The Proton's Magnetic Field: Gravitation May Be Sum of Mis-aligned Atomic Magnets Neutrino May Be the Magnetic Radiation Quantum

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Abstract The Hydrogen electron that orbits a static proton radiates power, and spirals onto the proton. To prevent the Atom's collapse, the proton must orbit the center, and radiate the electron with the same power.

Then, the inertia moments of the electron orbiting at radius R, and the proton orbiting at radius ρ are equal,

$$M_p\rho^2 = m_e R^2. \Rightarrow R = \sqrt{\frac{M_p}{m_e}\rho} \approx 42.5\rho.$$

$$\text{And } R \sim 6 \cdot 10^{-11} m \Rightarrow \rho \sim 1.2 \times 10^{-12}$$

The electron current in its orbit $I_e = \frac{e}{T_e}$ induces a magnetic field induction $B_e = \frac{\mu_0 I_e}{2R}$. The proton current in its orbit $I_p = \frac{e}{T_p}$ induces a magnetic field induction $B_p \approx 280 B_e$.

Then, $\frac{\text{Hydrogen's Proton's Magnetic Energy}}{\text{Hydrogen's Electron's Magnetic Energy}} \approx 78{,}670$

In most atoms, these magnetic fields may not line up in one direction. But the resultant magnetic field in any direction may be the gravitational force.

Since the Neutrinos may be the particles of gravitational energy, and since gravitational energy may be a manifest of magnetic energy, the Neutrinos may be the quantum of magnetic energy.

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Physics & Astronomy Classification Scheme: 41.60-m; 32; 32.10-f; 31.15.B-

Contents

1.

The Magnetic Field of Hydrogen's Proton

We consider the Hydrogen electron orbiting the proton along a circle of radius R so that the centripetal force balances the electric attraction

$$m_e \omega^2 R = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{R^2}$$

Thus, the electron's accelerates towards the proton at

$$\omega^2 R = \frac{1}{m_e}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R^2}.$$

The electron's velocity is far slower than light speed c.

To see that, note that a wave in the mid optical spectrum with length

$$\lambda \sim 6\times 10^{-7}\,\text{meter.}$$

corresponds to the optical frequency

$$\nu = \frac{c}{\lambda} \sim \frac{3\times 10^{8}}{6\times 10^{-7}} = 5\times 10^{14}\,\text{cycles/sec.}$$

and to the angular velocity

$$\omega = 2\pi\nu \sim 6\times 5\times 10^{14} = 3\times 10^{15}\,\text{radians/sec.}$$

If the electron orbit's radius is

$$R \sim 6\times 10^{-11}\,\text{meter}$$

The electron's velocity is

$$v = \omega R \sim 3 \times 10^{15} \times 6 \times 10^{-11} \sim 2 \times 10^{5} \text{meter/sec}$$

Thus,

$$\frac{v}{c} \sim \frac{2 \times 10^5}{3 \times 10^8} \ll 1,$$

Then, Lorentz Factor

$$\gamma(v) = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \approx 1,$$

and the electron's velocity is $\gamma(v)v \approx v$.

From

$$m\frac{v^2}{R} = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{R^2},$$

the kinetic energy of the electron is

$$\tfrac{1}{2}mv^2 = \frac{1}{2}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R}.$$

The electric energy of the Hydrogen Atom is

$$-\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R}.$$

Therefore, the total electron energy is

$$-\frac{1}{2}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R},$$

and its rate of change is

$$\frac{d}{dt}\left\{-\frac{1}{2}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R}\right\} = \frac{1}{2}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R^2}\frac{dR}{dt}.$$

The electron radiates energy as it accelerates towards the proton, at rate

$$\left[\frac{e^2}{6\pi\varepsilon_0 c^3}a^2\right]_{t-\frac{R}{c}},$$

where the retarded time is

$$t-\frac{R}{c}\approx t-\frac{6\times 10^{-11}}{3\times 10^{8}}=t-\frac{2}{10^{19}}\approx t\,,$$

and the acceleration of the electron is

$$a=\frac{v^2}{R}.$$

Therefore, the Electron's Radiation rate is

$$\frac{e^2}{6\pi\varepsilon_0 c^3}\left(\frac{v^2}{R}\right)^2\approx\frac{e^2}{6\pi\varepsilon_0 c^3}\left(\frac{1}{m}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R^2}\right)^2.$$

