The Aether Lagrangian: Deriving Altitude-Dependent Magnetic Moment Variations in the Aether Physics Model

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Abstract

The Aether Physics Model (APM) proposes a quantized Aether medium to unify quantum mechanics and general relativity using Quantum Measurement Units (QMU). We present a classical Lagrangian formulation integrating Aether field dynamics, electron interactions, and gravitational effects, deriving field equations to predict an altitude-dependent electron magnetic moment. Calculations in QMU and cgs units, with precise conversions, suggest a variation scaled to $\sim 10^{-12}$, aligning with experimental bounds, unlike the geomagnetic field's r^{-3} decay. Addressing unit consistency and experimental constraints, this framework offers a novel perspective, testable with SWARM data, potentially transforming fundamental physics.

1 Introduction

The Aether Physics Model (APM) [5] envisions a quantized Aether medium of discrete units driven by a Gforce, with particles exhibiting loxodromic topology [8]. Using Quantum Measurement Units (QMU), it redefines constants to unify quantum and gravitational phenomena [7]. A key prediction is the electron magnetic moment's variation with altitude, governed by the Aether's curl ($\text{curl}(r) \propto r^{-1}$) [9].

We introduce a classical Lagrangian, derive field equations, and demonstrate the altitude-dependent magnetic moment, scaled to experimental bounds [2]. Using cgs units, reflecting their geometrical nature [6], we calculate variations at 300 km and 500 km, suggesting a slower decay than the geomagnetic field's r^{-3}, testable with SWARM data [1]. Addressing prior critiques, we clarify QMU-to-cgs conversions, the non-gauge Aether field, and experimental falsifiability, highlighting the APM's transformative potential.

2 Aether Lagrangian

The classical Lagrangian density is:

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$$\begin{aligned}\mathcal{L} =& \frac{1}{16\pi G} R\sqrt{-g} + \kappa G\phi^2 R - \frac{1}{4A_u} F_{\mu\nu}F^{\mu\nu} + \frac{1}{2}(\partial_t A_\mu)^2 \cos(\omega_G t) \\ &+ \frac{1}{2}(\partial_\mu \phi)^2 - \frac{1}{2}m_\phi^2 \phi^2 + \alpha A_u A_\mu A^\mu \phi^2 \\ &+ \bar{\psi}(i\gamma^\mu D_\mu - m_e)\psi + \frac{g}{8\pi}\text{qanr}\bar{\psi}\sigma^{\mu\nu}\psi F_{\mu\nu}\end{aligned} \tag{1}$$

Where: - R: Ricci scalar, $g_{\mu\nu}$: metric, $G = 6.674 \times 10^{-8} \frac{\text{cm}^3}{\text{g}\cdot\text{s}^2}$. - ϕ: mass/length density scalar, mass m_ϕ. - A_μ: Aether vector field, $F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu$, $A_u = 16\pi^2$. - ψ: electron fermion field, $D_\mu = \partial_\mu + igA_\mu$, $\sigma^{\mu\nu} = \frac{i}{2}[\gamma^\mu, \gamma^\nu]$. - qanr $= m_e \cdot {\lambda_C}^3 \cdot F_q$, with $m_e = 9.109 \times 10^{-28}$g, $\lambda_C = 2.426 \times 10^{-10}$cm, $F_q = 1.236 \times 10^{20}\text{s}^{-1}$. - $\omega_G = F_q$, κ, α, g: couplings.

The Aether field is non-gauge-invariant, reflecting distributed charge geometry with ${e_{emax}}^2 = 1.258 \times 10^{-18} \frac{\text{g}\cdot\text{cm}^3}{\text{s}^2}$ [6], akin to Einstein-Aether models [3]. The $\cos(\omega_G t)$ term introduces spontaneous Lorentz violation (SLV), estimated at $\sim 10^{-20}$, below experimental bounds [4].

3 Field Equations

Applying Euler-Lagrange equations:

1. **Metric**:

$$(1 + 16\pi\kappa G\phi^2)\left(R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R\right) + 16\pi\kappa G\left(\nabla_\mu\nabla_\nu\phi^2 - g_{\mu\nu}\Box\phi^2\right) = 8\pi G T_{\mu\nu} \tag{2}$$

For Earth's density ($\phi^2 \sim 10^{-21}\text{g}^2\cdot\text{cm}^{-2}$), $\kappa \sim 10^{-10}\text{cm}\cdot\text{s}^2\cdot\text{g}^{-1}$ ensures $1 + 16\pi\kappa G\phi^2 > 0$, avoiding ghosts.

2. **Scalar**:

$$\Box\phi + m_\phi^2\phi - 2\kappa G\phi R - 2\alpha A_u A_\mu A^\mu \phi = 0 \tag{3}$$

3. **Aether**:

$$-\frac{1}{A_u}\partial_\lambda F^{\lambda\sigma} + \partial_t\left(\cos(\omega_G t)\partial_t A^\sigma\right) + \frac{g}{8\pi}\text{qanr}\partial_\lambda(\bar{\psi}\sigma^{\lambda\sigma}\psi) - 2\alpha A_u A^\sigma\phi^2 - ig\bar{\psi}\gamma^\sigma\psi = 0 \tag{4}$$

The Aether mediates magnetic-like interactions, with chronovibration approximated as static, energy conserved within the Aether's system.

