The Universal Fundamental Charge (e) and Spin $(h/4\pi)$

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It is a great mystery that the electron, muon and proton all have exactly the same fundamental charge (e) of ($1.602176487 \cdot 10^{-19}$ Ampere seconds) and spin angular momentum of exactly $h/4\pi = 5.272858141258 \cdot 10^{-35} m^2 \cdot kg \cdot s^{-1}$ (Joule-seconds) when, at the same time, each has it's own unique mass (in kilograms) and magnetic moment (in Ampere meter squared).

The Final Particle Physics

The answers to the previously intractable mysteries of charge and spin can be now given by a mathematical analysis of newly discovered particle geometric structures.

The whole process begins by deducing a structure for the photon (energy) and then simply combining the photon in *all* possible ways. This method, for the first time, automatically and precisely gives the structures for the electron, positron and two types of neutrinos. Only these three pair of lepton structures could be formed, and it was then possible to deduce what lepton particle types each structure mimicked.

This result is the best possible outcome, because one does not have to invent the different lepton structures, they are given to us automatically by simple exhausting all possible ways for the photon (energy) to construct basic particles.

Experimentally, these exclusive basic particles (electrons, neutrinos and photons) are known to be the final decay particles for all unstable composite particles (even the stable proton was later proved to be a stable combination of these). For proof that the electrons and neutrinos are building blocks for a composite particle, see Figure 1 for a typical decay (branching) in the negative cascade Ξ^- hyperon.

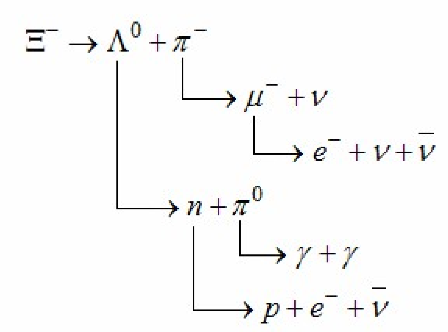

Figure 1. The negative cascade Ξ^- hyperon shows a typical decay into electrons (e) neutrinos (ν) gammas (γ) and proton (p) as basic building blocks.

Thus the deduced structure for the photon (energy) correctly indicates that all composite particles are composed of just electrons and neutrinos.

It is known, experimentally, that the photo-production of the electron positron pair occurs at an exact exclusive energy. The photo-production of a particle pair will occur at the exclusive energy where the photon changes from a non-interacting boson to an interacting fermion. The exclusive energy obtains as both of the photon's electric and the magnetic *independent* lateral amplitudes instantaneously develop equal amplitudes at the required rationalized Compton $(\lambda / 2\pi)$. These instantaneously equal lengths allow joining of vectors into closed spinning particle cubes. This mechanism assures the electron and positron will form in absolutely perfect closed particles, of exactly the same size, here or in the far reaches of the universe, in fact, I find that all precision in nature scales from the exact size of the electron. The mystery of how the newly formed electron and positron can separate, against the enormous attraction of their opposite charges can be shown to be the superior near field force of their opposing magnetic moments. Were this not so, all matter of the universe would immediately be annihilated as it was trying to form in pairs.

Photoproduction of Electron and positron

Thus the building blocks of matter are shown as spinning electromagnetic cube structures formed by the photon's orthogonal Poynting vector (S) composed of the electric field strength (E = volt per meter) and the magnetic field strength (H = Ampere per meter) orthogonal vector axial and lateral amplitudes. To determine the perfect cube edge length, the calculus of related rates shows that a spinning cube of electromagnetic energy has an edge length of exactly the required rationalized $(\lambda / 2\pi)$ wavelength. Figure 2 shows the photon structure generated electron and positron.

