The High Q Resonance Characteristics of the CEWL Electron Model May Predict Directionality of Virtual Photons and Neutrinos

Donald Bowen
Quark377@aol.com
PO Box 1383, Concord, MA 01742, USA

Abstract

The High Q resonance characteristics of the CEWL Electron Model [1] [2], suggests that virtual photons and Neutrinos will form in 2 specific directions relative to a Lepton (see below). The Charged Electromagnetic Wave Loop (CEWL) model is the only known model of the Electron which explains pair production and also exactly matches all known values of the electron, including energy, de Broglie frequency, charge, mass, and generates the correct magnetic moment without resorting to superluminal velocities. The model also explains the previous mystery of why the Electron's g-factor is 2 rather than one (½ spin) [2].

Two new insights stemming from the CEWL model are explored in this paper:

One new insight is that since the model represents an electromagnetic oscillation with zero internal resistance, the capacitive and inductive reactance must match each other, and also match the reactive impedance of free space, leading to unique values for the Electron's capacitance and inductance in free space, i.e. $3.41912126348 \times 10^{-24}$ Farads and 4.85262×10^{-19} Henries. (An LC resonant loop using these two values matches the Electron's de Broglie frequency as well as the CEWL rotational frequency).

The second new insight (which might be testable) predicts the probable directionality of virtual photons and Neutrinos. This stems from the fact that the loop characteristics of the CEWL Model, in which the loop circumference exactly matches the wavelength of a (virtual) photon equal to the Electron's energy, is analogous to the characteristics of a high Q (resonant) loop antennae in which the circumference must also exactly match the wavelength in order to achieve high Q resonance, which leads to a prediction that the virtual photons of leptons will be generated in the same directions as high Q loop antennas i.e. in the North and South magnetic directions generated by the CEWL loop (loop antennas without these high Q resonance characteristics have very different radiation/absorption patterns). This new insight about probable directionality might help guide future research into how and where Neutrinos and virtual photons form near the Electron, Muon, and Tau Leptons.

Keywords

Charged Electromagnetic Wave Loop, CEWL Electron Model, Pair Production, g-factor of 2, Electron Capacitance, Inductance, Reactance, Impedance of Free Space, General Relativity Mass, Magnetic Moment, Spin, Lepton, Muon, Tau, Neutrino, Loop Antennae, High Q Resonance.

Introduction:

Many interesting models of the electron have been attempted since the early 20th century, but none has given a full picture or accurately generated all electron values. Some for example use point like charges which have infinite energy issues, and others (Parson's, Lorentz's, Uhlenbecks & Goudsmitts', and Mac Gregor's for example [1] [2]) have unvarying charge shapes that don't fully explain how the charge would produce magnetism (without any apparent δCoulomb/δt). Some invoke superluminal velocities (that violate Einstein's relativity) to produce the necessary magnetic moment. Here's a brief history of the famous Lorentz model and how it was later used in a superluminal model. Lorentz was one of the first to equate energy with mass (Einstein later simplified his calculations into the more famous $\boldsymbol{E = mc^2}$). Lorentz used that mass-energy equivalence to develop a spherical electron model, but it relied only on static "capacitive" energy which produced an electron radius that was therefore much too small. The only reason he didn't originally include spin (magnetic energy), is that "spin" had not yet been discovered and accepted until Uhlenbeck and Goudsmit published their famous spin paper. Their famous spin paper unfortunately relied on the then prevalent spherical Lorentz electron model (with a radius that was too small), and it therefore failed to generate the correct magnetic moment without resorting to superluminal velocities of the charge on the surface of their sphere [2]. In their defense, the Lorentz "static" Electron model had gained persistent acceptance in the "current" theories of the time.

