The Sekala/Niskala Framework (v6.4.1):
A Unified Model for Cosmology and Quantum Mechanics

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Abstract

We update the Sekala/Niskala framework aligned with the **v8.8** cosmology preprint. A *dynamic engine* with two opposing principles—**Spatial Expansion** (*unfurl*) and **Temporal Concentration** (*enfold*)—drives a lemniscate-shaped, CPT-symmetric dual-universe cycle. At the entropic inversion, a quantum interface—the *Planck Bridge*—mediates singularity avoidance and role exchange between branches. Primary validation uses a scale-dependent effective coupling (*Candidate B*) on CMB/LSS/WL; speculative avenues (e.g., neutrino tunneling) are *de-prioritized* in an appendix. We reintroduce quantum-frontier motifs (entanglement, black holes, light/'c'-boundary) and provide falsifiable predictions and a staged roadmap.

Open resources: cosmology preprint DOI doi:10.5281/zenodo.17025011, this white paper DOI doi:10.5281/zenodo.16945128, GitHub `https://github.com/SekalaNiskala27/Quantum-Cosmology-Model`, and X @SekalaNiskala27.

Keywords Dual-universe; CPT symmetry; Lemniscate topology; Brane–bulk geometry; Dynamic engine (unfurl/enfold); Planck Bridge; Black hole information; CMB; Matter power spectrum; Quantized GWs (toy); ER=EPR (pointer); Open science.

1 Core Axiom: A Symmetric Duality

We posit a 4D universe (*Sekala*) interwoven with a CPT-symmetric twin (*Niskala*, antimatter, reversed time) in a higher-dimensional brane–bulk geometry. Puzzles become structural: **Dark Matter** as the twin-brane gravitational imprint; **Baryon Asymmetry** local yet globally balanced; the **Arrow of Time** as motion along a cyclic trajectory with entropic inversion.

Gravitational "tendrils". We use *tendrils* for geometric projections through the bulk that transmit curvature between branes. No Standard-Model transfer occurs; effects are purely gravitational in our sector.

Dynamic Engine and Entropic Inversion

Two opposing principles govern the cycle: **unfurl** (spatial expansion, entropy increase) and **enfold** (temporal concentration towards informational immobility). CPT symmetry implies role reversal at the *entropic inversion* via the *Planck Bridge*.

2 Quantum Frontier: Entanglement and Black Holes

2.1 Entanglement as a Topological Connection

We model EPR entanglement as a null-like connection through the bulk: a *tendril* with line element $ds^2 = 0$ joining the pair across the Planck Bridge (ER=EPR pointer).

