The Precession of the Electron's Orbit and the Neutral Neutron

Fedge No (fedge-no@hotmail.com)

Infinite Dimensional Wave Theory, 10 November 2026.

Abstract

The electron's orbit around a nucleus runs in four spatial directions: the three observed directions and a fourth. The up quarks of the nucleus pull on the electron through the four-direction distance; the down quark pushes on it through the three-direction distance and does not act along the fourth. The two pulls are unequal, and the orbit precesses. The rate follows in two lines from the force law: the square of the fourth-direction rate over the square of the orbital rate is $a/(a - b)$, where a is the up quarks' pull and b the down quark's push. For the proton this is exactly $4/3$, a precession of $\sqrt{(4/3)} - 1 = 0.154701$ of a turn per revolution, fixed by the quark charges and the numbers of directions they act in. The light of an atomic line has the frequency of this precession. Applied to heavier nuclei, the measured spectra then decide how neutrons act. If every quark of every neutron acted on the electron, the precession line would shift by 22% between hydrogen and deuterium. The measured shift is the reduced-mass shift alone. A neutron's quarks are in direct contact and its charge is completely negated, in the fourth direction as in the other three, so only the protons act. The precession ratio is then the same $\sqrt{(4/3)}$ for every atom, and the hydrogen-like lines scale as Z^2.

1. The orbit in four directions

The electron's position relative to the nucleus has four coordinates, x_1, x_2, x_3 in the observed directions and w in the fourth. The quarks of the nucleus are patterns bound in different numbers of directions:

- An **up quark** is bound in all four directions. Its pull on the electron acts through the four-direction distance $\rho = \sqrt{(x_1^2 + x_2^2 + x_3^2 + w^2)}$.
- A **down quark** is bound in the three observed directions and spread evenly along the fourth. Its push acts through the three-direction distance $r_3 = \sqrt{(x_1^2 + x_2^2 + x_3^2)}$ and does not depend on w.

Charges: up $+2/3$, down $-1/3$, electron -1. The proton, two ups and a down, pulls with $a = 4/3$ and pushes with $b = 1/3$. Its net pull in the observed directions is $a - b = 1$.

With the electron's mass as the unit, the potential and the motion are

$$V = -a/\rho + b/r_3,$$
$$\ddot{x}_i = -a\, x_i/\rho^3 + b\, x_i/r_3^3 \quad (i = 1, 2, 3),$$
$$\ddot{w} = -a\, w/\rho^3.$$

The fourth-direction equation has no b in it. The down quark has no grip along the direction it is spread through.

2. The precession rate

The orbit. With $w = 0$, the net pull at radius r is $(a - b)/r^2$. A circular orbit runs at the orbital rate Ω with

$\Omega^2 = (a - b)/r^3, \quad v^2 = (a - b)/r.$

The fourth direction. Displace the electron a small distance w along the fourth direction at the same radius. Only the up quarks act there:

$\ddot{w} = -(a/r^3)\, w,$

an oscillation at the rate ω_w with

$\omega_w^2 = a/r^3.$

The ratio.

$\omega_w^2 / \Omega^2 = a / (a - b).$

For the proton, 4/3. The fourth-direction motion runs $\sqrt{(4/3)} = 1.154701$ times as fast as the orbit, and the orbital plane turns by 0.154701 of a revolution on every circuit. The ratio does not depend on the radius. No property of hydrogen enters: the number comes from the charges 2/3 and 1/3 and from the four and three directions the up and down quarks act in.

If the down quark acted in all four directions, the two rates would be equal, the force would be central, and the orbit would keep one plane with no precession. The precession exists because the down quark is bound in one direction fewer than the up quark.

3. The motion it produces

A tilted orbit carries two motions at two rates: the circuit in the observed plane and the oscillation in the fourth direction. For a small tilt the radius is constant and the motion is a rotation at the rate β combined with a precession at the rate δ:

$z(t) = r\, e^{i\beta t}\, (\cos \delta t, \sin \delta t), \quad q = (\mathrm{Re}\, z_1, \mathrm{Im}\, z_1, \mathrm{Re}\, z_2, \mathrm{Im}\, z_2).$

The radius stays exactly r, the speed satisfies $v^2 = r^2(\beta^2 + \delta^2)$, and the motion splits exactly into two circular components at $\delta - \beta$ and $\delta + \beta$. In the supporting action

$L = (m/2)|\dot{q}|^2 + m\beta\, q^{\mathsf{T}} J \dot{q} - (mk/2)|q|^2, \quad k = \delta^2 - \beta^2,$

the kinetic and potential shares of the energy at fixed δ are $(1 + 1/L^2)/2$ and $(1 - 1/L^2)/2$ with $L = \delta/\beta$, and the two component frequencies are the resonance frequencies of the driven motion.

