# The Transitional Quantum State of Matter

Adapted from the theory of Frank Znidarsic

Nov 9, 2010

**Abstract**

The field of quantum mechanics revolves around the stationary quantum state solutions, but says nothing of the actual physical interactions which take place in order to produce these stationary states. This paper attempts to describe the stationary state solutions by modeling the behavior of the transitional quantum state. This new solution will then be shown to produce Schrodinger's Equation, Special Relativity, the Fine Structure constant, as well as inertial and gravitational mass.

## The Velocity of Nuclear Waves

We start by calculating the speed of mechanical waves inside the nucleus beginning with Coulomb's Law to calculate the Force between an electron and a proton,

$$F = k_e \frac{q_1 q_2}{r^2} \hat{r} = ma \tag{1}$$

The coulombic force produced between an electron and a proton compressed to within $2r_p$equals 29.05 Newtons, $F_{coulomb} = k_e \frac{q^2}{(2r_p)^2}$

The force produced by an amount of energy equal to the rest mass of the electron confined to within $2r_p$ is also 29.05 Newtons, $F_{max} = 29.05N$

This balancing confinement force $F_{max}$ was qualified as

$$F_{max} = \frac{M_{-e}c^2}{2r_p} = 29.05N \tag{2}$$

The electrical spring constant for a proton, would then be

$$K_{-e} = \frac{29.05}{r_x} = \frac{F_{max}}{r_x}$$

**The Energy of the electrical spring constant was tested at two radii:** First, the radius $r_x$ was set equal to the classical radius of the electron $2r_p = 2.82 \times 10^{-15} m$

$$U = \frac{1}{2}\frac{29.05}{2r_p}(2r_p)^2 = 14.525 \times 2r_p = 4.1 \times 10^{-14} \tag{3}$$

The elastic energy contained by an elastic discontinuity of displacement of $2r_p$ equals the rest energy of the electron $E = M_{-e}c^2$

If $r_x$ is set to the Bohr radius $r_h = 5.29 \times 10^{-11}$, we get the Rydberg constant

$$U = \frac{1}{2}\frac{29.05}{r_h}(2r_p)^2 = 2.18 \times 10^{-18} \tag{4}$$

By converting Eq 1. it into the differential equation form, $\ddot{x} + \omega_o^2 x = 0$ , Where $\omega_o = \sqrt{\frac{K_{e-}}{M_{e-}}}$ is the angular velocity of the harmonic oscillator, we can then calculate the speed of these mechanical waves as $V_t = \omega_o \lambda$ , Wavelength $\lambda$ can be then be expressed as integer multiples of the classical proton radius $\lambda = nr_p$

$$V_t = \sqrt{\frac{K_{e-}}{M_{e-}}} nr_p$$

or,

$$V_t = \sqrt{\frac{F_{max}/r_x}{M_{e-}}} nr_p$$

Solving for $r_x$, produces the radii of the hydrogen atom.

$$r_x = n^2 [\frac{F_{max} r_p^2}{V_t^2 M_{-e}}] \tag{5}$$

The quantity within the brackets is equal to the ground state radius of the hydrogen atom. This simplifies to the modern physics law,

$$r_x = n^2 r_{+h} \tag{6}$$

If the velocity of sound in the nucleus $V_t$ is then set equal to the velocity of light in the impedance matching electron orbitals $2\pi f_t r$, we get a photon wavelength $r$ multiplied by the frequency of transition. The wavelength of light couples directly with the wavelengths of the optical phonons which bind the condensate electron cloud at each discreet orbit.

$$V_t = \frac{\sqrt{K_{-e}/M_{-e}}}{2\pi}(2\pi nr_p) = 2\pi f_t r = V_{light} \tag{7}$$

If we then square, reduce, and solve for $r$ we get the amplitude of the transitional quantum state squared. This is the wavelength of the interacting photon squared.

$$r^2 = \frac{K_{-e} n^2 r_p^2}{4\pi M_{e-} f^2} \quad (8)$$

The transitional frequency $f_t$ of the daughter state is a harmonic multiple of the transitional frequency of the parent state.

The product of the transitional frequency $f_t = \frac{V_t}{2\pi n r_p}$and the integer $n$ can be factored to produce the amplitudes of the parent and daughter states.

$$r^2 = [\frac{2\pi K_{-e} r_p^3}{V_t}](\frac{n^2}{4\pi^2 M_{-e} f}) \quad (9)$$

The elastic constant of the electron $K_{-e}$ can be expressed in terms of lengths of energetic accessibility, $K_{-e} = \frac{F_{max}}{n r_p}$

By factoring in the elastic constant of the electron $K_{-e}$ and multiplying the top and bottom by 2 we get

$$r^2 = [\frac{4\pi F_{max} r_p^2}{V_t}](\frac{n}{8\pi^2 M_{-e} f}) \quad (10)$$

The factors within the brackets equals Planck's constant $h = [\frac{4\pi F_{max} r_p^2}{V_t}]$

The reduction of these terms produces Heisenberg's formulation for the amplitude of electronic harmonic motion squared

$$r^2 = \frac{nh}{8\pi^2 M_{-e} f} \quad (11)$$

This formula expresses the numerical intensity of the emitted photons. The intensity of a spectral line is a function of the probability of transition. The probability of transition is proportionate to the product of the transitional amplitudes of the parent and daughter states.

