

# Fluxonic Matter Formation: A Unified Approach to Atomic and Molecular Physics

Independent Theoretical Study

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## Abstract

This paper explores the formation of atomic and molecular structures within the Fluxonic Model. By numerically simulating fluxonic solitons, we demonstrate the emergence of quantized energy levels, charge distributions, and molecular bonding effects. These findings suggest that fundamental particles and their interactions arise from deeper solitonic field structures rather than existing as discrete entities. Our results offer a novel alternative to traditional quantum mechanical descriptions of atomic and molecular physics.

## 1 Introduction

The Standard Model of particle physics assumes that elementary particles are fundamental entities. However, recent advances in fluxonic field theory suggest that all matter may emerge from solitonic wave interactions. This work extends fluxonic physics into the domain of atomic and molecular structures.

## 2 Fluxonic Atomic Structure

We model atomic behavior using a nonlinear fluxonic field equation:

$$\frac{\partial^2 \phi}{\partial t^2} - \nabla^2 \phi + m^2 \phi + g\phi^3 + V(\phi) = 0, \quad (1)$$

where  $\phi$  represents the fluxonic field,  $m$  is a mass parameter,  $g$  governs nonlinear interactions, and  $V(\phi)$  represents an external potential binding force.

Key properties of fluxonic atomic structures:

- Charge density:  $\rho_{fluxon} = \nabla \cdot E$ , where  $E = -\nabla\phi$ .
- Current density:  $J_{fluxon} = \nabla \times B$ , where  $B = \nabla \times E$ .
- Quantized energy levels emerging from fluxonic stabilization.

### 3 Numerical Simulations of Atomic Structure

We implemented finite-difference simulations to verify fluxonic atomic behavior. The key results are: - Formation of stable bound states resembling atomic orbitals. - Discrete energy levels corresponding to atomic quantization. - Charge conservation maintained throughout all simulations. - Mass-energy relation emergent from solitonic motion.

### 4 Fluxonic Molecular Interactions

Beyond atomic structures, we extend our simulations to multi-body systems to verify: - The formation of molecular-like structures from interacting fluxons. - The presence of stable molecular bonding energy levels. - Fluxonic "valence" effects leading to structured interactions.

### 5 Mass-Energy Equivalence in the Fluxonic Model

The mass-energy relation is derived by tracking kinetic and potential energy within fluxonic bound states:

$$E_{fluxon} = K + U, \quad (2)$$

where  $K$  is kinetic energy and  $U$  is potential energy derived from nonlinear interactions. Numerical simulations confirm that mass-energy conservation emerges as a fundamental property of fluxonic structures.

### 6 Conclusion

Our findings indicate that atomic and molecular physics can be reformulated in terms of fluxonic solitons, eliminating the need for discrete fundamental particles. This work paves the way for further research into nuclear interactions, periodic table structure, and alternative charge quantization mechanisms.