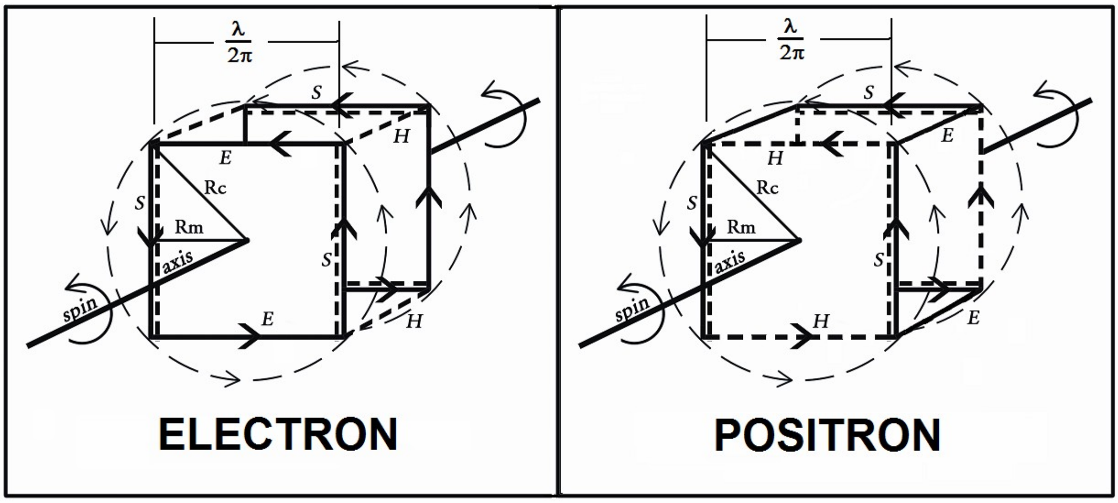

Figure 2. The electron and the positron structures both have a cube edge length of exactly the electron rationalized Compton $(\lambda_e / 2\pi) = 3.8615926459 \cdot 10^{-13} m$ **.**

It will now be instructive to refer to Figure 2 and follow the analysis showing the process for the deriving of particle characteristics. By inspection one can see the mass radius (Rm) is $(\lambda_e / 4\pi)$ and the charge radius (Rc) is $\sqrt{2}\,(\lambda_e / 4\pi)$.

In Figure 2, both the electron and positron particles are spinning at exactly (c) because momentum directions of the photon's Poynting vectors, in front and back cube faces, are thrusting in the same direction. The electron particle spin results from the linear momentum of the photons being conserved in the spin angular momentum of these unique photo-production electron and positron structures. The vector types give us the correct conjugate structures, where the electron has an E vector the positron has an H vector, and the reverse. This would occur during electron-positron pair photo-production as the S photon vector splits apart. Annihilation into photons again will occur when the E and H vectors line up and combine to reconstitute the original photons. These vector structures thus explain the different annihilation lifetimes between para-positronium and ortho-positronium as the different time the E and H vectors would take to align spins properly for reforming photons. Notice also that the structures show the nature of *anti-matter*. Anti-matter is thus *conjugate* matter. In both leptons, the mass radius centroid is at the mid point of an edge, making the cube corners (vector junctions) have a velocity of $(\sqrt{2}\,c)$. The calculus of related rates, applied to photon's sine wave structure, indicates there are four points on the sine wave at $(\lambda/2\pi)$ amplitude where the rate of change of the photon's vectors is exactly the effective velocity of light $(c = 2.99792458 \cdot 10^{8}\, m \cdot s^{-1})$. The photon's sinusoidal vector lengths are shown to change at a rate that varies between zero, on the sine waveform top dead center, to a maximum velocity of $(\sqrt{2}\,c)$ as the sine waveform passes through zero.

