Rotating Wave Theory of the Electron

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Abstract

I have reverted to the classical concepts of 3-dimensional space which is independent of time in order to develop a pure wave theory of the electron (or fermion) as a simple Rotating Wave. The essential postulate is that an electromagnetic wave is transmitted through space and brought into rotation by a local binding energy. The spin model then yields the required phenomena of charge, relativity, mass, gravity, and quantum mechanics in a naturally derived and graphic fashion. In addition, the Kaluza 5th dimension and expansion of the universe are derived and predicted from curvature calculation in the rotating wave model.

1. Introduction

It is well known that in 1887 A.A. Michelson and E.W. Morley could not detect any luminiferous ether by detecting a path length difference between light transmitted in the direction of the earth's travel through the stationary ether and perpendicular to that direction by a fringe shift. In 1889, H.A. Lorentz suggested that the null result of this famous experiment might be due to an actual physical length contraction of the interferometer as measured in the direction of its motion of the earth's orbit. According to Lorentz, the length contraction was merely due to an electrodynamic effect on physical processes within the electron particle make-up. Lorentz also suggested that such physical processes had a cyclical function, or local time, which must slow down or dilate in conjunction with their length contraction. However, the reasons for local time dilation and length contraction as suggested by Lorentz required a complicated and unconvincing model of an electron to be composed of many like charges bound by a nonelectric force infinitely strong at the centre. Ironically, the Lorentz transformation equations of time dilation and length contraction survived to form the basic math of a much more acceptable, although revolutionary, theory put forth by Albert E. Einstein in 1904. Albert E. Einstein's Special Theory of Relativity was much more acceptable because it was simple and universally consistent. His Special Theory stated that all laws of nature, including mechanical as well as electromagnetic field laws, must be invariant with respect to the Lorentz transformations.

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He proved the consistency of his theory by applying the principle of equivalence to the Special Theory and created his General Theory of Relativity, which in turn correctly predicted the influence of a gravitational field on light. Also in 1904, Albert Einstein demonstrated that light behaved as individual particle – like packages of energy called photons in order to explain the photo-electric effect. Thus, in a quasi-corpuscular theory akin to that of Sir Isaac Newton, Einstein stated that the nature of light must have a wave-particle duality. However, matter was still considered to be only particle-like until twenty years later when Louis de Broglie suggested that matter as well as light might have a dual, wave-particle nature. Both the Lorentz and Einstein interpretations of the Michelson– Morley experiment required that the interferometer be "particle-like" only.

I began to wonder how the Michelson Morley experiment might have been interpreted had the dual, wave-particle nature of matter been established prior to this famous experiment. Furthermore, I considered that matter might simply be a localized wave and that its particle-like nature is simply a phenomenon derived of its localization.According to Einstein's definition of simultaneity there is no need for a physical length contraction of the Michelson–Morley interferometer. However, if as Lorentz contended, the length of the interferometer did indeed contract in the direction of its motion, then there could not be any fringe shift detected on the interferometer and real time could remain constant. One could disagree with Einstein's assumption that his operational definition of simultaneity is valid in any inertial reference frame and revert back to the nineteenth century classical view of light which accepts such a definition as "valid only in the rest frame of ether" (EM vacuum field). My alternative conclusion about the experiment, coupled with the fact that matter is localized energy and that energy in the form of electromagnetic waves is indeed transmitted as light, compelled me to find a basic form of matter: a particle equivalent to a localized electromagnetic wave with an innate time cycle that would explain the fact of time dilation and a configuration that would require its own physical length contraction. Most other forms of matter that arise out of the EM vacuum field would only be variations or further developments in the evolution of this principle form of matter which is from hereon referred to as the Rotating Wave (or RW for short). The EM vacuum field is here stated as a universal reference frame only to a degree of which our perception is capable. The intent of this work is, therefore, to explain by the EM vacuum field, the creation of the principle form of matter and the phenomena of relativity, gravity, and quantum mechanics beginning with two postulates which compare with those of Einstein's theory as rephrased by Casper and Noer in The Evolution of Physics on p. 330:

I. The Principle of Relativity According to the Rotating Wave: No physical measurement can distinguish one inertial reference frame from any other inertial reference frame - because - such distinction is obviated by changes in the actual physical time cycle, length, and mass of a particle with respect to that particle's motion relative to the stationary, EM Vacuum field. Such changes are illustrated by the Rotating Wave.

II. Independent of the motion of the light source, only wave fronts of light which proceed in a straight line with respect to a Euclidean universal reference frame (defined by the stationary EM vacuum field) always propagate in empty space (the vacuum state of the EM field) with a definite velocity C relative to that universal reference frame.

Other wave fronts which do not proceed in a straight line, propagate with an angular velocity such that all wave fronts remain planar. From the two postulates above, I can simply state that the null result of the Michelson-Morley experiment is due to an actual physical length contraction of the interferometer in the direction of its motion. The actual physical time cycle of the whole interferometer apparatus slows down in unison and therefore time is not the culprit. The two postulates above also provide an explanation to the outcome of another experiment: the low rate of decay of mesons entering the earth's atmosphere is due to a combination of some degree of actual physical length contraction of the earth's atmosphere and some degree of actual physical slowing of the time cycle decay of mesons.

2. The Electron as a Basic Form of Matter

The electron and its antiparticle, the positron, elegantly fit the requirements of this basic form of matter. The electron RW complies with the universal laws of electromagnetism and the previous two postulates. By doing so, it inherently explains relativity, mass, and quantum mechanics. According to the electromagnetic theory of light, the change in the electric field of the photon induces a magnetic field and, conversely, the change in the magnetic field induces an electric field. These changes are made with particular direction at the speed of light through the electromagnetic field, which was once labelled as "ether". In order to exist, the photon must move forward through this electromagnetic field such that the changes in both the electric and magnetic fields induce each other. The photon cannot be at rest with respect to the electromagnetic field and therefore does not have any rest energy or rest mass. However, there are two types of motion: translational (linear) and rotational (angular). We perceive the photon to move forward through space in translational motion. If the two vectors of the electromagnetic wave of a photon could be brought to spin, not as in the case of a circular polarized wave, but as in the case of the electron model shown in Figures 1 and 2, then it might create a magnetic dipole and an electric monopole.
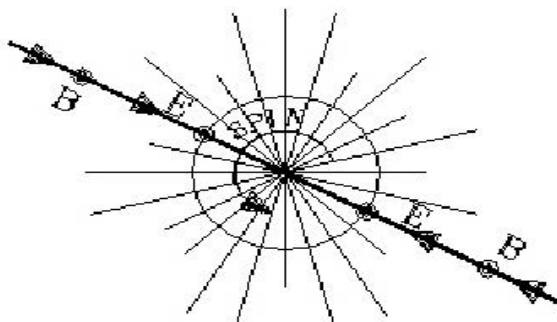

Figure   1: Sectional Plan View of counter clockwise rotating (spinning) electron wave inducing magnetic lines of force B (as arrows coming up from the page) and electric field E.
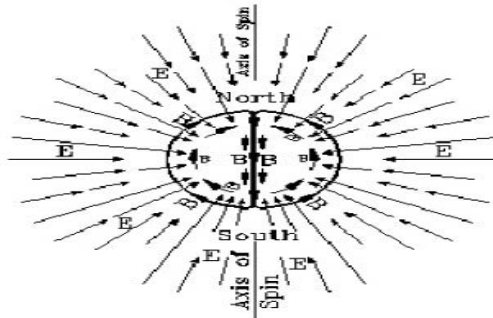
Figure 2: Sectional Side View of spinning electron wave inducing magnetic dipole and electric monopole. At some small radius (very close to the axis of spin) where the velocity of the rotating wave is less than C, the direction of the magnetic and electric fields might reverse with respect to their cross product to allow for the singular connection between the north and south poles. Just as the magnetic field of a photon changes in translational motion, thus inducing an electric field, so does the magnetic field of the electron change in rotational motion thus inducing the electric field of the electron. Likewise, as in the photon, the change in the electric field of the electron induces the magnetic field of the electron. In compliance with the electromagnetic theory of light, the electron RW (and likewise the positron) is nothing but one half of a gamma photon brought into rotation by a binding energy equivalent to another half of a gamma photon. This is confirmed by experiment. If a gamma ray is brought under enough localized energy, an electron-positron pair will be created. All of the energy will be conserved as rest mass and kinetic energy of the particles. When the electron and positron are then brought together in annihilation in free space, they produce two photons whose total energy is equal to that of the original photon and the localized energy from which the particles were created. When positive and negative charged particles are oscillated towards each other they will induce an electromagnetic wave which spreads out in every direction except the path of their oscillation. Similarly, two photons are emitted in opposite directions during the annihilation of an electron-positron pair in free space. Note that the counter-clockwise spinning electromagnetic wave which is shown as a dark straight line in Figure 1 is actually a sectional view of a planar wave front with the maximum (or nodal) electromagnetic magnitude. Other lines representing lesser magnitudes are not drawn for the sake of simplicity. Also note that the speed of the wave must be greater at distances further from the centre of spin.

As noted in Figure 2, the singular connection between the poles of the electron and thus the curved magnetic lines might be due to a reversal of the electric and magnetic directions with respect to the direction of rotation at very low speeds and thus in close proximity to the axis of spin. At a greater radius the rotating nodal wave front might be interpreted as a virtual particle blinking into existence with negative charge while at a lesser radius the rotating nodal wave front might be interpreted as a virtual particle of positive charge. The boundary between the reversal might not be so definite. Furthermore, the reversed fields might provide a binding energy which sustains the speculated rotating wave of the RW.

Figure 3: Photon wave existing in translational motion.
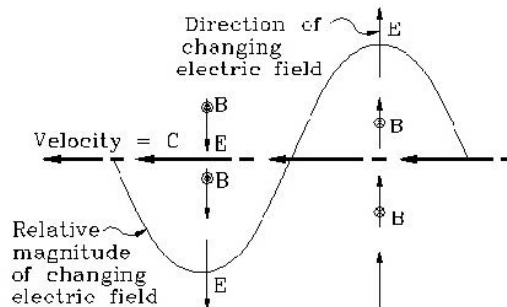
It is not fully apparent how the originating electromagnetic wave of the photon, as illustrated in Figure 3, is brought into rotation by a local binding energy. However, given a nodal planar wave front which extends to infinity in accordance with the wavicle, one can deduce that any curvature in the photon's translational path will require a definite point of rotation for that wave front and thus an associated magnetic dipole along with a symmetrical electric field. Therefore, any curvature in the photon's path will immediately result in fermion type particles, albeit with negligible and short-lived mass. Given sufficient and local binding energy, the curvature will result in the sustained electron and positron as illustrated in Figure 4.

Figure 4: In this case the formation of the electron (left) and the positron (right), each with their own self-sustaining and rotating electromagnetic wave, conserves electric field (charge), magnetic moment, and spin angular momentum.
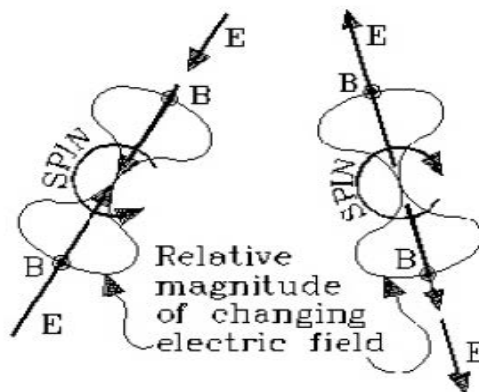
One immediate variation of the foregoing concept of a rotating electromagnetic wave could be that which creates a magnetic monopole and an electric dipole. Or perhaps the rotating wave might show that the electric and magnetic fields of light are merely two different directions of stress, distinguished from each other only upon the creation of the dipole of the electron.