The Charged Electromagnetic Wave Loop (CEWL) model solves both the magnetism and superluminal problems by using a charged electromagnetic wave (similar in electromagnetic nature to the photon that produces an electron-positron pair) whereby the sinusoidally varying charge rotates in a loop at a diameter of **$7.72318536 \times 10^{-13}$m,** at the speed of light (the circumference of the loop happens to exactly match the wavelength of a photon of the same energy as an Electron). In addition to exactly generating the correct magnetic moment without resorting to superluminal velocities, the CEWL model also exactly matches all other known values of the electron, including energy, de Broglie frequency, charge, mass, and also explains the mystery of why the Electron's bare g-factor is 2 rather than one (½ spin).

This paper starts with a description of how the CEWL model explains electron-positron pair production from high energy photons (sections 1 & 2), and then goes on to show a new insight about how to estimate the resonant capacitance of the electron and then uses that value to estimate the rough width of the charged loop (sections 3 & 4) and then goes on to discuss a variety of characteristics of the CEWL model including the second new insight about the probable directionality of virtual photons and Neutrinos (section 5). Section 6 is a brief conclusion.

Note: Reliable references are included for all subject "matter", (pun) but many common concepts can be quickly googled if those expensive references are not available. The "Waveplate" Wiki article for example has excellent diagrams showing how a photon's E potential (due to charge separation) rotates as it travels through space, and also shows how a photon's cross-section can be transformed from any form of an elliptical cross-section to any other form of an elliptical cross-section. Likewise, the "Stress-energy tensor" wiki article is a quick way to find Einstein's General Relativity Tensor equation which equates the space time distortions of electromagnetic energies to the space time distortions of mass.

1. The CEWL Electron Model:

The CEWL model [1][2], starts with the premise that since electron-positron pairs form from purely electromagnetic photons (of energy >1.022 Mev [3]), and since the resulting pairs of an electron and a positron (of energy 0.511 Mev each) have the same electromagnetic nature (as witnessed by their de Broglie wavelengths/frequencies), then they must have the same electromagnetic wave nature as the photons from which they originated, except for one detail; The charge and magnetic field lines of electrons and positrons can close back on themselves (trapping a specific amount of magnetic moment), which allows matter to exist at rest, whereas the magnetic field lines and charge separations within photons do not close back on themselves (and hence the magnetic and electric fields of photons chase each other forward at the highest speed possible, i.e. the speed of light).

Note: Maxwell was the first to be able to calculate the speed of light "c" with his equation $c^2 = \frac{1}{\epsilon_0 \mu_0}$, where ϵ_0 and μ_0 are the electric and magnetic permittivity constants of free space. Where does the mass come from? One can combine Maxwell's equation above with Einstein's $E = mc^2$ to get $m = E\epsilon_0\mu_0$ where mass can be equated to the purely electromagnetic terms on the right. The electromagnetic energy tensor equations of general relativity theory are also shown to contribute to space time distortion exactly the same as mass does (see below).

2. From Photon to Fermion

2.1. From Photon:

Modern modelling of photons generally focuses on the "potential" E and B fields (Electric and Magnetic fields), but it is impossible to generate an E potential without a charge separation, which is why Maxwell himself first envisioned a photon as composed of a charge separation spiralling through space at the speed of light [4] (the electric permittivity constant of free space ϵ_0 describes the capacitance like ability to induce a charge separation in free space). Fig 1 "before" is a representation of how Maxwell envisioned the charge separation of a photon spiralling through space (the spiral can be either right hand or left polarity). Note: The cross section perpendicular to the direction of travel is of the general form of an ellipse [5], with "circularly" polarized light having the circular extreme of elliptical cross section, and regular "polarized" photons having the more elongated extreme of elliptical cross section. Circularly polarized photons can be changed into "regular" elliptically polarized photons and, vice versa, "regular" photons can be changed to circularly polarized by sending the photon through non-linear optics such as "quarter wave plates" [6].

2.2. To Fermion

Matter in the form of an Electron Positron pair forms when a gamma photon of at least 1.022Mev strikes a plate of aluminum (or otherwise gets accelerated sufficiently by some other interaction with matter/energy), The CEWL model for electron positron pair production is shown below by the transition from a high energy photon in Fig 1 "before" to two charged loops in Fig 2 "after". The positively charged loop is a Positron and the negatively charged loop is an Electron. Due to the original spin rotation of each at formation, the magnetic fields are opposed at the moment of formation, allowing the electron and positron to separate despite their enormous electrostatic attraction at that scale. The original paper [1] contains the math to show that the opposing magnetic field at initial formation of an electron-positron pair would exceed the electrostatic attraction between them.

