2 axes, as in a $x^3/3!$ tetrahedron. In Superposition States of Planck's Constant it was shown that inertial motion creates anterior contraction and posterior dilation (comets' heads face gravitational bodies while tails point away). In a 3-dimensional oscillation this inertial contraction/dilation creates an oscillating energy density disparity or dipole between the resultant's center and its peak that causes the 3-dimensional energy oscillation and the density's dipole oscillation center is at the resultant's $2^{-\frac{1}{2}}$ average sine 45° point.

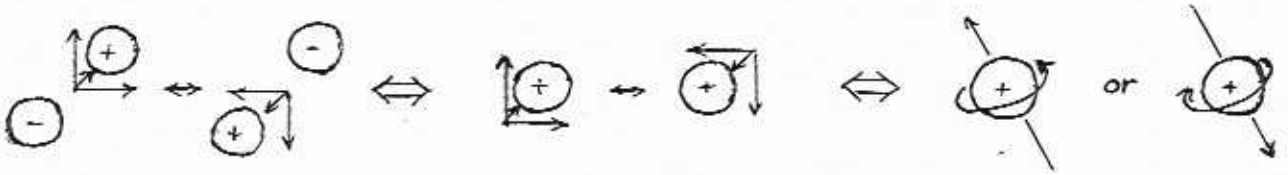
The density dipole oscillates with the resultant's oscillation such that the resultant always moves toward the high energy density region, since inertial energy creates the contracted space that is the density region. Because of this a resultant may be thought of as pointing at a density region with a 3-dimensional oscillation moving back and forth with respect to it. Perspective is position dependent and at a density region the oscillation moves, at a oscillation node the density region moves, and independent observers see a resonance.

So the density region sees itself as [+] energy with a 3-dimensional oscillation passing axially through it, 180° out of phase with its neighboring point. The oscillation sees a [+ - -]:[- + -]:[- - +] energy oscillating with its resultant. And the independent observer sees a [± ± ±] resultant axis energy density resonance oscillation.

If a neighboring point's 3-dimensional oscillation resultant rotates about an energy density region it induces equal and opposite rotation in the 1st point's resultant (since a neighbor's resultant and projections influence the 1st point's space). With rotation and oscillation a resultant has two degrees of centripetal acceleration, similar to what occurs in clover-leaf nuclear binding orbitals with neutron and transition region tip orbital radii. A resultant rotates with its 45° point being the average energy density region radius, as in a neutron radius, and it radially oscillates which causes its 3-dimensional oscillation to reorient 180° toward the energy density region, as when an electron's absorbed coulomb energy reorients its inertial vectors and changes neutron states in the clover-leaf tip.

This means the 3-dimensional oscillation's anterior contraction fields always point toward a energy density region and its posterior dilation fields always point away by reorientation of the resultant each revolution. The resultant's rotational angular momentum occurs by induction of a phase shift in the orthogonal oscillations. From an independent observer's perspective 1 orthogonal oscillation moves the 3-dimensional oscillation side-to-side, a 2nd moves it front to back, and the 3rd moves it up and down. So a resultant always points

toward a high density region center, its posterior points to a low density region, and this energy dipole rotates with the resultant's 3-dimensional oscillation about the high density region in a ½-spin orbital 45° from the horizontal with a rotation dependent polarity.



It is ½-spin because under inertial motion the direction vector must align with a 3-dimensional oscillation projection, since least distortion to space results by relativistic contraction of a single energy dimension, so the angular moment of the resultant's orbital is 45° from the propagation axis. And it has rotational polarity because a right hand rotation results in a 45° angular moment and a left hand rotation yields a 225° moment. This is the basis of the Right Hand Rule and wave:particle duality in particle structures. A ½-spin fermionic structure can't constructively superimpose while an integral spin bosonic structure may, and since the propagation axis oscillation relativistically contracts with velocity the resultant's orientation rotates orthogonal to the propagation axis to a spin-1.

So under very low velocity conditions, as with Stern-Gerlach's electrons generated from an ion source, a ½-spin fermionic particle nature manifests and under high velocity conditions a 1-spin bosonic wave nature manifests according to $\lambda = h\,(2mq\,dV)^{-\frac{1}{2}}$. In double-slit experiments low energy electrons statistically distribute over time in a wave interference pattern because velocity determines degree of 1-spin wave nature which in turn influences electron distribution.

(Note: A particle of charge q and mass m accelerated by dV potential difference gains $\frac{1}{2}mv^2$ KE and loses q dV PE so $\frac{1}{2}mv^2 = q\ dV$. If $p = mv$ then $p^2/2m = q\ dV$ and $p = (2mq\ dV)^{\frac{1}{2}}$, so $\lambda = h/p = h\ (2mq\ dV)^{-\frac{1}{2}}$.)

Wave-particle duality thus results from the orbital resultant's shift from ½ to 1-spin as the propagation axis oscillation contracts with motion. This comports with a quantum mechanical interpretation of a spherically symmetrical zero angular momentum structure when no inertial motion is present, since the orthogonal oscillations freely orient, and a $(1^2 + 1^2 + 1^2)^{\frac{1}{2}} = 3^{\frac{1}{2}}$ resultant at $\cos^{-1} 3^{-\frac{1}{2}} = 54.7356^o$ from the energy oscillation in the propagation axis direction during inertial motion. Since oscillation energy is massless and the energy density region has an inertial center of mass, the resultant offsets by ½ the mass's diameter so the net resultant of $3^{\frac{1}{2}} \times \frac{1}{2}$ occurs at a $\cos^{-1} 3^{\frac{1}{2}}/2 = 30^o$ ½-spin angular momentum.