Other immediate variations, such as the muon and tau fermions, could simply be created by the rotation of waves which have different frequencies than that of the gamma photon. Virtual photons, gluons, and gravitons causing electrodynamic, chromodynamic, and gravitational interactions amongst particles might simply be the rotating waves of the particles themselves. However, any speculation of immediate or evolved variations of the rotating electromagnetic wave form will not be further discussed in this paper.

3. Relative Time (Dilation) Redefined

According to the Special Theory of Relativity, the spin of a moving electron, as measured by an outside observer, must be slower than the spin of a stationary electron.

However, without regard to relativity, the angular velocity of an electron wavicle's spinning electromagnetic wave must slow down as it gains translational motion simply because the speed of light remains constant at the same distance from its axis of spin. This is illustrated in Figure 5.

Figure 5: Cylindrical model of the vectors of the RW (spinning) electromagnetic wave of an electron with translational velocity V and spin 1/2.
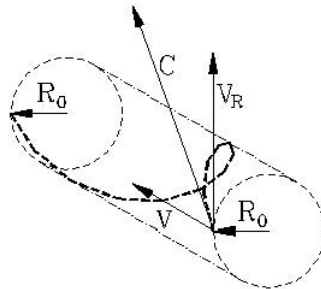
At a certain distance R_0 from the centre of the electron and midway between its magnetic poles, let us say that the electron wavicle's electromagnetic wave is moving at a tangential velocity v_R (here defined as the rotational velocity) about the center. If the electron is stationary (without translational motion), then the time it takes the electron wave to complete one cycle about the centre will be T_0 If the electron is given a translational motion of velocity v, then the new time it takes the electron wave to complete one cycle about the centre can be called T. The permeability μ_0 and the permittivity ε_0 of free space will remain constant about the same radius R_0 from the axis of the electron's rotation regardless of whether or not the electron is in translational motion. Therefore the resultant rotational velocity v_R of the electron wave must decrease as the translational velocity v of the electron increases in the direction of the axis of the electron's spin.

From Figure 5. $$v_R = (c^2 - v^2)^{1/2}$$ (

Without translational motion ($v = 0$) and we have,

$$T_0 = \frac{2\pi R}{v_R} = \frac{2\pi R}{c}$$

With translational motion $v \neq 0$ we get,

$$T = \frac{2\pi R}{v_R} = \frac{2\pi R}{(c^2 - v^2)^{1/2}}$$

and therefore $T = T_0 \left(1 - \frac{v^2}{c^2}\right)^{-1/2}$ which agrees with the time dilation formula of the

Special Theory of Relativity.

Since this concept of the electron contains only a spinning electromagnetic wave, then it is only the electromagnetic wave that exhibits time dilation. Furthermore, according to Quantum Mechanics, ionic and thus mechanical functions must slow down merely in response to the time dilation of the electron's electromagnetic wave. Therefore, Real Time does not slow down according to the Special Theory of Relativity; rather, the fact of time dilation is due to the electron's (and positron's) spin of its electromagnetic wave coupled with the constant speed of light at a given radial distance from the axis of the electron's rotation.

4. Required Length Contraction

The direction of propagation of an electromagnetic wave must always be at right angles to the direction of both its electric and magnetic fields. Therefore, an RW with translational motion will have each rotating planar wave front reoriented such that each respective resultant velocity c , as previously shown in Figure 5, will be normal to the wave front. Figure 6 shows a side elevation of an electron moving with a translational velocity v and viewed at an observed radius $R = \ell_0/2$. Since the electric field of an electron must always point to the centre, then the rotating wave of a moving electron wavicle will be inclined from the normal axis of rotation of a stationary electron such that the rotating wave of a moving electron will trace a helical path through the electromagnetic vacuum field.

Figure 6: Side Elevation of moving electron wavicle with translational velocity V at an
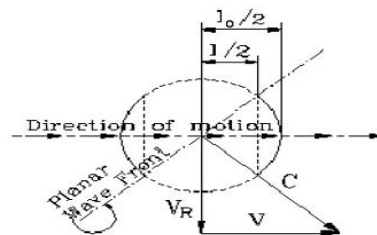
observed radius $R = \ell_0/2$

From Figure 6 we can see that for a given electric field at an observed radius $R = \ell_0/2$, is the length of the wavicle contracts in the direction of its motion by a factor of v_R/c such that:

$$\frac{\ell}{\ell_0} = \frac{v_R}{c} \ and \ v_R = (c^2 - v^2)^{-1/2}$$

$$\ell = \ell_0 \left(1 - \frac{v^2}{c^2}\right)^{1/2}$$

which is the length contraction formula for the transformation laws of the Special Theory of Relativity. Since the equilibrium distance between wavicles is assumed to be ultimately determined by their electromagnetic fields, then the distance between RW's should contract correspondingly in the direction of their motion. Therefore, the required length contraction is due to the RW's spin of its electromagnetic wave, coupled with the fact that the direction of propagation of an electromagnetic wave must always be at right angles to the direction of both its electric and magnetic fields. Note that as indicated in Figure 6, the magnetic poles of the electron are displaced from the line of the electron's translational motion, thus inducing the required magnetic field of a moving field of a moving charge. At any one instance this displacement would be characterized by two polar cones: one extending out forward and one extending out backward from the direction of the electron's motion. A stroboscopic detection of this polar cone by an apparatus similar to a cathode ray oscilloscope would prove the physical length contraction of the electron as required by the concept of the RW.Figures 7, 8, and 9 further clarify how the configuration of the RW transforms when put in motion. Figure 9 more clearly illustrates the forward polar cone (rear polar cone is hidden) and illustrates the induced, right-handed magnetic field.

Figure 7: Stationary Wavicle $v_R = c$ Oblique Elevation of stationary electron RW with magnetic lines of force B (electric field not shown here for simplicity) and nodal wave front spinning with tangential velocity c.
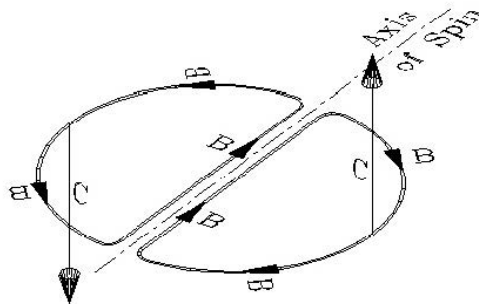

Figure 8: Moving Wavicle $v_R = (c^2 - v^2)^{1/2}$ Oblique Elevation of moving electron RW with magnetic lines of force B and nodal wave fronts reoriented at an angle as previously illustrated in Figure 6.
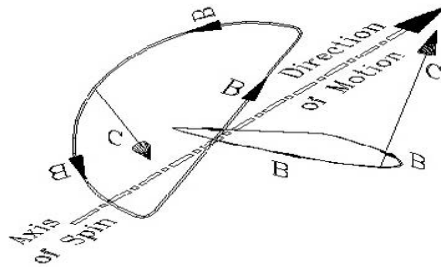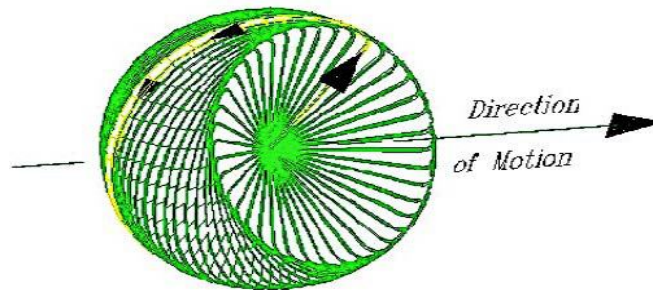
Figure 9: Moving RW Creating a Right-handed Magnetic Field - Oblique Elevation of moving electron RW with wave fronts of lessor field strengths shown as well as the nodal wave front (highlighted lines with arrows). This figure clearly indicates a right-handed induced magnetic field.

5. A Definition of Rest (Energy) Mass

Rest Mass is localized energy without translational motion; therefore, according to the concept of the electron RW, the energy of Rest Mass called Rest Energy E_0 is simply the Rotational Energy E_R of the half-photon which is rotating in one spot, plus the Binding Energy E_B which keeps the half-photon in that rotation. The half-photon has a kinematic rotational energy $E_R = h\nu/2$ which is equal to the binding energy such that the electron's total Rest Mass Energy $E_0 = E_R + E_B = 2E_R E_0$ is thus equal to a whole photon's energy $h\nu$ as given by Planck's constant h and the frequency of the photon ν. According to Rotational Kinematics, where E_R is the rotational energy, k is an assigned constant for the derivation of rotational inertia I, m_0 is a non-relative mass of a symmetrical spinning object, and v_R is the velocity of spin at the radius R_0 of the object, then $E_R = (1/2)km_0v_R^2$ can be derived. Since, according to the RW concept, all mass is assumed to be derived from electromagnetic waves, then the rotational energy and non-relative mass of the stationary RW can be equated in the same manner.

By convention, k is assigned the value of unity for the wavicle, such that all objects are thus correctly allowed to have their rotational inertia computed as the summation of point wavicle masses at their respective radii. Therefore, $E_R = (1/2)m_0 c^2$ for a stationary electron and a stationary electron will thus have a total rest energy $E_0 = m_0 c^2$. The rotational energy of a stationary electron can also be defined in kinematic terms by its angular frequency ω_0 and its angular momentum L_0 such that $E_R = \omega_0 L_0 = 2\pi v_0 L_0 = h v/2$, where v_0 is the frequency of electron spin. Since we know the values: $h = 6.63 \times 10^{-34}$ Joule-sec.

and $L_0 = 0.52723 \times 10^{-34}$ Joule-sec., then $v_0 = 2v$ which is as it should be because according to Quantum Mechanics the spin of the electron must be quantized with respect to the originating gamma photon. Finally, since $c = 2\pi R_0 v_0$, then $h = 4\pi R_0 m_0 c$.

6. Relative Mass with Respect to Motion

According to the foregoing Figures 5 and 6, an electron with translational motion will have an angular momentum

$$p_R = mv_R = m(c^2 - v^2)^{1/2}$$

which according to the conservation of momentum is equal to the angular momentum $p_0 = m_0 c$ of a stationary electron. A relative mass m is defined with respect to its translational velocity v because the configuration of the mass as indicated in Figure 6 and 9 changes with respect to v. Note the increased flux or density of electromagnetic lines as illustrated in Figure 9.
Therefore:

$$m = m_0 \left(1 - \frac{v^2}{c^2}\right)^{-1/2} \qquad (06)$$

which agrees with the Special Theory of Relativity where m is the relative mass with respect to translational motion. The total energy E of an electron must be the sum of its rest energy $E_)$ plus its kinetic energy K due to its translational motion such that:

$$E = E_0 + K \text{ and since}$$

$$K = \int_0^X F\,dx = mc^2 - m_0 c^2$$

while F is constant force over a distance X to give the electron translational motion, then $E = mc^2$. Furthermore, the translational momentum p_v and resultant momentum p of a moving electron RW can be vectorially related such that:

$$p^2 = p_v^2 + p_0^2 \text{ and then multiplying by } c^2$$

$$m^2 c^4 = p_v^2 c^2 + m_0^2 c^4 \text{ hence}$$

$$E^2 = p_v^2 c^2 + E_0^2 \qquad (08)$$

According to the RW concept, the correct relative mass and its associated momentum and energy have been derived with respect to translational motion regardless of the Special Theory of Relativity because real time has been kept constant.

7. An Electromagnetic Wave Theory of Gravity

According to the Wavicle, free space or vacuum is defined as the electromagnetic ether field in which light and matter waves are able to propagate. The basic premise of this theory of gravity is that the binding energy E_B holds the classical wave of the RW in rotation by affecting the permittivity and permeability of free space.

Thus any other incidental wave will similarly be affected by the binding energy of the RW, although indirectly and to a lesser degree. Figure 10, illustrates a passing test photon with a given Huygen's wavelet at distance R from the center and midway between the magnetic poles of a single stationary electron RW. Regardless of the RW charge, the wavelet will be permitted to go at the velocity $u_1 = pu = 2\pi pR\nu_0$ either in the same or opposite direction of the rotating wave.