Since it equals the rate of change of the electron's energy,

$$\frac{\cancel{e}^2}{6\cancel{\pi}\cancel{\varepsilon}_0 c^3}\left(\frac{1}{m}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R^2}\right)^2\approx\frac{1}{2}\frac{1}{4\cancel{\pi}\cancel{\varepsilon}_0}\frac{\cancel{e}^2}{R^2}\frac{dR}{dt},$$

$$dt\approx\frac{3}{4}c^3\left(4\pi\varepsilon_0\frac{m}{e^2}\right)^2R^2dR$$

Therefore, the electron will spiral into the proton in

$$t\Big|_{R=0}^{R=6\times 10^{-11}}\approx\frac{1}{4}c^3\left(4\pi\varepsilon_0\frac{m}{e^2}\right)^2R^3\Big|_{R=0}^{R=6\times 10^{-11}}\ \text{sec}$$

$$\approx \underbrace{\frac{1}{4}c^3(\underbrace{\frac{4\pi}{\mu_0}}_{10^7}\underbrace{\mu_0\varepsilon_0}_{c^{-2}})^2}_{\frac{1}{4c}10^{14}}\left(\frac{m}{e^2}\right)^2 6^3 10^{-33}$$

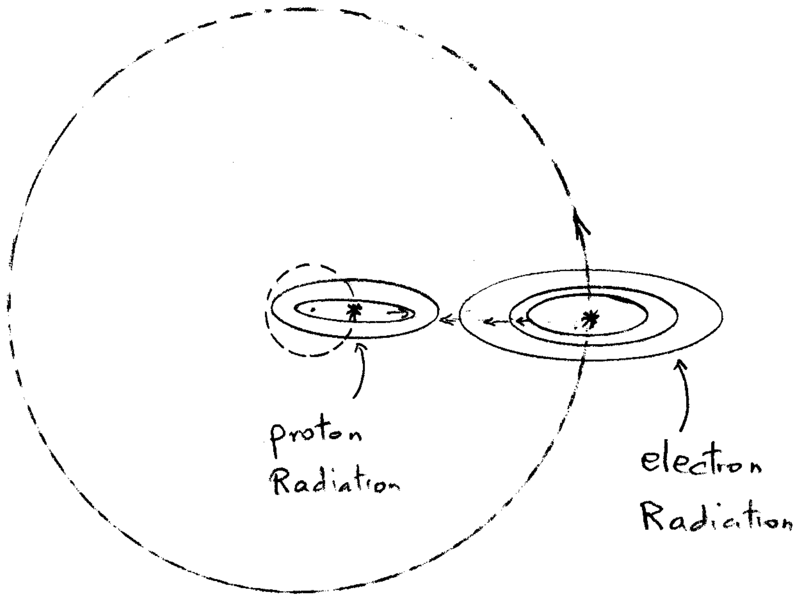
$$\approx \frac{1}{12\cdot 10^8}10^{14}\frac{(9.11\cdot 10^{-31})^2}{(1.6\cdot 10^{-19})^4}6^3\cdot 10^{-33}$$

$$\approx 18\cdot\frac{(9.11)^2}{(1.6)^4}10^{-13}$$

$$\approx 2.23\times 10^{-11}\,\text{sec.}$$

To prevent the Atom's collapse, the Proton must have its own orbits, in which it accelerates towards the electron, and radiates it. Then, the electron and the proton exchange equal amounts of energy between them, and balance each others loss. And the atom does not collapse.

The proton showers the electron with photons that compensate for the photons' radiated by the electron,



$$\text{The Power} = \frac{d}{dt}\left\{\text{radiation energy}\right\}$$

radiated by the accelerating proton onto the electron equals the Power radiated by the electron onto the proton.

The electron with acceleration $a_{electron}$ radiates the power

$$\frac{e^2}{6\pi\varepsilon_0 c^3} a_{electron}^2 .$$

The proton with acceleration A_{proton} radiates the power

$$\frac{e^2}{6\pi\varepsilon_0 c^3} A_{\text{proton}}^2 .$$

<u>The Proton's Orbit Radius in Hydrogen</u>

We model the electron in its orbit by a charge e^- concentrated at the center of the electron's orbit.

