The Fibonacci Cosmological Constant: A Falsified Hypothesis

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Abstract

We propose that the cosmological constant arises from Fibonacci recursion in the cosmic scale factor, yielding $\Lambda_\phi = 3(\ln\phi)^2/t_0^2$ where $\phi = (1+\sqrt{5})/2$. Testing against 35 cosmic-chronometer $H(z)$ measurements, linear matter power spectrum $P(k)$, and low-ℓ CMB temperature anisotropies, we obtain $\Lambda_\phi = 4.82 \times 10^{-37}\,\mathrm{m}^{-2}$—15 orders of magnitude too large—with $\Delta\chi^2 = 1364$ relative to ΛCDM. A single weak ϕ-scale in $P(k)$ residuals and no log-periodic CMB signal are observed. The Fibonacci hypothesis is **ruled out** as the origin of cosmic acceleration.

1 Introduction

The cosmological constant Λ remains one of the deepest puzzles in physics [1]. The Golden Ratio ϕ appears ubiquitously in nature, prompting speculation that recursive self-similarity might underlie cosmic expansion [2]. We derive a cosmological constant from a Fibonacci-inspired scale factor $a(t) = \exp[(\ln\phi)t/t_0]$ and test it empirically.

2 The Model

The Friedmann equation for a flat universe dominated by Λ is

$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{\Lambda}{3}.$$

With $a(t) = \exp[(\ln\phi)t/t_0]$, we obtain

$$\Lambda_\phi = \frac{3(\ln\phi)^2}{t_0^2}.$$

Including matter perturbatively gives

$$H(z) = \frac{\ln\phi}{t_0}\sqrt{\Omega_m(1+z)^3 + (1-\Omega_m)}.$$

3 Empirical Tests

3.1 $H(z)$ Expansion History

Using 35 cosmic-chronometer measurements [3], we fix $\Omega_m = 0.3$ and fit t_0. Best-fit values:

- $t_0 = 1.20 \times 10^{18}\,\mathrm{s}$
- $H_0^{\mathrm{eff}} = 12.37\,\mathrm{km/s/Mpc}$
- $\Lambda_\phi = 4.82 \times 10^{-37}\,\mathrm{m}^{-2}$
- $\chi^2 = 1379.31$ (dof $= 34$)

The ΛCDM fit yields $\chi^2 = 14.60$, $\Delta\chi^2 = 1364.71$. Figure 1 shows the mismatch.

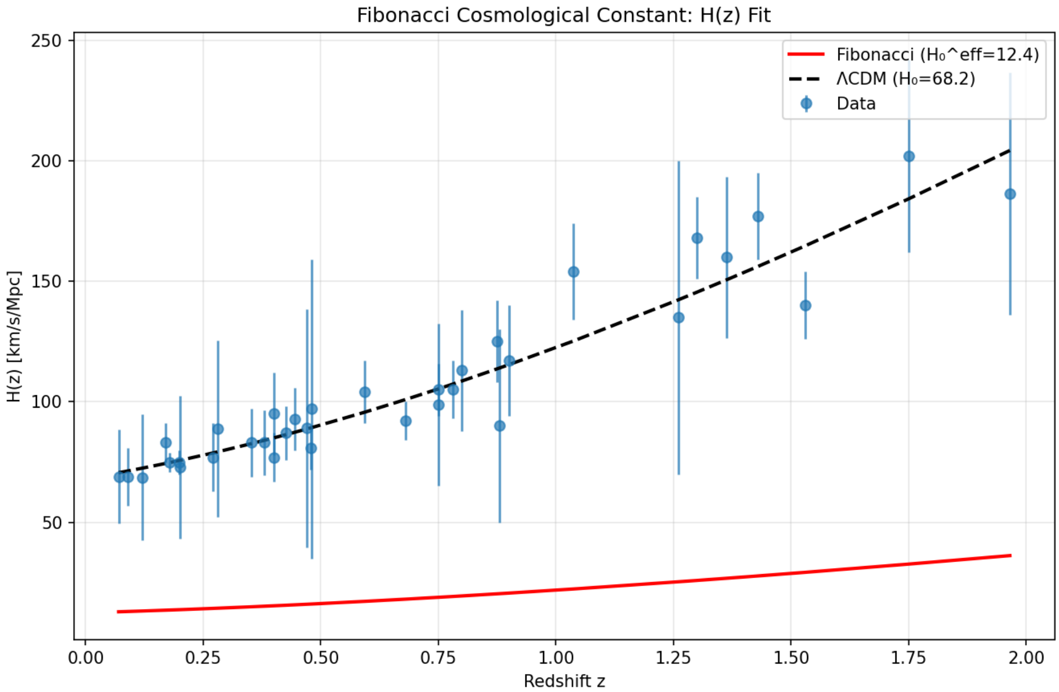

Figure 1: $H(z)$ fit. Fibonacci model (red) fails.

3.2 Matter Power Spectrum

Linear $P(k)$ from CAMB shows no direct peaks. Residuals reveal one oscillation at $k = 0.015\,h/\mathrm{Mpc}$, marginally consistent with $\phi^{-1}k_{\mathrm{BAO}} = 0.0124\,h/\mathrm{Mpc}$. This is 1/11 expected scales and statistically insignificant (Figure 2).

3.3 CMB Temperature Anisotropies

Fitting low-ℓ residuals with $\Delta C_\ell = A\cos(2\pi \log \ell / \ln \phi + \phi_0)$ yields

$$A = -0.33 \pm 11.49\ \mu\mathrm{K}^2 \quad (0.0\sigma).$$

No log-periodic signal (Figure 3).