$\lambda = 2.4263102175 \times 10^{-12}\,\mathrm{m}$ Compton wavelength	$\lambda 1 := 1 \cdot \mathrm{m}$ Fictional particle wavelength
$Js := \frac{(h \cdot c \cdot \alpha)}{\lambda}$ $Js = 5.97441869080294 \times 10^{-16}\,\mathrm{kg\,m^2\,s^{-2}}$	$Js := \frac{(h \cdot c \cdot \alpha)}{\lambda 1}$ $Js = 1.44957931131181 \times 10^{-27}\,\mathrm{kg\,m^2\,s^{-2}}$
$Vol := \frac{\lambda^3}{16 \cdot \pi^2}$ $Vol = 9.04522247606751 \times 10^{-38}\,\mathrm{m^3}$	$Vol := \frac{\lambda 1^3}{16 \cdot \pi^2}$ $Vol = 6.33257397764611 \times 10^{-3}\,\mathrm{m^3}$
$Pe := \frac{(2 \cdot Js \cdot c)}{Vol}$ $Pe = 3.9602910136836 \times 10^{30}\,\mathrm{kg\,s^{-3}}$	$Pe := \frac{(2 \cdot Js \cdot c)}{Vol}$ $Pe = 1.37250017556258 \times 10^{-16}\,\mathrm{kg\,s^{-3}}$
$Z_0 = 376.730313474969\,\mathrm{kg\,m^2\,s^{-3}\,A^{-2}}$ Ohm impedance of space	$E :=$ V/m electric field intensity
$E := \sqrt{Pe \cdot Z_0}$ $E = 3.86259197306307 \times 10^{16}\,\mathrm{kg\,m\,s^{-3}\,A^{-1}}$	$E := \sqrt{Pe \cdot Z_0}$ $E = 2.27390066050419 \times 10^{-7}\,\mathrm{kg\,m\,s^{-3}\,A^{-1}}$
$\varepsilon_0 = 8.854187817 \times 10^{-12}\,\mathrm{s^4\,A^2\,kg^{-1}\,m^{-3}}$ Farad per meter of space	$D :=$ Charge density
$D := \varepsilon_0 \cdot E$ $D = 3.4200114789937 \times 10^{5}\,\mathrm{s\,A\,m^{-2}}$	$D := \varepsilon_0 \cdot E$ $D = 2.01335435253045 \times 10^{-18}\,\mathrm{s\,A\,m^{-2}}$
L2 = Two loop areas, front and back	L2 = Two loop areas, front and back
$L2 := \frac{\lambda^2}{4 \cdot \pi}$ $L2 = 4.68471084627891 \times 10^{-25}\,\mathrm{m^2}$	$L2 := \frac{\lambda 1^2}{4 \cdot \pi}$ $L2 = 0.079577471545948\,\mathrm{m^2}$
$e_m := D \cdot L2$ $e_m = 1.60217648700402 \times 10^{-19}\,\mathrm{s\,A}$	$e_m := D \cdot L2$ $e_m = 1.60217648700402 \times 10^{-19}\,\mathrm{s\,A}$
CODATA $e = 1.602176487 \times 10^{-19}\,\mathrm{s\,A}$ fundamental charge	NOTE: Lambda (λ) can be any length (what-so-ever) and particle cube structures always have exactly a fundamental charge of (e)
ELECTRON STRUCTURE	

Figure 3. Demonstration that the fundamental charge depends only on the geometric cube shape of the basic particles, not on their size.

In Figure 3, the geometry given by the electron's orthogonal photon Poynting vectors gives us a means to now calculate the particle volume (Vol) , hence particle power density (Pe), from which the particle electric field strength (E) and charge density (D) may be derived. With the charge density (D) and the two current loop areas (L2), given by the spinning geometry, will finally obtain the fundamental charge (*e*) value, exactly, regardless of spinning particle size.

The numbers are easily verified, see Figure 3. In the left panel an electron sized structure proves, from it's geometry, to perfectly derive the fundamental charge.

The right side panel of Figure 3 performs the calculation on an enormous one meter cube edge length showing the fundamental charge (e_m) at an enormous one meter wavelength. This demonstrates that any wavelength size will have a cube volume and attending spinning cube current loop areas that maintain the same proper ratios, hence the same fundamental charge. All basic particles, by having the given cube geometric shape, then, will always have the same fundamental charge (e) regardless of size, explaining the universality of (e) equal to ($1.602176487 \cdot 10^{-19}$ Ampere seconds) as was to be proved.