Then, the centripetal force $m\omega^2 R$, is balanced by the electric attraction on the electron $\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R^2}$,

$$m\omega^2 R = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{R^2},$$

Hence, the Electron Acceleration in its Orbit is

$$a = \omega^2 R = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{mR^2}$$

Similarly, the Proton acceleration in its Orbit is

$$A = \Omega^2 \rho = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{M\rho^2}$$

The Hydrogen electron accelerates towards the proton at

$$a = \frac{1}{m_e}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R^2}$$

and radiates the proton at power

$$\frac{e^2}{6\pi\varepsilon_0 c^3}a^2 = \frac{e^2}{6\pi\varepsilon_0 c^3}\left(\frac{1}{m_e}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R^2}\right)^2.$$

The Hydrogen Proton accelerates towards the electron at

$$A = \frac{1}{M_p}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{\rho^2},$$

and radiates the electron with power

$$\frac{e^2}{6\pi\varepsilon_0 c^3}A^2 = \frac{e^2}{6\pi\varepsilon_0 c^3}\left(\frac{1}{M_p}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{\rho^2}\right)^2.$$

At power equilibrium,

$$\frac{e^2}{6\pi\varepsilon_0 c^3}\left(\frac{1}{m_e}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{r^2}\right)^2 \approx \frac{e^2}{6\pi\varepsilon_0 c^3}\left(\frac{1}{M_p}\frac{1}{4\pi\varepsilon_0}\frac{e^2}{\rho^2}\right)^2.$$

Hence,

$$\boxed{m_e R^2 \approx M_p \rho^2}$$

That is, inertia moments are equal.

Consequently, the proton orbit radius, which is the nucleus radius is

$$\boxed{\frac{R}{\rho} \approx \sqrt{\frac{M_p}{m_e}} \approx \sqrt{1836.152701} \approx 42.8503524}$$

With $R \sim 6 \times 10^{-11} m$,

$$\rho \approx R\sqrt{\frac{m_e}{M_p}}$$

$$= 5.29277249 \times 10^{-11} \ / \ 42.8503524$$

$$= 1.221173735 \times 10^{-12}.$$

Therefore, the Nucleus Radius of the Hydrogen Atom

$$\boxed{\rho \approx R\sqrt{\frac{m_e}{M_p}} \sim 1.221173735 \times 10^{-12}}$$

The Proton's Period in Hydrogen

From

$$m\omega^2 R = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{R^2},$$

$$M\Omega^2\rho = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{\rho^2},$$

$$m\omega^2 R^3 = \frac{e^2}{4\pi\varepsilon_0} = M\Omega^2\rho^3$$

$$m\left(\frac{2\pi}{T_e}\right)^2 R^3 = M\left(\frac{2\pi}{T_p}\right)^2 \rho^3$$

$$\left(\frac{T_e}{T_p}\right)^2 = \frac{m}{M}\left(\frac{r}{\rho}\right)^3$$

$$= \frac{m}{M}\left(\sqrt{\frac{M}{m}}\right)^3$$

$$= \sqrt{\frac{M}{m}}$$

$$\boxed{\frac{T_e}{T_p} = \sqrt[4]{\frac{M}{m}}}$$

$$\boxed{\frac{\Omega_p}{\omega_e} = \frac{T_e}{T_p} \approx \sqrt[4]{\frac{M_p}{m_e}} \approx (1836.152701)^{\frac{1}{4}} \approx 6.546018057}$$

The Proton Period in Hydrogen is

$$\boxed{T_p \approx T_e\sqrt[4]{\frac{m_e}{M_p}}}$$

To approximate T_e, note that a wavelength in the mid optical spectrum is $\lambda \sim 6\times 10^{-7}$ meter.

This wavelength corresponds to the optical frequency

$$\nu = \frac{c}{\lambda} \sim \frac{3\times 10^8}{6\times 10^{-7}} = 5\times 10^{14}\text{cycles/sec.}$$

This frequency corresponds to a period

$$T_{electron} = \frac{1}{\nu} \sim \frac{1}{5\times 10^{14}} = 2\times 10^{-15}\text{sec/cycle}$$

Therefore, the Proton's Period is approximately

$$\boxed{T_p \approx T_e \sqrt[4]{\frac{m_e}{M_p}} \sim \frac{2\times 10^{-15}}{6.546} \sim 3\times 10^{-16}}$$

The Proton's Angular Velocity in Hydrogen

The frequency ν corresponds to the electron's angular velocity

$$\omega_{electron} = 2\pi\nu \sim 6\times 5\times 10^{14} = 3\times 10^{15}\text{radians/sec.}$$

Therefore, the Proton's Angular Velocity in Hydrogen is

$$\boxed{\Omega_{\mathrm{p}} \approx \omega_e \sqrt[4]{\frac{M_p}{m_e}} \sim 3\times 10^{15}\times 6.546 \sim 2\times 10^{16}}$$

The Proton's velocity in Hydrogen is

$$V = \Omega\rho \sim 2\times 10^{16}\times 1.2\times 10^{-12} \sim 2.4\times 10^4\text{meter/sec}$$

$$\frac{V}{c} \sim \frac{2.4\times 10^4}{3\times 10^8} \ll 1,$$

Then,

$$\gamma(V) = \frac{1}{\sqrt{1 - V^2 / c^2}} \approx 1,$$

and the proton's velocity is

$$\gamma(V)V \approx V.$$

2.

