The Electron

by William Gray

The electron has a 0.51099906 MeV mass, $-1.60217733 \times 10^{-19}$ C charge, $\mu_B = ½(e/m_e)(h/2pi) = 9.2740154 \times 10^{-24}$ J/T magneton, ½-spin, and. 0.05 fm radius. These properties are shown to derive from an Electromagnetic wave with angular momentum.

1) Ground state hydrogen with a E_o = 13.605698 eV orbital energy and $a_o = 0.529177249 \times 10^{-10}$ m Bohr radius represents the lowest naturally occurring proton—electron resonance energy.

2) An orbital proton—electron charge dipole generates a magneton and is an EM wave with angular momentum since the dipole magnitude E varies according to the $d^2E/dx^2 = (1/v^2)$ d^2E/dt^2general wave equation (Maxwell's Equations with velocity v) and Schroedinger's $\psi(x) = E \sin(2pix/\lambda)$ wave equation form of Euler's $E\, e^{ix} = E \cos x + i\, E \sin x$ identity, if x = 2pix/ λ, when observed from any perspective.

3) The $E_o = ½m_ev_o^2$ = 13.605698 eV orbital electron has a $v_o = (2E_o/m_e)^{½} = 2.18769142 \times 10^6$ m/s EM wave velocity, or v_o/c = 0.007297353092 c, and c/v_o = 137.0359899 times less than the speed of light. Relativity becomes significant at this point since the $m/m_e = (1 - v_o^2/c^2)^{-½}$ = 1.000026627 Lorentz Transform shows a 0.000026627 m_e = 13.606239 eV mass increase equal to the 13.605698 eV orbital energy. In Wave Particle Duality the discrepancy was shown to result from a proton orbital gyration relativistic offset.

4) An E_o = 13.605698 eV EM wave has a $\lambda = hc/E_o$ = 911.2669951 Å wavelength and $f = E_o/h$ = $3.289842161 \times 10^{15}$ Hz frequency.

5) The electron $\lambda = h/m_ev_o$ = 3.3249185 Å de Broglie wavelength equals its 2pi a_o orbital path, $2(c/v_o)$ = 2(137.0359899) times less than the 911.2669951 Å EM wave. The factor 2 results because the orbital EM wave has two orthogonal 13.605698 eV components.

6) Its $f_o = v_o / 2pi \cdot a_o = 6.579683917 \times 10^{15}$ Hz orbital frequency yields a $\mu = IA = ef_opi{\cdot}a_o^2$ = 9.2740154×10^{24} J/T magneton, equal to the μ_B = ½ (e/m_e)(h/2pi) Bohr magneton.

7) Similarly, if the E_o = 13.605698 eV orbital EM wave energy is increased to the E_e = 0.51099906 MeV electron energy it will have a $\lambda_e = hc/E_e = 2.426310438 \times 10^{-12}$ m wavelength, equal to the $\lambda = h/m_ec$ de Broglie wavelength, and c/v_o = 137.0359899 times shorter than the λ_o = 3.3249185 Å orbital wavelength. Wavelength varies inversely with both energy and velocity because energy increases with velocity at relativistic speeds, by $E = E_o(1 - v^2/c^2)^{-½}$ instead of with v^2 by $E = ½mv^2$ at Classical speeds.

8) This $\lambda_e = 2.426310438 \times 10^{-12}$ m wavelength is however for linear space only, without corrections for relativistic angular momentum effects. Its E_e = 0.51099906 MeV EM wave's frequency is $F_e = E_e/h = 1.235589862 \times 10^{20}$ Hz, $(c/v_o)^2 = 137.036^2$ times the orbital electron's $f_o = 6.579684 = 10^{15}$ Hz frequency, and its magneton value is $\mu = IA = ef_e(pi)(\lambda_e/2pi)^2$ = 9.274015×10^{-24} J/T, equal to $\mu_B = ½(e/m_e)(h/2pi)$ Bohr magneton since mass varies linearly with energy by $E = mc^2$ at relativistic speeds and it is energy that increases permeability and attenuates the magneton.