The great scientists described the energy of a photon in terms of its frequency. The energy of classical wave is a function of its amplitude, not its frequency. This discrepancy has been a long standing mystery. The principle of quantum correspondence was invented in an attempt to circumvent this problem. It proposes, with some slight of hand, that the frequency of a quantum system appears as amplitude in a classical system. This author has rejected this proposition and will now show that the energy of light is an effect of the light's displacement. Analysis of this formulation reveals an analog between the intensity of a quantum wave, and the amplitude of a classical wave.

The convergence of the motion constants is an affect of an equalization in the strength of the magnetic component of the electrical, gravitational, and nuclear forces. The equalization in the strength of the forces matches the impedance of the interacting states and allows the fields to slip into a new configuration. Energy flows, the wavefunction collapses, and the quantum transition proceeds.

## The Fine Structure Constant

The constant $V_t$ , like Planck's, has produced the atomic energy levels and the intensity of spectral emission. The convergence of the motion constants provides a clue as to the origin of $V_t$. It is a condition where the velocity of light within the electronic structure of the atom equals the velocity of mechanical waves within the nuclear structure of the atom.

The speed $V_t$ is inversely proportional to the inductance and capacitance of the system.

$$V_t \propto \frac{1}{\sqrt{LC}} \tag{12}$$

This author has also described the energy levels of the atoms in terms of an impedance match. Electrical impedance $\Omega$ is also a function of the capacitance and inductance of the system.

$$\Omega = \sqrt{L/C} \tag{13}$$

A change in the dielectric of a material equally affects the characteristic impedance and the speed of light. The electrical properties of materials tend to vary and the magnetic properties remain mostly constant. The principle quantum numbers are effects of a change in the electrical constant. The principle spectral lines split into several fine lines under the influence of a magnetic field. Arnold Sommerfeld qualified these fine lines through the introduction of a second quantum number.

Equations (12) and (13) diverge under a condition were the magnetic permeability of the material is varied. States of matching impedance are no longer associated with states of matching speeds. The fine structure of the atom emerges under this condition. The difference between the length of the longer fine line and the length of the shorter fine line divided by the length of the longer line yields the fine structure constant.

The origin of this constant has long been a mystery. Richard Feynman stated, "Physicists put this number up on their wall and worry about it."[16] This author has classically produced the fine structure constant as the ratio of the transitional speed to the speed of light.

$$\alpha = \frac{2V_t}{c} \approx \frac{1}{137} \tag{14}$$

The factor of 2 arises from the reflection of the electromagnetic wave within the nucleus. The electron Compton wave rides the reflected elecromagnetic wave to a higher energy state, and the quantum transition proceeds.

Electron spin can be incorporated into this model to account for the fine structure splitting observed in the ground state of atomic nuclei.

## Einstein's Photoelectric Effect

The geometry a photon experiences, during absorption or emission, is approximately that of a flat plate capacitor. The capacitance $C$ of a flat plate capacitor of area $A$ and spacing $D$ is given by

$$C = \frac{\epsilon_0 A}{D} \tag{15}$$

The area $A$ was set equal to the displacement of the photon squared $\lambda^2$. The displacement between the peaks in the amplitudes $D$ equals one half wavelength $.5\lambda$. The capacitance experienced by a cycle of light is thus given by $C = \frac{\epsilon_0 \lambda^2}{.5\lambda}$ which reduces to the capacitance of the captured photon.

$$C = 2\epsilon_0 \lambda_t \tag{16}$$

Substituting for $\lambda_t = \frac{V_t}{f}$ yields a relationship between the capacitance and the frequency of the photon.

$$C = \frac{2\epsilon_0 V_t}{f_n} \tag{17}$$

The potential energy $E$ of electrical charge $q$ is a function of capacitance $C$.

$$E = \frac{q^2}{2C} \tag{18}$$

The voltage produced by an electrical charge increases as its capacitance decreases. The energy of a photon is proportionate to the amplitude of its voltage. The action, of this voltage, replaces the principle of quantum correspondence. This is the state of the light that produces Einstein's photoelectric effect.

$$E = [\frac{q^2}{4\epsilon_0 V_t}]f \tag{19}$$

The quantity within the brackets is equal to Planck's constant.

$$E = hf \tag{20}$$

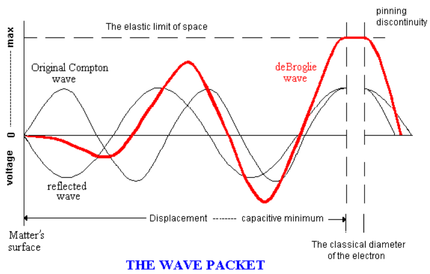
The amplitude of light is thus expressed by its capacitance. The capacitance of the "in flight" photon is indeterminate. Its energy is strictly a function of its momentum and, as such, it is independent of the photon's displacement. The lack of restriction allows the displacement $\lambda$ to vary. The geometry, of the traveling photon, is that of a boundless wave. This variability may produce, as Einstein called it, "a spooky interaction at a distance".[7] The state of the "in flight" photon is, as Feynman called it, the sum of every possible history.[8] This is the state of the light that simultaneously passed through the two slits in Thomas Young's experiment.