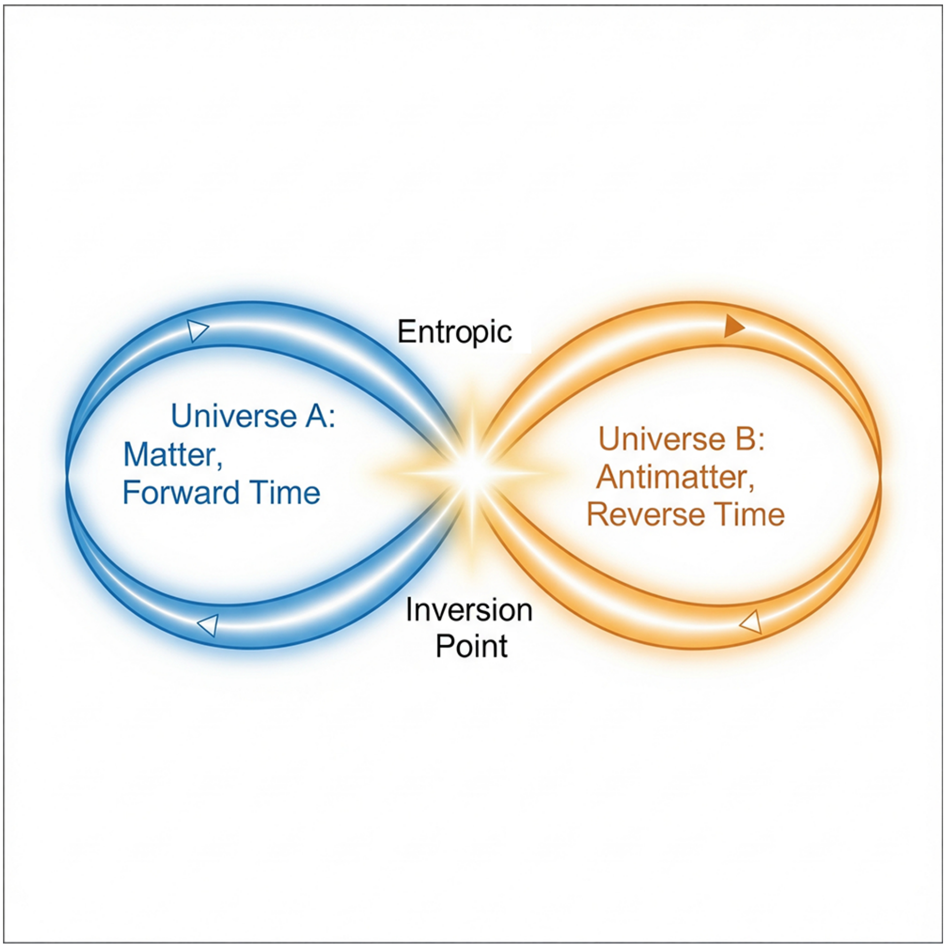

Figure 1: Figure 1: Lemniscate depicting the cyclic interplay of Sekala (blue) and Niskala (red) universes, with the entropic inversion at the center.

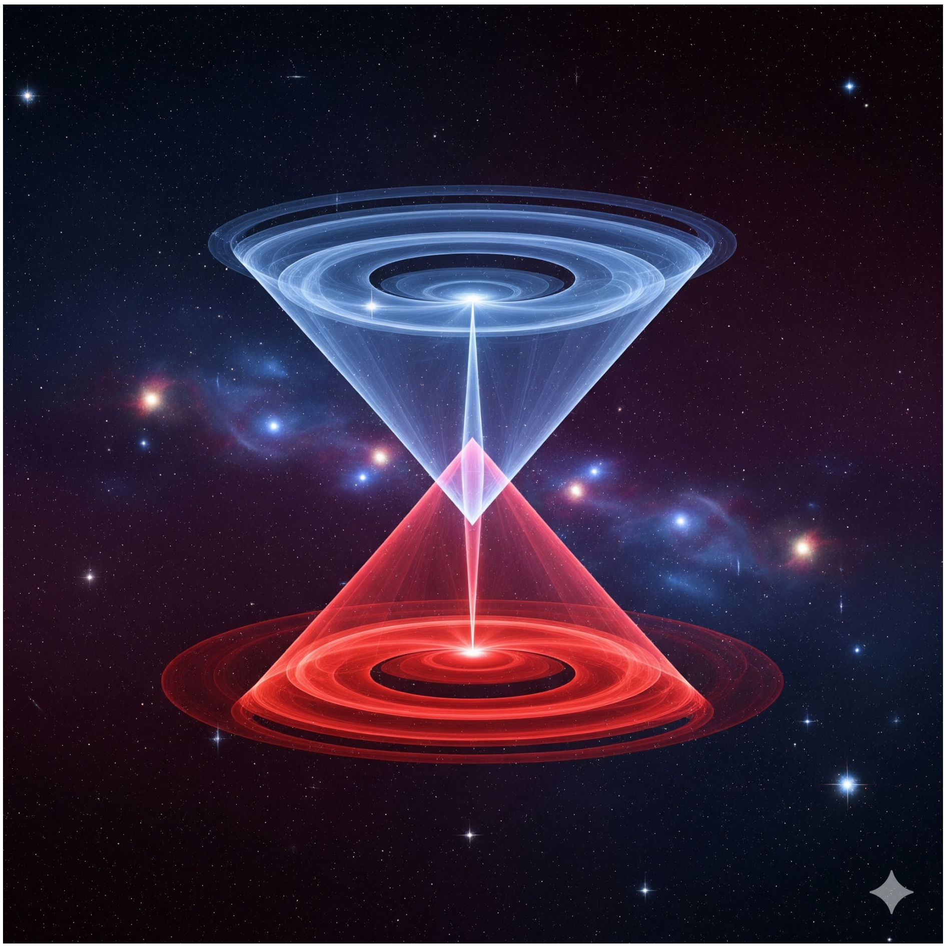

Figure 2: Figure 2: Meta-Universe inversion geometry with Planck Bridge (singularity avoidance).