Universal Particle Spin Angular Momentum

As for universal spin, one can now demonstrate that a basic particle's spinning geometry will always result in the spin angular momentum of exactly one half *h* bar $(h/4\pi)$ where *h* is the published value for the Planck constant, in Joule seconds $(h = 6.62606896 \cdot 10^{-34} m^2 \cdot kg \cdot s^{-1})$. Spin of basic particles have been wrongly referred to as simply spin (1/2). This is misleading since the one half *h* bar is simply a momentum *numerical* value, not a mechanical description of spin. Some theorists have even mistakenly said that the electron goes around twice, while the rest of the world goes around once, which is a wrong interpretation of the one half *h* bar momentum value.

With a cube edge length of $(\lambda/2\pi)$ and the spin axis passing through the midpoint of opposite cube faces, the mass centroid is at the mid point of the edges. This gives a mass radius of $(\lambda/4\pi)$. The mass radius of $(\lambda/4\pi)$ obtains the spin angular momentum equal to $(h/4\pi = kg \cdot (\lambda/4\pi) \cdot c)$. One can show that mass (*kg*) is inversely proportional to particle wavelength $(\lambda = h/kg \cdot c)$ thereby making the mass wavelength product $(kg \cdot \lambda/4\pi) = 1.75883615499722 \cdot 10^{-43} kg \cdot m$ an *absolute* constant for any wavelength what-so-ever. Thus, with (*c*) as a constant any mass basic particle proves to have the same spin angular momentum of $(h/4\pi = 5.27285814125887 \cdot 10^{-35} kg \cdot m^2 \cdot s^{-1})$ as was to be proved.

Electron Flux Quantum and Magnetic Moment

The rotating electromagnetic cube corners describe two current loop areas that perfectly derive the Bohr magneton, the electron anomalous magnetic moment and a geometrically derived (and previously unknown) electron single current loop flux quantum $(\alpha\left[h/2e\right])$ where $(\alpha = \mathit{fine\,stucture} = 7.2973525376 \cdot 10^{-3})$ making the flux equal numerically to; $1.5089711255 \cdot 10^{-17} kg \cdot m^2 \cdot s^{-2} \cdot \mathrm{A}^{-1}$ (volt seconds or Weber) for each of the two current loops.

The Bohr magneton magnetic moment $(\mathrm{A} \cdot m^2)$ is derived from the geometry, but unlike spin and charge as was demonstrated above, the fixed Ampere charge current (A) is related to the particle size $\mathrm{A} = (e \cdot c)/\lambda$ as is the current loop areas $(m^2 = \lambda^2/4\pi)$. The electron's Compton wavelength $(\lambda = 2.4263102175 \cdot 10^{-12} m)$ thus obtains the electron's Bohr magneton $(\mu_B = e \cdot c \cdot \lambda/4\pi) = 9.2740091465 \cdot 10^{-24} \mathrm{A} \cdot m^2$ which is exactly equal to the published Bohr magneton value $\mu_B = 9.27400915 \cdot 10^{-24} \mathrm{A} \cdot m^2$.

Anomalous Electron Magnetic Moment

The electron's anomalous magnetic moment is slightly larger than the Bohr magneton by a geometric factor $(1+\alpha_u)$ where $\alpha_u = 2\left[(\sqrt{1+\alpha_e}\,) - 1\right]$ is the geometric radius extension derived from the QED $(\alpha_e = 1.15965218111 \cdot 10^{-3})$ NIST published value. The spinning cube charge radius extension acting from the extension's centroid is then, $(x = \left[\alpha_u(\sqrt{2}\,\lambda / 8\pi)\right] = 1.58279023226618 \cdot 10^{-16} m)$ finally then, this gives a slightly larger current loop area $(m^2 = 2\pi\left[(\sqrt{2}\,\lambda/4\pi) + x\right]^2 = 4.69014348142966 \cdot 10^{-25} m^2)$. The anomalous magnetic moment $(\mu_e = \mathrm{A} \cdot m^2) = 9.28476377143694 \cdot 10^{-24}\,\mathrm{A} \cdot m^2$ derived value is exactly equal to the published value, $(\mu_e = 9.28476377 \cdot 10^{-24}\,\mathrm{A} \cdot m^2)$ by using the previously calculated loop current, as proof of concepts.