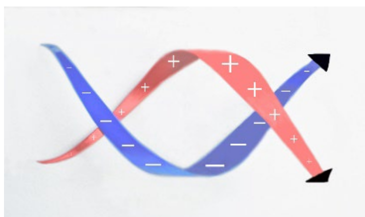

Fig 1."Before" Photon λ=12.13 x 10^{-13}m

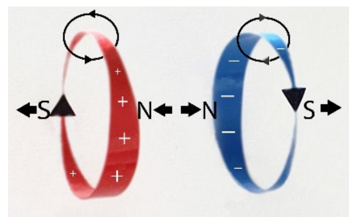

Fig 2. "After" Loop Diam = 7.723 x 10^{-13}m

Fig 1 "Before" and Fig 2 "After" show the transition from a 1.022 Mev photon to positive and negative loops, of 0.511Mev each, that are now closed loops and repelling away from each other magnetically. The positive loop is a positron, and the negative loop is an electron.

Note a) The charge distribution shown for a photon in Fig 1 should be viewed as a representation of how a varying charge separation within a photon induces a sinusoidally varying "potential" as the photon passes a given point in our own rest frame (and is not necessarily an exact representation of the charge distribution in its own rest frame).

Note b) "Matter" only forms when the charge fields and magnetic fields can close back on themselves (trapping a specific magnetic moment), which allows "Matter" to exist at rest in a given rest frame (a Photon has no "rest" mass, i.e. only "moving" mass in the form of momentum, whereas the Mass of Matter can exist at "rest" within a given rest frame).

Note c) In the same way that a photon is "contained" from expanding laterally by its own electric and magnetic fields, the closed loops of Matter somehow also "contain" themselves into loops using their own resonant electromagnetic fields. A Tokomak torus, although not necessarily resonant, might give insight about the mechanisms by which a Lepton's own (resonant) magnetic fields confine the circulating charge.

Note d) The charge is shown varying sinusoidally as it progresses around the loop in Fig 2 (and 3) due both to resonance requirements and also because it produces the necessary δCoulomb/δt required to produce magnetism).

Note e) The width "W" of the loops in Fig. 2 and 3 are exaggerated to show how the charge inside an Electron is most likely sinusoidally distributed around the loop but the capacitance calculations (below) indicate a narrower width that is approximately 0.53% of the loop diameter.

Note f) Feynman describes how a photon's momentum energy can be transferred into circular electromagnetic energy that is transverse to the direction of photon travel [5].

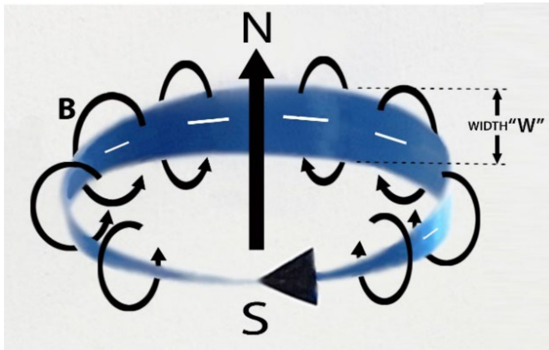

Fig. 3. The Magnetic "B" field lines which are due to the rotation of the charge inside an electron/positron have no component in the direction of the charge rotation and hence can add no rotational energy / mass. An electron or positron has zero internal resistance (or it would lose energy and decay) therefore ½ the mass is "electric" and ½ is "magnetic" [1]. Since only half the mass rotates, it is a ½ spin particle with a "bare" (undressed) gyromagnetic g-factor of 2 rather than 1.