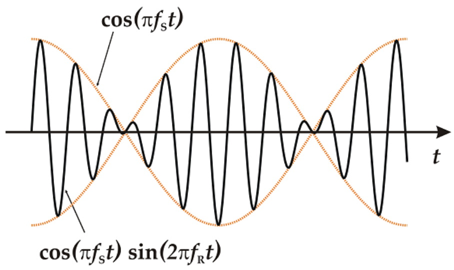
## DeBroglie's Matter Wave

In 1924 Prince Louis DeBroglie proposed that matter has a wavelength associated with it. Schrödinger incorporated deBroglie's idea into his his famous wave equation. The Davission and Germer experiment demonstrated the wave nature of the the electron. The electron was described as both a particle and a wave. The construct left many lingering questions. How can the electron be both a particle and a wave? Nick Herbert writes in his book "Quantum Reality" Pg. 46;[24]

> "The manner in which an electron acquires and possesses its dynamic attributes is the subject of the quantum reality question. The fact of the matter is that nobody really these days knows how an electron, or any other quantum entity, actually possesses its dynamic attributes."

Louis deBroglie suggested that the electron may be a beat note.[4] The formation of such a beat note requires disturbances to propagate at light speed. Matter propagages at velocity $v$. DeBroglie could not demonstrate how the beat note formed. This author's model demonstrates that matter vibrates naturally at its Compton frequency . The luminal Compton wave is pinned in place by restraining forces. The reflected wave doppler shifts as it is restrained. The disturbances combine to produce the dynamic DeBroglie wavelength of matter. The graphic shows the DeBroglie wave as the superposition of the original and the Doppler shifted waves.




The harmonic vibration of a quantum particle is expressed by its Compton wavelength.

$$l_c = \frac{h}{mc}$$

The relationship between frequency $f$ and wavelength $l$, is expressed in terms of the phase velocity of the wave, which is $c$.

$$c = fl$$

Substituting back we get the Compton Frequency of matter,

$$f_c = \frac{Mc^2}{h}$$

A doppler shifted component of the original frequency is produced by the restraint on the wave function. Classical doppler shift is given by

$f_2 = f_1(1+/-\frac{v}{c})$

A beat note is formed by the mixing of the doppler shifted and original components. This beat note is the deBroglie wave of matter.

A beat note is produced by additive wave interference such as that of two different waves.

$f(t) = \sin(2pf_c 7 + p) + \sin[2pf_c(1+/-\frac{v}{c}t)]$

$f(t) = \sin(2p(\frac{mc^2}{h})t + p) + \sin[2pf_c(\frac{mc^2}{h})(1+/-\frac{v}{c}t)]$

Refer to the figure above. A minimum in the beat note envelope occurs when the component waves are opposed in phase. At time zero the angles differ by $p$ radians. Time zero is a minimum in the beat note envelope. A maximum in the beat envelope occurs when the component waves are aligned in phase. The phases were set equal, to determine the time at which the aligned phase $q$ condition occurs.

$q_1 = q_2$

$2p(\frac{mc^2}{h})t + p = 2p(\frac{mc^2}{h})t(1+/-\frac{v}{c}t)$

$ct = \mp(\frac{h}{2mv})$

$l_d = \frac{h}{mv}$

The result is the deBroglie wavelength of matter. Reflections contain a luminal compton wave. The superposition of these reflections is the deBroglie wave of matter which relates the wavelength $\lambda$ and frequency $f$ to the momentum $p$ and energy $E$, in terms of Planck's constant $h$

$\lambda = \frac{h}{p}$ and $f = \frac{E}{h}$

These can also be written in terms of angular components

$p = \hbar k$ and $E = \hbar\omega$

Where $\hbar$ "h-bar" is Dirac's constant $\hbar = \frac{h}{2\pi}$ and $k$ is the angular wavenumber.

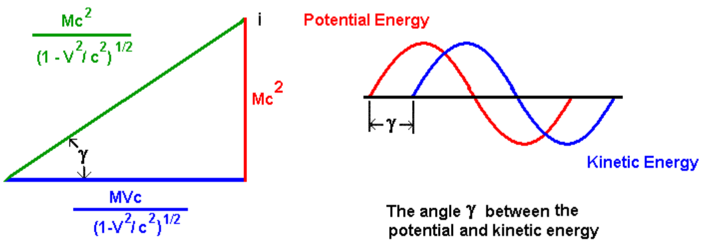
This angular representation allows us to better visualize the Potential and Kinetic Energy solutions we get for our Schrodinger differential wave equations as will be shown later. The Euler equation allows us to better visualize the time and space components of waves, in addition to providing us with Special Relativity, which falls out as a result of this reformulation and doesn't need to be injected ad hoc into the theory.