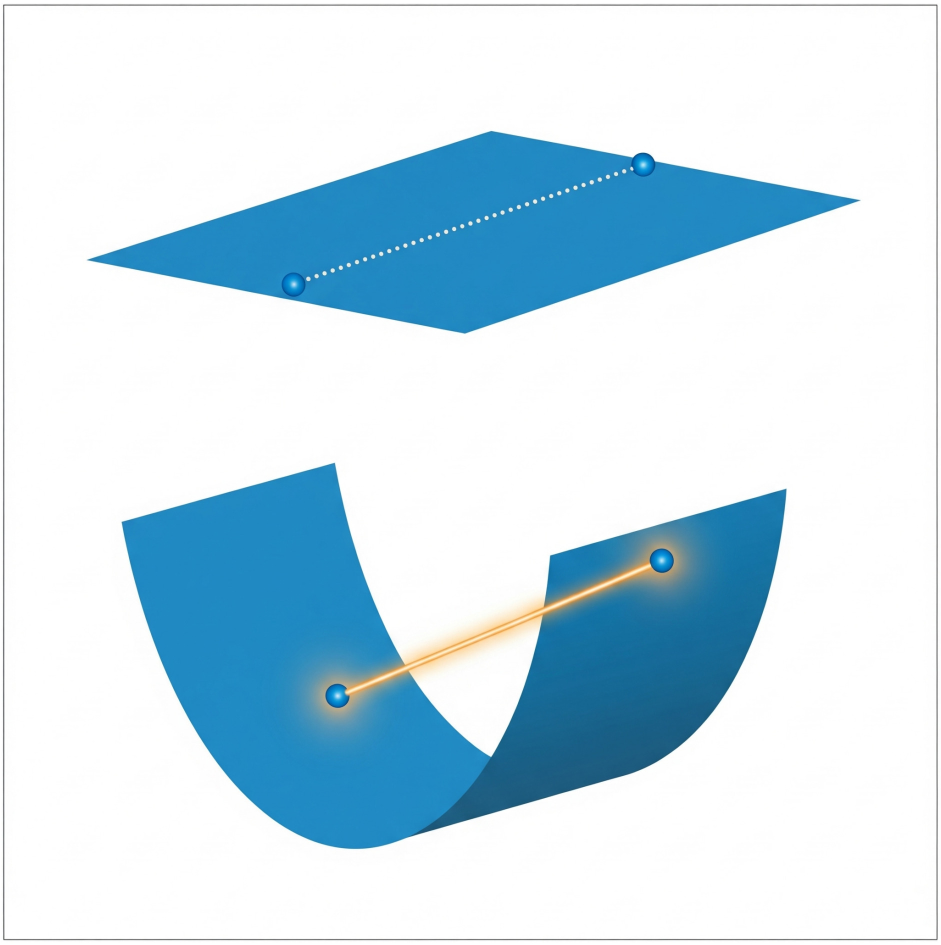

Figure 3: Figure 3: Folded Universe showing entangled particles A and B linked via a Niskala tendril (green), with $ds^2 = 0$.

2.2 Black Holes as Conduits (Information Preserved)

Black holes can act as conduits to Niskala. Information is preserved by transfer across the interface rather than destroyed at a singularity, reframing the paradox in the larger Meta-Universe.

3 Dimensional & Topological Frontiers: Light and the Space–Time Swap (3S/1T $\leftrightarrow$ 1S/3T)

A heuristic Wick-like continuation ($t \to i\tau$) near the inversion maps our 3S/1T metric to a 1S/3T structure in Niskala, aligning with the unfurl/enfold role-exchange.