2.3. Electromagnetic Energy and Mass

MIT Physics professors' emeriti Slater & Frank have used solutions to Maxwell's Electromagnetic equations for the general case of plane wave propagation of photons to show that the total Electro-Magnetic Energy Density in free space, i.e. with no resistive component is:

Total Electro-Magnetic Energy Density = $U = \frac{1}{2}\left(\epsilon_0 E^2 + \frac{1}{\mu_0} B^2\right)$[7] (1)

As further explained by Slater & Frank, the average magnetic component (the B half of this equation) is only greater than the average Electric component when a resistive component is present [7]. In any given rest frame, photons and electrons do not lose energy, i.e. they have no resistive component, so therefore if the electrons and positrons maintain the same electromagnetic wave nature as the photons from which they originated, then the average electric energy must exactly equal the average magnetic energy in both cases.

Using E $= mc^2$, one can divide the above Energy density equation (1) by c^2 to get Mass density:

Mass density = $\frac{U}{c^2} == \frac{1}{2c^2}(\epsilon_0 E^2 + \frac{1}{\mu_0} B^2)$ (2)

Note: Using Maxwell's $c^2 = \frac{1}{\epsilon_0 \mu_0}$ to get rid of μ_0, it is easy to show that this is exactly the same equation as the Electromagnetic Stress-Energy tensor form for mass used in Einstein's General Relativity [8]

Electromagnetic Tensor equation for Mass: $T = \frac{\epsilon_0}{2}\left(\frac{E^2}{c^2} + B^2\right)$ [8] (3)

Since only half the electromagnetic mass contributes to L angular momentum, then we can simply substitute L/2 for L into Feynman's electron gyromagnetic equation:

Feynman: Gyromagnetic ratio= $\frac{\mu}{L} = g_e * (\frac{q}{2m_e})$ [9], Where $g_e = 1$ (4)

With L/2 instead of L:

Gyromagnetic ratio= $\frac{\mu}{L/2} = 2 * (\frac{q}{2m_e})$ (5)

Therefore, with only half the internal mass rotating, the electron's g-factor g_e is 2 instead of one (½ spin).

2.4. No other Diameter model can match reality without violating either Einstein's General relativity or Maxwell's equations.

The various reasons why the CEWL model leads to a unique solution for the Electron diameter ($7.72318536 \times 10^{-13}$m) can be found in a previous CEWL paper [2], but in general the main reason the CEWL Diameter is unique is as follows:

Due to the energy constraints of Einstein's Relativity, all velocities must be at or under the speed of light, therefore:

A) The charge must rotate at or **<u>inside</u>** the CEWL diameter in order to produce the correct de Broglie frequency/energy.

B) In order to generate the correct magnetic moment, the charge must rotate at or **<u>outside</u>** the CEWL diameter

The only simultaneous solution to both conditions is that the charge rotates at the speed of light at the CEWL diameter.

3. Calculating the Capacitance and Inductance of the Electron

When designing efficient power supplies or antennas, capacitors and/or inductors are generally added to the circuits to increase power factor and to match impedances for maximum energy transfer. The graph below shows a typical reactance graph showing the "real" resistance on the X axis and the positive and negative "impedances" due to the net capacitance and inductance of the circuit on the Y axis. Man-made Inductors have real internal resistance which needs to be allowed for when calculating the best capacitor / inductor to add to the circuit.

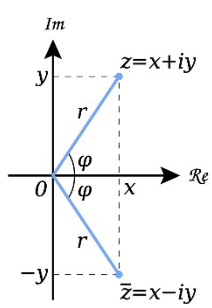

Fig. 4

Electrons and positrons however have zero "real" internal resistance (or they would decay) which simplifies the analysis to the case of simply matching the positive and negative impedances on the Y axis, i.e. the capacitance reactance must match the inductance reactance, i.e. both will match the reactive impedance of free space $\mathbf{X}_0$.

