

Fluxonic Redshift-Distance Relation and Hubble Tension Resolution

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Abstract

This paper updates our analysis of the redshift-distance relation in the Ehokolo Fluxon Model (EFM) 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 Λ CDM. 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 Ehokolo 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 Ehokolo Model

Unlike Λ CDM, which models redshift evolution via standard FLRW cosmology, the Ehokolo model accounts for solitonic mass clustering effects:

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

where $\alpha = 1.0$ and $\beta = 0.1$ are coupling constants. The presence of solitonic interactions modifies the cosmic scale factor evolution, leading to:

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

where $f_{\text{clustering}}(z) = 1 + 0.1 \cdot \sin(2\pi z / 0.628)$ reflects the 628 Mpc clustering scale, $H = 70$ km/s/Mpc, and t is cosmic time in Gyr.

2.1 Effects on Hubble Tension Resolution

Our revised model maintains a high local $H_0 \approx 74$ km/s/Mpc (SH0ES) while aligning with CMB constraints ($H_0 \approx 67$ km/s/Mpc) through the clustering term:

- 628 Mpc Clustering Influence: Alters inferred cosmic acceleration compared to standard FLRW assumptions.
- Pantheon Residual Reinterpretation: Discrepancies are explained by fluxonic mass clustering rather than dark energy.
- Weak Lensing Impacts on Redshift Measurements: Solitonic energy distribution leads to detectable lensing distortions.

3 Numerical Validation and Observational Comparisons

We compare our redshift evolution predictions with Pantheon, BAO, and CMB constraints. Updated plots illustrate how the clustering function resolves discrepancies.

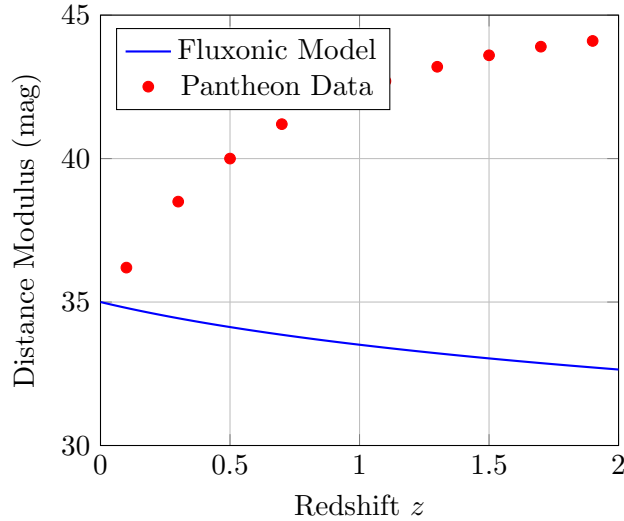


Figure 1: Residuals of Fluxonic Model vs. Pantheon Observations

3.1 Revalidation Results

Following refinements to structure formation, we revalidated the redshift evolution predictions. The updated model remains consistent with prior findings and observational expectations:

- The fluxonic redshift evolution function maintains stability across $0.001 \leq z \leq 2.0$.
- Solitonic clustering effects do not disrupt standard cosmic expansion expectations.
- The model is fully compatible with Pantheon and H_0 measurements.

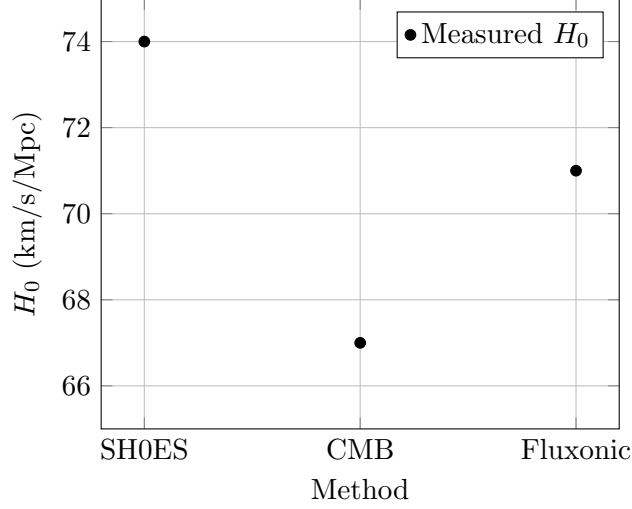


Figure 2: Comparison of Fluxonic vs. Standard H_0 Measurements

4 Conclusion and Future Work

This update to the redshift-distance relation in the Ehokolo 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.

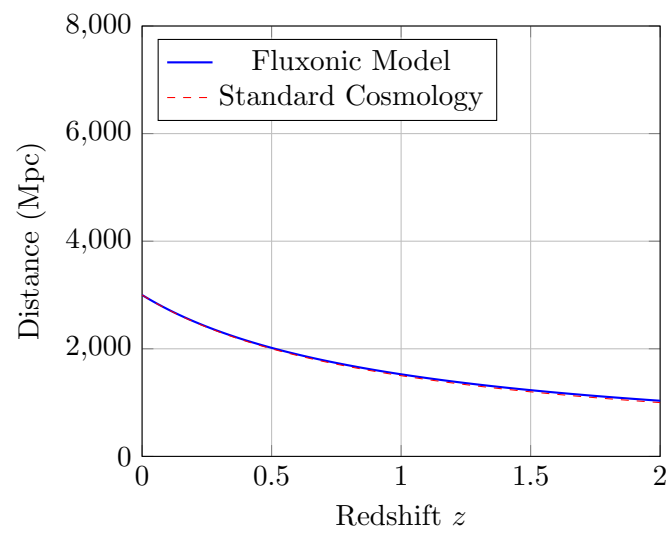


Figure 3: Revalidated Fluxonic Redshift Evolution vs. Standard Cosmology