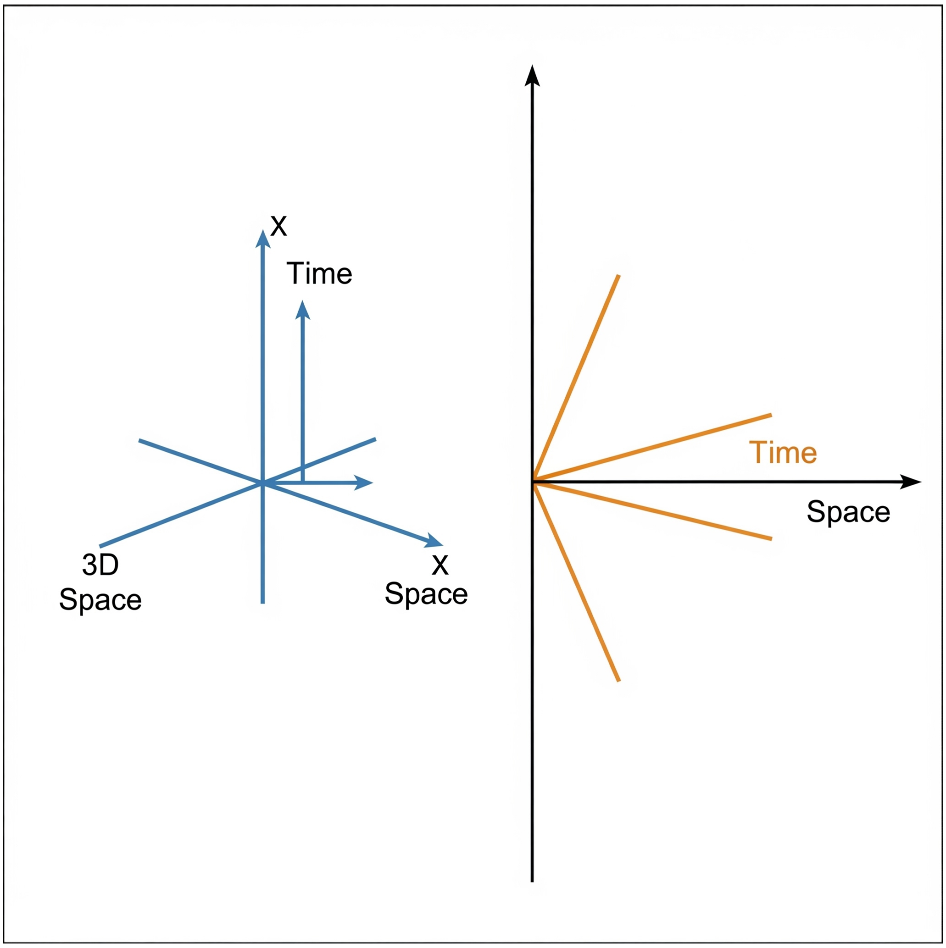

Figure 4: Figure 4: Space–Time Swap illustrating 1S/3T (Niskala, red) vs. 3S/1T (Sekala, blue).

3.1 The 'c'-Boundary and the Nature of Light

The speed of light acts as a topological boundary of the Sekala brane: photons propagate along this boundary, which separates Sekala from Niskala at the Planck Bridge. At the dual limit (maximal speed $\leftrightarrow$ immobility in the twin branch) the inversion is triggered.

4 Cosmology-First Validation: Candidate B (aligned with v8.8)

We retain the scale-dependent kernel $G_{\text{eff}}(k)$ to compare with ΛCDM while preserving large-scale successes:

$$k^2\Phi(a,k) = -4\pi G\, a^2\, \rho_m(a)\, \delta_m(a,k)\, G_{\text{eff}}(k), \qquad G_{\text{eff}}(k) = 1 + \frac{\alpha_0}{1+(k/k_c)^2}. \tag{1}$$

Normalization to σ_8. For each (α_0, λ_c) we rescale the linear spectrum to match the ΛCDM baseline on large scales before comparing small-scale departures, following the approach consolidated in **v8.8**.

