Neutrons

by w. t. gray

Neutrons have zero charge, a 939.56563 MeV mass, a -1.9135 nuclear magneton magnetic moment and decay with a 10.4 min ½-life into a proton, electron, electron anti-neutrino and a 0.78233 MeV energy. Protons have a 1.602177×10^{-19} C charge, a 938.2723 MeV mass and a +2.7928 nuclear magneton magnetic moment. And electrons have a $-1.602177 \times 10^{-19}$ C charge, a 0.511 MeV mass and a Bohr magneton magnetic moment m_p/m_e = 1836.153 times greater than the nuclear magneton. The neutron mass equals the proton and electron masses plus 0.78233 MeV and all, including the neutrino, are ½-spin.

Neutrons were not previously understood because their zero charge, mass, magnetic moment and ½-spin behaviors could not be explained. Using Bohr's hydrogen atom analysis, a 0.78233 MeV electron would have 3 energy components: its orbital magnetic moment, its kinetic energy, and its charge energy with the proton nucleus. To be in equilibrium each of the energies must be equal, or 0.78233 MeV / 3 = 0.260777 MeV, but since the magnetic moment is orthogonal to the orbital plane, by the **F** = q**v** x **B** Right-hand Rule, only the kinetic and electric energies affect orbital radius. By Bohr's **E** = $k_e e^2$ / 2r relation r = $k_e e^2$ / 2E = (8.99×10^9 Nm²/C²) (1.602×10^{-19} C)² / 2 (0.260777 MeV) (1.602×10^{-19} J / eV) = 2.76136×10^{-15} m.

A 2.76136 fermi radius is too large for a neutron but the orbital electron's 0.78233 MeV added energy constitutes a relative mass increase of (0.78233 MeV + m_e) / m_e = 2.531, which by the Lorentz Transformations in Relativity results in an equivalent contraction of space. So a 2.76136 fm calculated Bohr radius reduces by 2.531 to the observed 1.091 fm radius. This explains a neutron's mass, size and 0 charge, since hydrogen atoms have no charge, in terms of accepted electromagnetic force and Relativity principles, and its -1.9135 nuclear magneton and ½-spin are similarly explained.

An electron's Bohr magneton is calculated by $u_B = \frac{1}{2}e \cdot h \; / \; 2 \cdot pi \cdot m_e$, where e represents an orbital charge, h is Planck's Constant, h / 2·pi is the fundamental angular momentum unit, and m_e is electron mass. Conceptually a magneton is a magnetic field generated by a current loop limited by its charge carrier masses. Since current from a surface charge is similarly hindered by its enclosed mass, scientists used the proton's mass in the Bohr magneton equation to calculate a nuclear magneton of $u_n = e \cdot h \; / \; 4 \cdot pi \cdot m_p = 5.05 \times 10^{-27}$ J / T, which is m_p / m_e = 1836.153 times less than the $u_B = 9.274 \times 10^{-24}$ J / T electron magneton, but incorrect because it's also 2.7928 times less than the actual $u_p = 1.4106 \times 10^{-26}$ J / T value.

This is because they did not consider that the density of mass in a current loop also affects its magnetic field. Electrons have a 0.05 fm radius and protons have a 1.0355 fm radius, or 20.71 times more so its volume is 20.71^3 = 8882 times greater. But its mass is only 1836.153 times more so its density is 8882 / 1836.153 =

4.8373 times less and lower density mass attenuates the magnetic field to a lesser degree. However, since density is 3-dimensional and magnetic moment is 1-dimensional, the resultant magneton is only $4.8373 / 3^{\frac{1}{2}} = 2.7928$ times greater than a nuclear magneton based on mass alone, so $u_p = u_n (p_e / p_p) / 3^{\frac{1}{2}} = 2.7928$.