Figure 10: Vectorial description of Rotating Wave showing resultant gravitational acceleration of wavelet.
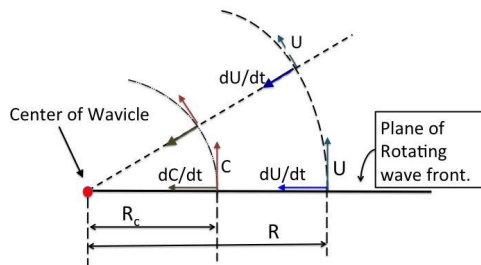
While u is the tangential velocity of the rotating wave at distance R , and ν_0 is the frequency of the RW's rotation, p is a variable dependent upon the strength of the vector field generated by the RW at radius . However, as illustrated in Figure 10, changes with respect to time and direction and therefore the photon wavelet would also be accelerated by the amount:

$$a_0 = p\frac{du}{dt} = p\frac{u^2}{R}$$

In other words the plane of the passing test photon or electromagnetic wave would be bent to some degree by the rotating wave and would account for the phenomenon of gravity. Obviously, according to the RW concept, a Huygen's wavelet closer to either of the magnetic poles, but at the same distance from the centre of the electron RW, will experience less gravitational acceleration.

However, the second premise of the theory of gravity is that uniformity of gravitational acceleration at a constant distance about a spherical mass is simply due to the fact that such mass is composed of many RW's at various angles of spin and random motion. Therefore, while the electron has a gravitational field severely distorted by its magnetic poles, larger non-elementary particles of matter have more uniform gravitational fields at a given radius. While p is the real constant assigned to the gravitational acceleration of the basic particle, a modified $p_1 = k_1 p$ can be assigned in a limiting case to the more uniform gravitational fields of larger particles at a given radius. However, as p_1 is only an average value of p, then it can be renormalized to p for simpler calculations that follow.

Since the wavicle must comply with Gaussian law at distances beyond which charge is screened, then the macroscopic laws of gravity must be able to be deduced in the same way. Gauss's Law gives a connection between the flux ϕ_E for the Gaussian Surfaces dS and the net charge q enclosed by the surface: $\varepsilon_0 \oint E \cdot dS = q$ where $\phi_E = \oint E \cdot dS$ and E is the electric field strength; ε_0 is the universal permittivity constant. Similarly, a universal constant $c^3/(Gh)$, which can be proved by deduction, operates on the gravitational field strength a_0 and its surface integral such that:

$$\frac{c^3}{Gh}\oint a_0 \cdot dz = \frac{u^2}{R} \text{ or}$$

$$\frac{1}{p} = \frac{c^3}{Gh}\oint dS \qquad\qquad ($$

Since $h = 4\pi R_0 m_0 c$ and the surface integral is a sphere, then:

$$\frac{1}{p} = \frac{c^3}{Gh}4\pi R^2 = \frac{c^2 R^2}{G R_0 m_0} \qquad\qquad (11)$$

and from above

$$a_0 = p\frac{u^2}{R} = \frac{Gm_0}{R^2}\frac{R_0}{c^2}\frac{u^2}{R} = \frac{Gm_0}{R^2}\frac{R_0}{c^2}\frac{c^2 R^2}{R_0^2 R} \text{ and thus} \qquad ($$

$$a_0 = \frac{Gm_0}{R^2}\frac{R}{R_0}$$

However, according to the General Theory of Relativity, our clocks run faster at higher heights and therefore, our acceleration at higher heights is actually greater than it appears to be such that:

$$\frac{a}{a_0} = \frac{R_0}{R} \text{ where } \frac{R}{R_0} = \frac{Rate\ of\ Real\ time}{Rate\ of\ Perceived\ time} \qquad\qquad ($$

and therefore $a = Gm_0/R^2$, where a is the apparent acceleration and m_0 is the apparent constant mass.

8. The Principle of Equivalence and the Gravitation of Matter

Albert Einstein predicted correctly by the "principle of equivalence" in his General Theory of Relativity that matter would gravitate or bend light and slow down time. He found a deeper significance than mere coincidence that a gravitational reference system could be made equivalent to a uniformly accelerated reference system because it enabled him to extend his Special Theory of Relativity to his all-encompassing General Theory. However, according to the foregoing Electromagnetic Wave Theory of Gravity, light is simply bent by the rotating wave (or matter wave) of the RW.

Since the rotating wave is itself light, then the path of that rotating wave will be bent in the same manner by another RW; thus two RWs each other by such gravitation. The gravitation of anRW by a larger mass M centered at point Q is illustrated by Figures 11 and 12.

Figure 11: Sectional plan view of rotating wave front centered at distance R from mass M centered at Q .
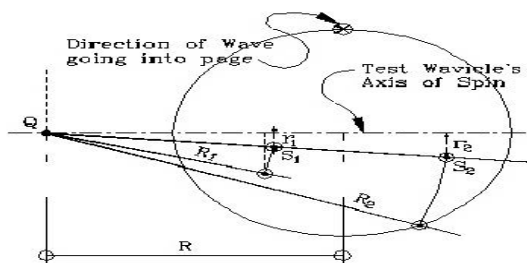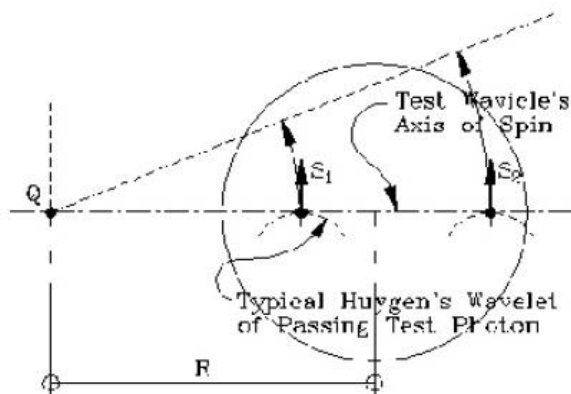

Figure12:Sectional Side View of rotating wave front of RW centered at distance R from mass M centered at Q .

Since the motion of the electron RW is limited to the direction of the axis of its spin, thenthe acceleration of the RW as illustrated in Figures 11 and 12 need only be considered in the direction of the axis of its spin. In figure 11 the rotational velocities of the RW's wave front are indicated as arrows (S_1 and S_2) coming up from the page and the wave front lies in the plane of the page. Note that at different distances along the same radial direction from Q , the ratio of velocities $QS_1/(QS_2) = r_1/r_2 = R_1/R_2$ and, therefore, the instantaneous effects of both the RW and larger mass M on the permittivity and permeability of free space are consistent. However, the lines drawn radially from point Q reveal different rotational velocities at a constant radius R_1 where the permittivity and permeability of free space is affected to some degree by the larger mass M .

Since the permittivity and permeability of free space is also instantaneously affected by the RW, such that the observed rotational velocity of the RW increases in direct proportion to its observed radius of spin, then the wave front of the RW must remain planar. However, as illustrated in Figure 12, the RW's planar wave front will be bent instantaneously as it rotates about its axis of spin which is directed towards Q . Although the wave front of the rotating wave remains planar, its inclination with respect to its axis of spin increases as the wave rotates and the RW is thus accelerated to point Q . The RW equally shows by Huygen wavelets how light is gravitated or bent and thus how matter is gravitated. Also, the Electromagnetic Wave Theory of Gravity shows by Huygen wavelets how light is permitted to go at greater speeds at distances further from the centre of the RW. Again, since the rotating wave of the RW is light, then the velocity of that rotating wave will be affected in the same manner by the proximity of another RW. Hence the spin frequency of the two RWs in close proximity will be less than that of two RWs separated by a greater distance. Therefore, the Electromagnetic Wave Theory of Gravity enables a reinterpretation of the General Theory of Relativity by predicting, first, the gravitation and slowing down of light and, second, the gravitation and slowing down of the time cycle of matter. The "principle of equivalence" can be explained by the equivalence of light and matter according to the concept of the RW.

9. Graphical Derivation of the $R_{k\ell}$ and $G_{k\ell}$ in the General Theory of Relativity

Tensor math forms the mathematical foundation upon which the laws of Einstein's General Theory of Relativity are defined. The Rotating Wave also shows how tensor math allows for the calculation of intrinsic curvature of space-time. According to relativity, it must be just as valid in one reference frame to analyze the path of free falling light influenced by the gravitational field of a stationary mass in order to describe the curvature of space-time as it is to postulate in another reference frame the curvature of space-time by the mass energy density tensor of an attracting mass which is in motion. Furthermore, according to the above 8. The Principle of Equivalence and Gravitation of Matter, the analysis of the path of free falling light in the the Rotating Wave must be equivalent to describing the gravitational field about a stationary attracting mass.

When there is an attracting mass, gravity will accelerate a free falling Rotating Wave. The axis of rotation of the Rotating Wave will of course be in the direction of motion towards the attracting mass. As the forward motion increases, the planar wave fronts of the Rotating Wave will incline as illustrated in Figure 6. While potential energy is converted into kinetic energy (as per $E^2 = p_v c^2 + E_0^2$ above), extra work will also be done and thus energy expended on the Rotating Wave to incline or bend the rotating planar wave fronts. This is just like the bending of light by mass in the above 7. An Electromagnetic Theory of Gravity. This extra change in energy is thus associated with the slowing down of the time cycle of the Rotating Wave regardless of whether it is in free fall motion or not. The fact is that mass does slow down time ("clocks run faster at higher heights") and a stationary Rotating Wave thus must slow down in the presence of an attracting mass. When there is no attracting mass present, the radius R_0 at which the Rotating Wave rotates at velocity $v_r = c - v$ stays constant as per Figure 5.

When there is an attracting mass present, the radius at which the Rotating Wave rotates must increase as its time cycle of rotation slows down. This increase in the radius of the Rotating Wave will be referred to as the Spiral Condition. Note the velocities of the Rotating Wave in one reference frame must correspond to those velocities of the mass energy density tensor of an attracting mass in another reference frame. Whereas in the General Theory of Relativity the attracting mass is defined by the mass energy density tensor and related to the Reimannian curvature of space-time, the following derivation of the $R_{kl\ell}$ is directly deduced by first defining the path of the Rotating Wave as a geodesic on a generated surface and then second deriving the intrinsic curvature of that surface. Consider the dashed helical path of the Rotating Wave as illustrated in the previous Figure 13. The helical path can be defined by a time derivative of the position vector $POS_c = POS_v + POS_T \cdot POS_v$ is the vector in the forward moving translational motion of the Rotating Wave and same direction of rotational axis. POS_T is a rotor and is the vector in the purely rotational motion. If the velocity vector v_T is greater than zero (or less than zero), then the velocity vector c of the Rotating Wave with constant speed of light will spiral outwards (or inwards):

Figure 13: Rotating wave of the Electron (fermion). Position vectors
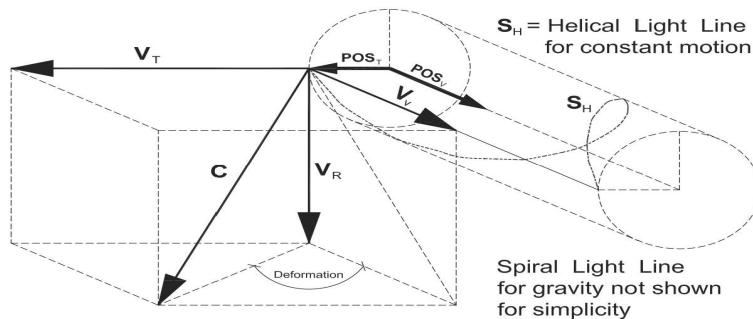
$POS_c = POS_v + POS_T$, where POS_T rotates. Velocity vectors, $c = v_v + v_R + v_T$.

$$c = \frac{dPOS_C}{dt} = \frac{dPOS_v}{dt} + \frac{dPOS_T}{dt} = v_v + \frac{dE_T}{dt} POS_T + E_T \frac{dPOS_T}{dt}$$

Vectorially: $c = v_v + v_R + v_T$ (

Note vectors are not embolded, but implied with base vectors.