The reactive Impedance of Free Space is:
$\mathbf{X}_0$ = 376.730313668 (57) Ω [10]

The Reactive Impedance X_L of an inductor L, and impedance X_C of a capacitor C depends on Frequency in the following way:

$X_L = \omega L$, and $X_C = 1/(\omega C)$ [11] (6)

Where $\omega = 2\pi F_{Hz}$

The CEWL rotational frequency (which also matches the de Broglie frequency of an Electron) is:
$F_{CEWL} = 1.235590085 \times 10^{20}$ Hz, Therefore:

ω_{CEWL} in this case is $= 2\pi F_{CEWL} = 7.76344147 \times 10^{20}$

Solving for L and C of the Electron:

L_{CEWL} (Inductance of the Electron) $= \mathbf{X}_0/\omega = 4.85262 \times 10^{-19}$ Henries (7)

C_{CEWL} (Capacitance of Electron) $= 1/(\omega\,\mathbf{X}_0) = 3.41912126348 \times 10^{-24}$ Farads (8)

The above C and L reactance calculations are frequency dependent (but silent on resonance) We can double check these values with an additional equation for **resonance** of a capacitor-inductor (CL) loop:

CL Loop Resonant $F_{Hz} = \mathbf{1} / \left(\mathbf{2\pi\sqrt{CL}}\right) = 1.235590085 \times 10^{20}$ Hz (9)
(Matches the Electron's de Broglie frequency and the CEWL rotational frequency).

4. CEWL Electron Charge Width Calculations:

The Width of the circulating charge in the CEWL Model (see fig. 3) can be estimated by calculating the area of the charged loop required to match the above Electron capacitance.

The capacitance of an isolated object is defined as Q/V, where Q is the total charge on the object when it is at V volt potential relative to infinity. In the case of a conductive sphere, only the exterior surface area affects capacitance due to the Faraday Cage effect. In the case of a sheet of thin conductive material however, the area of both sides of the sheet would be used to calculate Capacitance. The capacitance of shapes other than spheres is generally approximated by applying a "shape factor" to the capacitance of a sphere with equivalent area [12].
Chow and Yovanovich have shown that an elongated needle-like spheroid or a long thin strip of conducting material will both have slightly more capacitance than a sphere of equivalent area and hence require an additional "Shape Factor" correction of approximately 1.2 [12]

Capacitance of a conductive Sphere in free space is well known to be $4\pi\epsilon_0 r$

Area of Sphere (with the same Capacitance as C_{CEWL}) $= 1.186647377 \times 10^{-26}$ m^2

The area of both sides of the sinusoidally rotating charge in the CELW model is

$= 2\pi D_{CEWL}$ x $(W_{max}/2)$ (see fig. 3)

Solving for W_{max} = (Area Sphere/1.2) / (πD_{CEWL})

$= 4.0757 \times 10^{-15}$ m (or Approx **0.53% of the Diameter D_{CEWL}**) (10)

Note: The Width "W" should not be confused with the size of the electron i.e. the electron is the entire electromagnetic loop, whereby the sinusoidally varying electric charge component rotates at the CEWL diameter, but the magnetic component extends further, leading to interactions which can have both a particle nature and/or a wave nature (the wave nature would interact with itself going through a double slit for example).

5. Discussions:

5.1. Compatibility with Quantum Mechanics

This Electron model does not contradict the amazing equations of quantum mechanics. The CEWL model exactly matches all known values of the electron (without resorting to superluminal velocities) and hence any quantum or other model of Electron behaviour, which has already been shown to be compatible with all known values of the electron, must therefore also be compatible with a model which exactly replicates all those same known values.

