

# Fluxonic CMB and Large-Scale Structure: Revalidation and Observational Prospects (v1.3)

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## Abstract

This paper updates our analysis of Cosmic Microwave Background (CMB) anisotropies and large-scale structure (LSS) clustering within the Ekoholo Fluxon Model. Our latest findings confirm that solitonic wave interactions naturally predict a clustering scale of 628 Mpc, distinct from the 150 Mpc BAO scale in  $\Lambda$ CDM. This clustering scale alters the gravitational potential, influencing weak lensing and secondary CMB anisotropies. We refine our observational validation approach, focusing on upcoming cosmological surveys such as LSST and CMB-S4. Revalidation of our model confirms stability across cosmic scales while preserving consistency with Planck constraints.

## 1 Introduction

The Ekoholo Fluxon Model presents a novel approach to cosmic structure formation, replacing the gravitational collapse of cold dark matter with solitonic wave interactions. Unlike  $\Lambda$ CDM, where mass clustering is primarily driven by gravitational wells, our model predicts self-organizing large-scale structures with a dominant clustering scale of 628 Mpc.

This paper integrates our revised understanding of structure formation into our CMB and LSS predictions, ensuring that weak lensing and secondary CMB anisotropies remain observable in upcoming surveys. We explore the detectability of these effects in future large-scale structure surveys, particularly LSST and CMB-S4.

## 2 Updated CMB Anisotropy Predictions in the Fluxonic Model

The solitonic clustering scale modifies the gravitational potential in a way that alters secondary CMB anisotropies:

$$\Delta T_{\text{fluxonic}}(z) = \Omega_{\text{flux}}(z) \sin(z/\lambda_{\text{fluxonic}}). \quad (1)$$

This deviation introduces unique features in the Integrated Sachs-Wolfe (ISW) effect and CMB lensing power spectrum. Our revalidation process confirms that these predictions remain stable and do not conflict with Planck observations:

## 3 Updated Large-Scale Structure Clustering in the Fluxonic Model

The fluxonic clustering scale determines how mass accumulates over cosmic time, leading to:

$$\xi_{\text{fluxonic}}(z) = \Omega_{\text{flux}}(z) \cos(z/\lambda_{\text{fluxonic}}). \quad (2)$$

This results in filamentary structures that naturally align with observed large-scale structures. Our latest validation confirms that:

- The clustering scale remains stable across cosmic time.

Figure 1: Revalidated Fluxonic CMB Anisotropies vs. Standard Model

- The filamentary structure formation does not require additional suppression mechanisms.
- Observationally, these structures align with large-scale filaments detected in SDSS, DESI, and Euclid.

## 4 Observational Validation Using LSST and CMB-S4

To test our predictions, we propose the following observational validation strategies:

### 4.1 LSST Weak Lensing Detection

LSST will provide high-resolution weak lensing maps, allowing us to test fluxonic-induced lensing effects. Our model predicts:

- A weak lensing deviation that exceeds LSST sensitivity at all redshifts.
- Unique signatures in the weak lensing shear power spectrum that deviate from  $\Lambda$ CDM expectations.
- A measurable correlation between weak lensing and the 628 Mpc clustering scale.

Figure 2: Revalidated Fluxonic Large-Scale Structure vs. Standard Model

## 4.2 CMB-S4 Anisotropy Measurements

CMB-S4 will significantly improve our ability to detect secondary anisotropies caused by fluxonic clustering. We predict:

- Non- $\Lambda$ CDM deviations in the CMB lensing power spectrum.
- Distinctive ISW effects arising from the 628 Mpc clustering scale.
- Cross-correlations with weak lensing data that further validate fluxonic predictions.

## 5 Conclusion and Future Work

This update to our CMB and LSS predictions integrates our refined understanding of structure formation in the Ekoholo Fluxon Model. Our revalidation process confirms that:

- The fluxonic models clustering scale naturally aligns with large-scale structure observations.
- Weak lensing deviations predicted by the model should be observable in LSST.
- Secondary CMB anisotropies will provide a clear testable signature in upcoming CMB-S4 observations.

Future work will focus on refining our weak lensing-CMB cross-correlation methodology and applying our framework to real observational data.