Flux Quantum Derived Anomalous Magnetic Moment

The newly discovered electron flux quantum $(\alpha\,[h/2e])$ was a complete surprise to me, but further proves the perfection of the derived basic particle geometry.

VERIFCATION OF ELECTRON CUBE STRUCTURE PREDICTIONS

$\lambda = 2.4263102175 \times 10^{-12}\,\mathrm{m}$ Electron wavelength

$e := 1.602176487 \cdot 10^{-19} \cdot \mathrm{A \cdot s}$ Fundamental charge

$\mathrm{Cir} := \left[\left(\dfrac{\lambda}{4\cdot\pi}\right)\cdot\sqrt{2}\right]\cdot 2\cdot\pi$ Flux ring circumference

$\mathrm{Cir} = 1.71566040805646 \times 10^{-12}\,\mathrm{m}$

$\mathrm{T} := \dfrac{\mathrm{Cir}}{\sqrt{2}\cdot c}$ Time in one ring

$\mathrm{T} = 4.0466498618521 \times 10^{-21}\,\mathrm{s}$

$\mathrm{Amp} := \dfrac{e}{2\cdot \mathrm{T}}$ Current in one ring

$\mathrm{Amp} = 19.7963320486876\,\mathrm{A}$

$\mathrm{RL} := \left(\dfrac{\mathrm{T}}{\lambda\cdot\varepsilon_0}\right) = 188.365156744084\,\mathrm{kg\,m^2\,s^{-3}\,A^{-2}}$

$\mathrm{Zo} := 3.76730313461 \cdot 10^2\,\mathrm{kg\cdot m^2\cdot s^{-3}\cdot A^{-2}}$

$\dfrac{\mathrm{Zo}}{2} = 188.3651567305\,\mathrm{kg\,m^2\,s^{-3}\,A^{-2}}$ Ohm resistance

$\mathrm{Volt1} := \mathrm{RL}\cdot\mathrm{Amp}$ Volt in one ring

$\mathrm{Volt1} = 3.72893918930897 \times 10^3\,\mathrm{kg\,m^2\,s^{-3}\,A^{-1}}$

$\mathrm{Flux} := \mathrm{Volt1}\cdot\mathrm{T}$ Weber, volt seconds

$\mathrm{Flux} = 1.5089711255272 \times 10^{-17}\,\mathrm{kg\,m^2\,s^{-2}\,A^{-1}}$

$\alpha_e := 1.15965218111 \cdot 10^{-3}$ NIST value

$\alpha_\mu := 2\cdot\left[\left(\sqrt{1+\alpha_e}\right) - 1\right]$

$\alpha_\mu = 1.15931617760978 \times 10^{-3}$

$x := \alpha_\mu \cdot \dfrac{(\sqrt{2}\cdot\lambda)}{8\cdot\pi}$ QVP radius extension centroid, meters

$x = 1.58279023226618 \times 10^{-16}\,\mathrm{m}$

$\mathrm{m2} := 2\cdot\pi\cdot\left[\left[\dfrac{(\sqrt{2}\cdot\lambda)}{4\cdot\pi}\right] + x\right]^2$ Two current loop areas

$\mathrm{m2} = 4.69014348142966 \times 10^{-25}\,\mathrm{m^2}$

$\mathrm{Tesla} := \dfrac{2\mathrm{Flux}}{\mathrm{m2}}$ Flux density two current loops

$\mathrm{Tesla} = 6.43464802943398 \times 10^7\,\mathrm{kg\,s^{-2}\,A^{-1}}$

$x\mu_e := \dfrac{(\mathrm{Volt1}\cdot e)}{\mathrm{Tesla}}$ Predicted electron anom. mag. moment

$x\mu_e = 9.28476377143694 \times 10^{-24}\,\mathrm{m^2 A}$

$\mu_e = 9.28476377 \times 10^{-24}\,\mathrm{m^2 A}$ NIST published

$\mathrm{Alpha} := \dfrac{(\mathrm{Flux}\cdot 2\cdot e)}{h}$ Fine structure constant

$\mathrm{Alpha} = 7.29735253730775 \times 10^{-3}$

$\alpha = 7.2973525376 \cdot 10^{-3}$ NIST published

Figure 4. The derivation of electron current ring resistance (RL), electron flux quantum Flux and derivation of the electron's anomalous magnetic moment, from flux density in Tesla, is shown as proof of geometry concepts. The fine structure (Alpha) can also be derived from the flux.