5.2. No Contradiction with Stern Gerlach Experiment

The Stern Gerlach experiment [13] does not contradict the CEWL model, i.e. it is solely an atomic ecosystem phenomenon. The outermost, lone, electron of the Silver atoms used in the experiment is usually in the lowest energy state, whereby that electron's internal magnetic moment aligns with the magnetic moment created by the same electron as it orbits the nuclei (the Down state), but after being heated in the oven (that sends a stream of silver atoms through a magnetic separator), many of the atoms now have their outermost electron in the next higher energy state i.e. the "Up" state (the only other stable state), which means it's internal magnetic alignment is opposite the direction of the orbital magnetic field. The Stern Gerlach magnetic separator then deflects the atoms which have the two magnetic fields aligned more than the atoms in which the alignments are in contradiction. Note: in a previous paper I suggested that the up or down alignment of the outmost electron will either add or subtracted to the nuclei magnetic moment (which is a phenomenon which does happen), but as Quantum Physics Professor J. Shertzer PHD pointed out to me, the nuclei magnetic moment is not strong enough to be detected by the Stern Gerlach experiment. (my own Muon loop model [1] for neutrons and protons predicts an insufficient magnetic moment as well, so that should also have alerted me that I was using the wrong ecosystem, so I apologize for the misdirection). The conclusion is the same however, i.e. the Stern Gerlach experimental results are an atomic ecosystem phenomenon, not a phenomenon of an isolated electron itself, so there is no contradiction with the CEWL model.

5.3. Magnetic moments:

An interesting side note about the internal magnetic moment of an electron vs the (separate) magnetic moment due to its atomic orbit, is that the first orbit of an electron as it orbits around a hydrogen nucleus will generate a magnetic moment that is exactly the same as the magnetic moment of the Electron itself. Then in the second allowable hydrogen orbit (see radius in allowed Rydberg orbits [14]), the magnetic moment of the orbit around the nucleus is now exactly twice the magnetic moment of the electron itself. This suggests that one interpretation of stable orbits is that only the atomic orbits with magnetic moments that are exact multiples of the electron itself will be stable. Larmor type "wobble" oscillations are proportional to the magnetic moment which means that, regardless of the external magnetic field, the Larmor "wobble" frequency of the atomic orbits [15] and the Larmor "wobble" frequency of the electron itself [15] will resonate together only at orbits which generate exact multiples of the electron's magnetic moment (and hence will only produce stable orbits when the orbit resonates with the electron itself). Huygens system of dual pendulum clocks is an example of how resonance between two nearby systems can lead to stable synchrony between the two systems. When two of his pendulum clocks were placed close to each other on a shelf, they interacted through vibrations to produce a combined stable state whereby the two pendulums swung in exact synchrony (180 degrees out of phase with each other)[17]. This was the 17th century's version of spooky action at a distance. It should be noted that the effect only lasted while the clocks were close to each other. The important part of this analogy is that much like Huygens pendulums, atomic orbital Larmor "wobble" frequencies that are different from the electrons wobble frequency, will get either retarded or advanced until they are in stable synchrony with the wobble frequency of the Electron itself (i.e. any non-resonant orbit will decay to a harmonic resonant orbit).

5.4. Resonance:

Resonance is the main unifying theme in this paper since without it an Electron would surely lose energy and decay. Any suggested form of an Electron/Lepton that doesn't include resonance type reabsorption of virtual photons (with zero energy loss), would lead to energy loss from the Lepton in the form of photons. Luckily the circular loop of the CEWL electron model happens to look extremely resonant, i.e. it has the exact same form as a high Q resonant inductive loop antenna [11] in that the circumference around such a resonant loop antenna must match the wavelength of the received/transmitted electromagnetic photons in order to prevent energy loss. Likewise, the circumference of the CEWL model exactly matches the wavelength of a photon of energy equal to that of an electron. Antenna theory subdivides electromagnetic interactions into 3 regions [11]: The "Near Field" where electromagnetic oscillations are induced near the antenna, but the electromagnetic interaction is strictly "reactive" i.e. energy in this near field leads to no net loss of energy from the antenna because all "virtual photon" energy is reabsorbed by the antenna, 2) The "Fresnel" intermediate region and 3) The "Far Field" where photons fully form and propagate away (leading to net energy loss from the antenna). An interesting "antennae" observation is that Feynman (one of the 4 QED originators) happened to be a radio antennae expert and had an intuitive sense of how all the radio waves reflecting off surrounding surfaces, back towards the antennae receiver needed to be summed both for intensity and phase, whereas Schwinger and Tomonaga (also QED originators) were antennae experts of the smaller microwave type (radar microwave cavity resonance experts). The interesting part is that Tomonaga and Schwinger both used very similar extremely complex purely mathematical models of QED self-interactions, whereas Feynman used his more visually intuitive Feynman diagram approach. Did their different backgrounds in antennae "fields" (pun) shape their approaches to QED? I suspect so but that will take some historical research "far afield" from the main topics of this paper.

