

Cosmos v5: Coherence Operators and Emergent Geometry

Abstract

This publication provides a structured synthesis for Cosmos v5: Coherence Operators and Emergent Geometry, with claim-to-evidence framing and a validation path for downstream readers.

Keywords

cosmos, research, publication

Main Content

Cosmos v5: Coherence Operators and Emergent Geometry

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Research Thread: Cosmos | Manuscript Type: Formal Synthesis

Abstract

This paper consolidates the current Cohera formulation of coherence operators and emergent geometry into a publishable baseline. It converts previously fragmented draft sections into a single formal narrative with explicit assumptions, computable definitions, and falsification hooks. The aim is methodological clarity: every equation should map to an observable claim and every interpretation should declare its uncertainty boundary.

Keywords coherence operators; emergent geometry; projection stability; holographic framework; model validation

1 Introduction

The Cosmos v5 line of work attempts to connect operator-level coherence metrics with geometry-like structures that emerge under constrained projection. Earlier drafts contained useful fragments but lacked unified notation and test discipline. This manuscript provides a cleaned synthesis suitable for critical reading and replication planning.

2 Formal Core

Let ρ_{loc} denote the localized state estimate and Π the projection operator over the selected coherent sector.

We define the off-diagonal coherence witness as:

$$\mathcal{C}(\rho_{\text{loc}}) = \sum_{i \neq j} |\rho_{ij}|. \quad (1)$$

Selection dynamics are controlled through an energy-coherence tradeoff:

$$\mathcal{F}_n = E_n - \kappa \mathcal{C}_n, \quad (2)$$

with minimization over recurrence windows.

Compatibility between projected and local flows is monitored via:

$$\varepsilon = \|\Pi \mathcal{F} - \mathcal{F}_{\text{loc}} \Pi\|_{\text{op}}. \quad (3)$$

A stable coherent regime is declared only if

$$\varepsilon < \delta_{\text{coh}}. \quad (4)$$

3 From Coherence to Geometry

Given pairwise distinguishability between projected states, a graph is constructed and embedded to estimate a local metric tensor and curvature profile. The practical interpretation is limited: geometry is treated as an emergent descriptor, not an ontological primitive.

4 Validation and Falsification

- Sweep κ and evaluate stability boundaries for δ_{coh} .
- Replace coherence witness families and test invariance of qualitative conclusions.
- Report failure cases where geometric reconstruction is unstable under mild perturbation.

5 Conclusion

Cosmos v5 now has a cleaner formal spine and a replicable validation path. This does not finalize the theory, but it does make the current claim set auditable and technically discussable.

References (working set)

1. Cohera internal draft set: Section 8.1–8.3 formal notes (2026).
2. Standard operator-norm and distinguishability references used in quantum information geometry.