Note: $c^2 = v_v^2 + v_R^2 + v_T^2$ and thus $dc/dt = 0 = v_v A_v + v_R A_R + v_T A_T$.

Also the base vectors for the Riemannian space time located along the light line are defined by the partial derivative of the position vector:

$e_\ell = \partial\ POS_c/\partial\ x^\ell = \partial\ POS_v/\partial\ x^\ell + \partial\ POS_T/\partial\ x^\ell = POS_{c,\ell} = POS_{v,\ell} + POS_{T,\ell}$ (

Thus $e_c c = e_\ell u_\ell = (POS_{v,\ell})u^\ell + (POS_{T,\ell})u_\ell = dPOS_v/dt + dPOS_T/dt$. Thus the path of the Rotating Wave with constant speed of light is defined by five vectors in our familiar three dimensions of space by: $c = v_v + v_R + v_T$ (

of which $v_v = v_X + v_Y + v_Z$.

The spiral helical path also lies within a generated surface that can be described in Riemannian five dimensional space-time with

$c = e_\ell u^\ell = e_v u^v + e_r u^r + e_t u^t$ (17)

of which again $e_v u^v = e_x u^x + e_y u^y + e_z u^z$ (with implied Einstein summation on ℓ).

The "light–line" of the Rotating Wave is defined as the geodesic where $c = v_v + v_R + v_T$ and the magnitude c (of $c = e_c c$) is kept constant at the speed of light. So, v_v, v_R , and v_T vary while c (of $c = e_c c$) is kept constant. v_v is the forward (translational) motion of the Rotating Wave along the direction of the axis of rotation. v_R is the purely rotational motion of the Rotating Wave. v_T is the velocity of outward radial expansion of the light–line such that the light–line traces a spiral helical path. To be clear, at any point on the light–line: $c = e_c c = e_\ell u^\ell = v_v + v_R + v_T$ and the base vector e_c varies while the magnitude c is kept constant. Also, note the spiral helical surface extends radially from the centre of axis of spin and is normal to the wave front.

Note that in the spiral condition: $c = v_v + v_R + v_T$ whereas before the simple helical (cylindrical) form of the Rotating Wave in accordance with the Special Theory of Relativity, $v_T = 0$ and thus $c = v_v + v_R$ as illustrated in figures 5 and 6. Note $v = v_v$ and the subscript is added to clarify the forward velocity. Clearly, v_T has been added to the Rotating Wave model to allow for the added Spiral Form (or Condition) in accordance with the General Theory of Relativity.

We now have the Spiral plus Helical conditions in which all possible directions of motion are allowed for the Rotating Wave. It is allowed to rotate, move forward, and now also move outward (or expand). It will be seen and further expounded in the $R_{k\ell}$ derivations that the rotational velocity v_R is of course greater at greater radii. Likewise, the u^ℓ components will be greater at greater radii. Note also that the generated spiral helical surface can equally be defined at any angle about the Rotating Wave's axis of spin, just as the planar wave fronts are rotated and arrayed around the axis of rotation in Figure 9. Likewise, the "light–line" as defined above can be rotated and arrayed infinitely around the axis of rotation. With no expansion and magnitude $v_T = 0$ (of $v_T = E_T v_T$), this array would take the shape of a cylinder which has no intrinsic curvature.

Even with a constant expansion speed v_T and constant forward motion v_v this array would form the shape of a cone that also has no intrinsic curvature. (A cone can be cut down its length to its point and laid out flat just as a cylinder can.) If the expansion speed v_T increases or the forward motion v_v decelerates, then the cone shape would curve and take the shape of a "flute" (or horn or bell) which would then of course have intrinsic curvature. So, in order to have intrinsic curvature on this array, the Rotating Wave must have forward motion and radial expansion plus acceleration (or deceleration) in either the forward motion or radial expansion or both. Note also that the $e_r u^r$ certainly corresponds to the rotational velocity v_R of the Rotating Wave while $c = e_c c$ corresponds exactly to $c = v_v + v_R + v_T$, so the $e_v u^v = e_1 u^1 + e_2 u^2 + e_3 u^3$ must as a result correspond to the forward (translational) velocity of the Rotating Wave. While any helical surface is extrinsically curved, it can be shown that the helical surface of the Rotating Wave does not necessarily have intrinsic curvature. If there is no attracting mass, then the axis of spin will not change and the above generated helical surface will be intrinsically flat. Such a helical surface when unwrapped from its helical path will become extrinsically flat. When there is an attracting mass, gravity will accelerate a free falling Rotating Wave and also cause it to spiral outwards. The combination of spiral and helical path will create intrinsic curvature. The helical path illustrated in Figure 13, can also be described by:

$$-e_r u^r = e_1 u^1 + e_2 u^2 + e_3 u^3 + e_4 u^4 = e_s u^s - c$$

such that the curvature invariant $- (u_R)^2 = g_{ij} u^i u^j$ with the use of the metric tensor and Einstein's summation convention of summing on repeated indices. According to Minkewski space-time coordinates, $u^4 = ic$ and $(u^4)^2 = -c$.

Note that the tensor relationship, which is graphically illustrated by the RW, can be more fundamentally described by the equation: $c^2 = b_{ij} u^i u^j$ in which b_{ij} is an equally valid metric tensor and now $u^4 = u^R$. This enables us to eliminate the imaginary component i and construct the b_{ij} from conventional base vectors.

From here on the summation convention will be used implicitly and the $b_{kl} = g_{kl} = e_k \cdot e_\ell$ such that $c^2 = g_{kl} u^k u^\ell$ to keep things simple. At the conclusion of the following derivation of $R_{k\ell}$ and thus $G_{k\ell}$, one can then compare the Rotating Wave with that of the Minkewski space-time coordinate system and the mass energy density tensor $T_{k\ell}$.

General Surfaces – Curvature Calculation – $R_{k\ell}$

The intrinsic curvature of the spiral helical surface can be calculated by the Reimannian curvature tensor $R_{ik\ell}^n$ and sufficiently by the Ricci tensor $R_{k\ell} = R_{k\ell n}$ which is the contraction of the curvature tensor. Note vectors are not embolded, but implied with base vectors.

$$R_{ik\ell}^n = T_{\ell i,k}^n - T_{\ell k,i}^n - T_{si}^n T_{\ell k}^s + T_{sk}^n T_{\ell i}^s = [T_{\ell i,k}^n + T_{sk}^n T_{\ell i}^s] - [T_{\ell k,i}^n + T_{si}^n T_{\ell k}^s] \qquad ($$

and thus summing on n and ℓ plus reorganizing:

$$R_{k\ell} = [T_{\ell n,k}^n + T_{sk}^n T_{\ell n}^s] - [T_{\ell k,n}^n + T_{sn}^n T_{\ell k}^s] \qquad (20)$$

Now let a vector: $A = e_s A^s = e_{\ell,k} = \partial e_{\ell/} \partial x^k$ and another vector $B = e_s A^s = e_{l,j} = \partial e_{\ell/} \partial x^j$ thus:

$$R_{ik\ell}^n = [A_{,k}^n + (e_{s,k} e^n) A^s] - [B_{,i}^n + (e_{s,i} e^n) B^s] \ and :$$

$$R_{ik\ell}^n = [e_s e^n A_{,k}^s + (e_{s,k} e^n) A^s] - [e_s e^n B_{,i}^s + (e_{s,i} e^n) B^s]$$

$$R_{ik}^n = [A_{,k} - B_{,i}] e^n = (e_{\ell,ik} - e_{\ell,ki}) e^n \qquad ($$

Summing on i and n, we thus have another mathematical formula for the Ricci Curvature Tensor $R_{k\ell}$:
$$R_{k\ell} = (e_{\ell,nk} - e_{\ell,kn}) e^n \qquad ($$

for any form of curved continuous surface. It is interesting that it looks a bit similar to the Faraday Tensor $F_{k\ell} = A_{,k}^n - A_{,n}^k$.

Rotating Wave Position Vectors and Curvature Calculation – $R_{k\ell}$

Since e_c and e_ℓ lie within the surface $c = e_c c = e_\ell u^\ell$ then by the Chain Rule:

$$e_{\ell,n} = \partial e_\ell / \partial x^n = \partial e_\ell / \partial x^c (\partial x^c / \partial x^n) = \partial e_c / \partial x^\ell (\partial x^c / \partial x^n)$$

$$= \partial e_c / \partial x^c (\partial x^c / \partial xl^\ell)(\partial x^c / \partial x^n)$$

$$= \partial e_c / \partial x^t (\partial x^t / \partial x^c)(\partial x^c / \partial x^\ell)(\partial x^c / \partial x^n)$$

$$= (de_c / dt) c^{-1} (e_c e_\ell) c^{-1} (e_c e_n) c^{-1}$$

$$= (de_c / dt) u_\ell u_n c^{-3} = R_c u_\ell u_n c^{-2} \qquad (0.$$

Note: R_c = curvature due to the rotational motion of the wave. Further derivation:

$$e_{\ell,nk} = R_{c,k} u_\ell u_n c^{-2} + R_c u_{\ell,k} u_n c^{-2} + R_{c,k} u_\ell u_{n,k} c^{-2} \qquad (24)$$

and by applying the Chain Rule again:

$$e_{\ell,nk} = R_{c,c}(\partial \, x^c/\partial \, x^k)u_\ell u_n c^{-2} + R_c u_{\ell,c}(\partial \, x^c/\partial \, x^k)u_n c^{-2}$$
$$+ R_{c,k}u_\ell u_{n,c}(\partial \, x^c/\partial \, x^k)c^{-2}$$

and thus:

$$e_{\ell,nk} = R_{c,c}u_k u_\ell u_n c^{-3} + R_c u_{\ell,c}u_k u_n c^{-3} + R_c u_\ell u_{n,c}u_k c^{-3} \;\; and$$
$$e_{\ell,kn} = R_{c,c}u_n u_\ell u_k c^{-3} + R_c u_{\ell,c}u_n u_k c^{-3} + R_c u_\ell u_{k,c}u_n c^{-3}$$

Note wherever you have $u_k u_n$, then for $R_{k\ell}$ the terms will obviously commute and thus the first two terms are discarded:

$$R_{k\ell} = (e_{\ell,nk} - e_{\ell,kn})e^n = R_c u_\ell c^{-3}(u_{n,c}u_k - u_{k,c}u_n)e^n \quad (27)$$

Again using the Chain Rule as above:

$$R_{k\ell} = R_c u_\ell c^{-4}(a_n u_k - a_k u_n)e^n \qquad\qquad (28)$$

Note: $c = e_c c = e_n u^n$ is always perpendicular to $cR_c = de_c/dt$ and thus the scalar dot product between R_c and $c = 0$. Thus for the Rotating Wave:

$$R_{k\ell} = R_c a u_k u_\ell c^{-4} \qquad\qquad (29)$$

while a = acceleration of the u_ℓ velocities and the Ricci scalar

$$R = g_{k\ell}R_{k\ell} = R_c a c^{-2} \qquad\qquad (30)$$

and

$$G_{k\ell} = R_{k\ell} - \frac{1}{2}g_{k\ell}R = \frac{R_c a}{c^2}\left(u_k u_\ell c^{-2} - \frac{1}{2}g_{k\ell}\right)(31)$$

which compares somewhat with the Einstein Tensor $G_{k\ell} = -8\pi k T_{k\ell}$ where the mass energy density tensor

$$T_{k\ell} = (\sigma + p)U_k U_\ell - g_{k\ell}\,p \qquad\qquad (32)$$

has been written. Also, the scalar

$$G = g^{k\ell}G_{k\ell} = \frac{1}{2}R_c a c^{-2}$$
$$(33)$$

Note again, we are deriving the surface curvature where the light line follows the path of the wave which is going at velocity c at certain radii from the axis of spin. That light–line spirals out and the angular velocity thus decreases, slowing down the time cycle of the rotating wave. This is relevant to the apparent expansion of the universe and the apparent slowing down of time. Without this expansion and slowing of time, there can be no intrinsic surface curvature of the path of the rotating wave and thus no gravity. An Electromagnetic Wave Theory of Gravity, the Binding Energy (E_B) of the Rotating Wave affects the permittivity and permeability of space which in turn causes incidental waves to slow down and accelerate towards the attracting mass.