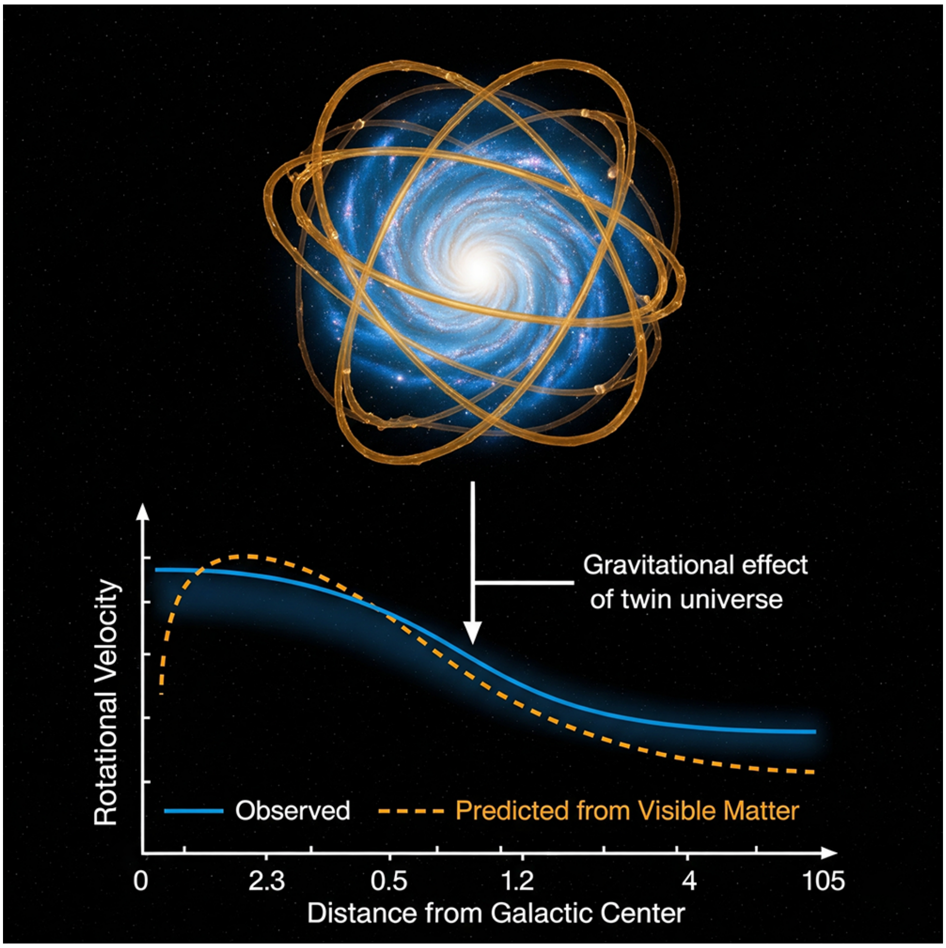

Figure 5: Figure 5: Simulated Dark Matter distribution from Niskala's imprint (red), showing rotation-curve deviations vs. visible-matter expectation (blue).

5 Falsifiable Predictions (Summary)

6 Gravitational Waves: Quantized Lines (Toy Ansatz)

We hypothesize that events coupling to the Planck Bridge may excite quasi-discrete GW modes. As a toy model:

$$f_n \approx f_0\sqrt{n+\delta}, \qquad n = 1, 2, \ldots, \qquad f_0 \in [10, 100]\ \text{Hz}, \tag{2}$$

with small linewidths set by environmental damping. This is not a replacement for standard templates, but an *additional* matched filter bank to scan archival data for narrow excess power.

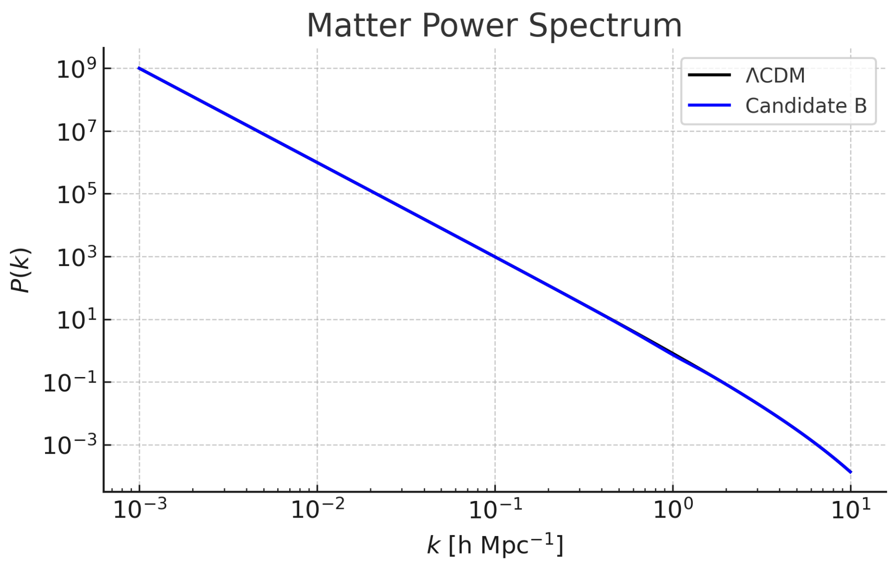

Figure 6: Figure 6: Matter power spectrum from the model compared to ΛCDM.

