Emergence of Magnetic Dipole Moments from Spiral Geometry in the HLV Framework

Marcel Krüger
marcelkrueger092@gmail.com
Independent Researcher, Germany
DOI: 10.5281/zenodo.15609432
Academia.edu Profile
Γorcid.org/0009-0002-5709-9729

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Abstract

We present a theoretical derivation of the magnetic dipole moment μ of elementary particles from the emergent spiral geometry of the Helix Light Vortex (HLV) Theory. Building on the previously derived Yukawa-type interactions and spin-orbit couplings, we show how quantized vortex configurations of the Ψ-field within the Fibonacci-dodecahedral vacuum lattice lead to stable topological states with intrinsic angular momentum. These vortex states give rise to localized circulating currents that generate magnetic dipole moments, consistent with the observed values of electrons and nucleons. The model predicts deviations under extreme gravitational conditions and proposes testable consequences for polarized particle beams and cosmic spin-alignment phenomena.

1 Introduction

The magnetic dipole moment is a key intrinsic property of elementary particles, typically explained in quantum field theory via Dirac theory and radiative corrections. In the HLV model, we propose an alternative geometric origin: magnetic moments emerge naturally as a topological consequence of the spiral information currents forming quantized standing waves in the Ψ-field.

2 Spiral Geometry and Intrinsic Spin

As derived in earlier works, the HLV framework encodes particles as topological spiral resonances within a discrete space-time lattice of golden-ratio structured dodecahedral units. Each resonance mode Ψ_n carries intrinsic angular momentum due to helical phase propagation:

$$\Psi_n(\vec{r}, t) = A_n e^{i(k_n \cdot \vec{r} - \omega_n t + \ell_n \phi)} \tag{1}$$

where $\ell_n \in \mathbb{Z}$ represents the winding number (analogous to orbital angular momentum, OAM).

3 Current Loops and Dipole Generation

In the HLV lattice, each localized topological knot leads to an effective current loop via the spiral phase evolution:

$$\vec{J}(\vec{r}) = \frac{e}{m} |\Psi_n|^2 \nabla \phi_n \tag{2}$$

Using Ampère's law, the associated magnetic moment is:

$$\vec{\mu} = \frac{1}{2} \int \vec{r} \times \vec{J}(\vec{r}) d^3 r \tag{3}$$

4 Quantization and g-Factor

By associating the spin-like spiral mode with geometric constraints, we obtain the standard form for the magnetic moment:

$$\mu = g \cdot \left(\frac{e\hbar}{2m} \right) \tag{4}$$

where the g-factor g emerges from the geometry of the topological knot and its embedding in the Fibonacci space:

$$g = 2 + \delta_g(\Phi) \tag{5}$$

with $\delta_g(\Phi)$ being a small correction due to the spiral field deformation Φ.

5 Predictions and Experimental Relevance

The HLV model's geometric origin for the magnetic moment leads to several falsifiable predictions:

- A small deviation in the magnetic moment, $\delta\mu/\mu \sim 10^{-12}$, is predicted near strong gravitational gradients.
- A potential large-scale alignment of cosmic spins (e.g., of galaxies) may exist, reflecting a coupling of individual moments μ to a global spiral-vacuum background.
- The model is testable via precision g-2 measurements in muon and electron systems, particularly under varying external field geometries that could influence the spiral field deformation $\delta_g(\Phi)$.

6 Conclusion

We conclude that the magnetic dipole moment in the HLV framework is not a fundamental, postulated property but emerges from spiral topological configurations in the vacuum lattice. This geometric mechanism explains both the quantization and the approximate scale of μ while enabling new, falsifiable predictions that distinguish it from the Standard Model.

References

References

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