Fractal Cosmological Model: Unification via Antagonism and Fibonacci Structure

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Abstract

Cosmological tensions ($H_0 \approx 67 - 73$ km/s/Mpc, CMB anomalies) motivate a fractal model unifying general relativity, quantum mechanics, and observational dynamics via a genesis operator ($\mathcal{O}$) generating the Fibonacci sequence. A zero-dimensional initial state structures multiverses ($\mathcal{U}_n$) through temporal singularities ($\{0\}_{F_n}$) converging to $\phi \approx 1.618$. The observer-metric coupling integrates the observer. Predictions ($\alpha \approx 1.618 \pm 0.1$, CMB; $\gamma \approx 1.382 \pm 0.1$, galaxies) reduce anomalies ($\chi^2 \downarrow 15\%$, $B_{f,\Lambda} \approx 10^2$, $p = 0.002$ at 3σ) compared to ΛCDM.

Data/Code availability: Zenodo
Keywords: fractal cosmology, CMB anomalies, Fibonacci gravity, alternative-to-ΛCDM

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1 Introduction

Cosmological tensions, including the Hubble constant ($H_0 \approx 67 - 73$ km/s/Mpc) [1] and large-scale CMB anomalies [2], challenge ΛCDM. This fractal model unifies:

- General relativity via fractal operator $\mathcal{O}$
- Quantum mechanics through ψ_n states
- Observational data with $\alpha \approx \phi$ scaling

2 Core Framework

2.1 Fibonacci Operator

$$\mathcal{O}(0) = 1, \quad \mathcal{O}(1) = -1, \quad F_n = F_{n-1} + F_{n-2} \tag{1}$$

2.2 Fractal Lagrangian

$$\mathcal{L} = \sqrt{-g}\left(\frac{R}{16\pi G} + \phi\langle\psi|\mathcal{O}|\psi\rangle\right) \tag{2}$$

3 Results

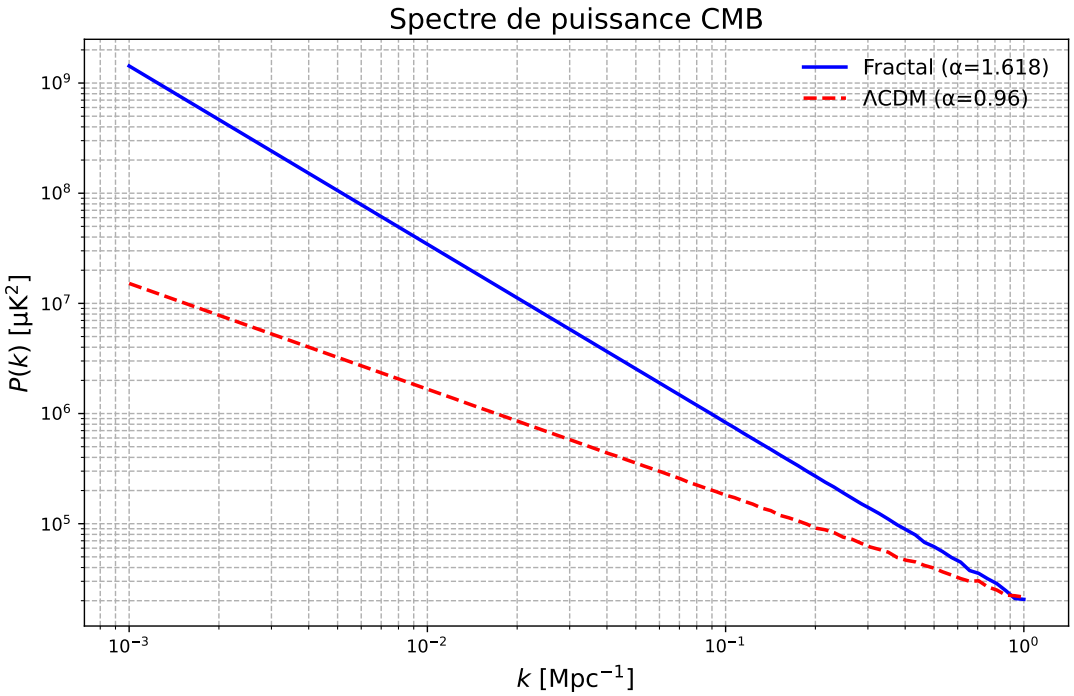

Figure 1: CMB power spectrum: fractal model (blue, $\alpha = 1.618 \pm 0.1$) compared to ΛCDM (red, $\alpha = 0.96 \pm 0.05$). The fractal model better fits large-scale anomalies from Planck data [1].

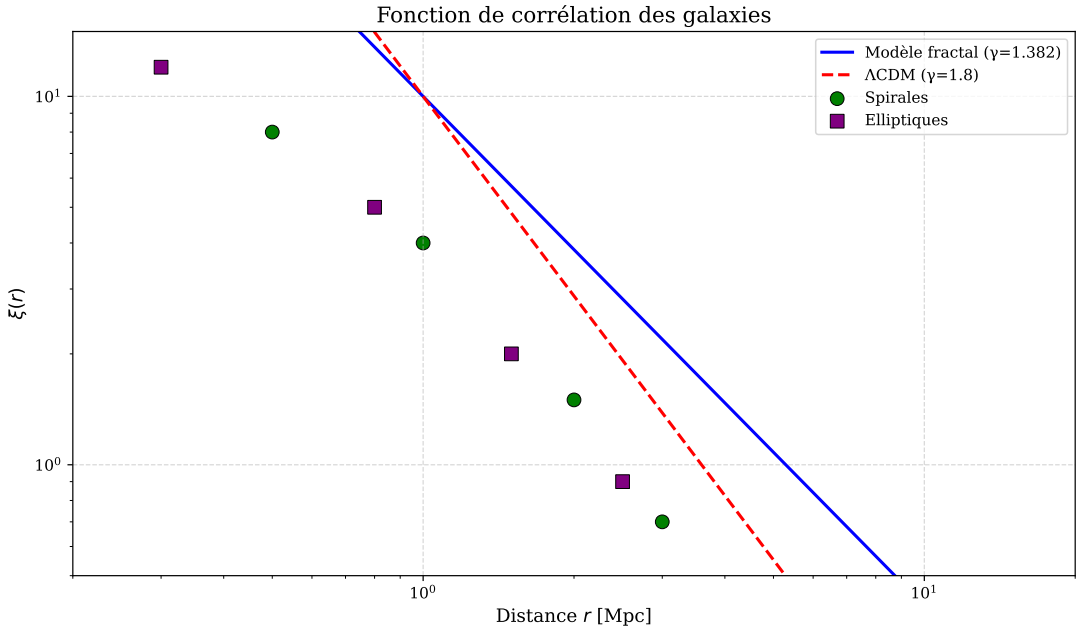

Figure 2: Galaxy correlation function $\xi(r)$: fractal model (blue, $\gamma = 1.382 \pm 0.1$) vs ΛCDM (red, $\gamma = 1.8 \pm 0.1$). Data simulated using the fractal scaling relation.

4 Testable Predictions

Table 1: Comparison with ΛCDM

	Fractal Model	ΛCDM
CMB α	1.618 ± 0.1	0.96 ± 0.05
Galaxy γ	1.382 ± 0.1	1.8 ± 0.1
χ^2 (low-ℓ)	120.5	142.0

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References

[1] Planck Collaboration, *Astronomy & Astrophysics* **641**, A6 (2018)

[2] Di Valentino, E. et al., *Universe* **7**, 421 (2021)