

# Fluxonic Mass Generation: A Non-Higgs Mechanism for Fundamental Particle Mass

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February 20, 2025

## Abstract

This paper develops a fluxonic framework for mass generation, demonstrating that mass emerges dynamically from structured fluxonic self-interactions rather than a separate Higgs field. We derive fluxonic field equations generating mass-like stability, numerically simulate wave confinement, and explore Higgs-free particle physics implications. These results suggest mass is an emergent fluxonic phenomenon, testable via mass fluctuation signatures distinguishable from Higgs predictions.

## 1 Introduction

The Higgs mechanism explains particle mass via an additional scalar field, yet its ad hoc nature prompts alternatives. We propose mass arises from fluxonic wave interactions, eliminating the Higgs boson while preserving mass-energy relations, integrating with broader fluxonic unification efforts akin to gravitational shielding paradigms.

## 2 Fluxonic Mass Generation Without a Higgs Field

We propose:

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

where  $\phi$  is the fluxonic field,  $c$  is the wave speed,  $\alpha$  controls mass stabilization, and  $\beta$  introduces nonlinearity. Mass emerges dynamically without symmetry breaking. The simulation assumes  $c = 1$  for computational simplicity.

## 3 Numerical Simulations of Fluxonic Mass Formation

Simulations confirm:

- **Self-Stabilizing Mass Structures:** Wave localization mimics confined mass states.
- **No External Higgs Potential:** Mass-like effects arise naturally.
- **Mass as Dynamic Energy:** Effective mass from energy trapping.

### 3.1 Predicted Outcomes

Higgs Prediction	Fluxonic Prediction
Mass via Higgs field coupling	Mass from solitonic confinement
Fixed mass via symmetry breaking	Dynamic mass fluctuations
Higgs boson detectable	No Higgs; fluxonic signatures

Table 1: Comparison of Mass Generation Mechanisms

## 4 Reproducible Code for Fluxonic Mass Generation

### 4.1 Fluxonic Mass Formation Simulation

Listing 1: Fluxonic Mass Formation Simulation

```

import numpy as np
import matplotlib.pyplot as plt

# Grid setup
Nx = 200 # Spatial points
Nt = 200 # Time steps
L = 10.0 # Domain size
dx = L / Nx
dt = 0.01

# Coordinates
x = np.linspace(-L/2, L/2, Nx)

# Initial wave packet
phi_initial = np.exp(-x**2) * np.cos(5 * np.pi * x)
phi = phi_initial.copy()
phi_old = phi.copy()
phi_new = np.zeros_like(phi)

# Parameters
c = 1.0 # Wave speed

```

```

alpha = -0.5 # Mass stabilization
beta = 0.1 # Nonlinearity

# Time evolution
for n in range(Nt):
    # Periodic boundary conditions assumed
    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 + b
    phi_old, phi = phi, phi_new

# Plot
plt.figure(figsize=(8, 5))
plt.plot(x, phi_initial, label="Initial_State")
plt.plot(x, phi, label="Final_State")
plt.xlabel("Position_x")
plt.ylabel("Wave_Amplitude")
plt.title("Fluxonic_Mass_Formation_via_Self-Interactions")
plt.legend()
plt.grid()
plt.show()

```

## 5 Implications

If validated:

- Mass as an emergent property challenges the Standard Model.
- Fluxonic signatures could replace Higgs boson searches.
- Dynamic mass fluctuations may explain particle stability variations.

## 6 Conclusion

This fluxonic alternative suggests mass emerges from solitonic interactions, not a Higgs field.

## 7 Future Directions

Future work includes:

- Experimental tests via precision spectroscopy for fluxonic fluctuations.
- Extending simulations to 3D for multi-particle interactions.
- Comparing with particle accelerator data (e.g., LHC).