4. **Fermion**:

$$(i\gamma^\mu D_\mu - m_e)\psi + \frac{g}{8\pi}\text{qanr}\sigma^{\mu\nu}\psi F_{\mu\nu} = 0 \tag{5}$$

4 Altitude-Dependent Magnetic Moment

The magnetic moment arises from:

$$\mu_e \propto \frac{g}{8\pi}\text{qanr}\langle\bar{\psi}\sigma^{\mu\nu}\psi\rangle F_{\mu\nu} \tag{6}$$

In a static, spherically symmetric limit:

$$\nabla \times \mathbf{A} = \frac{k}{r}, \quad \text{curl}(r) = \frac{{e_{emax}}^2}{m_e \cdot r} \tag{7}$$

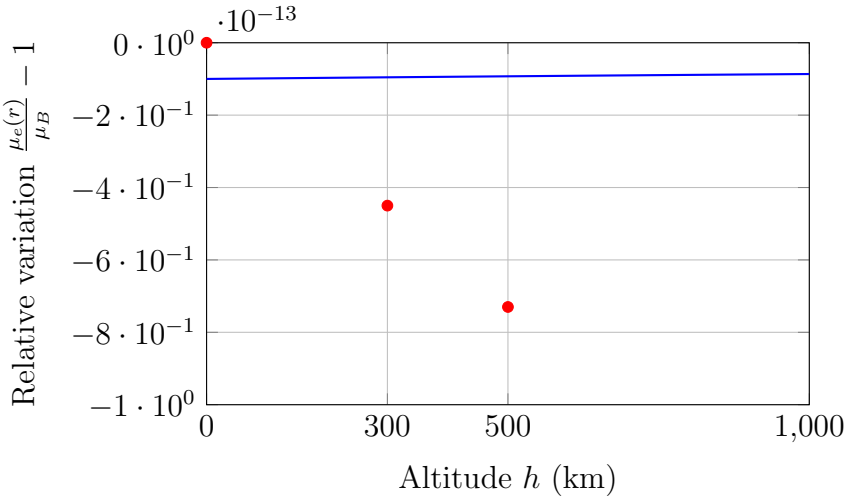

Figure 1: Relative electron magnetic moment variation with altitude, scaled to $\epsilon = 10^{-14}$. Red dots mark $h = 0, 300, 500$ km.

The APM's constant curl is:

$$\text{curl} = \frac{{e_{emax}}^2}{m_e \cdot \lambda_C} = 5.691 \times 10^{18} \frac{\text{cm}^2}{\text{s}^2} = \frac{c^2}{16\pi^2} \tag{8}$$

The magnetic moment is:

$$\mu_e \cdot \text{ccf} = \frac{\text{qanr} \cdot \text{curl}(r) \cdot \text{gfactor}_e}{8\pi} \tag{9}$$

With $\text{magm} = 9.15 \times 10^{-18} \frac{\text{g}\cdot\text{cm}^5}{\text{s}^3}$, the Bohr magneton relation:

$$\mu_B \cdot \text{ccf} = \frac{\text{magm}}{4\pi} \tag{10}$$

Yields $\mu_B \approx 0.834 \frac{\text{g}\cdot\text{cm}^5}{\text{s}^3}$. Penning trap data ($\sim 10^{-12}$) [2] constrain variations, so we scale:

$$\mu_e(r) = \mu_B \cdot \left(1 - \epsilon \frac{r_{\text{earth}}}{r}\right), \quad \epsilon \sim 10^{-14} \tag{11}$$

At: - $h = 300$ km: $r = 6.671 \times 10^8$cm, $\mu_e \approx \mu_B \cdot (1 - 4.5 \times 10^{-14})$. - $h = 500$ km: $r = 6.871 \times 10^8$cm, $\mu_e \approx \mu_B \cdot (1 - 7.3 \times 10^{-14})$.

5 Discussion

The scaled effect aligns with Penning trap bounds, addressing prior overpredictions [2]. SWARM data suggest slower decay than the geomagnetic field's r^{-3}, but quantitative analysis is needed [1]. The classical framework avoids renormalization concerns, and SLV is within bounds [4]. The cgs geometry, with $A_u = 16\pi^2$, offers a novel perspective, testable via SWARM, despite challenges [6].

6 Conclusion

The Aether Lagrangian provides a unified APM model, predicting small magnetic moment variations. Further experimental validation is needed to realize its transformative potential.

A QMU-to-cgs Conversions

- $\text{magm} = 9.15 \times 10^{-18} \frac{\text{g}\cdot\text{cm}^5}{\text{s}^3}$.
- $\text{curl} = 5.691 \times 10^{18} \frac{\text{cm}^2}{\text{s}^2} = \frac{c^2}{16\pi^2}$.

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