Thus the slowing of time, spiral expansion of the light–line, and the gravitational force all go hand in hand to explain the expansion of the universe from the quantum mechanical level. The Binding Energy given up through the interaction of Rotating Waves thus appears to go into the background radiation.

Line Eq. (29) is very telling. If $a = 0$ or a is perpendicular to R_c, then there will be no intrinsic curvature. In order to get intrinsic curvature, we need spiral expansion of the helical light line plus the forward motion and use of Riemannian geometry. A spiral light line of a stationary rotating wave would indeed spiral, but remain on a flat plane. A helical light line without spiral expansion would remain on a cylindrical surface that has no intrinsic curvature. A helical light line with spiral expansion could trace a path on a cone which again has no intrinsic curvature. If the radial expansion is increasingly faster than the forward motion, then the resultant helical spiral light line can be infinitely arrayed around the axis of wave rotation (albeit with with varying amplitude accounting for quantum mechanics) and the array will form the shape of a "flute".

A flat space "cone" tangent to the "flute" would represent a local inertial reference frame. Thus according to the Rotating Wave, the requirement for intrinsic curvature and hence gravity is a range between two extremes: the Accelerating Spiral and Constant Forward Motion or Constant Spiral and Accelerating Forward Motion. Note the Spiral Condition (or form) of the spiral helical Rotating Wave immediately suggests the slowing down of time and expansion of matter. Where the Rotating Wave had a rotational velocity v_R before at lessor radius of rotation, the time cycle of the Rotating Wave slows down in a gravitational field and v_r is now at a greater radius. Thus the Rotating Wave of the RW has a built-in function that manifests itself in the apparent slowing down of time and expansion of the universe. The Spiral Condition immediately obviates the need for the Cosmological Constant. According to the Rotating Wave, the Cosmological Constant is not required because the spiral helical Rotating Wave is already slowing down and expanding. In order to maintain the law of energy conservation, the

$$G_{k\ell} = R_{k\ell} - \frac{1}{2} g_{k\ell} R = \frac{8\pi G}{c^4} T_{k\ell} \qquad (34)$$

is sufficient.

10. An Explanation of Quantum Mechanics

The concept of the RW simply explains why Plank's constant h is intimately included and quantized in the characteristics of the electron and all cyclical functions. According to the Definition of Rest (Energy) Mass, h automatically enters any equation of matter. Also, since the two nodes of the RW rotate, the effect of their electromagnetic and gravitational field strengths on an adjacent particle must vary in a cyclical fashion. Therefore, an orbiting electron RW must have a distance from the nucleus which undulates in direct correspondence to the electron's spin. Relativistic effects of the orbiting electron and nuclear particles would of course further define the path of orbit.

Furthermore, since the nuclear particles themselves spin and therefore must have cyclical variations in their effective field strengths, then the electron RW must make an integral number of spins for each orbit in order to stabilize in that orbit. Thus orbital energies must be quantized with respect to spin or rotational energies E_R. Matrix quantum mechanics requires that the energy level of an electron orbiting in an atom be $h\nu(n+1/2)$ where ν is the frequency and n is the number of typical photons which are absorbed or emitted. According to Rotational Kinematics, the energy level should be equivalent to the total angular energy of the electron RW, which is equal to its orbital energy plus its innate rotational energy E_R. The rotational energy $E_R = h\nu/2$ explains why the ground state or "zero point" energy of the electron in an atom must be $h\nu(n+1/2)$ where $n=0$ for an electron with no orbit. Also, the concept of the RW simply explains why matter has a wave probability distribution. Since the wavicle is purely a rotating electromagnetic wave, then the probability of detecting the wavicle near some point in space should be described by a wave function.

The derivative operators, postulated by Erwin Schrödinger, are simply deduced from the basic wave equation of the RW and the effects of relativistic quantum mechanics are graphically illustrated with the addition of potentials. The only real wave function of the RW is that which describes the amplitude ψ at a certain time t and length S as measured along the wave's helical path shown in Figure 14.

Figure 14: Cylindrical model of the helical path of real wave of amplitude   and measurements of & in the direction of the particle motion and   in the direction of the wave's rotation. Vectorially .
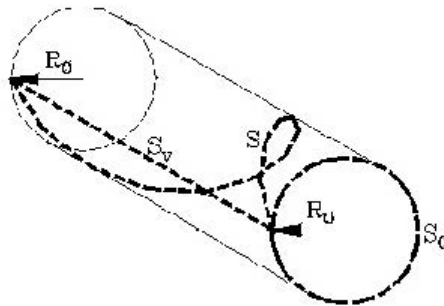
Given an arbitrary maximum amplitude N, wavelength λ, and spin angular velocity ω, the sinusoidal real wave function of the traveling RW must be defined as:

$$\psi = N\sin\left(\frac{2\pi}{\lambda}S - \omega t\right)$$

11. Comparison of Dirac Matrix Equation with Rotating Wave vectors

It was a busy time for new physics in the first three decades of the twentieth century. After the photoelectric effect, relativity, and Bohr's atom, came Louis de Broglie's insight in 1924 to suggest that if light photons can be considered as particles as well as waves, then matter might also have a wave nature and its wave function must comply with relativity. Later in 1924 Wolfgang Pauli suggested an inner degree of freedom of the electron, followed by Ralph Kroenig and then in 1925 George S. Uhlenbeck and Samuel E. Goudsmit had theorized that the electron must have an inner rotational motion (later termed "spin" by Pauli) in order to have an associated magnetic moment and thus explain spectroscopic evidence. Hans C. Ohanian in his review (What Is Spin?) [1] states it apparently was immediately recognized by Goudsmit and Uhlenbeck that spin would very likely lead to serious problems with Special Relativity". However, much concentration at the time was on the developing Quantum Mechanics and classical concepts were deemed insufficient to describe the macroscopic world. Then in 1926 Schrödinger really started Quantum Mechanics with his wave equation and had then tried to further it with relativity, but did not derive electron spin.

Also, Pauli knew that the spin of a rotating body could be described by matrices and hence introduced matrices into the wave equation, which in turn suggested pairs of opposite spins of the electron. Knowing that the light wave can have two possible directions of polarization, C.G. Darwin suggested that the electron might also have two opposite polarizations which then yielded the correct fine structure of the hydrogen spectrum. It was Paul A.M. Dirac who in 1928 then used the matrices to combine the Special Theory of Relativity with wave mechanics and naturally derived electron spin. However in his "Quantum Theory of the Electron" [2], Dirac further clearly credits Gordon (and thus Klein) for suggesting that the time derivative operator for the relativistic Hamiltonian $W = ih\partial /\partial t$ should be linear in the first order (and likewise the momentum operator $p_r = -ih\partial /\partial x_r$), just as in the case of the non-relativistic wave equation. Quoted from P.A.M. Dirac:

What is the probability of any dynamical variable at any specified time having a value lying between any specified limits, when the system is represented by a given wave function ψ_n. The Gordon-Klein interpretation can answer such questions if they refer to the position of the electron (by use of ρ_{nm}), but not if they refer to its momentum, or angular momentum or any other dynamical variable. We should expect the interpretation of the relativity theory to be just as general as that of the non-relativity theory. Thus Dirac got the idea to factorize the relativistic wave equation in order to get the first order derivative operators which then suggested a positive charge (positron later discovered) as well as the electron. Again quoted from P.A.M. Dirac: The true relativity equation should thus be such that its solutions split up into two non-combining sets, referring respectively to the charge $-e$ and the charge e .

11.1 Derivation of Dirac's Matrix/Wave Equations

Dirac first considers the case of no field present and and posits the form of the four dimensional wave equation

$$(p_0 + \alpha_1 p_1 + \alpha_2 p_2 + \alpha_3 p_3 + \beta)\psi = 0.$$

this is the same as Dirac [2] Eqn 4. which we shall refer to as D4. Then he multiplies the conjugate (with minus p_0) and the non-conjugate in his equation [2] D5,

$$0 = (-p_0 + \alpha_1 p_1 + \alpha_2 p_2 + \alpha_3 p_3 + \beta)(p_0 + \alpha_1 p_1 + \alpha_2 p_2 + \alpha_3 p_3 + \beta)\psi$$

$$(37)$$

To get the required equation (D3) with no field present: (vectors in bold):

$$0 = (-p_0^2 + p^2 + m^2 c^2)\,\psi$$

With derivative operator: $p_0 = W/c = (ih/c)\partial/\partial t$ = Relativistic Hamiltonian. Readers can refer to the Quantum Theory of the Electron/PAM Dirac online. Dirac derives the various matrices required to get his wave equation (D9):

$$[p_0 + \rho_1(\sigma, p) + \rho_3 mc]\,\psi = 0$$

where σ denotes the vector $(\sigma_1, \sigma_2, \sigma_3)$. Finally Dirac considers the electron in an electromagnetic field and adds in the vector potential and scalar in his equation (D14):

$$[p_0 + \frac{e}{c} A_0 + \rho_1(\sigma, p + \frac{e}{c} A) + \rho_3 mc]\,\psi = 0$$

And then analogous to his equations (D3) and (D5) he multiplies the conjugate [with $-(p_0 + \frac{e}{c} A_0)$] and the non-conjugate in his equation (D15):

$$0 = \left[-\left(p_0 + \frac{e}{c} A_0\right) + \rho_1\left(\sigma, p + \frac{e}{c} A\right) + \rho_3 mc\right] \times$$

$$\left[+\left(p_0 + \frac{e}{c} A_0\right) + \rho_1\left(\sigma, p + \frac{e}{c} A\right) + \rho_3 mc\right]\psi$$

$$= \left[-\left(p_0 + \frac{e}{c} A_0\right)^2 + \left(\sigma, p + \frac{e}{c} A\right)^2 + m^2 c^2\right.$$

$$+ \rho_1\left[\left(\sigma, p + \frac{e}{c} A\right)\left(p_0 + \frac{e}{c} A_0\right)\right.$$

$$\left.\left.-\left(p_0 + \frac{e}{c} A_0\right)\left(\sigma, p + \frac{e}{c} A\right)\right]\right]\psi$$

The last equation above is D15. Note rewritten, equations (D5) and D15) can take the form:

$$p_0^2\,\psi = [\rho_1(\sigma, p) + \rho_3 mc]^2\,\psi$$

$$\left(p_0 + \frac{e}{c} A_0 \right)^2 \psi = \left[\rho_1 (\sigma, p + \frac{e}{c} A) + \rho_3 mc \right]^2 \psi$$

The first Eq. is D3 last Eq. is D15a. Upon squaring the terms in equation (D15a), Dirac finds extra terms:

$$\left(p_0 + \frac{e}{c} A_0 \right)^2 \psi = \left[\left(p + \frac{e}{c} A \right)^2 + \frac{e\hbar}{c} (\sigma, H) + i \frac{e\hbar}{c} \rho_1 (\sigma, E) + m^2 c^2 \right] \psi$$

(43)

where this is D15a, again, here: $\hbar = h/2\pi$. From that, Dirac divides by $2m$ and finds:

$$\frac{e\hbar}{c} \frac{(\sigma, H)}{2m} = \frac{e\hbar}{mc} \cdot \sigma = magnetic\,moment\,of\;1\,Bohr\,Magneton\,and$$

$$i \frac{e\hbar}{c} \rho_1 \frac{(\sigma, E)}{2m} = i \frac{e\hbar}{mc} \cdot \rho_1 \; \sigma = electric\,moment\,with\,imaginary\,number$$

(44)

Quoted from P.A.M. Dirac: This magnetic moment is just that assumed in the spinning electron model. The electron moment, being a pure imaginary, we should not expect to appear in the model.

