Cosmos Dark Matter Cores As1063 20260223 Publication V1

Abstract

This publication provides a structured synthesis for Cosmos Dark Matter Cores As1063 20260223 Publication V1, with claim-to-evidence framing and a validation path for downstream readers.

Keywords

cosmos, research, publication

Main Content

Large Dark-Matter Cores in AS1063: A Coherence-Constrained Interpretation

Cohera Lab

February 2026

Abstract

We reframe the AS1063 large-core problem through a coherence-constrained lens that distinguishes observational signal, model prior, and geometric inference. Instead of forcing a single mechanism, we formalize a bounded comparison between self-interacting dark-matter (SIDM) and alternative coarse-grained reconstruction effects. The analysis is anchored in distance-based state discrimination and explicit failure tests. **Falsification Hook:** if posterior support for large-core structure vanishes under jointly perturbed lensing priors and independent profile reconstructions, the coherence-constrained SIDM interpretation is rejected.

Keywords dark matter cores; AS1063; lensing inference; model selection; falsification

1 Introduction

Claims of large dark-matter cores in cluster environments are sensitive to reconstruction assumptions. This manuscript provides a cleaner publication baseline: assumptions are explicit, inference metrics are declared, and interpretive claims are bounded by rejection criteria.

2 Coherence Functional

Let θ denote a profile-parameter vector and $\mathcal{L}(\theta)$ the likelihood under lensing constraints. We define a coherence-weighted objective

$$\mathcal{J}(\theta) = -\log \mathcal{L}(\theta) + \lambda\, \Omega(\theta), \tag{1}$$

where Ω penalizes profile incoherence across reconstruction channels and $\lambda > 0$ controls regularization strength.

3 Stability Threshold

Profile stability is tracked under perturbation set $\mathcal{P}$ (priors, noise model, source-plane assumptions):

$$\Delta_{\text{core}} = \sup_{p \in \mathcal{P}} \left| r_c^{(p)} - r_c^{(0)} \right| . \tag{2}$$

A robust core claim requires

$$\Delta_{\text{core}} < \delta_c, \tag{3}$$

with pre-registered tolerance δ_c.

4 Emergent Geometry Protocol

We compare posterior state families through Bures-type distinguishability between reconstructed profile states ρ_i:

$$D_B(\rho_i, \rho_j) = \sqrt{2\left(1 - \sqrt{F(\rho_i, \rho_j)}\right)}, \tag{4}$$

where

$$F(\rho_i, \rho_j) = \left[\mathrm{Tr}\left(\sqrt{\sqrt{\rho_i}\,\rho_j\,\sqrt{\rho_i}}\right)\right]^2. \tag{5}$$

If SIDM and non-SIDM reconstructions remain distinguishable under bounded perturbations, the large-core hypothesis retains constrained support; otherwise support collapses.

Validation and Falsification

- Re-run reconstructions with alternative prior families and source selection cuts.
- Require cross-method agreement (independent lensing pipelines) within δ_c tolerance.
- Reject large-core interpretation if stability fails or Bures separation becomes non-significant.

Conclusion

The AS1063 core claim is treated as a testable constrained hypothesis, not a narrative endpoint. This publication version prioritizes explicit model boundaries and falsifiability over rhetorical certainty.