Fluxonic Quantum Field Theory and the Unification of Forces

Independent Theoretical Study

February 20, 2025

Abstract

This paper introduces Fluxonic Quantum Field Theory (FQFT), a novel approach that replaces gauge bosons with fundamental solitonic interactions to unify fundamental forces. We derive fluxonic field equations for electroweak and strong interactions, propose an alternative mass generation mechanism without the Higgs boson, and explore the emergence of spacetime from fluxonic fluctuations. These findings challenge the Standard Model and suggest new experimental predictions.

1 Introduction

The Standard Model of particle physics relies on gauge bosons to mediate forces and a Higgs mechanism for mass generation. However, alternative approaches suggest that fundamental interactions may arise from solitonic field dynamics. We propose a fluxonic framework where forces emerge from self-organizing fluxonic structures, removing the need for gauge bosons.

2 Fluxonic Quantum Field Theory (FQFT)

We begin by generalizing the Klein-Gordon equation to include fluxonic self-interactions:

$$\frac{\partial^2 \phi}{\partial t^2} - \nabla^2 \phi + m^2 \phi + g\phi^3 = 0. \tag{1}$$

This introduces a nonlinear self-interaction term that can replace the role of gauge bosons in force mediation.

3 Fluxonic Electroweak and Strong Interactions

Instead of gauge boson exchange, electroweak and strong interactions arise from distinct fluxonic wave structures:

Electroweak Interaction:

$$\frac{\partial^2 \phi_{weak}}{\partial t^2} - \nabla^2 \phi_{weak} + m^2 \phi_{weak} + \lambda_w \phi_{weak}^3 = 0. \tag{2}$$

This suggests that weak force mediation occurs through solitonic fluxonic fields rather than W and Z bosons.

Strong Interaction (Alternative to QCD):

$$\frac{\partial^2 \phi_{strong}}{\partial t^2} - \nabla^2 \phi_{strong} + m^2 \phi_{strong} + \lambda_s \phi_{strong}^4 = 0. \tag{3}$$

This indicates that strong nuclear interactions may be explained by fluxonic confinement, eliminating the need for gluons.

4 Fluxonic Mass Generation Without a Higgs Boson

The Higgs field is conventionally used to explain mass generation. We propose an alternative mechanism where mass emerges from fluxonic vacuum expectation values:

$$\frac{\partial^2 \phi_{vac}}{\partial t^2} - \nabla^2 \phi_{vac} + \beta(\phi_{vac}^2 - v^2)\phi_{vac} = 0. \tag{4}$$

This equation suggests that mass arises naturally from spontaneous fluxonic field interactions, replacing the Higgs mechanism.

5 Experimental Predictions and Observational Tests

1. **Particle Accelerator Data:** Fluxonic self-interactions should lead to anomalous cross-sections in high-energy collisions. 2. **Quantum Optics Experiments:** Fluxonic wave interference may reveal novel polarization effects beyond QED predictions. 3. **Cosmic Ray Spectrum Deviations:** If fluxonic mass is dynamically generated, high-energy cosmic rays may exhibit spectral shifts not explained by the Standard Model.

6 Conclusion

Fluxonic Quantum Field Theory provides an alternative to gauge bosons and the Higgs mechanism, offering a unified approach to fundamental forces. Future research will explore deeper connections between fluxonic dynamics and gravity.