It is doubtful whether the electrical moment has any physical meaning, since the Hamiltonian in (14) that we started from is real, and the imaginary part only appeared when we multiplied it up in an artificial way in order to make it resemble the Hamiltonian of previous theories.

11.2 Rotating Wave - Vectors and Derivative Operators

Again refer to figure 14., where the sinusoidal wave function was defined as;

$$\psi = N \sin\left(\frac{2\pi S}{\lambda} - \omega t \right)$$

Since for a light wave $P = h/\lambda$ then for a Rotating Wave $P_c = h/\lambda$ and thus:

$$\psi = N \sin\left(\frac{P_c S}{\hbar} - \omega t \right).$$

It is also apparent from Figure 10. that: $P_c = P_v c/v_v = P_R c/v_R$ and $S = S_v c/v_v = S_R c/v_R$ such that:

$$\psi = N \sin\left(\frac{P_c S}{\hbar} - \omega t \right) = N \sin\left(\frac{P_v S_v c^2}{v_v^2 \hbar} - \omega t \right)$$

$$= N \sin\left(\frac{P_R S_R c^2}{v_R^2 \hbar} - \omega t \right)$$

and thus,

$$\frac{\partial \psi}{\partial S} = \frac{NP_c}{\hbar} \cos\left(\frac{P_c S}{\hbar} - \omega t\right)$$

$$\frac{\partial \psi}{\partial S_v} = \frac{NP_v c^2}{v_v^2 \hbar} \cos\left(\frac{P_v S_v c^2}{v_v^2 \hbar} - \omega t\right)$$

$$\frac{\partial \psi}{\partial S_R} = \frac{NP_R c^2}{v_R^2 \hbar} \cos\left(\frac{P_R S_R c^2}{v_R^2 \hbar} - \omega t\right)$$

deriving further we get,

$$\frac{\partial^2 \psi}{\partial S^2} = -\frac{NP_c^2}{\hbar^2} \sin\left(\frac{P_c S}{\hbar} - \omega t\right) = -\frac{\psi P_c^2 c^4}{c^4 \hbar^2}$$

$$\frac{\partial^2 \psi}{\partial S_v^2} = -\frac{NP_v^2 c^4}{v_v^4 \hbar^2} \sin\left(\frac{P_v S_v c^2}{v_v^2 \hbar} - \omega t\right) = -\frac{\psi P_v^2 c^4}{v_v^4 \hbar^2}$$

$$\frac{\partial^2 \psi}{\partial S_R^2} = -\frac{NP_R^2 c^4}{v_R^4 \hbar^2} \sin\left(\frac{P_R S_R c^2}{v_R^2 \hbar} - \omega t\right) = -\frac{\psi P_R^2 c^4}{v_R^4 \hbar^2}$$

Thus: $P_c^2 \psi = \frac{c^4}{c^4 \hbar^2} \psi$

$$P_v^2 \psi = \frac{v_v^4}{c^4 \hbar^2} \psi$$

$$P_R^2 \psi = \frac{v_R^4}{c^4 \hbar^2} \psi$$

and thus: $P_c^2 \psi = (P_v^2 + P_R^2)\psi$. with P_c, P_v, and P_R as either simple variables or derivative operators. Note, one can extend the Rotating Wave equation into the General Theory of Relativity: $P_c^2 \psi = (P_v^2 + P_R^2 + P_T^2)\psi$

11.3 Comparison of Derivative Operators between Dirac & Rotating Wave.

In order to compare with Dirac's equations we of course need to limit our discussion here to the Special Theory of Relativity. When the electron is in constant motion, the momentum operators of the Rotating Wave can also be related in the vector sum: $P_c = P_v + P_R$ which upon multiplication by the amplitude of the wave function and then squaring yields the equations:

$$P_c \psi = (P_v + P_R)\psi$$

$$P_c^2 \psi = (P_v^2 + P_R^2)\psi \ \ .$$

Note in above equations (D3) and D15a) the Dirac terms which relate to the vectors of the Rotating Wave are: $p_0 = P_c$, $p = P_v$ and $mc = m_0 c = P_R$ for constant motion (where m_0 is the Rest Mass of the Rotating Wave). Thus when an electromagnetic field is introduced to the electron, the associated vector potentials can be added respectively (see Figure 15):

$$\left(P_c + \frac{e}{c} A_c \right) \psi = \left(P_v + \frac{e}{c} A_v \right) \psi + \left(P_R + \frac{e}{c} A_R \right) \psi$$

which represents another (boosted) state of constant motion. See Figure 15. The newly introduced potential $e/c\ A_R$ has a magnitude and direction such that the spin momentum is always conserved in magnitude and changed only in direction in order to maintain itself at right angles to the direction of motion of the particle. Vectors noted are embolded.

Figure 15: The vector potential is added to the 3–space vector momentum while the spin momentum is maintained at right angles to the direction of motion. The dashed lines indicate the resultant momenta with added potentials..
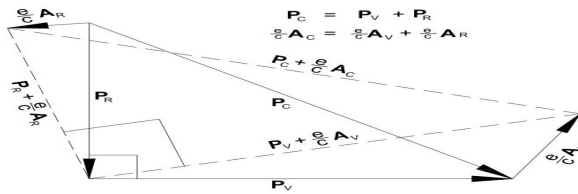
If we are going to conserve the rest mass energy and momentum in the rotational direction (as in the Special Theory of Relativity), while applying potentials from an electromagnetic field that change the direction of the electron's angular and magnetic moment, then the magnitude of mv_R will remain $= m_0 c = P_R$, but note P_R must change in direction in order to remain at right angles to the translational motion and momentum of $P_v = mv_v$.

$$p_0^2 \psi = \left[\rho_1 (\sigma, p) + \rho_3 mc \right]^2 \psi$$

$$\left(p_0 + \frac{e}{c} A_0 \right)^2 \psi = \left[\rho_1 (\sigma, p + \frac{e}{c} A) + \rho_3 mc \right]^2 \psi$$

In comparison, as noted in previous sections, the Rotating Wave momenta can be added vectorially: $P_c = P_v + P_R$ for Special Theory of Relativity (constant motion),

$$P_c = P_v + P_R + P_T$$

for General Relativity and likewise when squared:

$$P_c^2 = P_v^2 + P_R^2 = mc^2 = (mv_v)^2 + (mv_R)^2$$
$$P_c^2 = P_v^2 + P_R^2 + P_T^2 = mc^2 = (mv_v)^2 + (mv_R)^2 + (mv_T)^2$$

Also note in the above it is implicit that: $P_v = p_1 + p_2 + p_3 = P_X + P_Y + P_Z$. These are mutually orthogonal 3 dimensional momentum vectors and when squared'

$$P_v^2 = p_1^2 + p_2^2 + p_3^2 \qquad (57)$$

Also note

$$0 = -P_c^2 + P_v^2 + P_R^2$$
$$iP_R = (-iP_c + P_v)(iP_c + P_v)$$

If the vector potential and scalar are added in the same way as Dirac:

$$\left(P_c + \frac{e}{c} A_0 \right) = \left(P_v + \frac{e}{c} A_v \right) + \left(P_R + \frac{e}{c} A_R \right)$$

where here $A_v =$ the real 3 dimensional vector potential $= A_X + A_Y + A_Z$, and then after squaring we get:

$$\left(P_c + \frac{e}{c} A_c \right)^2 \psi = \left(P_v + \frac{e}{c} A_v \right)^2 \psi + \left(P_R + \frac{e}{c} A_R \right)^2 \psi \quad (60)$$

However, Dirac gets:

$$\left(P_c + \frac{e}{c} A_c \right)^2 \psi = \left(P_v + \frac{e}{c} A_v \right)^2 \psi + P_R^2 \psi + extra\ terms\ noted\ in\ (D15)\ above.$$

$$(61)$$

Since we are conserving magnitude of momentum and energy in the rotation, then

$$\left(P_R + \frac{e}{c} A_R \right)^2 = P_R^2 \ and\ thus:$$

$$\frac{e}{c} A_R = -2P_R = -2m_0 c = -2\frac{\hbar}{R_0}$$

Recall from the previous section 5. A Definition of Rest (Energy) Mass that $h = 2\pi R_0 m_0 c$ and thus $\hbar = R_0 m_0 c$. Thus the Rotating Wave has an angular moment $L = \hbar$ which agrees with an orbital state of $N = 1$ where $N = [\ell(\ell+1)]^{1/2}$ and $\ell = 0$. The magnetic dipole moment is thus:

$$\mu = -\frac{e}{2m_0} L = -\frac{e}{2m_0} \hbar = -\frac{e}{2m_0} R_0 m_0 C = -\frac{1}{2} eR_0 c$$

Note, a light wave has an energy defined by the Poynting Vector: $S = E \times B / \mu_0$. S is in the direction of motion of the light wave, thus the Poynting Vector for the Rotating Wave will be in the spiral or helical direction: $S = e_c S$.

Since in the light wave $E = cB$, then for the Rotating Wave:

$$S = \frac{EB}{\mu_0} = \frac{E^2}{c\mu_0} \ and$$

$$\frac{dS}{dt} = 2\frac{E}{\mu_0 c} \frac{dE}{dt} = -4\frac{E}{\mu_0 c} \frac{kQv_T}{d^3}$$

12. An Explanation of the Kaluza 5th Dimension by the Rotating Wave.

My initial references on Kaluza's idea are from the internet article of William Straub PhD: Kaluza-Klein for Kids June 27 2014 [3] and I appreciate his sharing of knowledge as I do by many others. I also reviewed the Kaluza Klein site by Victor Toth as he always tries to make physics as simple as possible and intuitive, yet comprehensive. [4] I looked at many other sites but got the Kaluza idea clear from those two. In 1919 the German mathematician Theodor Kaluza developed a theory in 5 dimensional Reimannian geometry from which electromagnetism appeared to be a natural consequence of the 5th dimension. Finnish physicist Gunnar Nordstrom had proposed a similar idea earlier in 1914 but it was ignored. Kaluza immediately approached Einstein who became very interested and it was finally published in 1921 under Einstein's recommendation. For almost a hundred years physicists and mathematicians have studied and tried to make clear sense of the Kaluza "miracle". The basic idea is that the extra components of the 5 dimensional metric seem to materialize in 4 dimensions as components of the electromagnetic vector potential. After rechecking the derivation of the $G_{k\ell}$ in previous section 12 and becoming sure of the intuitive model of the Rotating Wave, I began to realize that its 5th vector v_T was most likely the same 5th dimension as suggested by Kaluza. Without the radial (outward or inward) v_T vector part of the Rotating Wave, one cannot derive intrinsic curvature of the surface on which the Light Line travels. In other words, the General Theory of Relativity GTR could not be explained by the Rotating

Wave function, unless it is allowed to spiral outwards (slowing down) or inwards (speeding up). The vector v_T essentially turns the Light Line inwards or outwards and thus deforms the metric. Also, the fact that electromagnetic energy adds curvature in addition to mass energy very clearly suggested to me that the Kaluza 5th dimension must be the same as v_T, the 5th vector of the Rotating Wave. Most recently, I came across the article Geometrical Interpretation of Electromagnetism in 5-Dimensional Manifold by TaeHun Kim & Hyunbyuk Kim [5]. In the article, they suggest the 5th dimensional manifold is constructed by dragging the 4D space-time, resulting in deformation. Clearly, as shown in Figure 13, one can see that the Rotating Wave v_T vector likewise redirects the 4D space-time manifold inwards (or outwards). In analyzing the Kaluza Klein theory, physicists usually start with the equation of motion. As Straub states, the Lorentz Force in the usual 4 dimensional space can be derived from an arbitrary coordinate variation δx^γ of the invariant quantity:

$$I = -mc\int ds - q\int A_\alpha \, dx_\alpha$$

and carrying the variation and setting it to zero yields the expression for the Lorentz Force:

$$\frac{d^2 x^\gamma}{ds^2} + \Gamma^\gamma_{\alpha\beta}\frac{dx^\alpha}{ds}\frac{dx^\beta}{ds} = \frac{q}{mc}F^\gamma_\alpha\frac{dx^\alpha}{ds}$$

