The Proton

by William Gray

This proton model, like Bohr's hydrogen atom model, is based on the charge-centripetal force equilibrium concept, only in this case it is an EM wave with angular momentum that yields the proton's mass, charge, magneton and ½-spin.

1) In Wave—Particle Duality it was shown that wave behavior results from space-time relativistic effects from harmonic oscillation between the particles.

2) For like charge equal mass particles, such as electrons with linear momentum, the harmonic resonance results from Pauli Exclusion Principle bonding as in chemical bonding between valence electrons.

3) In a hydrogen atom the wave effect exists between the proton and electron , has the proton-electron charge dipole, Bohr magneton based on an orbital charge with angular momentum, and equalizes their mass difference with angular momentum.

4) Such a wave would be Electromagnetic with a velocity, angular momentum, spin effect, charge dipole that oscillates in space according to Schroedinger's wave equations , have an orthogonal magneton, and equalize the proton-electron mass difference in addition to their charge difference.

5) In the neutron orbital model this EM wave was shown to contain 0.78233 MeV more mass than a proton and electron and cause its ½-spin effect by a relativistic contraction of space and dilation of time that holds the proton offset in space after the electron moves on.

6) The ½-spin effect and increased mass is a time dilation phase delay between the EM wave and an electron with a 2.75400306 x 10^8 m/s orbital velocity calcualated by the $m_o/m = (1 - v^2/c^2)^{½}$ Lorentz Transform.

7) To yield the $m_p / (m_n - m_p - m_e)$ = 938.2723 MeV / 0.78233 MeV = 1199.32915 mass increase of a proton the EM wave would have a $m_o/m = (1 - v^2/c^2)^{½}$ velocity of 2.99792354 x 10^8 m/s = 0.999999653 c.

8) This EM wave with angular momentum model is based on the concept that relativistic compression of dark energy increases the density of the region contained by the charge centripetal force equilibrium and will similarly increase the permeability and permittivity of the region as well.

9) The dark energy density of a ground state hydrogen atom is not relativistically compressed so its space permeability and permittivity and serves as the relativistic reference base.

10) In the Bohr charge-centripetal force equilibrium model total energy is defined as E_{tot} = KE + PE = ½mv^2 - $k_e e^2/r$ for equal $k_e e^2/r^2 = mv^2/r$ charge and centripetal forces where mass energy is exactly balanced by charge energy over a distance r.

11) At near light speed the mv^2 mass energy becomes the $E = mc^2$ mass energy equivalent so $mc^2 = k_e e^2/r$ and in orbital equilibrium $m = 1/c^2\ k_e e^2/r$.

12) Since the coulomb constant for space is $k_e = 1/4\pi\varepsilon_o$ and $c^2 = 1/\mu_o\varepsilon_o$ then $k_e = \mu_o c^2 / 4\pi$ and $mc^2 = k_e e^2/r$ becomes $m = (\mu_o/4\pi)\ (e^2/r) = 2.5669722 \times 10^{-30}$ kg/Fermi.

13) This is the mass-energy density per unit of radial distance for dark energy in a hydrogen atom's ground state EM wave adjusted to the distance of 1 fm between charges (as in a proton) but without any relativistic compression.

14) Comparing the $l = l_o(1 - v^2/c^2)^{½}$ Lorentz Transform of the 13.605698 eV orbital electron's EM wave with a 2.187692×10^6 m/s velocity and the 2.99792354×10^8 m/s velocity of an EM wave with a m_p = 938.2723 MeV mass, by comparison with the neutron's 0.78233 MeV relativistic mass increase, yields a 1200.514 radial compression. (Note: An electron with a 13 .605698 eV kinetic energy and $a_o = 0.529177249 \times 10^{-10}$ m Bohr radius in $½mv^2 = k_e e^2/2a_o$ equilibrium has a $v_o = (k_e e^2/m_e a_o)^{½} = 2.187691414 \times 10^6$ m/s classical velocity and the proton's EM wave has a $v_p = 2.99792354 \times 10^8$ m/s relativistic velocity. The radial compression for the ground state electron is $l_o = a_o(1 - v^2/c^2)^{½}$ or $l_o / a_o = (1 - v^2/c^2)^{½} = 0.999973374$ and the radial compression for the relativistic EM wave is $l_p/a_o = (1 - v^2/c^2)^{½} = 8.329549808 \times 10^{-4}$, which yields a $l_o/l_p = 0.999973374 / 8.329549808 \times 10^{-4} = 1200.514$ radial compression of free space.)