$e^{i\theta} = \cos\theta + i\sin\theta$ or $e^{-i\theta} = \cos\theta - i\sin\theta$

Where $\theta = (kx - \omega t)$ is the classical wave equation for plane travelling waves, which is a general solution to the differential wave equation $\frac{d^2}{dx^2} = \frac{1}{v^2}\frac{\partial^2}{\partial t^2}$

## Reconciling Special Relativity and Quantum Mechanics

Mass Energy ($E_m$) is a standing wave $E_m = Mc^2$. A standing wave is represented on the $i$ axis of a complex plane




The phase of a standing wave is 90 degrees. All standing waves are localized by restraining forces.

A traveling wave has its kinetic and potential components aligned in phase. An ocean wave is a good example of this type of harmonic motion. The wave's height (potential energy) progresses with the kinetic energy of the wave.

The energy $E$ contained by a wave carrying momentum $P$ is expressed as

$$E = Pc$$

The traveling wave expresses itself through its relativistic momentum $P$ , where

$$P = \frac{Mv}{\sqrt{1-\frac{v^2}{c^2}}}$$

Substituting yeilds the amount of energy that is in motion $E_q$

Energy flows are represented on the X axis of a complex plane.

We will then show how t

$$E_q = \frac{Mvc}{\sqrt{1-\frac{v^2}{c^2}}}$$

The vector sum of the standing wave ($E_m$) and traveling wave ($E_q$) components equals the relativistic energy ($E_r$) of moving matter.

$$[E_r]^2 = [E_m]^2 + [E_q]^2$$

$$[E_r]^2 = [Mc^2]^2 + [\frac{Mvc}{\sqrt{1-\frac{v^2}{c^2}}}]^2$$

$$E_r = \frac{Mc^2}{\sqrt{1-\frac{v^2}{c^2}}}$$

The ratio of standing energy to the relativistic energy $\frac{E_m}{E_r}$ reduces to $\sqrt{1-\frac{v^2}{c^2}}$ This function expresses the properties of special relativity.

$$\gamma = \arcsin(\sqrt{1 - \frac{v^2}{c^2}})$$

The phase $\gamma$ expresses the angular separation of the potential and kinetic energy of matter. The physical length of a standing wave is determined by the spatial displacement of its potential and kinetic energy. This displacement varies directly with the phase $\gamma$.

The phase $\gamma$ varies inversely with the group velocity of the wave. This effect produces the length and contraction associated with special relativity as shown by Zeigler who first suspected that matter moved with phase velocity $c$

Time is represented on the $z$ out of the plane axis on a complex diagram. The rotation of a vector around the X axis into the Z axis represents the change in potential energy with respect to time. The rotation of a vector around the Y axis into the Z axis represents a change in potential energy with respect to position. Relativistic energy is reflected on both axes. The loss in time by the relativistic component $E_r$ is compensated for by gain in position.

The phase $\gamma$ of a wave expresses the displacement of its potential and the kinetic energy. When place on a complex diagram the phase directly determines the relativistic momentum, mass, time, and length. These effects reconcile special relativity and quantum physics.

Kinetic and Potential Energy were represented as vecotrs on a two dimensional complex plane. The rotation of this complex plane through a third dimension added the element of time to the construct. The inclusion of additional dimensions should enable this model to extend into the realms of high energy physics.

## Schrodinger Equation

While Schrodinger was touting the theoretical developments of the deBroglie wave, Pete Debye famously asked "where's the wave equation?" [25]

We will now go through a short derivation of Schrodinger's Wave Equation.

The Classical Wave Equation is given by:

$$\nabla^2 \Psi = \frac{1}{v^2} \frac{d^2 \Psi}{dt^2}$$

The wave equation for light can be derived from Maxwell's Equations as follows.

Maxwells Equations are:

$\nabla \times E = -\frac{\partial^2 B}{\partial t^2}$ , $\nabla \cdot E = \frac{\rho}{\varepsilon_0}$ , $\nabla \times B = \mu_0 J + \mu_0 \varepsilon_0 \frac{\partial^2 E}{\partial t^2}$ , $\nabla \cdot B = 0$

In a vacuum there is no charge so $\rho = 0$ and $J = 0$, so $\nabla \cdot E = 0$, and $\mu_0 J = 0$ making $\nabla \times B = \mu_0 \varepsilon_0 \frac{\partial^2 E}{\partial t^2}$

Leaving us with just two equations for electromagentic waves inside the vacuum

$\nabla \times E = -\frac{\partial^2 B}{\partial t^2}$ and $\nabla \times B = \mu_0 \varepsilon_0 \frac{\partial^2 E}{\partial t^2}$

From these equations we can see how the electric and magentic field feed back into one another in the form of a differential equation. We can find the wave equation by taking the curl of a curling electric field.