The ability of electrons, positrons and other forms of matter to induce oscillations in the vacuum of free space is what distinguishes modern quantum physics from the previous more "classical" interpretations of physics, i.e. interactions of particles with a pure vacuum cannot be calculated as simply "one-way" interactions, but rather the energy fluctuations of all the virtual photons (and virtual particles) induced near matter must also be calculated, both for their effect back on the original particle as well as for their effect on nearby photons and matter [9][16].

5.5. Q factor of Resonance:

Antenna Theory uses a "Q" resonance factor [11] to characterize the efficiency of an antenna. Since an Electron does not lose energy (or it would decay), therefore the "Q" resonance of an Electron is effectively near infinite. High "Q" loop antennas are ones where the circumference of the loop exactly matches the wavelength of the transmitted or absorbed photon [11]. Loop antennas in which the circumference does Not match the absorbed/transmitted wavelength generally transmit/absorb best in the same plane as the loop (90 degrees away from the rotational axis of the loop) [11]. At perfect "Q" resonance however, when the loop circumference exactly matches the wavelength, the photons are best transmitted and absorbed in a completely different direction, i.e. when their travel direction lines up directly with the rotational axis of the loop i.e. only in the North and South magnetic directions generated by the loop. [11]. To visualize this, refer to Fig. 1 and Fig 2, where either the electron or the positron in Fig. 2 will induce circular "virtual" proto photons like what is shown in Fig. 1, (propagating away from both sides of the electron or positron loop), except due in part to the extremely high Q of the electron or positron loop, the virtual photons are immediately reabsorbed. Note: Reference [11] "Antenna Theory Analysis And Design" By Balanis has excellent visual diagrams showing the 90 degree difference in directionality between High Q resonant loop antennas (where the wavelength exactly matches the circumference) vs loop antennas without these characteristics.

5.6. CEWL Model is compatible with Other Leptons:

Other Leptons match the CEWL model. The Muon and Tau forms of the electron have the same CEWL Model characteristics as the electron, except that the charge would rotate at a smaller diameter (the Muon rotates at a diameter that is about 207 times smaller than the electron, and the Tau rotates at a diameter about 3,477 times smaller than the Electron). The magnetic moment of a rotating charge is proportional to amperage multiplied by the area enclosed. For a constant speed of light velocity, as the diameter decreases, the amperage increases in inverse proportion to the diameter, but the area enclosed falls off faster due to being proportional to the diameter squared, hence the CEWL model predicts that the magnetic moment for each will be proportional to the diameter of each (which matches reality). One of the greatest mysteries of physics is why the Electron, Muon, and Tau (as well as the positively charged antimatter forms of these Leptons) only form stable matter at the mass of the electron and again at roughly 207 times that mass and again at roughly 3,477 times the Electron mass. If the

CEWL model is correct, then that question might also be re-stated as: Why does the high "Q" resonance only occur at precisely the CEWL diameter and again at ~(1/207) of that diameter (the Muon diameter) and again at ~(1/3,477) of the CEWL diameter (the Tau diameter).

5.7. Thoughts on Neutrinos:

Neutrinos come in 3 flavours, i.e. the Electron, Muon, and Tau, so they most likely have the same diameter as the Electron, Muon, and Tau respectively (but with a much smaller charge). If the rotating charge in Fig. 3 above induces a charge separation loop (offset above and below the Fig. 3 loop), that follows the CEWL charge around the loop, at the same diameter as the CEWL model, but with a much smaller Net charge (that is opposite the CEWL charge), then the resulting oppositely aligned magnetic field of the lesser-charged loop might add a stabilizing effect on the CEWL loop by "guiding" the CEWL magnetic fields back towards the purely reactive "Near Field" thereby preventing any possibility of photon or energy escape. This is just a preliminary guess about the nature of Neutrinos, but whatever the actual form of Neutrinos, it is highly likely to be a necessary part of achieving the near perfect "Q" required for Lepton stability.

