

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

Independent Theoretical Study

February 20, 2025

## Abstract

This paper develops a fluxonic framework for zero-point energy, gravity, and quantum measurement, demonstrating that vacuum fluctuations and quantum wave evolution 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. Finally, we explore quantum measurement and wavefunction evolution in the fluxonic model, proposing an alternative to wavefunction collapse through deterministic fluxonic wave interactions. We derive equations governing fluxonic quantum states, simulate a double-slit experiment, and provide an alternative explanation for superposition and measurement. These results challenge the standard quantum field interpretation of zero-point fluctuations and measurement dynamics. Furthermore, we propose experimental tests to detect fluxonic gravitational and quantum effects, including alternative explanations for gravitational waves, black hole horizons, and quantum coherence.

## 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. Additionally, standard quantum measurement theory relies on a probabilistic wavefunction collapse mechanism, whereas our fluxonic model suggests a deterministic wave evolution without needing external collapse rules.

## 2 Fluxonic Quantum Evolution and Measurement

We propose a fluxonic alternative to traditional quantum wavefunction collapse:

$$i\hbar \frac{\partial \psi}{\partial t} = -\frac{\hbar^2}{2m} \frac{\partial^2 \psi}{\partial x^2} + \alpha \psi, \quad (1)$$

which is replaced in the fluxonic framework by:

$$\frac{\partial^2 \phi}{\partial t^2} - c^2 \frac{\partial^2 \phi}{\partial x^2} + \alpha \phi = 0. \quad (2)$$

This equation suggests that quantum evolution is not a probabilistic wavefunction collapse but a structured fluxonic wave evolution governed by deterministic field interactions.

## 3 Numerical Simulations of Fluxonic Quantum Measurement and Gravity

We performed numerical simulations to analyze fluxonic quantum and gravitational behavior: - **Fluxonic Double-Slit Experiment:** Instead of wavefunction collapse, measurement arises from deterministic fluxonic wave evolution, preserving superposition as structured fluxonic interactions. - **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 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.

## 4 Reproducible Code for Quantum Simulations

### 4.1 Fluxonic Double-Slit Experiment

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

# Define spatial and temporal grid
Nx = 300 # Number of spatial points
Nt = 200 # Number of time steps
L = 10.0 # Spatial domain size
dx = L / Nx # Spatial step size
dt = 0.01 # Time step

# Define initial fluxonic wave packet (double-slit interference)
```

```

x = np.linspace(-L/2, L/2, Nx)
phi = np.exp(-x**2) * np.cos(5 * np.pi * x)  # Initial wave function

# Define slits in space (mimicking double slit experiment)
slit_width = 0.2
barrier = np.ones(Nx)
barrier[np.abs(x - 1.5) < slit_width] = 0  # Left slit
barrier[np.abs(x + 1.5) < slit_width] = 0  # Right slit

# Apply barrier effect to wave function
phi *= barrier

# Initialize previous state
phi_old = np.copy(phi)
phi_new = np.zeros_like(phi)

# Fluxonic parameters
c = 1.0  # Wave propagation speed
alpha = -0.1  # Energy interaction term

# Time evolution 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 * (c**2 * d2phi_dx2 + alpha * phi)
    phi_old, phi = phi, phi_new

# Plot fluxonic wave interference pattern
plt.figure(figsize=(8, 5))
plt.plot(x, phi, label="Fluxonic_Wave_Intensity")
plt.xlabel("Position_(x)")
plt.ylabel("Wave_Amplitude")
plt.title("Fluxonic_Double-Slit_Interference")
plt.legend()
plt.grid()
plt.show()

```

## 5 Conclusion

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