9) EM waves with angular momentum have 3 orthogonal oscillations with equal velocities over an orbital revolution (its propagation axis and its E and B field oscillations that complete a cycle each revolution) and thus relativistically contract space radially by $3(c/v_o) = 3(137.0359899) = 411.1079697$. However the contraction also has an associated time dilation which causes a persistence of the relativistic effects and compounds them to a $(3c/v_o)^2 = 169009.7628$ total radial contraction.

10) This results in the $2.426310438 \times 10^{-12}$ m wavelength being relativistically contracted by $(3c/v_o)^2$ to 1.435604×10^{-17} m which is the radial resultant of the 3 oscillation's relativistic contractions and yields a 1.4356×10^{-17} m propagation axis radius. Since the propagation axis is the EM wave's midpoint adjusted for the 3 oscillation's relativistic effect, it is also the electron's radial midpoint if the propagation axis' 3 orbital resultant is factored out. Since it is the midpoint it must also be multiplied by 2 to yield the full electron radius, or $2 \cdot 3^{½} \cdot 1.435604 \times 10^{-17} = 4.9731 \times 10^{-17}$ m within 0.55% of its approximate 0.05 fm radius.

11) Thus the electron's radius relates to the a_o Bohr radius by the $c/v_o = 137.036$ wavelength decrease between the 13.605698 eV and 0.51099906 MeV orbitals and the $(3c/v_o)^2$ compounding effect of time dilated contractions from a 3-d oscillation, adjusted for the fact that the propagation axis is at a $½ \cdot 3^{½}\ r_e$ radius. Thus $r_e = [(2\text{pi}\ a_o) / (c/v_o)\ (3c/v_o)^2]\ 2 \cdot 3^{½} = 0.049731$ fm = 0.05 fm.

12) The electron's mass results from relativistic compression of dark energy excited by the EM wave's field energies and contracted by its angular momentum, as explained in The Particle Effect. In ground state hydrogen the 13.605698 eV EM wave energy causes an electron mass increase, as shown in Step 3, that is the result of compression of excited dark energy and time dilation persistence.

13) A 0.51099906 MeV EM wave has a $\lambda_e = 0.0242631$ Å wavelength, $c/v_o = 137.036$ times less than $\lambda_o = 3.324919$ Å, so $\lambda_e = \lambda_o / (c/v_o)$, but this has no mass effect because relativistic compression of the excited dark energy from angular momentum has not been taken into account. The EM wave's 2 fields precess as it propagates on its orbital path and yield orthogonal 2-d planar orbital energies that result in its 3-d spherical form. Thus each field causes a $2^{½}$ compression resultant from its two orthogonal (c/v_o) orbital components to yield a $2^{½}\ (c/v_o)$ resultant which is then compounded to $[2^{½}\ c/v_o]^2$ because there are two fields.

14) This $[2^{½}\ (137.0359893)]^2 = 37557.725$ compression of ground state hydrogen's 13.605698 eV EM field energy yields a $37557.725 \times 13.605698$ eV = 0.51099906 MeV electron mass, so $m_e = E_o(2^{½}\ c/v_o)^2$ as the relative orbital EM wave velocity increases from v_o to c. The EM wave generates the dark energy's excited state and the mass effect is its compression by the wave's angular momentum, with the time dilation persistence that contains it as the EM wave proceeds along its orbital propagation axis.

15) The increased density dark energy and resultant mass also has increased permeability and permittivity. In the proton the wave traverses a comparatively large orbital and captures a large dark energy region. Its angular momentum generates the magneton and its increased density represents inert mass that attenuates its field by capturing it within the region's increased permeability.

16) However the electron's energy is a 0.51099906 MeV 0.0242631 Å wavelength EM wave relativistically compressed in 3-d by $(3c/v_o)^2$ to a r = 0.014356 fm radius, where c/v_o is the λ_o / λ_e EM wavelength contraction ratio from a hydrogen ground state where relativistic effects just start to appear. Thus the EM wave energy generates the magneton and its increased dark energy density takes part in the generation, unlike the proton where it captures dark energy that captures the generated magneton's field.

