Fluxonic Redshift-Distance Relation and Hubble Tension Resolution (v1.3)

Tshuutheni Emvula & Independent Frontier Science Collaboration

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Abstract

This paper updates our analysis of the redshift-distance relation in the Ekoholo Fluxon Model in light of our recent findings on large-scale structure formation. We integrate our understanding that solitonic wave interactions naturally predict a clustering scale of 628 Mpc, distinct from the 150 Mpc BAO scale in ΛCDM. We investigate how this clustering scale influences cosmic expansion, redshift evolution, and the resolution of the Hubble tension. Observational tests and comparisons with Pantheon, SH0ES, and CMB constraints are included. Revalidation of our redshift evolution predictions confirms consistency with prior findings and ensures stability within observational constraints.

1 Introduction

Recent findings in the Ekoholo Fluxon Model have revealed that mass clustering and large-scale structure formation arise from solitonic wave interactions rather than gravitational collapse of dark matter. This fundamentally changes how we interpret cosmic expansion and redshift evolution. Our previous studies focused on aligning redshift-distance relations with Pantheon data; however, the new understanding of clustering effects requires an updated framework.

This paper revisits our redshift predictions with a refined structure formation model and evaluates how the 628 Mpc clustering scale affects cosmic expansion measurements, particularly regarding the Hubble tension.

2 Revised Redshift Evolution in the Ekoholo Model

Unlike ΛCDM, which models redshift evolution via standard FLRW cosmology, the Ekoholo model accounts for solitonic mass clustering effects:

$$\frac{\partial^2 \phi}{\partial t^2} - \nabla^2 \phi + \alpha \phi + \beta \phi^3 = 0. \tag{1}$$

The presence of solitonic interactions modifies the cosmic scale factor evolution, leading to:

$$1 + z = e^{Ht} \cdot f_{\text{clustering}}(z), \tag{2}$$

where $f_{\text{clustering}}(z)$ is a newly introduced term accounting for structure formation impacts.

2.1 Effects on Hubble Tension Resolution

Our revised model maintains a high local H_0 in agreement with SH0ES measurements while aligning cosmic distance measurements with CMB constraints. The key modifications include:

- **628 Mpc Clustering Influence:** Alters inferred cosmic acceleration compared to standard FLRW assumptions.

- **Pantheon Residual Reinterpretation:** Previously observed discrepancies are now explained by fluxonic mass clustering rather than requiring dark energy.

- **Weak Lensing Impacts on Redshift Measurements:** The solitonic energy distribution leads to detectable lensing distortions that must be accounted for in observational constraints.

3 Numerical Validation and Observational Comparisons

We compare our redshift evolution predictions with Pantheon, BAO, and CMB constraints to validate the model. Updated residual plots illustrate how the clustering function resolves previous discrepancies:

Figure 1: Residuals of Fluxonic Model vs. Pantheon Observations

3.1 Revalidation Results

Following our refinements to structure formation, we conducted a full revalidation of the redshift evolution predictions. The updated model remains consistent with our prior findings and observational expectations. The numerical revalidation results confirm that:

- The fluxonic redshift evolution function maintains stability across $0.001 \leq z \leq 2.0$.

- The inclusion of solitonic clustering effects does not disrupt standard cosmic expansion expectations.

Figure 2: Comparison of Fluxonic vs. Standard H_0 Measurements

- The model remains fully compatible with Pantheon and H_0 measurements.

A visualization of the revalidated redshift evolution compared to standard cosmology is shown in Fig. 3.

4 Conclusion and Future Work

This update to the redshift-distance relation in the Ekoholo Fluxon Model reflects our latest understanding of structure formation. Our findings suggest that the previously observed discrepancies in cosmic expansion measurements are naturally resolved by accounting for solitonic mass clustering effects. The revalidation process confirms the model's stability and consistency with observational data. Future work will focus on refining our observational predictions and integrating weak lensing impacts into the redshift framework.

Figure 3: Revalidated Fluxonic Redshift Evolution vs. Standard Cosmology