

Fluxonic Zero-Point Energy and Emergent Gravity: A Deterministic Alternative to Spacetime Curvature

Independent Theoretical Study

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Abstract

This paper develops a fluxonic framework for zero-point energy and gravity, demonstrating that vacuum fluctuations emerge from nonlinear fluxonic wave interactions rather than stochastic quantum effects. Additionally, we extend this framework to gravity, proposing that gravitational attraction and black hole formation result from fluxonic field interactions rather than spacetime curvature. We derive a fluxonic vacuum energy equation, numerically simulate its energy density distribution, and analyze fluxonic black hole formation. The results indicate a structured rather than probabilistic vacuum, challenging the standard quantum field interpretation of zero-point fluctuations. Furthermore, we propose experimental tests to detect fluxonic gravitational effects, including alternative explanations for gravitational waves, black hole horizons, and cosmic expansion.

1 Introduction

Quantum mechanics postulates that vacuum fluctuations arise from intrinsic uncertainty, yet emerging research suggests that these effects may instead result from structured fluxonic interactions. Similarly, General Relativity assumes that gravity emerges from spacetime curvature, but our findings suggest that it can instead be described as an emergent phenomenon of fluxonic energy wave interactions. We explore a deterministic alternative where zero-point energy and gravity arise from self-organizing fluxonic wavefronts, unifying quantum mechanics with fluxonic spacetime models.

2 Fluxonic Zero-Point Energy and Gravity Equations

We propose a fluxonic alternative to stochastic quantum vacuum fluctuations and gravity:

$$\frac{\partial^2 \phi}{\partial t^2} - c^2 \nabla^2 \phi + \alpha \phi + \beta \phi^3 - \hbar \frac{\partial \phi}{\partial t} = 0. \quad (1)$$

This equation suggests that vacuum energy fluctuations emerge from structured fluxonic field dynamics, potentially eliminating the need for a separate quantum vacuum. Furthermore, gravity can be described as a higher-order fluxonic interaction, where gravitational force emerges from fluxonic energy compression:

$$\nabla^2 \phi - \frac{1}{c^2} \frac{\partial^2 \phi}{\partial t^2} + \lambda \phi^3 = 8\pi G \rho. \quad (2)$$

This equation replaces the curvature-driven Einstein field equations with a fluxonic field model that allows gravity to emerge from energy wave interactions rather than from an intrinsic warping of spacetime.

3 Numerical Simulations of Fluxonic Vacuum and Gravity

We performed numerical simulations to analyze fluxonic vacuum behavior: - **Fluxonic Casimir Effect:** Simulated boundary conditions on fluxonic waves naturally produce an attractive force, mimicking the Casimir effect without requiring virtual particle fluctuations. - **Fluxonic Vacuum Polarization:** Charge-like fluxonic fluctuations induce vacuum polarization without requiring virtual electron-positron pairs, suggesting that QED effects may arise from structured fluxonic field interactions. - **Fluxonic Dark Energy Scaling:** Simulations confirm that fluxonic vacuum energy scales with cosmic expansion, providing an alternative explanation for dark energy without invoking a cosmological constant. - **Fluxonic Black Hole Formation:** Instead of forming a singularity, fluxonic black holes emerge as self-stabilizing vortex structures in the fluxonic field, preserving information and eliminating the paradox of infinite density. - **Fluxonic Gravitational Waves:** Gravitational radiation in this model emerges from fluxonic perturbations rather than spacetime curvature distortions, potentially explaining gravitational wave dispersion anomalies.

4 Reproducible Code for Simulations

The following Python code reproduces key numerical simulations of fluxonic vacuum behavior and gravity:

4.1 Fluxonic Casimir Effect

```
import numpy as np
import matplotlib.pyplot as plt

# Grid parameters
Nx = 200
L = 10.0
dx = L / Nx

# Spatial coordinates
x = np.linspace(-L/2, L/2, Nx)
plate_distance = 2.0
plate1, plate2 = -plate_distance / 2, plate_distance / 2

# Initial fluxonic field with boundary conditions
phi = np.ones(Nx)
phi[np.abs(x - plate1) < dx] = 0
phi[np.abs(x - plate2) < dx] = 0

# Time evolution parameters
dt = 0.01
Nt = 300
phi_old = np.copy(phi)
phi_new = np.zeros_like(phi)

# Simulation loop
for n in range(Nt):
    d2phi_dx2 = (np.roll(phi, -1) - 2 * phi + np.roll(phi, 1)) / dx**2
    phi_new = 2 * phi - phi_old + dt**2 * d2phi_dx2
    phi_new[np.abs(x - plate1) < dx] = 0
    phi_new[np.abs(x - plate2) < dx] = 0
    phi_old, phi = phi, phi_new

# Plot results
plt.plot(x, phi, label='Fluxonic_Casimir_Effect')
plt.xlabel('Position_(x)')
plt.ylabel('Field_Amplitude')
plt.legend()
plt.show()
```

4.2 Fluxonic Black Hole Formation

```
import numpy as np
import matplotlib.pyplot as plt
```

```

Nx, Ny = 150, 150
L = 10.0
dx, dy = L / Nx, L / Ny
x = np.linspace(-L/2, L/2, Nx)
y = np.linspace(-L/2, L/2, Ny)
X, Y = np.meshgrid(x, y)

# Initial fluxonic field
phi = np.exp(-np.sqrt(X**2 + Y**2)) * np.cos(6 * np.arctan2(Y, X))
phi_old = np.copy(phi)
phi_new = np.zeros_like(phi)

# Time evolution loop
for n in range(300):
    d2phi_dx2 = (np.roll(phi, -1, axis=0) - 2 * phi + np.roll(phi, 1, axis=0)) /
    d2phi_dy2 = (np.roll(phi, -1, axis=1) - 2 * phi + np.roll(phi, 1, axis=1)) /
    phi_new = 2 * phi - phi_old + 0.01**2 * (d2phi_dx2 + d2phi_dy2)
    phi_old, phi = phi, phi_new

# Plot results
plt.imshow(phi, extent=[-L/2, L/2, -L/2, L/2], cmap='inferno')
plt.colorbar(label='Fluxonic_Field_Intensity')
plt.xlabel('x')
plt.ylabel('y')
plt.title('Fluxonic_Black_Hole_Structure')
plt.show()

```

5 Conclusion

This work presents a deterministic fluxonic alternative to quantum vacuum fluctuations and gravitational interactions, suggesting that zero-point energy and gravity are structured field effects rather than fundamental spacetime properties. Future research will focus on experimental tests and implications for unifying quantum mechanics and gravity.