$\nabla \times (\nabla \times E) = \nabla \times B$

Using the BAC-CAB Rule $A \times (B \times C) = B(A \cdot C) - C(A \cdot B)$

$\nabla \times (\nabla \times E) = \nabla(\nabla \cdot E) - E(\nabla \cdot \nabla) = \nabla(0) - E(\nabla^2) = \nabla^2 E$

Since the divergence of the electric field is zero $\nabla \cdot E = 0$ in the absense of electric charge, we are left with the Laplacian $\nabla^2 = (\frac{d^2}{dx^2} + \frac{d^2}{dy^2} + \frac{d^2}{dz^2})$ Which means that

$$\nabla^2 E = \nabla \times B$$

or

$$\frac{d^2}{dx^2} E = \mu_0 \varepsilon_0 \frac{\partial^2}{\partial t^2} E$$

Dividing both sides by $E$ leaves us with the wave equation for light. You can get the same formulation by taking the curl of a curling magnetic field $\nabla \times (\nabla \times B) = \nabla \times E$ using similar substitutions for Maxwell's equations in the vacuum to derive the wave equation for light.

$$\frac{d^2}{dx^2} = \mu_0 \varepsilon_0 \frac{\partial^2}{\partial t^2}$$

The constant $\mu_0 \varepsilon_0$ gives us the inverse square of the velocity of the wave, $\mu_0 \varepsilon_0 = \frac{1}{v^2}$ or $c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$ which is also the speed of light.

The wave equation describes the classical relationship between velocity, time, and position. The velocity of the wave packet is $v$.

$$\nabla^2 \Psi(x, t) = \frac{1}{v^2} \frac{d^2 \Psi(x, t)}{dt^2}$$

The exponential form of the sine function $e^{i\omega t}$is introduced as a solution to this differential equation. The $i$ in the exponent states that the wave contains real and imaginary components. The potential energy of the wave is represented by the real components and the kinetic energy of the wave is represented by the imaginary component. In a standing wave these components are 90 degrees out of phase. Standing waves are produced by reflections.

The time-independent Schrodinger equation.

$$\Psi(x, t) = \psi(x) e^{i\omega t}$$

Therefor:

$$\nabla^2 \psi(x) e^{i\omega t} = \frac{1}{v^2} \frac{d^2 \psi(x) e^{i\omega t}}{dt^2}$$

A solution is obtained by integrating both sides twice with respect to time.

$$\nabla^2 \int\int \psi(x)e^{i\omega t}dt = \frac{1}{v^2}\int\int \frac{d^2\psi(x)e^{i\omega t}}{dt^2}dt^2$$

Step by step:

$$\int \frac{\nabla^2\Psi(x,t)}{i\omega}dt = \int \frac{1}{v^2}\frac{d\psi(x)e^{i\omega t}}{dt}$$

$$\frac{\nabla^2\Psi(x,t)}{-\omega^2} = \frac{1}{v^2}\psi(x)e^{j\omega t}$$

After the double integration, the equation is reduced

$$\nabla^2\psi(x) = \frac{-\omega^2}{v^2}\psi(x)$$

Replacing angular velocity $\omega$ with frequency $f$

$$\nabla^2\psi(x) = (\frac{-4\pi^2}{l^2})\psi(x)$$

The Schrodinger equation describes the deBroglie wave of matter. The deBroglie wave and Planck's constant were introduced ad-hoc. When Schrodinger The introduction of the DeBroglie wave was questioned by Einstein and Langevin. The introduction became accepted because it matched with the experimental facts.

> "Schrodinger also had to explain how wave packets could hold together, elaborate the meaning of the wave function, and demonstrate how the discontinuities of quantum phenomena arise from a continuous wave processes." The Great Equations, Robert P. Creese, Pg. 248 [22]

$$l^2 = \frac{h}{mv}$$

$$\nabla^2\psi(x) = (\frac{-4\pi^2 M^2 v^2}{h^2})\psi(x)$$

$$\nabla^2\psi(x) = (\frac{-4\pi^2 M(Mv^2)}{h^2})\psi(x)$$

The relationship between kinetic, total, and potential energy is expressed as:

$$(Mv^2) = 2(Total - Potential)$$

Substituting

$$\nabla^2\psi(x) = (\frac{-4\pi^2 M2(E-U)}{h^2})\psi(x)$$

Simplifying

$$\frac{-h^2\nabla^2\psi(x)}{-4\pi^2 2M} = (E-U)\psi(x)$$

Substituting $\hbar = \frac{h}{2\pi}$

$$\frac{-\hbar^2\nabla^2\psi(x)}{2M} = (E-U)\psi(x)$$

The result below is the time independent Schrodinger equation. The Schrodinger equation states that the total energy of the system equals the sum of its kinetic and potential energy. Energy is a scalar quantity. Scalar quantities do not have direction. This type of equation is known as a Hamiltonian. The Hamiltonian ignores restraining forces. The unrestrained matter wave propagates at velocity v. It is an error to assume that an unrestrained wave propagates without dispersion.

$$[\frac{-\hbar^2\nabla^2}{2M} + U]\psi(x) = E\psi(x)$$

or

$$\hat{H}\psi = E\psi$$

# A New Approach

Frank Znidarsic discovered the velocity of sound within the nucleus $V_t$ from his observations of cold fusion and anti gravity experiments. The electron's Compton frequency was classically extracted from this velocity.

$$F_c = \frac{V_t}{2\pi r_p}$$

The frequency is known as the Compton frequency of the electron.

