Fluxonic Cosmology: The Evolution of Space-Time from Solitonic Interactions

Independent Theoretical Study

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Abstract

This paper explores the hypothesis that cosmic structure and space-time evolution emerge from fluxonic solitonic interactions rather than a pre-existing metric. We investigate large-scale cosmic filament formation using nonlinear Klein-Gordon equations with an expansion factor. Our results suggest that cosmic expansion, structure formation, and dark energy effects may arise naturally from fluxonic dynamics, challenging traditional CDM models.

1 Introduction

Modern cosmology relies on CDM models to describe cosmic expansion and large-scale structure. However, these models require dark energy and dark matter as ad-hoc components. We investigate whether fluxonic solitonic interactions can provide a unified alternative by naturally generating cosmic expansion and structure formation.

2 Mathematical Framework

The governing equation for fluxonic cosmology follows the nonlinear Klein-Gordon model with an expansion term:

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

where $\phi(x,t)$ represents the fluxonic field, m is a mass parameter, g governs nonlinear interactions, and we introduce an expansion factor:

$$t' = te^{-Ht}, \tag{2}$$

where H is the expansion rate.

3 Numerical Simulation and Results

A numerical simulation was performed with an initial density fluctuation, and we observed:

$$\begin{aligned} \text{Filament Formation} &: \text{Stable large-scale structures emerged over time.} \\ \text{Cosmic Expansion Effects} &: \text{Wave evolution slowed as expansion progressed.} \\ \text{Dark Matter Equivalence} &: \text{Solitonic energy retention mimicked missing mass effects.} \end{aligned}$$

4 Discussion and Implications

1. **Dark Matter Alternative:** The solitonic structures act as gravitational sources without requiring exotic particles. 2. **Dark Energy Connection:** The emergent expansion term provides a natural mechanism for accelerating universe expansion. 3. **CMB Signatures:** Future work will compare fluxonic predictions with observed cosmic microwave background fluctuations.

5 Conclusion

Our findings suggest that fluxonic solitonic interactions provide a viable alternative to conventional cosmological models. Future work will investigate three-dimensional simulations and comparisons with observational data.