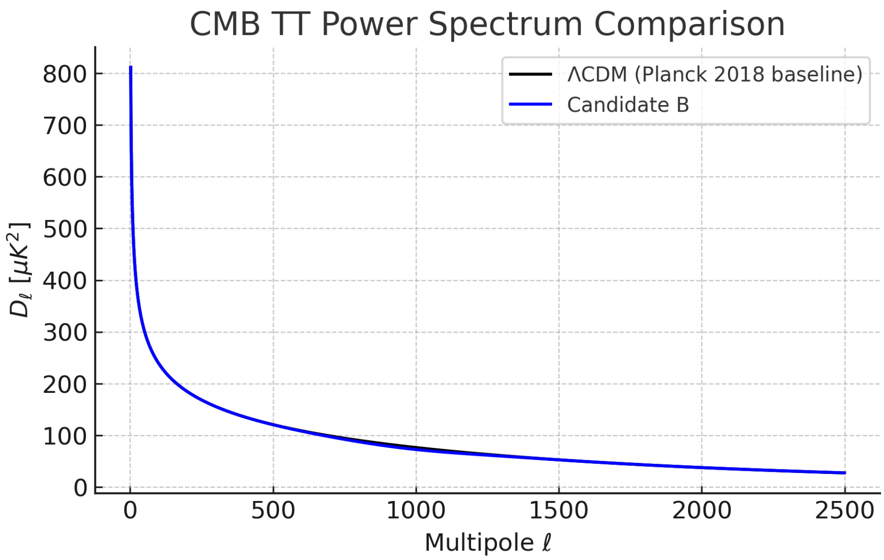

Figure 7: Figure 7: CMB TT power spectrum predictions from the model vs. Planck 2018 baseline.

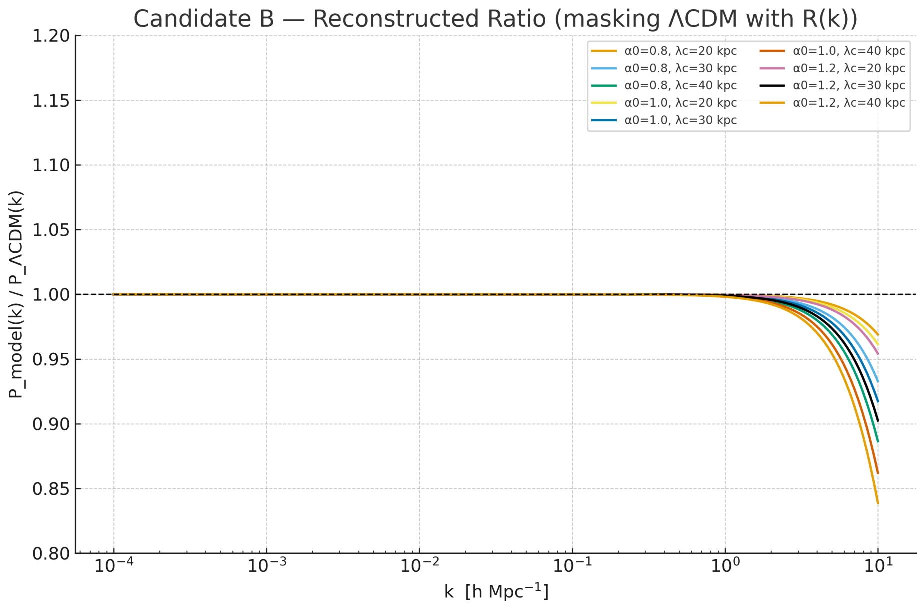

Figure 8: Figure 8: Ratio $P_{\mathrm{model}}(k)/P_{\Lambda\mathrm{CDM}}(k)$:
preservation on large scales and scale-dependent suppression on small scales.