Planck's quantum constant emerges as an affect of this classical phenomena. The Compton angular velocity is

$$\omega_c = \frac{Mc^2}{\hbar}$$

squaring and factoring

$$\omega_c^2 = \frac{M(Mc^4)}{\hbar^2}$$

The simple harmonic motion is of a restrained wave is given by

$$\frac{d^2\psi(x)}{dt^2} = -\omega^2\psi(x)$$

The Compton angular velocity squared was substituted for $\omega^2$below

$$\frac{d^2\psi(x)}{dt^2} = -[\frac{M(Mc^4)}{\hbar^2}]\psi(x)$$

Dividing by $c^2$

$$\frac{d^2\psi(x)}{dt^2}\frac{1}{c^2} = -[\frac{M(Mc^2)}{\hbar^2}]\psi(x)$$

H. Zeigler pointed out in a 1909 discussion with Einstein, Planck, and Stark that relativity would be a natural result if all of the most basic components of mass moved at the constant speed of light.[23] Frank Znidarsic's work is based on the idea that local fields are restrained at elastic discontinuities. Disturbances within the restrained fields propagate at light speed. Substituting $\nabla^2$for acceleration divided by light speed squared $\frac{a}{c^2} = \frac{d^2x}{dt^2}\frac{1}{c^2}$. This step embodies the idea that disturbances in the matter wave propagate at luminary velocities. This provides for a unification of Special Relativity and quantum physics.

$$\nabla^2\psi(x) = -[\frac{M(Mc^2)}{\hbar^2}]\psi(x)$$

Mass energy is expressed as the difference between the total energy and the potential energy of the matter wave.

$$Mc^2 = 2(E - U)$$

Substituting

$$\nabla^2\psi(x) = -[\frac{2M(E - U)}{\hbar^2}]\psi(x)$$

The result below is the time independent Schrodinger equation

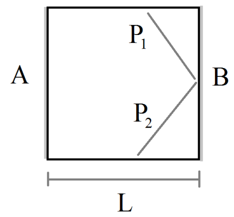
$$[\frac{-\hbar^2\nabla^2}{2M} + U]\psi(x) = E\psi(x)$$

The time independent Schrodinger equation has been derived from a simple technique. Disturbances within the matter wave propagate at luminary velocities. Restraining forces prevent dispersion. The deBroglie wave arose naturally from the restraint of the Compton wave.

## Inertial Mass

An analysis was done that described inertial mass in terms of a restraining force. This force restrains disturbances that propagate at the speed of light.

Consider energy trapped in a perfectly reflecting containment:




This energy in a containment model is a simplistic representation of matter. In this analysis no distinction will be made between baryonic, leptonic, and electromagnetic waves.

The wavelength of the energy represents the Compton wavelength of matter. The containment represents the surface of matter. The field propagates at light speed. Its momentum is equal to $E/c$ . The containment is at rest. The energy is ejected from wall "$A$" of the containment, it's momentum is $p_1$. The energy now travels to wall "$B$", It hits wall $B$ and immediately bounces off. Its momentum is $p_2$ . The energy now travels back to wall $A$, immediately bounces off, its momentum is again $p_1$. This process repeats continuously. If the energy in the containment is evenly distributed throughout the containment, the momentum carried by this energy will be distributed evenly between the forward and backward traveling components. The total momentum of this system is given by

$$p_t = (\frac{p_1}{2} - \frac{p_2}{2})$$

The momentum of a flow of energy is given by

$$p = \frac{E}{c}$$

or

$$p_t = \frac{E_1}{2c} - \frac{E_2}{2c}$$

Given the containment is at rest. The amount of energy in the containment remains fixed, the quantity of energy traveling in the forward direction equals the quantity of energy traveling in the reverse direction.

$$E_1 = E_2$$

Which means

$$p_t = \frac{E}{2c}$$

and gives us the total momentum of the system at rest. If an external force is applied to the system its velocity will change. The forward and reverse components of the energy will then Doppler shift after bouncing off of the moving containment walls. The momentum of an energy flow varies directly with its frequency. Given that the number of quantum's of energy is conserved, the energy of the reflected quantum's varies directly with their frequency.

$$E_2 = E_{(1)} \frac{f_f}{f_i}$$

Substituting this back in to the previous equation gives us

$$P_t = (\frac{E}{2c})[\frac{f_{f1}}{f_{i1}} - \frac{f_{f2}}{f_{i2}}]$$

This give us the momentum of the system after all of its energy bounces off of the containment walls. This is the momentum of a moving system. The reader may desire to analyze the system after successive bounces of its energy. This analysis is quite involved and unnecessary. Momentum is always conserved. Given that no external force is applied to the system after the first bounce of its energy, its momentum will remain constant.