The correctness of this flux quantum in each of two current loops is now proved in calculations of the anomalous magnetic moment. The calculation of the anomalous magnetic moment, based on the two current loop flux is carried out in Figure 4.

In Figure 4, left panel, the flux current ring circumference (Cir) is calculated for obtaining the time (T) around the loop, from the $(\sqrt{2} \cdot c)$ velocity in the loop. The loop current (Amp) is calculated from half the fundamental charge in each loop and the time around the loop (T). The one loop Ohm resistance (RL) from time (T) around one loop is, surprisingly, exactly half of the published Ohm resistance of the space impedance $(Zo = 3.7673525376 \cdot 10^2 kg \cdot m^2 \cdot s^{-3} \cdot \mathrm{A}^{-2}\ Ohm)$. This result suggests that (Zo) is an artifact of the electron used to measure it, not as the vacuum impedance of space itself. The voltage in one loop (Volt1) is shown to be (RL) times the (Amp) in the loop. The one loop (Flux) in Weber (volt-seconds) is then obtained as (Volt1) times the loop time (T).

The right side panel of Figure 4 calculations prove the value of (Flux) just determined is absolutely correct, by deriving the anomalous magnetic moment of the electron by a geometric adjustment of the current loop area based on the NIST (QED) given value $(\alpha_e = 115965218111 \cdot 10^{-3})$. The published electron anomalous magnetic moment is traditionally calculated as $(1+\alpha_e)$ times the Bohr. (I personally don't like the NIST use of the QED coefficients of the alternating power series to obtain (α_e). The second coefficient should be -1/3, but QED uses -0.328478444, and the third coefficient should be +1/4, but QED uses +1.1763). The QED factor $(1+\alpha_e)$ is a very, very small correction to the Bohr, so not much effect is seen after the second coefficient. I find, if one uses a normally constructed alternating power series of (α / π) with normal coefficients of 1/2, -1/3, +1/4, -1/5, one gets within 37.7 parts per billion of the QED specious Bohr anomalous magnetic moment published value, as proof of my contention.

Be that as it may, in the Figure 4 right panel, the NIST value of (α_e) is used to compare the adjusted NIST anomalous electron magnetic moment value for (μ_e) to the electron flux quantum derived value. The geometric size of the junctions (α_μ) at S, E, and H current loop radius protrusions adjusts current loop sizes. The charge radius geometric extension is squared for obtaining the current loop areas. The new slightly larger current loop areas are obtained by setting $(1+\alpha_e) = (1+\alpha_\mu)^2$ and solving for $(\alpha_\mu = 1.15931617760978 \cdot 10^{-3})$. The rotating extension acts from the centroid (x) giving the adjusted two current loop areas (m2). To obtain the flux density in Tesla, the (2Flux) is divided by the two loop areas (m2). The anomalous magnetic moment in Joule per Tesla is then obtained from (Joule = Volt1 x e) divided by Tesla giving $(x\mu_e = 9.28476377143694 \cdot 10^{-24} m^2 \mathrm{A})$ as (J/T) which is exactly equal to the published NIST value $(\mu_e = 9.28476377 \cdot 10^{-24} \mathrm{A} \cdot m^2)$ as proof of concepts.

Information used in this article was excerpted from the book, "FUNDAMENTAL PHYSICAL CONSTANTS Derived From PARTICLE GEOMETRIC STRUCTURES" (ISBN-13: 978-0-9631546-3-7 TNL Press 2008)

Available from; www.amazon.com 096315463X $24.95