Now let $ds/dt = c$ (speed of light) as defined in the Rotating Wave Figure 13 where

$$c^2 = g_{\alpha\beta}u^\alpha u^\beta \ \ thus:$$

$$\frac{1}{c^2}\left[\frac{d^2x^{\gamma}}{dt^2}+\Gamma^{\gamma}_{\alpha\beta}\frac{dx^{\alpha}}{dt}\frac{dx^{\beta}}{dt}\right]=\frac{q}{mc^2}F^{\gamma}_{\alpha}\frac{dx^{\alpha}}{dt}$$

and thus:

$$a^{\gamma}+\Gamma^{\gamma}_{\alpha,\beta}u^{\alpha}u^{\beta}=\frac{q}{m}F^{\gamma}_{\alpha}u^{\alpha}$$

Now a vector can be constructed by pairing the contravariant components with covariant base vector components so:

$$(a^{\gamma}+\Gamma^{\gamma}_{\alpha\beta}u^{\alpha}u^{\beta})e_{\gamma}=(\frac{e}{m}F^{\gamma}_{\alpha}u^{\alpha})e_{\gamma}$$

$$e_{\gamma}a^{\gamma}+\Gamma_{\alpha\beta}u^{\alpha}u^{\beta}=\frac{q}{m}F_{\alpha}u^{\alpha}$$

where F_{α} is now embolded because it acts like a base vector. Note that as indicated previously Eq. (16) for the Rotating Wave model:

$$c=e_cc=v_v+v_R+v_T=e_{\alpha}u^{\alpha}+v_T$$

Also, as is common practice when analyzing Kaluza Klein theory, Greek indices are again here used to denote 4 dimension quantities ($c_4=e_{\alpha}u^{\alpha}$) while Latin indices are used to denote overall 5 dimensional quantities ($c_5=e_{\ell}u^{\ell}=e_{\alpha}u^{\alpha}+v_T$). To be clear: $c_5=c_4+v_T$ Thus for 4 dimensions when $v_T=0$ (Rotating Wave cylinder condition of constant translational motion):

$$\frac{dc_4}{dt}=c\frac{de_c}{dt}=c^2R_4=e_{\alpha}du^{\alpha}+\frac{de_{\alpha}}{dt}u^{\alpha}$$

$$=e_{\alpha}a^{\alpha}+\Gamma_{\alpha\beta}u^{\alpha}u^{\beta}=\frac{q}{m}F_{\alpha}u^{\alpha}$$

And for the Rotating Wave 5 dimensions (or 5 vectors):

$$\frac{dc_5}{dt}=c^2R_5=e_{\alpha}du^{\alpha}+\frac{de_{\alpha}}{dt}u^{\alpha}+\frac{dv_T}{dt}$$

$$=e_{\alpha}a^{\alpha}+\Gamma_{\alpha\beta}u^{\alpha}u^{\beta}+\frac{dv_T}{dt}$$

Now, as per the standard model of General Relativity the Equation of Motion (EOM) is set to zero for the straightest geodesic and thus the rotation curvature R_5 is not considered nor observed. So for the moment let:

$$c^2R_5=0=e_{\alpha}a^{\alpha}+\Gamma_{\alpha\beta}u^{\alpha}u^{\beta}+\frac{dv_T}{dt}$$

$$e_{\alpha}a^{\alpha}+\Gamma_{\alpha\beta}u^{\alpha}u^{\beta}=-\frac{dv_T}{dt}$$

but from the variational principle Eq.(67) leads to Eq.(72)

$$c^2 R_4 = e_{\alpha} a^{\alpha} + \Gamma_{\alpha\beta} u^{\alpha} u^{\beta} = \frac{q}{m} F_{\alpha} u^{\alpha} = -\frac{dv_T}{dt}$$

Thus according to the Rotating Wave model, the extra term (E_T) generated by the Kaluza Klein 5 dimensional model is clearly:

$$E_T = -\frac{dv_T}{dt} = \frac{q}{m} F_{\alpha} u^{\alpha}$$

Also note as per the Rotating Wave model,

$$c^2 R_5 = c^2 R_4 + \frac{dv_T}{dt}$$

So according to the Rotating Wave, the $F_{\alpha} u^{\alpha}$ would appear to rotate like the R_5 and R_4.

$$c^2 R_5 - c^2 R_4 = \frac{e}{m} F_{\alpha} u^{\alpha}$$

Expanding further,

$$-E_T = -\frac{e}{m} F_{\alpha} u^{\alpha} = \frac{dv_T}{dt} = \frac{d\, bE_T}{dt} v^T + E_T \frac{dv^T}{dt}$$

$$= -\frac{e}{m} F_{\alpha} u^{\alpha} = \frac{v_R}{P_T} v_T + E_T A_T$$

So when a homogeneous electric field is present, there appears to be a boost in potential that is both rotational $(v_R P_T^{-1} v_T)$ and radial ($E_T A_T$). One can imagine this intuitively when using the right hand rule of thumb: it is like tightening the fist while pushing the thumb forward. When the homogeneous electric field is attracting the negative field of the electron?s Rotating Wave, then the potential is positive and the rotation and forward translational motion is immediately amplified. In that case, the Light Line (radius at which Rotating Wave speed is c) spirals inwards (tightens) creating the bullet form of intrinsic curvature and the mass energy is increased. When the potential is negative, the rotation and translational motion are immediately decreased. In that negative case, the Light Line spirals outwards and mass energy is dissipated. In comparison to the gravitational theory and its slowing down of time and energy, this suggests some additional impact on the expansion of the universe by electromagnetic interactions.

Consider a Rotating Wave held stationary (on the wall) while in a homogeneous attracting electric field. At a certain radius R_R, the tangential velocity of the rotating wave is traveling at the speed of light $c_R = v_R$ and thus;

$$\frac{dc_R}{dt} = c^2 R_R = \frac{q}{m} F_R u^R$$

and the R_R is simply the inverse of the radial vector.

Now consider a Rotating Wave (off the wall) and free falling straight in a homogeneous attracting electric field:

$$c_4 = v_v + v_R = v_v c_R$$

$$c_5 = v_v + v_R + v_T$$

$$\frac{dc_4}{dt} = c^2 R_4 = \frac{q}{m} F_\alpha u^\alpha$$

$$= E_v \frac{dv}{dt} + \frac{q}{m} F_R u^R$$

$$c^2 R_4 = A_v + (q/m) F_R u^R$$

$$dc_5/dt = c^2 R_5 = (q/m) F_\alpha u^\alpha + dv_T/dt = A_v + (q/m) F_R u^R + dv_T/dt$$

$$c^2 R_5 = A_v + (q/m) F_R u^R + d E_T/dt v_T + E_T dv_T/dt$$

$$= A_v + (q/m) F_R u^R + v_R P_T^{-1} v_T + A_T$$

Letting $c^2 R_5 = 0$, then the extra term,

$$E_T = -v_R P_T^{-1} v_T - A_T = A_V + (q/m) F_R u^R$$

and thus:

$$dv_v/dt = (q/m) F_v u^v$$

$$dv_R/dt = (q/m) F_R u^R$$

$$dv_T/dt = (q/m) F_T u^T \quad .$$

TaeHun Kim and Hyunbyuk Kim also suggest "is possible to imagine a mechanical wave propogating along a particle-thread". That thread according to the Rotating Wave model would appear to be the Light Line at a radius where the wave front has the constant speed of light (c). Again that Light Line would be dragged or deformed by an electric field outwards or inwards depending on charge. Essentially the enormous difference between the strength of electromagnetism and gravity can probably be accounted for by comparison of the direct and immediate deformation of electric field verses the slight and indirect affect of a Rotating Wave on another wave via the bending interaction through the permeability and permittivity of EM Vacuum field. The Rotating Wave theory is grounded in the 3 dimensional space we are very familiar with and observe everywhere. The Rotating Wave theory suggests that the 5th dimension as suggested by Kaluza is likely the 5th radial vector v_T of the Rotating Wave. The Rotating Wave obviously requires faster than light velocities at greater radii plus non-local interaction. What one observer sees might be just another perspective compared to others. In an article prepared by Lance L. Williams [6] he states that:"It has been little – appreciated but motion in the 5th dimension is identified with electric charge. He also notes: The 5 D Theory would seem to offer an avenue toward breakthrough physics (breakthrough propulsion) because it satisfies the expectations for such a theory as well as hinting at a possible approach to hyper–luminal travel: the 5th dimension."

Note that as per the Rotating Wave, the speed of light increases at greater radii. Perhaps it is possible to detect Rotating Waves like beacons of light at great distances, albeit with associated weak fields. With futuristic applied technological advances, that might permit communication across stellar distances and significantly further the potential of quantum entanglement. In the more near term, perhaps we could just try to model the Rotating Wave and see what technological applications it might have. The Rotating Wave suggested to me long ago that we might be able to create an electromagnetic propeller that can "push or pull" against the EM Vacuum field of space. The "push or pull" traction is due to transmission and rotational energy could be redirected into forward motion. Certainly, if we are going into space for the long haul, we can't afford to pollute it with micro particles from propellant along the same trajectory. Also, a massless rocket (like an electromagnetic propeller) would certainly be much more efficient overall with much less fuel payload. Furthermore, the acceleration and deceleration along trajectories would save time and have fewer moving parts, making space travel more comfortable and safe. Newton wondered why gravity worked. Einstein explained that mass bent space. But again, then why does mass bend space? I think it is the Rotating Wave affecting the permeability and permittivity of the EM Vacuum field. What binds the photon into rotation in the first place is imparted to other interacting waves.

13. Zitterbewegung (zbw) as Evidence of the Rotating Wave

Many people are familiar with David Hestene's work on Zitterbewegung as well as geometrical algebra and his space time algebra (STA). I came across his article of 1990 [7] and immediately noticed a similarity between Zitter and the Rotating Wave. Right at the outset of the abstract, Hestenes states: The Zitterbewegung is a local circulatory motion of the electron presumed to be the basis of the electron spin and magnetic moment.

Hestenes notes that the rest frame $\Omega \cdot S$ $(= m_0 c^2$ where here $m_0 =$ rest mass) energy has a familiar form of rotational kinetic energy for a body with angular momentum S and rotational velocity Ω. The $\Omega \cdot S = mc^2$ suggested to Hestenes that the "rest mass" of the electron has a kinetic origin. Refer to previous section 5. A Definition of Rest (Energy) Mass. According to the Rotating Wave, the Rest (Energy) Mass $E_0 =$ Rotational Kinematic Energy $(E_R = 1/2 m_0 c^2) + E_B$ (Binding Energy) $= m_0 c^2$ and thus $E_R = E_B$. The mass is due to kinematics of a Rotating Wave brought into classical rotation by a binding energy. Hestenes states that "In analyzing free-particle wave packet solutions of the Dirac wave equation, Schrödinger noted the existence of "interference" between positive and negative energy states oscillating with circular frequency $\omega_0 = 2 m_0 c^2 / \hbar = 1.6 x 1021 s^{-1}$. That would be like a wave rotating at a billion billion times a second. No wonder it interacts like a hard particle as well as a wave. Hestenes further states: "But the greatest challenge will be to prove that the zbw is a real physical phenomena and not just a metaphorical trick." He had already thought that "barrier penetration can be interpreted as manifestations of the zbw". Apparently, Louis de Broglie in his 1924 doctoral thesis had already proposed that the electron has an internal clock, with frequency at about a billion billion times a second.