Relativistic Doppler shift is given by

$$\frac{f_f}{f_i} = \frac{\sqrt{1 - \frac{v^2}{c^2}}}{1 + \frac{-v}{c}}$$

Substituting this back into our equation gives us

$$P_t = \frac{E}{2c} \left[ \frac{\sqrt{1 - \frac{v^2}{c^2}}}{1 + \frac{-v}{c}} - \frac{\sqrt{1 - \frac{v^2}{c^2}}}{1 + \frac{-v}{c}} \right]$$

$$= \frac{E}{2c} \frac{(1 + \frac{v}{c})}{(1 + \frac{v}{c})} \frac{(1 - \frac{v^2}{c^2})}{(1 + \frac{-v}{c})} - \frac{(1 - \frac{v}{c})}{(1 - \frac{v}{c})} \frac{(1 - \frac{v^2}{c^2})}{(1 + \frac{-v}{c})}$$

$$= \frac{E}{2c} \left[ \frac{\sqrt{1 - \frac{v^2}{c^2}}(1 + \frac{v}{c} - 1 - \frac{v}{c})}{1 - \frac{v^2}{c^2}} \right] = \frac{Ev}{c^2 \sqrt{1 - \frac{v^2}{c^2}}}$$

Substituting Mass for Energy $M = \frac{E}{c^2}$

$$P_t = \frac{Mv}{\sqrt{1 - \frac{v^2}{c^2}}}$$

The result is the relativistic momentum of moving matter. This first analysis graphically demonstrates the inertial mass is produced by a containment force at the surface of matter. A fundamental change in the frame of reference is produced by the force of containment. This containment force converts energy, which can only travel at light speed, into mass, which can travel at any speed less than light speed.

## Gravitational Mass

(A version of this section was published in "Infinite Energy" Vol 4, #22 1998)

The matter wave function is composed of various fields. Photons were employed to represent these various fields. Photons exhibit the underlying relationship between momentum and energy of a field (static or dynamic) in which disturbances propagate at the speed of light. Consider photons trapped in a mass-less perfectly reflecting box. The photon in a box is a simplistic representation of matter. Light has two transverse modes of vibration and carries momentum in the direction of its travel. All three modes need to be employed in a three dimensional model. For the sake of simplicity this analysis considers only a single dimension. The photons in this model represents the matter wave function and the box represents the potential well of matter. As the photons bounce off of the walls of the box momentum "$p$" is transferred to the walls of the box. Each time a photon strikes a wall of the box it produces a force. This force generates the gravitational mass associated with the photon in the box. The general formula of gravitational induction, as presented in the General Theory of Relativity is given by

$$E_g = (\frac{G}{c^2 r})(\frac{dp}{dt})$$

This is the gravitational field produced by a force, where

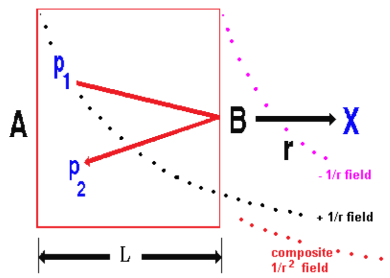
$E_g$= the gravitational field in newtons / kg

$G$= the gravitational constant

$r$= the gravitational radius

$\frac{dp}{dt}$ = force

Each time the photon strikes the wall of the box it produces a gravitation field. The gravitational field produced by an impact varies with the reciprocal of distance $\frac{1}{r}$. The gravitational field produced by matter varies as the reciprocal of distance squared $\frac{1}{r^2}$. This author has ascertained how the $\frac{1}{r^2}$ gravitational field of is produced by a force. The superposition of a positive field that varies with an $\frac{1}{r}$ rate over a negative field that varies with an $\frac{1}{r}$ rate, produce a combined $\frac{1}{r^2}$ gravitational field of matter. An exact $(\frac{G}{c^2})(\frac{dp}{dt})$ mathematical analysis of the gravitational field produced by the photon in the box will now be undertaken.




$L$= The dimensions of the box

$p$= momentum

$t$= the time required for the photon to traverse the box= $2\frac{L}{c}$

$r$= the distance to point X

The far gravitational field at point X is the vector sum of the fields produced by the impacts on walls $A$ and $B$.

This field is given by below.

$E_g$at $x = (\frac{1}{r}$ field from wall $A$) - ($\frac{1}{r}$ field from wall $B$)

Showing the super-position of two fields.

$E_g$at $x = (\frac{G}{[c^2(r+L)]})(\frac{dp}{dt}) - (\frac{G}{[c^2 r]})(\frac{dp}{dt})$

Simplifying.

$E_g$at $x = -(\frac{G}{c^2})(\frac{dp}{dt})[\frac{L}{(r^2+rL)}]$

Taking the limit to obtain the far field.

$E_g$at $x = \lim_{r \ggg L} -(\frac{G}{c^2})(\frac{dp}{dt})[\frac{L}{(r^2+rL)}]$

The result, is the far gravitational field of matter. Far, in this example, means greater than the wavelength of an elementary particle. In the case of a superconductor far means longer than the length of the superconductor.