Gravitation May be the Sum of Mis-aligned Atomic Magnets

The Proton's Current in Hydrogen

The electron's current over a period T_e seconds is

$$I_e = \frac{e}{T_e} \sim \frac{(1.6)10^{-19}C}{2\times 10^{-15}\sec} = 8\times 10^{-5}A$$

The Proton's current over a period T_p seconds is

$$\boxed{I_p = \frac{e}{T_p} \sim \frac{(1.6)10^{-19}C}{3\times 10^{-16}\sec} = 5.3\times 10^{-4}A}$$

The Proton's Magnetic Induction in Hydrogen

The electron's magnetic induction is

$$B_e = \frac{\mu_0}{2R}I_e \sim \frac{(4\pi)10^{-7}}{2(6\times 10^{-11})}8\times 10^{-5} \sim (0.84)\frac{weber}{m^2}$$

The proton's magnetic induction is

$$\boxed{B_p = \frac{\mu_0}{2\rho}I_p \sim \frac{(4\pi)10^{-7}}{2(1.2\times 10^{-12})}(5.3)\times 10^{-4} \sim 139\frac{weber}{m^2}}$$

$$\frac{B_p}{B_e} = \frac{\frac{\mu_0}{2\rho}I_p}{\frac{\mu_0}{2R}I_e}$$

$$= \frac{R}{\rho}\frac{I_p}{I_e}$$

$$= \sqrt{\frac{M}{m}}\frac{T_e}{T_p}$$

$$= \sqrt{\frac{M}{m}}\sqrt[4]{\frac{M}{m}}$$

$$= \left(\sqrt[4]{\frac{M}{m}}\right)^3 = \left(\sqrt[4]{1836}\right)^3 \approx 280$$

In most atoms, these magnetic fields may not line up in one direction. But the resultant magnetic field in any direction may be the gravitational force. Thus,

Gravitation May Be the Sum of Misaligned Atomic Magnets

The Proton's Magnetic Energy in Hydrogen

The Magnetic energy of Field Induction B is $\frac{1}{2\mu_0}B^2$.

Therefore,

$$\frac{\text{Proton's Magnetic Energy in Hydrogen}}{\text{Electron's Magnetic Energy in Hydrogen}} = \frac{\frac{1}{2\mu_0}B_p^2}{\frac{1}{2\mu_0}B_e^2}$$

$$= \frac{B_p^2}{B_e^2} = \left(\sqrt{\frac{M}{m}}\right)^3 \boxed{\approx 78{,}670}$$

3.

Neutron Magnetic Energy, Neutron Stars, and Cosmic Magnets

We have shown that the Neutron is a collapsed Hydrogen Atom[1], where

The Electron Orbit Radius in the Neutron is

$$R_{Neutron} \sim 10^{-13}\text{m},$$

The Proton Orbit Radius in the Neutron is

$$\boxed{\rho_p \sim 2.2 \times 10^{-15}\text{m}}$$

The Electron's Angular Velocity in the Neutron is

$$\omega_{electron} \sim 3.6 \times 10^{21} \frac{\text{radian}}{\text{sec}}$$

Then,

The Electron's Period in the Neutron is

$$\boxed{T_{electron} = \frac{2\pi}{\omega_{electron}} \sim \frac{2\pi}{3.6 \times 10^{21}} \sim 1.75 \times 10^{-21}}$$

The Proton's Period in the Neutron is

$$\boxed{T_{proton} = T_{electron} \sqrt[4]{\frac{m_e}{M_p}} \sim 1.75 \times 10^{-21} \frac{1}{6.546} = 2.7 \times 10^{-22}}$$

[1] The Neutron as a Collapsed-Hydrogen Atom: Zero Point Energy & Nuclear Binding Energy, X Rays & Gamma Rays, Nuclear Forces & Bonding, Neutronic Electrons Orbitals, and Neutron Stars

The electron's current in the neutron over time T_e is

$$I_e = \frac{e}{T_e} \sim \frac{(1.6)10^{-19}C}{1.75\times 10^{-21}\sec} \sim 90A$$