15) This 1200.514 radial compression ratio, adjusted by the $4/3\ \pi\ r^3 / (2r)^2 = 0.5236$ spherical to cubic volume ratio, and multiplied by the $2.5669722 \times 10^{-30}$ kg/fm mass-energy density of free space per unit of radial distance yields a $1\ .613570823 \times 10^{-27}$ kg mass, within 3.53% of the proton's actual 1.672623×10^{-27} kg mass.

16) This error results because the electron's classical angular momentum with a 2.1877×10^6 m/s velocity and $a_o = 0.529177249 \times 10^{-10}$ m radius results in a $m_e/m_p = r_p/a_o$ 28.82 fm proton gyration radius.

17) The electron's 13.605698 eV energy actually causes a 0.000026627 mass increase and 1-dimensional contraction of a_o, or 1.408987 fm, and a $3^{½}\ a_o\ (0.000026627) = 2.0322$ fm offset to the proton's 28.82 fm gyration , or 2.0322/28.82 = 7.0513% peak offset and 7.0513/2 = 3.52567% average offset which represents the electron's relative mass increase to the proton.

18) This mass effect is contained in the EM wave and must be added to the charge based compression ratio to yield a 1200.513 (1.0352567) = 1243 compression ratio and 1243 x 0.5236 x $2.5669722 \times 10^{-30}$ kg/fm = $1.6704586 \times 10^{-27}$ kg, within 0.13% of the proton's mass.

19) This means the proton's mass correlates exactly to its charge by the principles of angular momentum and Relativity, and that mass relates to permeability such that increasing the density of space by radial contraction also increases the relative permeability.

20) Since increased permeability reduces external magnetic field leakage the proton 's magneton would be derived from its charge and angular momentum or $\mu = ½eh/2pi$, attenuated by its mass, or $\mu = ½eh/m_p2pi$, and mitigated by its density ratio to the electron, or $\mu_p = ½(eh/m_p2pi)(\rho_e/\rho_p 3^{½})$ = 2.7928 nuclear magnetons

21) These effects along with the structure of dark energy and the specific relation of permeability and permittivity to mass-energy are detailed in The Particle Effect.

22) Polarity of charge was shown to result from orientation of the EM wave's angular momentum and quantity of charge is fixed by the permittivity of space which is the reason both the proton and electron have identical charges but opposite polarities.

23) The size of the proton is determined by the fact that the EM wave is at its maximum 0.9999996 c velocity in a charge-centripetal force equilibrium. Since orientation determines charge polarity the positive charge at its surface yields a net negative gradient towards its center.

24) Since relativistic time dilation holds the charge and relativistic offset of contracted space (i.e. increased density and thus mass) in dilated time, the EM wave sees an opposite charge polarity as it moves to the proton's opposite side, thus providing charge attraction to maintain its angular momentum.

25) The EM wave from its perspective has its propagation axis at exactly half of the proton's 1.0355 fm radius and the maximum relativistic contraction permitted while maintaining equilibrium must be an equal amount in each dimension which yields an observed propagation axis at $½(1.0355)/3^{½}$ = 0.2989 fm exactly as observed at SLAC in 1961 by Hofstadter, with a $½e^+$ at 0.3 fm and $1e^+$ charge at the surface.

26) The relativistic offset in dilated time as the EM wave moves along its orbital path yields the observed $\cos^{-1} 3^{-½}$ = 54 .74° ½-spin effect.

27) This proton model is based on the wave principles of Quantum Theory and yields the exact mass, density, charge, magneton value and ½-spin effects empirically observed for protons.