$E_g$at $x = -(\frac{G}{c^2})(\frac{dp}{dt})\frac{L}{r^2}$

This momentum of an energy field that propagates at light speed is given by $p = \frac{E}{c}$

$E$= the energy of the photon

$c$= light speed

$p$= momentum (radiation pressure)

The amount of force ($\frac{dp}{dt}$) that is imparted to the walls of the box depends on the round trip travel time of the photon. The force on the walls of the box is thus $\frac{dp}{dt} = (\frac{2E/c}{2L/c}) = \frac{E}{L}$

Note: This force is 29.05 Newtons at the classical radius of the electron.

Substituting back we get the far gravitational field produced by energy bouncing in a box

$E_g$at $x = -(\frac{G}{c^2})(\frac{E}{L})(\frac{L}{r^2})$

From which we can substitute for Einstein's relationship between matter and energy $M = \frac{E}{c^2}$

Substituting mass for energy yields Newton's formula for gravity.

$E_g$at $x = -\frac{GM}{r^2}$

Forces are produced as energy is restrained. These forces induce the gravitational field of matter.

## Conclusion:

The motion constants of an electron orbiting a nucleus resembles that of electromagnetics in a superconductor, the dynamic fields are expelled while the static fields are confined. During the quantum transition between electron orbits, there is a coupling between the photon and the electron which orbits the nucleus. During this period of quantum transition the velocity of light changes, much as it does when entering or exiting any Bose Condensate. During this transition the speed of light couples with the speed of mechanical waves inside the electron. This allows a mechanism for energy transfer as photons are absorbed and emitted. The constants of motion during the transitional quantum state tend toward those of electromagnetics in a Bose Condensate being sonically stimulated at a dimensional frequency of 1.094 megahertz-meters.

## References


[1] Planck, M. 1901. "On the Law of the Distribution of Energy in the Normal Spectrum," Annalon der Physik, 4, 553.

[2] Einstein, A. 1909. "Development of Our Conception of the Nature and Constitution of Radiation," Physikalische Zeitschrift, 22.

[3] Einstein, B. Podolsky, and N. Rosen, "Can Quantum-Mechanical Description of Physical Reality Be Considered Complete", Phys. Rev. 47, 777 - 780 (1935)

[4] Louis Duc de Broglie, PhD thesis, "Recherce sur la Theorie des Quanta", U. of Paris, (1924).

[5] Bohr, N. 1913. "On the Constitution of Atoms and Molecules," Philosophical Magazine, 6, 26, 1-25.

[6] Maxwell, J.C. 1865. "A Dynamical Theory of the Electromagnetic Field," Philosophical Transactions of the Royal Society of London, Vol. 155.

[7] Bell, Physics 1, 195 (1964), reproduced as Ch. 2 of J. S. Bell, "Speakable and Unspeakable in Quantum Mechanics" (Cambridge University Press 1987)

[8] Feynman, R. P. (1948). "The Space-Time Formulation of Nonrelativistic Quantum Mechanics". "Reviews of Modern Physics" 20: 367–387.Bell, 1964: J. S.

[9] Heisenberg, W. (1927), " Over the Descriptive Contents of the Quantum Kinetics and Mechanics", Zeitschrift für Physik 43: 172–198

[10] A. Einstein, " Does the Inertia of a Body depend upon its Energy-Content?" Annalen der Physik 18 639-641 (1905)

[11] Znidarsic, F. 2005. "A Reconciliation of Quantum Physics and Special Relativity," The General Journal of Physics, December, http://www.wbabin.net/science/znidarsic.pdf.

[12] Znidarsic, F. 2009. "The Control of the Natural Forces" http://www.wbabin.net/science/znidarsic3.pdf

[13] Max Born, The Statistical Interpretation of Quantum Mechanics, Nobel Lectures, 1964

[14] A Einstein, B. Podolsky, and N. Roses, Can Quantum-Mechanical Description of Physical Reality Be Considered Complete, Phys. Rev. 47, 777 - 780 (1935)

[15] A. Sommerfeld, Principles of the Quantum Theory and the Bohr Atomic Model, Naturwissenschaften (1924), 12 1047-9

[16] Richard Feynman, The Strange Theory of Light and Matter, 1988

[17] The Lex Foundation, What is Quantum Mechanics, page 189, 1996

[18] I. Bernard Cohen, Henry Crew, Joseph von Fraunhofer, De Witt Bristol Brac, The Wave theory, light and Spectra. Ayer Publishing, 1981

[19] Robert Bunsen, Journal of the American Chemical Society, Volume 22, 1900

[20] L Hartmann, Johann Jakob Balmer, Physikalische Blätter 5 (1949), 11-14

[21] W. Ritz, Magnetische Atomfelder und Serienspektren, Annalen der Physik, Vierte Folge. Band 25, 1908, p. 660–696.

[22] Robert P. Creese, “The Great Equations: Breakthroughs in Science from Pythagoras to Heisenberg”, Pg. 248 , 2008

[23] Vernon Brown, “Proton Theories of the Universe”, (http://photontheory.com/Einstein/Einstein06.html#Ziegler) Quote attributed to H. Ziegler, 1906

[24] Nick Herbert, "Quantum Reality: Beyond the New Physics" Pg. 46 , 1985

[25] Max Tegmark & John Archibald Wheeler, “100 Years of Quantum Mysteries”, 2001