While Schrödinger adopted de Broglie's wave hypothesis in his famous equation, de Broglie's clock hypothesis was ironically forgotten. In a later article Hestenes reveals that he met with French experimental physicist Michel Gouanere "who argued that if the electron clock is physically real, channeled electrons should interact resonantly with the crystal periodicity at some energy to produce a dip in transmission rate." Gouanere and colleague M. Spighel had already conducted an electron channelling experiment which supported the electron clock and was published in Annales de la Fondation Louis de Broglie in 2005, but was rejected by Physical Review Letters and many said it was implausible. I suspect that implausibility was the billion billion times a second. One reviewer said perhaps it could be explained by Zitterbewegung, so Gouanere got in touch with David Hestenes.As noted in previous section 11. Hans C. Ohanian [1] noted that Goudsmit and Uhlenbeck in 1925 immediately realized that their proposed electron "spin" would very likely lead to serious problems with Special Relativity, but Quantum Mechanics was just starting to develop and was drawing more attention at the time. The Dirac matrices appeared to refer to some characteristics of the electron itself and thus Dirac commented on their presence in the energy equation of an electron:"They must therefore denote some quite new dynamical variables, which may be pictured as describing some internal motion in the electron. We shall see later that they just describe the spin of the electron." – Paul A.M. Dirac The key to the Rotating Wave and Relativity is that: when a light wave travels in a straight direction it moves at the speed of light, but when it rotates, it travels at greater velocity at further radii from it center of spin. In 2008 Michel Gouanere along with Denis Dauvergne, Robert Kirsch, Jean-Claude Poizat, Joseph Remillieux, Michel Chevallier, Cedric Ray, Etienne Testa, Robert Chehab, Marcel Bajard, and Philippe Lautesse proposed RICCE (Research for an Internal Clock by Channelling of Electrons), [8] . I don't know the details nor the outcome of RICCE, but I suspect that if one posits relativistic properties purely as a function if the Rotating Wave and not a connection between space and time itself, alternate findings might be considered and observed.

14. Stern Gerlach and 720 Degrees

Stern Gerlach:

In 1922 Otto Stern and Walter Gerlach performed an experiment which involved sending a beam of silver atoms through an inhomogeneous (non-uniform) magnetic field and onto a detection screen. The silver atoms were each considered neutral in charge, but had an extra electron. Classical spinning particles would be expected to just show up on the detection screen in a random pattern, but the beam split into exactly two which indicated that half of the electrons had an intrinsic quantized angular moment of $+\hbar/2$ (spin up) and the other half had $-\hbar/2$ (spin down).The Stern Gerlach quantum mystery still is: Why does one particle appear to have a possible spin of either up or down and not just in one way? Electrons have a spin opposite to that of positrons, but they are two types of particles which cancel each other out in annihilation. Electrons do not cancel each other out, but appear to have two types of spin. Note that the Rotating Wave model of the electron has a forward (translational) motion in line with its axis of spin.

Thus if an electron orbits clockwise around a silver atom nucleus, it will have a specific direction and angular moment of spin. Furthermore, the most stable motion of a whole silver atom would require that the orbital plane of the extra electron be in line with the trajectory of the atom towards the detection screen. However, for each silver atom with a clockwise (or upside up) orbit there is an equally statistical chance of having a counterclockwise (or upside down) orbit. One is just the mirror of the other. Hence, the orbit-up motion of the silver atom could be observed and interpreted as spin-up while the orbit-down motion could be observed and interpreted as spin-down. That might invite discussion and argument, but it is one possible way that I can think of in explaining quantized spatial orientation of spin with the classically Rotating Wave.

720 degrees and Spin ½

Apparently a rotation of 360 degrees does not return the electron to its original state. It requires a 720 degree rotation to do that. Also note that this is true not just for electrons but any spin-1/2 particle. Now note that as per Figure 4, there are two symmetrical nodes so when the Rotating Wave is spun 1/2, it looks the same as the original. The intrinsic spin angular moment is one half of the orbital moment, so for each orbit the electron spins only half the way around. It would take two orbits or 720 degrees of rotation to get the electron a full spin and back to the original state. I also note that there are two nodes on the ½ spin Electron RW. Perhaps there are three nodes on others particles, such as Quarks with -1/3 and 2/3 charge.

15. Possible Solutions to Paradoxes of Modern Physics

The foregoing concept of the electron wavicle might resolve well known paradoxes of physics such as the wave-particle duality of both light and matter, the EPR (Einstein, Podolsky and Rosen) paradox, and the age-old Zeno's paradox of motion. By this concept one would expect the electron to be affected by a double diffraction slit in just the same way that a photon would, simply because the electron is composed of half a spinning photon plus binding energy. Similarly, the photo-electric effect might be explained by the consequent one-on-one relationship of the photon and the electron RW. In 1935 Einstein, Podolsky and Rosen published a paper on a thought experiment which stated that if the position and momentum of only one of two particles is measured after an initial measure of their combined position and momentum, then the final momentum of the two particles cannot be the same unless there is some kind of instantaneous "action at a distance" or "non-local reality" between the two particles. However, modern experiments, which have measured the polarization of twin photons instead of position and momentum of particles, have confirmed the violation of Bell's inequality and thus support the "non-local reality" of Neils Bohr's Quantum Theory and the EPR paradox. The apparent action at a distance might be simply due to the action of the infinitely extended rotating wave of the RW. The apparatus which interferes with one photon while measuring its polarization would, according to the RW, also interfere with its twin photon of equal and opposite momentum. The twin photon, although at a greater distance from the centre of the interfering apparatus, would still be affected by the same electromagnetic wave function of that measuring apparatus. The locality of a particle might be thus better interpreted as the centrality of spin of the RW's electromagnetic wave. Zeno's paradox prescribes discrete motion of particles.

However, the electron RW is transmitted through the EM Vacuum field as a wave. The EM Vacuum field might also be predicated upon a substrata energy fieldof wave functions and perhaps enable the creation and transmission of electromagnetic waves and move themselves very likely with speeds much greater than that of light. Given an infinite amount of real time and space, an infinite number of energy strata could have evolved into something as substantial as light and thus the existence and motion of matter.

16. Conclusion

The Rotating Wave (RW) model of the Electron provides an elegant and simple solution for wave function of matter and in doing so, it explains the apparent relativistic connection between space and time. A number of physicists have considered the "circular motion" within the electron, but tried to maintain the direct connection between space and time. An in depth study of Louis de Broglie's thesis would be interesting because he studied relativity, was the first to consider matter as a wave form, and apparently also considered there might be circular form of motion in the electron. Basically, the RW agrees with the assumption that the speed of light is independent of it's source and is constant at speed $= c$ in a straight direction. However, the RW also requires that the bending of light allows for speeds greater than c at greater radii. Given that, everything seems to naturally derive from a classical rotation of "spin": mass, charge, magnetic dipole, relativity, quantum mechanics, and a number of paradoxes. Relativity and quantum mechanics are thus inseparably innate to the real wave equation of the RW. Furthermore, rotation of the wave clearly explains how a magnetic dipole field is self induced and thus how a magnetic field is induced by the motion of a charged particle.The RW form also allows one to derive the $G_{k\ell}$ intrinsic curvature in detail and is congruent with the mass energy density tensor. That is perhaps not surprising because after all, the mass energy density tensor is itself indirectly derived from rotating wave forms of mass.

One thing the detailed $G_{k\ell}$ of the RW does in addition is to inherently explain the expansion of the universe. Without expansion there is no curvature. Any energy expended by the RW in its coupling with other particles or waves would, by its definition of mass, require its gravitational field to decrease as the RW's time cycle of spin slows down. The RW's inherent connection between gravity, spin and time thus provides an elegant explanation to the expansion of the universe.The RW model does yield additional insights which might stimulate unification theory as well as provide alternate models for teaching current theory. For example, by applying the Definition of Rest (Energy) Mass according to the RW, a radius Rq, at which a hypothetical wave of the quark is rotating at the speed of light, can be defined as: $R_q = (m_e R_e)/m_q$ where m_e and m_q are the stationary masses of the electron and quark respectively. R_e is, of course, the radius of the electron wavicle at which its rotating wave is traveling at the speed of light. The radial distance R_q could be compared with the distance to which the strong force extends. Such speculations might provide some enlightenment upon current QCD theory.

S.A. Emelyanov in his 2012 [9] : "Toward a real synthesis of quantum and relativity theories: experimental evidence for absolute simultaneity", states that their observations leads them to believe that the de Broglie-Bohm and aether related Lorentz-Poincare theories are capable of providing a real synthesis of quantum and relativity theories. Again, the RW model has two nodes of maximum amplitude (see Figure 4) which create quantum mechanics and the planar wave fronts of these nodes incline and with a longer helical wavelength, thus creating relativistic effects (see Figures 5, 6, and 8).

Dr. Louis M. Houston at the University of Louisiana at Lafayette posted his 2013 article in IJESIT: "The Physics of a Rotating de Broglie Wave Packet" [10]. As per his abstract, Dr. Houston finds that the field generated by a rotating de Broglie wave packet results in a "quantized electromagnetic-centripetal field for a small angular range".Dr. Robert Close in Portland has developed a Classical Wave Description of Electrons [11] that is likely similar to the RW model and which he uses for comparative modeling in teaching Physics. [00] One thing I agree with on the Classical Wave Description is that the wave function actually causes relativistic effects rather than just complying with relativity. In the Emelyanov, Houston, and Close concepts, it could be very revealing in comparing the Rotating Wave vectors with the Dirac matrix equations and Rotating de Broglie wave packet. After some analysis, that would be greatly facilitated by in person discussion groups, also including Hestenes and Kim. A revisit of the Gouanere et el channeling and RICCE type experiments [8] might be done in order to find out if the classical Rotating Wave model is correct.Refer to Figure 16 below. While comparing the spin and charge of an electron with its anti-particle the positron, I noticed that the quarks were of a different size as well as charge. The electron positron pair annilihate each other while the proton is formed of two up quarks plus one down quark. It is speculation only, but perhaps the next higher complex form of spin is the figure eight. The electromagnetic wave would be able to wind in a figure eight fashion because there are two maximum nodes with half spin for both the quarks and the electron (as shown in Figure 4).

Figure 16: The Rotating EM Waves are shown winding through the proton and the neutron in figure eight fashion, possibly manifesting the strong force.
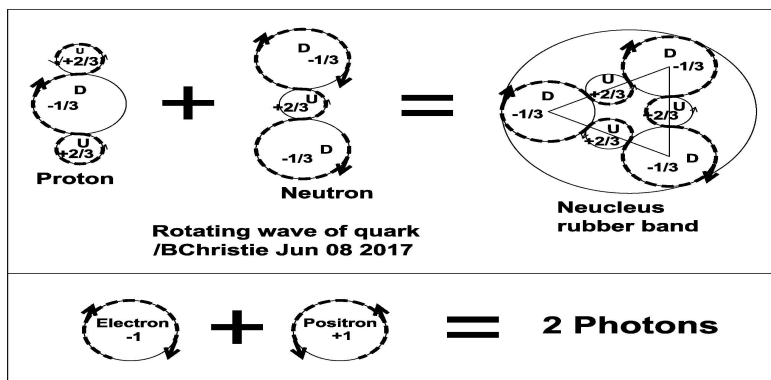
Regardless of whether the Rotating Wave model is absolutely correct or not, more study might be done in that direction to advance theory and also see what technological applications might be developed. Finally, the Rotating Wave theory might not have be so radical if the de Broglie wave nature of matter had been established prior to the famous Michelson-Morley experiment. The RW model requires that all matter is being transmitted through space, after all it is energy. That would have avoided any discussion about aether drag. Aether really is just the homogeneous electromagnetic field of empty space. It allows the transmission of light, matter, and other forms of radiation. It appears to extend through the universe as we know it, but perhaps there are more substrata fields which are so far undetected and extend much further.

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