17) A magneton is given by $\mu = IA = (ev/2pir)(pir^2) = ½evr$. But this does not account for the EM wave's increased energy density, just as the $\mu_n = ½eh/2pi{\cdot}m_p$ nuclear magneton does not account for the proton's 4.8373 times lower density than an electron's (i.e. $4.8373 / 3^{½} = 2.7928$) so it captures less of the generated field. The EM wave's $(3c/v_o)^2$ energy density increase must be included so $\mu_e = ½evr(3c/v_o)^2 / 2pi = 9.274 \times 10^{-24}$ J/T $= \mu_B$, where v = c is its orbital velocity and r = 0.014356 fm is the compression radius. The 2pi factor is needed since the EM wave's 3 oscillations cause its midpoint to gyrate on a path equal to r.

18) The electron's mass from time dilation persistence conforms to the $\mu_B = ½eh / 2pi{\cdot}m_e$ Bohr magneton relation where mass appears to attenuate the magneton but it is a time dilated persistence of the EM wave. It holds the mass effect of the wave's relativistic dark energy contraction, resulting in an inertial offset from the electron's center of mass giving it a ½-spin. It also holds the EM wave's 3 inertial oscillation energies' effects in space which results in the electron's charge polarity, - radially outward and + radially inward. This attracts the actual EM wave on the opposite side of its orbital because it sees an opposite radial inward charge by its opposite direction of motion and maintains charge attraction.

19) The relativistic mass effect equals the 0.51099906 MeV energy of the EM wave because the 3 oscillation's inertias' relativistic effect on space and time equals their energies. Thus the virtual EM wave effect has a virtual magneton component in the direction of the angular moment while the EM wave on the orbital's opposite side generates an opposite magneton component to yield $m_s = +/- ½$ magnetic quantums shown in the Stern Gerlach experiment. However charge polarity is (-) since oscillation orientations with respect to motion are the same by the right-hand-rule for any observer.

20) The $\mu = ½evr$ magneton relates to angular momentum by $\mu = ½(e/m)mvr$ (masses cancel), and thus yield the $\mu_B = ½(e/m)(h/2pi)$ Bohr magneton, where h/2pi is the quantized angular momentum unit. It also means that the mass and magneton are opposing effects such that $m\mu = ½eh/2pi$, where mass increase decreases the magneton and vice versa for a charge with angular momentum. This substantiates that an EM wave with angular momentum relativistically compressing space to create mass attenuates the proton magneton and an EM wave with angular momentum compressing its own space yields less mass but increased magnetic moment from its increased energy density, making the proton and electron opposing quantum states of matter.

21) To be correct the $m\mu = ½eh / 2pi$ relation takes the form $\mu_B = ½(e/m_e)(h/2pi) = ½ecr(3c/v_o)^2 / 2pi = 9.274 \times 10^{-24}$ J/T for an electron, where $h/m = cr(3c/v_o)^2 = 7.273895638 \times 10^{-4}$ J·s/kg, the ratio of the $\lambda_e c = \lambda_o v_o = 7.273895638 \times 10^{-4}$ velocity-wavelength products for electron and ground state hydrogen orbital EM waves. And it takes the form $\mu_P = ½(e/m_e)(h/2pi)(\rho_e/\rho_p)/3^{½} = 2.7928\ \mu_n$ for a proton, where $\rho_e/\rho_p = 4.8373$ is electron to proton density. Thus increased EM

wave energy density increases magnetic effects but captured energy density increases mass effects.

22) The electron is thus explained as a 0.51099906 MeV EM wave with angular momentum with an $r_e = [(2pia_o)/(c/v_o)(3c/v_o)^2]2 \cdot 3^{½}$ = 0.05 fm radius, an $m_e = E_o\ (2^{½}\ c/v_o)^2$ = 0.51099906 MeV mass, and $\mu_B = ½ecr(3c/v_o)^2/2pi$ = 9.274 x 10^{-24} J/T magneton, where a_o = 0.529177249 x 10^{-10} m Bohr radius, v_o = 2.18769142 x 10^6 m/s ground state orbital velocity, E_o = 13.605698 eV ground state EM wave energy, and r = 1.4356 x 10^{-17} m EM wave propagation axis in the electron. The ½-spin results from the virtual mass offset, the charge polarity results from the EM wave's orientation, and the charge field strength equals the dipole of the EM wave between the proton and electron in hydrogen which takes into account the permeability and permittivity of free space.