The neutron's magneton is similarly affected by the density of its proton center. Its magnetic moment results from a 2-dimensional orbital area current loop so its magneton is $u = IA$, or current x area, so there is no $3^{\frac{1}{2}}$ factor to attenuate the enhancement to the magnetic field from the proton's lower density. But there is an attenuation from the relativistic contraction of the electron's orbital radius from 2.76316 fm to 1.091 fm. So in this case the magnetic enhancement from a 4.8373 lower density is attenuated by 2.531 and its magneton is $u_N = u_n (4.8373 / 2.531) = 1.9111$ times greater that the nuclear magneton.

This 1.9111 value is 0.126% less than its 1.9135 empirical value because a neutron magneton is measured using a deuterium nucleus. A proton and neutron mass are 938.2723 + 939.5656 = 1877.8379 MeV but a deuterium nucleus mass is 1875.614 MeV, or 2.224 MeV less. This 2.224 / 1875.614 = 0.1186% lower mass results in a measured value 1.001186 times higher than the 1.9111 calculated value, or 1.001186 x 1.9111 = 1.913366, which is only 0.007% less than the 1.9135 measured value and attributed to resolution errors in the radius and energy values used in the calculations.

A negative -1.9135 nuclear magenton indicates a magnetic moment in a direction opposite the orbital angular moment. An orbiting mass normally has a spin 1 moment pointing upward and orthogonal to the orbital plane from the structure's center of mass, so a gyroscope with a spin 1 balances itself in an upright position orthogonal to its centripetal acceleration. However, a negative electron charge orbiting a proton center of mass would generate a magnetic moment opposite to the orbital angular moment, which agrees with the (-) sign on the -1.9135 nuclear magnetic moment for the neutron.

A neutron's $\frac{1}{2}$-spin magnetic moment is also explained by the 2.531 orbital radius contraction. Observers see the neutron's surface, not its center, so they reference to the surface. The electron in its local space is always 2.76136 fm from the proton's center and Bohr's Classical analysis applies since local observers can't tell when they have relativistic energy. But independent observers see a 1.091 fm contracted radius with a mass center moved toward them when an orbital electron passes between them and the proton so the observed spin is vector sum of a 2.531 contracted space and spin 1 moment, with a resultant $\frac{1}{2}$-spin magnetic moment wobble.

However only 13.6 eV is needed to ionize hydrogen so the neutron's 3 (0.260777 MeV) = 0.78233 MeV quantum energy state can only store temporarily in the electron's semi-stable relativistic state. And since the relativistic contraction results in a $\frac{1}{2}$-spin effect to a spin 1 orbital, and angular momentum must be conserved, a $\frac{1}{2}$-spin particle must be emitted on the neutron's radioactive decay. This relativistic angular momentum conservation manifests as the $\frac{1}{2}$-spin electron anti-neutrino released with the proton, electron and 0.78233 MeV as the neutron decays to its spin 1 ground state.

Since a spin 1 moment results from the 2-dimensional energies of a particle's planar orbital, and a $\frac{1}{2}$-spin moment is a 3-dimensional resultant the dimensional transformation must be conserved. Bohr showed that hydrogen's 0.529 A orbital radius was a result of 13.6 eV electric and kinetic energies. The 2-dimensional resultant is $(13.6^2 + 13.6^2)^{\frac{1}{2}} = 19.23$ eV and after a 0.78233 MeV neutron decays this will be its ground state. But if the neutron's 3-dimensional $\frac{1}{2}$-spin state was retained after decay, the 19.23 eV resultant would have non-relativistic $(19.23)^{1/3} = 2.68$ eV and relativistic 2.68 x 2.531 = 6.78 eV energies in each of its three dimensions.

The 6.78 eV energy is the electron anti-neutrino emitted on decay, and makes it a $\frac{1}{2}$-spin relativistic centripetal acceleration energy structure, rotating like a propeller in its propagation direction, as Lee and Yang discovered in 1957 and difficult to detect because of its relativistic nature. And this means that all the neutron's unexplained behaviors (mass, spin, magneton, zero charge and decay components) can be explained in terms of Classical electromagnetic forces and the 2.531 relativistic effect caused by the electron in a 0.78233 MeV quantum energy state.

W. T. Gray
11/14/03