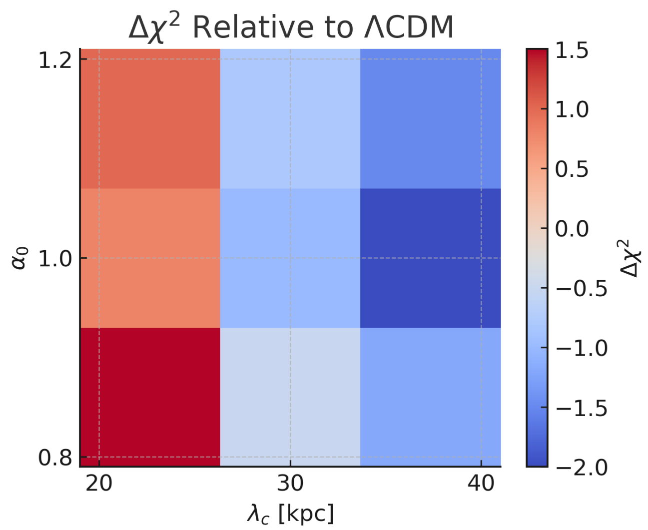

Figure 9: Figure 9: Parameter interest map ($\Delta\chi^2$ vs. ΛCDM):
ROI evidenziata per una successiva esplorazione MCMC.

Table 1: Selected falsifiable predictions and where to test them.

Prediction	Signature / Dataset	Priority
Scale-dependent growth (Candidate B)	$P(k)$ suppression at $k \gtrsim 0.1\,h\,\mathrm{Mpc}^{-1}$; WL shear spectra; BAO residuals.	High
CMB high-ℓ texture	Small fractal-like modulations at $\ell \gtrsim 10^3$ (TT/TE/EE).	Medium
Boundary-annihilation hints	Faint 511 keV line in special morphologies.	Low
Quantized GW lines (toy)	Narrow features at 10 Hz to 100 Hz in LIGO/Virgo/KAGRA archives (mergers near Bridge).	Exploratory
Neutrino tunneling (low-priority)	Sterile-like $\Delta m^2 \sim 0.1\,\mathrm{eV}^2$ to $1\,\mathrm{eV}^2$; joint cosmology+oscillations fit.	Deferred

7 Conclusions and Strategic Roadmap

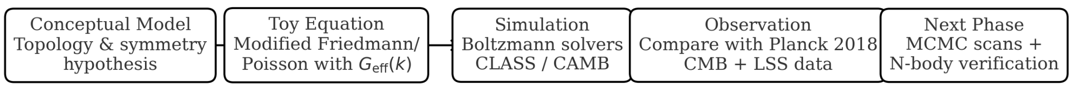

Figure 10: Figure 10: Research phases: model refinement, MCMC simulations (e.g., via PyMC3/Cobaya), and observational tests.

1. **Consolidate:** Full MCMC posteriors for Candidate B (CMB+$P(k)$+WL) with robust σ_8 normalization.
2. **Hunt:** Add a narrow-line GW matched-filter pass to LIGO/Virgo/KAGRA archives.
3. **Defer:** Revisit neutrino tunneling (Appendix C) only if data demand it.

Open Science and Contributions. Cosmology preprint (v8.8) DOI: doi:10.5281/zenodo.17025011.
This companion white paper DOI: doi:10.5281/zenodo.16945128.
GitHub: `https://github.com/SekalaNiskala27/Quantum-Cosmology-Model`. X: @SekalaNiskala27.

A Toy Growth and Normalization (Reference)

Assume ΛCDM background, $H^2(a) = H_0^2(\Omega_m a^{-3} + \Omega_\Lambda)$, and solve

$$\frac{d^2 D}{da^2} + \left(\frac{3}{a} + \frac{d\ln H}{da}\right)\frac{dD}{da} - \frac{3}{2}\frac{\Omega_m H_0^2}{a^5 H^2(a)}\,G_{\mathrm{eff}}(k)\,D = 0, \qquad D(a{=}1,k) = 1, \tag{3}$$

with $P_{\rm model}(k) = P_{\Lambda\rm CDM}(k)\, D^2(a{=}1, k)$ and σ_8 renormalization applied per (α_0, λ_c).

B Mini-Derivations

B.1 Null Geodesic Link for Entanglement

In Minkowski signature $(-,+,+,+)$, a null interval satisfies $ds^2 = 0$. The bulk *tendril* connecting an EPR pair imposes a null-like separation in the embedding, enabling correlation without superluminal signaling in 4D.

B.2 Wick-like Map for 1S/3T

Near inversion, an analytic continuation $t \to i\tau$ sketches a map from 3S/1T to 1S/3T, providing a heuristic bridge between dynamic engine roles and CPT reversal.