It is important to recognize that change in particle spin from ½ to 1, and thus particle to wave nature, is a continuous phenomena from relativistic contraction to independent observers but for local observers it is a ½-spin particle. So inertial particles interact classically while bound particles exhibit quantum behavior. This is not because Planck's Constant $h = 6.626075 \times 10^{-34}$ J·s is an energy quanta, rather it is because $h = 6.626075 \times 10^{-34}$ N·m·s is a force·space·time relation that causes energy to exist as a 3-dimensional orthogonal oscillation, since maximum energy with minimum distortion to space exists in equilibrium by balancing energy relativistically as inertial energy oscillating in the four space-time dimensions.

Because of this energy has an oriented resultant if observed or influenced from independent dimensions and this results in quantum h based behavior in bound orbital states, since angular momentum is a 3-dimensional vector which integrally equates to h's 3-dimensional energy oscillation over time so orbital motion may be expressed in integral multiples of h as in $L = mvr = n \cdot h/2 \cdot pi = [\ell(\ell + 1)]^{\frac{1}{2}} h/2 \cdot pi$. If $2 \cdot pi$ is the circumference then $h/2 \cdot pi$ J·s is the angular momentum energy/orbital ($E = hf$, if f = orbital frequency) and since rotation energy has polarity, and the h oscillation resultant forms a dipole, electromagnetic Right Hand Rule particle behavior may be explained.

The Bohr magneton was derived by showing that magnetic moment = angular momentum x $\frac{1}{2}\mu_o e/m$, substituting $h/2 \cdot pi$ for angular momentum. Since angular momentum constitutes energy and mass equates to energy by $E = mc^2$ the relation may be seen as $\mu_B / e = \frac{1}{2}\mu_o (h/2 \cdot pi) / m$, or magnetic moment / charge = $\frac{1}{2}\mu_o$ angular momentum / mass energy ratio. Calculation of proton and neutron magnetons (Superposition, p. 26-7) also showed that energy density affects permeability so the equation must be rewritten as $\mu_n / e = \frac{1}{2}\mu_o \mu_r \, h/2 \cdot pi \cdot m$, where $\mu_r = \rho_e / 3^{\frac{1}{2}} \rho_p$ = 1-dimensional electron:proton energy density ratio. Permeability is relativistic energy density ratio. It inversely affects light speed because increased energy contracts space and an observer sees light slowed but at a local level light still traverses uncontracted space in dilated time, so permeability stores energy temporially.

Permittivity on the other hand is a measure of relative energy pressure and directly relates to light speed because energy in high

Conclusion

A good conclusion should briefly tie up lose ends and lead to a sequel. How's This?

A tau particle, being the relativistic contraction energy of a neutron electron, forms on decay of its neutron state. And a pion, being the sub-relativistic energy of a BE well, forms on decay of a transition region. Both transform to the relativistic energy of an independent observer's system, an electron, through an intermediary muon particle and the orbital electron relativistic angular momentum is conserved during decay by the neutrinos produced, with total spin conserved by the sum of particle spins produced in the decay stages.

It should be recognized that in every event, where a particle's energy undergoes a quantum leap, to independent observers, energies are continuously conserved in relativistic states. That is, nuclear binding orbital electrons exists in supra-relativistic neutron and sub-relativistic BE states, and these states represent positive and negative quantum energy levels on an energy dimension axis.

In other words, independent observer's see the electron as the normal state, which a neutron with positive energy must decay to and a BE well with negative energy must have energy added to decay from. Since both decay paths always result in the same outcome there must be a continuity connecting the energy information of the quantum neutron and BE well states and this connection is relativistic.

Higher and lower energy states equate to an independent system by Lorentz Transforms that relate space-time contraction-dilation to any observer, and since these contraction-dilations must equal zero when energy equalizes with an independent observer's, every quantum event's energy levels must have sub- and supra-relativistic states that equate the energy-space-time variables to the observer's state.

This means that quantum energy change occurs between relative negative and positive energy states with respect to an independent observer mid-way between the states (all energy-space-time regions are accessible in quantum theory), both negative and positive energy states have a relative energy greater than the observer's, and these energy states have contracted-dilated space-time, as in the BE well that equalizes coulomb repulsion to spatial contraction or a 2.76136 fm neutron orbital contracted to 1.091 fm for an observer, and the forces are accordingly multiplied by these relativistic windows.

Since dilated time would exist for negative and positive energy states with greater relative energy than a mid-point observer of the event, then events in the negative and positive energy states must occur before and after the observer's relative time, and the events in either state must synchronize to those occurring in the other by a Riemann space-time curve through the mid-point while each point in space-time maintains its four dimensional Euclidean integrity.

So from an independent perspective at an event's mid-point, space-time must be continuously connected through the mid-point by

conical space-time regions, with their apexes at the mid-point, and which encompasses all dynamic energy inertia's before and after the event. As such, a bi-directional causal relation exists in time such that the energy resultant of every space-time point is predetermined by the outcome to the same extent that a cause determines an effect.

This means that while observation must affect outcome according to Heisenberg's Uncertainty, particle momentums and positions must also relativistically affect each other so as to possess continuity between them which allows their momentums and positions to be known over time. Hindsight is 20/20 because a continuity can be derived looking back in time, and if the observer moves forward in time a 20/20 continuity may be derived which also includes the event of the first point of observation. Since this continuity exists for both points in time, then from the first point of observation continuity must also exist in future time to the second point of observation.

For awe in a sunset to exist its recognition must also exist, both deriving from a common origin, and each create and depend on the existence of the other, just as the energies in relativistic supra and sub states must be mutually dependent, both prior to and after the event, and as such position in the dimension of time may be altered and future may alter past just as past alters future.

This premise, an "unseen communication" between past and future via sub and supra relativistic states surrounding an event, becomes the basis for the continuity of matter interactions.

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APPENDIX