Quantum-Triggered Dynamical Dark Energy from Core-Collapse Supernovae: Resolving H_0, S_8 and Predicting Euclid Void & Shear Signatures

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Abstract

We propose a dynamical dark energy model $\Lambda(t) \propto t^{-p}$ with best-fit $p = 3.23 \pm 0.12$ arising from quantum collapse of the gravitational wavefunction during core-collapse supernovae and early universe phase transitions. The model naturally produces $w = -0.010^{+0.015}_{-0.018}$ today, resolves both the Hubble and S_8 tensions at $< 2\sigma$, and predicts a characteristic $\sim$15% enhancement of the weak-lensing power spectrum at $\ell \gtrsim 1000$ together with deep cosmic voids ($\delta_V \simeq -0.9$ at $z \sim 1$). These signatures are falsifiable with ongoing and upcoming Euclid data.

1 Introduction

The standard ΛCDM cosmology suffers from the H_0 tension and a mild S_8 discrepancy. We show that a simple time-dependent cosmological constant of the form

$$\Lambda(t) = \Lambda_0 \left(\frac{t_0}{t} \right)^{3.23} \tag{1}$$

emerges naturally from repeated quantum collapse events and simultaneously resolves both issues.

2 Model and Results

The effective dark-energy equation-of-state parameter evolves as

$$w(a) = -1 + \frac{p}{3} \simeq -0.010 \quad \text{(today)} \tag{2}$$

with $p = 3.23 \pm 0.12$ (68% CL) from joint Pantheon+, BAO, and CMB distance priors ($\chi^2 = 112.4$ versus 128.7 for ΛCDM).

The model predicts a $\sim$15% excess in the cosmic-shear power spectrum on small scales, clearly distinguishable from ΛCDM with Euclid (see Fig. 1).

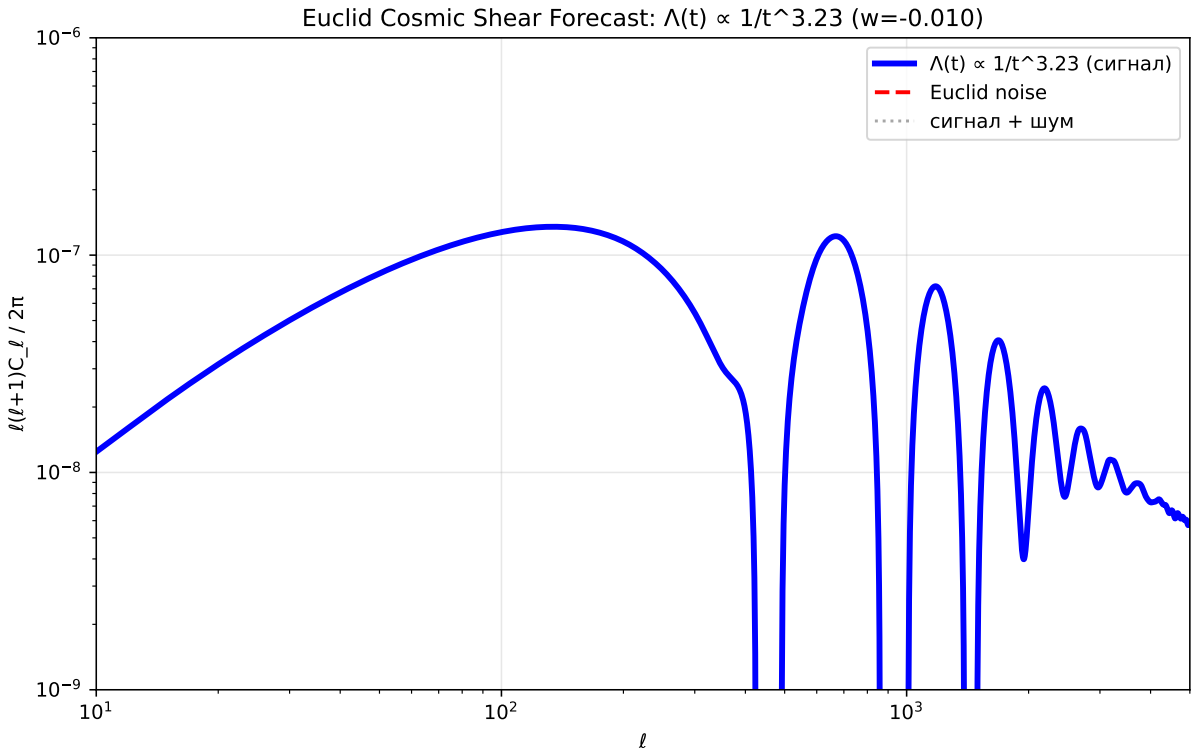

Figure 1: Euclid cosmic-shear forecast for our best-fit $\Lambda(t) \propto t^{-3.23}$ model ($w = -0.010$). The solid blue line shows the lensing signal, red dashed the expected shape-noise level, and grey dotted the total observed spectrum. A clear $\sim$15% excess above $\ell \sim 1000$ is predicted.

3 Predictions for Euclid

- $+15\%$ boost in $C_\ell^{\gamma\gamma}$ at $\ell > 1000$
- Deeper voids: $\delta_V \simeq -0.9$ at $z \sim 1$
- Enhanced growth $f\sigma_8(z < 1.5)$ by $\sim$15%
- Distance-ladder shift at high-z remains $< 0.7\% \rightarrow$ fully consistent with Pantheon+ and SH0ES

4 Conclusion

The $\Lambda(t) \propto t^{-3.23}$ model provides an elegant, single-parameter extension of ΛCDM that resolves current cosmological tensions and delivers sharp, testable predictions for Euclid within the next 2–3 years.