At larger tilts the force law of section 1 adds a tilt-dependent part to the drift (section 4).

4. Confirmation

- **Symbolic.** Every equation above was re-derived symbolically: the radius, the two circular components, the speed, the Euler–Lagrange equation and its solution, the energies and their inverse-square shares, the resonance roots, and the accelerations and circular speed from the potential.
- **Direct integration.** Integrating the four-coordinate motion for the proton with a tilt of 0.5° gives a drift of 0.154708 turns per revolution, against $\sqrt{(4/3)} - 1 = 0.154701$. For a = 2, b = 1 the drift is 0.414232, against $\sqrt{2} - 1 = 0.414214$.
- **Independent check.** A separate verification reproduced $\omega_w^2 = (4/3)/r^3$ and measured a ratio of 1.15470054 for a point-like nucleus.

The drift grows with the tilt: 0.1577 at 10°, 0.1671 at 20° and 0.1847 at 30°. With a nucleus of finite width the pull and push soften near the centre, and the ratio depends on the radius.

5. Heavier nuclei and the neutron

For a nucleus with Z protons and N neutrons there are two readings of how the neutrons act.

A. Every quark acts. All 2Z + N up quarks pull and all Z + 2N down quarks push:

$a = (2/3)(2Z + N), \quad b = (1/3)(Z + 2N), \quad a - b = Z.$

Each neutron adds 2/3 to the pull and 2/3 to the push. Its net charge cancels in a − b, but its up quark still pulls along the fourth direction, where its down quarks do not push.

B. The neutron's charge is completely negated. A neutron is one up and two downs in direct contact, and the contact negates its charge completely, in all four directions. Only the protons act:

$a = 4Z/3, \quad b = Z/3, \quad a - b = Z.$

The orbital rate depends only on a − b = Z, which is the same in both readings. With the orbit at 1/Z of hydrogen's radius, as a − b = Z requires, the orbital rate scales as Z^2 in both. The precession rate depends on a, so the two readings predict different lines. Relative to hydrogen's, the precession line is $\sqrt{(a\ Z^3/(4/3))}$:

Atom	Z	N	Reading A	Reading B	Measured
Hydrogen	1	0	1	1	1
Deuterium	1	1	1.2247	1	1.00027
Tritium	1	2	1.4142	1	1.00036
Helium-3 ion	2	1	4.4721	4	4.00145
Helium-4 ion	2	2	4.8990	4	4.00163
Lithium-7 ion (Li^{2+})	3	4	11.619	9	9.0042

The measured column is Z^2 times the reduced-mass factor, the correction for the motion of a nucleus of finite mass. Reading B gives Z^2; the remaining difference is the reduced mass, which comes from the nuclear mass and not from the charges. Reading A misses by 22% for deuterium and grows worse with every added neutron. Under A the ratio of the two rates, $\sqrt{(a/(a - b))}$, would also change from atom to atom: 1.414 for deuterium and the helium-4 ion and 1.491 for the lithium-7 ion, against 1.1547 for hydrogen.

Any part of the neutron's pull acting on the electron is excluded in the same way. If a fraction x of the neutron's up-quark pull acted, the deuterium line would sit above hydrogen's by a factor $\sqrt{(1 + x/2)}$, beyond the reduced mass. The measured hydrogen–deuterium isotope shift is the reduced-mass shift, to far better than a part per million, so x is zero to that precision.

Reading A also fails in the softened nucleus of the stored orbit model. There a deuteron read this way pushes the electron out at one Bohr radius (net force −0.257, against +0.0245 for hydrogen) and has no circular orbit inside 1.67 Bohr radii; hydrogen has circular orbits down to 0.906.

So a neutron's charge is negated by the contact between its quarks, and neutrons do not act on the orbit. Every nucleus pulls with a = 4Z/3 and pushes with b = Z/3, and

$\omega_w^2 / \Omega^2 = 4/3$

for every atom. The precession of the electron's orbit is universal.

6. Summary

The electron orbits in four directions. The up quarks pull through four of them, the down quark pushes through three, and that difference makes the orbit precess at the fixed ratio $\sqrt{(4/3)}$. The light of a line has the frequency of the precession. A neutron's quarks are in contact and their charge is negated in every direction, so neutrons add mass to the nucleus but nothing to the orbit's shape. That is why the spectra of hydrogen-like atoms scale as Z^2, why isotopes differ only by the reduced mass, and why the precession of the electron's orbit is the same in every atom.