The Proton's current in the neutron over time T_p is

$$\boxed{I_p = \frac{e}{T_p} \sim \frac{(1.6)10^{-19}C}{2.7\times 10^{-22}\sec} \sim 600A}$$

The Electron's magnetic induction in the Neutron is

$$B_e = \frac{\mu_0}{2R_e}I_e \sim \frac{4\pi\times 10^{-7}}{2\times 10^{-13}}90 \sim 5.7\times 10^{8}\frac{weber}{m^2}$$

The Proton's magnetic induction in the neutron is

$$\boxed{B_p = \frac{\mu_0}{2\rho}I_p \sim \frac{4\pi\times 10^{-7}}{2(2.2\times 10^{-15})}600 \sim 1.7\times 10^{11}\frac{weber}{m^2}}$$

Similarly to the Hydrogen Atom,

$$\frac{B_p}{B_e} = \frac{\dfrac{\mu_0}{2\rho}I_p}{\dfrac{\mu_0}{2R}I_e}$$

$$= \frac{R}{\rho}\frac{I_p}{I_e}$$

$$= \sqrt{\frac{M}{m}}\frac{T_e}{T_p}$$

$$= \sqrt{\frac{M}{m}}\sqrt[4]{\frac{M}{m}}$$

$$= \left(\sqrt[4]{\frac{M}{m}}\right)^3 = \left(\sqrt[4]{1836}\right)^3 \approx 280$$

Neutron Stars

The magnetic fields of the neutrons in a Neutron Star may not line up in one direction. But due to their size, the resultant magnetic field appears as magnetic.

$$\frac{\text{Proton's Magnetic Energy in Neutron}}{\text{Electron's Magnetic Energy in Neutron}} = \frac{\frac{1}{2\mu_0}B_p^2}{\frac{1}{2\mu_0}B_e^2}$$

$$= \frac{B_p^2}{B_e^2}$$

$$= \left(\sqrt{\frac{M}{m}}\right)^3 \boxed{\approx 78{,}670}$$

$$\frac{\text{Neutron's Magnetic Energy}}{\left|\text{Neutron's Electric Energy}\right|} \approx \frac{\frac{1}{2\mu_0}B_p^2}{\left|-\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R_e}\right|}$$

$$= \frac{\frac{1}{2\mu_0}\left(\frac{\mu_0}{2\rho}I_p\right)^2}{\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R}}$$

$$= \frac{\frac{1}{2\mu_0}\frac{\mu_0^2}{4\rho^2}\frac{e^2}{T_p^2}}{\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R}}$$

$$= \frac{1}{2c^2}\pi\frac{1}{\rho}\frac{R}{\rho}\frac{1}{T_p^2}$$

$$= \frac{1}{2c^2}\pi\frac{1}{\rho}\sqrt{\frac{M}{m}}\frac{1}{T_p^2}$$

$$= \frac{1}{2(3^2 10^{16})}\pi\frac{1}{2.2(10^{-15})}\sqrt{1836}\frac{1}{(2.7\times 10^{-22})^2}$$

$$\boxed{\sim 4\times 10^{43}}$$

Cosmic Magnets

The self-rotation of the sun, the earth, and the planets, creates electric currents that induce magnetic fields, and make the planets into cosmic magnets with north, and south poles. These magnetic fields are not aligned but should affect other universal object more than plain gravitation.

4.

The Neutrino May be the Magnetic Energy Quantum

The photons of electro-magnetic energy are created by accelerating electric charges. They can be created in an antenna by will. Electromagnetic theory suggests that photons carry mainly electric energy, and negligible magnetic energy[2].

Since neutrinos are electrically invisible, they do not carry electric energy. Thus, Neutrinos qualify to be the quanta of magnetic energy, or gravitational energy which may be the same.

Neutrinos are spontaneously emitted in radioactive processes, and appear in gravitational events. They are emitted from the sun core, and in supernovas.

Their energies can be as low as $0.12eV$. And Cosmic Neutrinos with energy of $2.2 \times 10^{17} eV$ were detected in supernova events.

The emission of Neutrinos in gravitational events indicates that they may be the particles of gravitational energy.

Since gravitational energy is a manifest of magnetic energy, Neutrinos may be to be the particles of magnetic energy.

To satisfy Planck's Radiation Law for electromagnetic radiation at frequency ν, photons have to carry energy in the amount $h\nu$,

[2] [Dannon2]

where h is Planck's Radiation constant. It follows that photons self turn at frequency ν.

No radiation law is known for Neutrino Radiation, and no frequency of self turning is known for Neutrinos.

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