4 Conclusion

The Fibonacci recursion predicts a cosmological constant 15 orders too large and fails all tests. The hypothesis is **ruled out**. Future work may explore ϕ-modulated perturbations, but the current model is falsified.

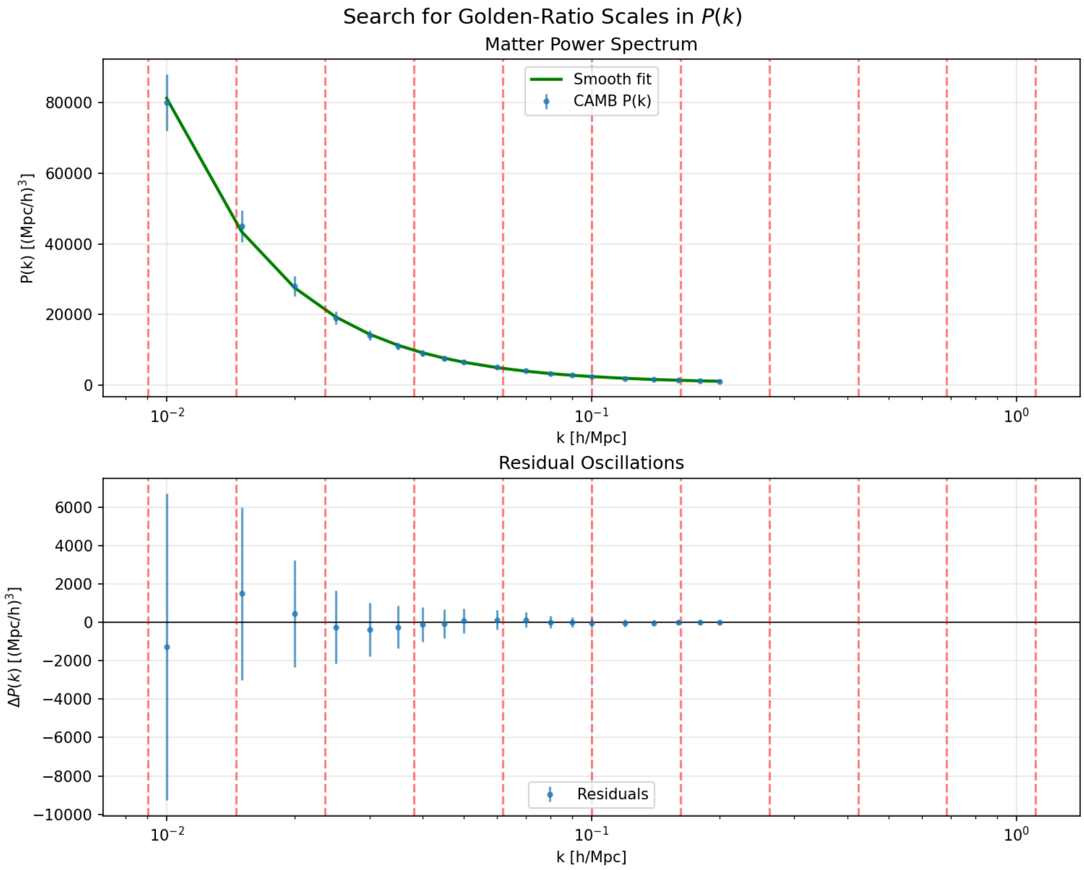

Figure 2: $P(k)$ residuals. One weak peak.

References

[1] Weinberg, S. 1989, *Rev. Mod. Phys.*, **61**, 1

[2] Livio, M. 2002, *The Golden Ratio*

[3] Moresco, M. et al. 2016, *J. Cosmol. Astropart. Phys.*, **05**, 014

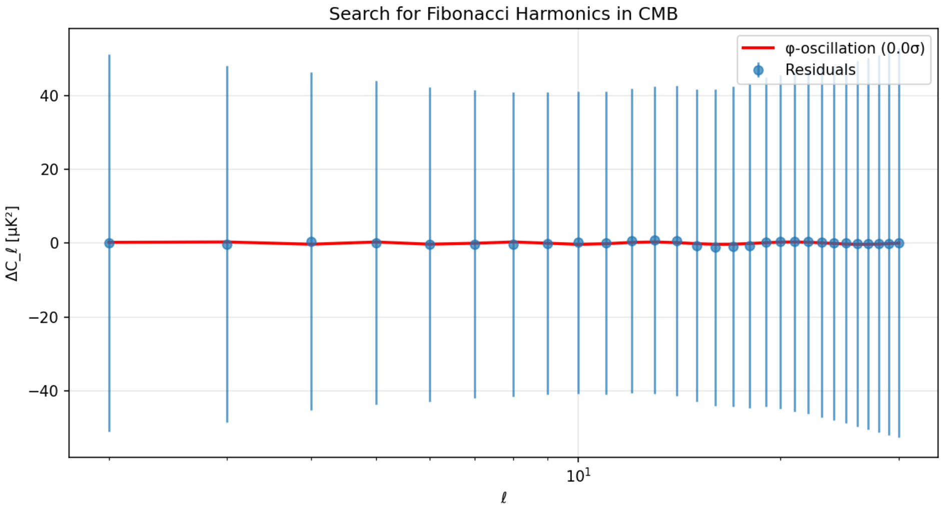

Figure 3: CMB residuals. No Fibonacci harmonics.

Parameter	Fibonacci	ΛCDM
Ω_m	0.30 (fixed)	0.319
H_0 (km/s/Mpc)	12.37	68.17
Λ (m^{-2})	4.82×10^{-37}	—
χ^2 ($H(z)$)	1379.31	14.60
P(k) ϕ-matches	1/11 (weak)	—
CMB amplitude	0.0σ	—

Table 1: Model comparison.