6. Conclusions:

The Charged Electromagnetic Wave Loop (CEWL) model of the Electron has been validated by the fact that it is the only known model that explains pair-production and exactly matches all known values of the electron, including energy, de Broglie frequency, charge, mass, and also generates the correct magnetic moment without resorting to superluminal velocities. The model also explains why Leptons have both a particle and wave nature and also explains the previous mystery of why the Electron's g-factor is 2 rather than one (½ spin). The new insight that the capacitance and inductance can be uniquely calculated and used to estimate the width "W" of the CEWL loop relative to the diameter (0.53%) is another validation of the model since it produces a realistic width that doesn't conflict with the anomalous magnetic moment or any other part of the model, i.e. the model is internally consistent.

A second recent insight stemming from the model provides a prediction about virtual photon directionality (and possibly Neutrino directionality). If one combines: A) How the CEWL Model's loop circumference exactly matches the wavelength of a virtual photon of energy and wavelength equal to that of an Electron, with B) How high Q resonant loop antennas also share the same characteristic, i.e. the circumference must exactly match the wavelength in order to achieve high Q resonance, and C) How high Q resonant loop antennae theory shows that virtual photons will be generated in the North and South magnetic directions generated by the CEWL loop (loop antennas without these high Q resonance characteristics have very different radiation/absorption patterns), all this suggests a possible new research "direction" into how and where virtual photons (and Neutrinos) form near the Electron, Muon and Tau Leptons.

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A quick personal and historical note: While Dr Mulkern and I were undergraduates at Cornell, I happened to notice an upperclassman start a tall beer bottle wobbling on its base (without falling over for many revolutions!). Being a highly curious type I experimented with saucer wobbling and eventually worked up to bottles. The trick is to start with a very slight tilt and then give the base a bit of tilting rotation. Many years later I discovered that while Feynman and Dyson (2 of the QED 4) were at Cornell working under Hans Bethe, Feynman also experimented with wobbling saucers/plates and I realized that That is probably why I saw some physics student carrying on the tradition! Feynman was in a depressed state when he arrived in Ithaca, but after consulting with his sister and a few others, (who urged him to ignore the expectations of others and just work on whatever he himself enjoyed wondering about), he then happened to notice the wobble ratio of a spinning plate, which started him thinking in a new way about Electron orbits and he finally became fully engaged in physics again and went on to later share a Nobel prize (with Schwinger and Tomonaga) for his QED contributions (Dyson was left out unfortunately because they only allow 3 to share a Noble prize).

There are however two conflicting historical accounts of how Feynman started his wobbling experiments at Cornell. One history is given by Caltech physics student Steve Watkins who chauffeured the knee injured Feynman for several weeks after Feynman left Cornell. Watkins recounts that the version he was given (directly from Feynman) was that a dish fell in the Cornell cafeteria, and Feynman saw the plate wobble and spin for an extended period and noticed that the ratio of wobble to spin rotation was 2 to 1. The more common story however, that Feynman himself later gives [18], is that he witnessed students throwing plates in the cafeteria and noticed that the Red Cornell logo rotated twice as fast as the wobble rate. Having done the saucer/ bottle wobble myself, I can assure you that the wobble to rotation ratio of this more prevalent history is wrong, i.e. the ratio has been inverted for some reason. The question then becomes did Feynman, the known practical joker, intentionally give us the ratio inverted to make sure we go out and verify for ourselves instead of just blindly accepting what we're told? That seems highly likely if you ask me.

When Feynman left Cornell for the West coast one summer, he invited his buddy Dyson to go along on for the road trip. This was the opportunity that allowed Dyson to pick Feynman's brains about QED physics and eventually figure out the equivalence between Feynman's intuitive visual approach and Schwinger's (and Tomonaga's) extremely complex purely mathematical approach (up til then not even Feynman or Schwinger, had been able to figure out how the other was getting the exact same correct answers). And they had a lot of fun on the road trip too apparently!

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