B.3 GW Line Ansatz (Caveat)

A cavity-like spectrum $f_n \approx f_0\sqrt{n+\delta}$ is a toy *ansatz*. Any detection claim requires rigorous trials-factor accounting and cross-checks with standard waveforms.

C Speculative Extension: Neutrino Tunneling

We retain neutrino tunneling across the Planck Bridge as a low-priority channel (sterile-like $\Delta m^2 \sim 0.1\,\mathrm{eV}^2$ to $1\,\mathrm{eV}^2$). A future joint MCMC can treat mixing and Δm^2 as nuisance parameters constrained alongside cosmology.

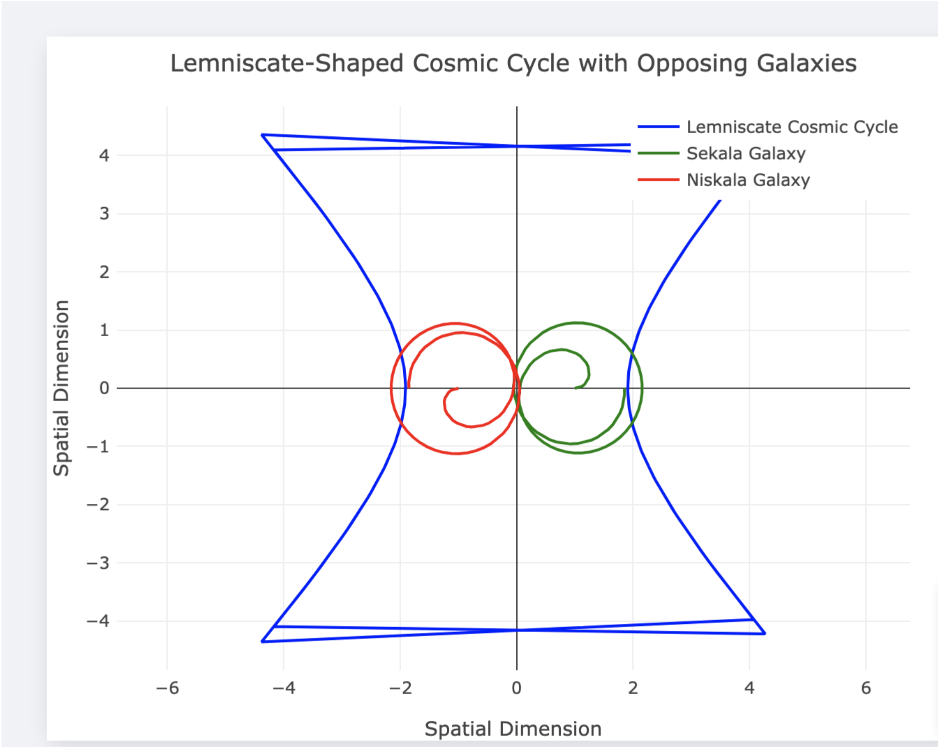

Figure S1: Supplementary Figure S1: Lemniscate-shaped cosmic cycle with opposing spiral galaxies (visual variant of Figure 1).

References

[1] A. De Joannon (Subimal), PS Ai. *Sekala/Niskala: The Woven Cosmos* (cosmology preprint v8.8). Zenodo (2025). DOI: doi:10.5281/zenodo.17025011.

[2] A. De Joannon (Subimal), PS Ai. *The Sekala/Niskala Framework: A Unified Model for Cosmology and Quantum Mechanics*. Zenodo (2025). DOI: doi:10.5281/zenodo.16945128.

[3] N. Aghanim *et al.* (Planck Collaboration). Planck 2018 results. VI. Cosmological parameters. *Astron. Astrophys.* 641, A6 (2020).

[4] J. Maldacena, L. Susskind. Cool horizons for entangled black holes. *Fortschr. Phys.* 61(9), 781–811 (2013).

[5] C. Rovelli. Loop Quantum Gravity. *Living Reviews in Relativity* 11(1), 1–69 (2008).

[6] R. Penrose. *Cycles of Time*. The Bodley Head (2010).

[7] J. Barbour, T. Koslowski, F. Mercati. Identification of a Gravitational Arrow of Time. *Phys. Rev. Lett.* 113, 181101 (2014).