IN MEMORY OF RAFAEL D. SORKIN · 1945–2026

Everpresent Λ

Rafael Sorkin’s cosmological constant, from the atoms of spacetime

Niayesh Afshordi

Perimeter Institute · University of Waterloo · 12 October 2026

Everpresent Λ *(Sorkin 1987)*

1. Unimodular gravity: Λ is conjugate to the 4-volume V_4

$$S_{\rm GR} = \frac{1}{16\pi G}\int (R - 2\Lambda)\, dV_4 \quad \longleftrightarrow \quad S = \int p\, dq - H\, dt$$

$$\Delta\Lambda\, \Delta V_4 \gtrsim 4\pi\hbar G$$

2. Causal sets: spacetime atoms, counted with Poisson noise

$$N \simeq V_4/\ell_{\rm P}^4 \quad \Rightarrow \quad \Delta V_4 \sim \ell_{\rm P}^2\sqrt{V_4}$$

3. Assume ⟨Λ⟩ = 0, but, **in 4d,** |ΔΛ| tracks the ambient density

$$\Lambda \sim \pm V_4^{-1/2} \sim H^2 \quad \Rightarrow \quad |\Omega_\Lambda| \sim 1 \ \text{ at every epoch}$$

1987

Rafael predicts Λ ~ ±10^{-120} in Planck units

11 years

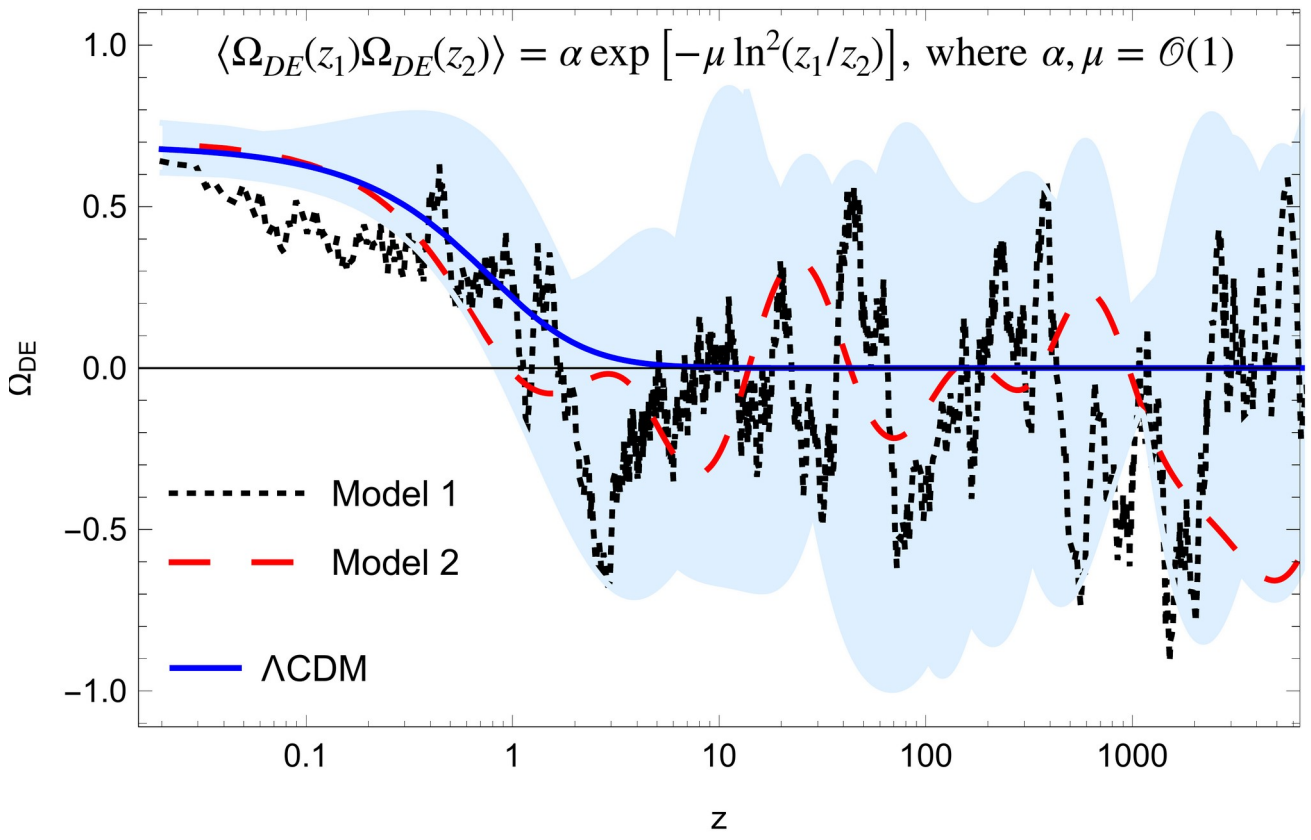
1998

Supernovae reveal cosmic acceleration: $\Omega_\Lambda \approx 0.7$

A prediction from quantum gravity, made before the data

R. D. Sorkin, Goa 1987, in Highlights in Gravitation and Cosmology (CUP 1988); Int. J. Theor. Phys. 33, 523 (1994) · Riess+ 1998; Perlmutter+ 1999

Everpresent Λ meets data



$\Omega_{DE}(z)$ histories that fit Planck + BAO; band: 68% of Model 2 realizations. Zwane, NA & Sorkin, CQG 35, 194002 (2018)


Nosiphiwo Zwane


Arad Nasiri


Yasaman Yazdi

2004 · Ahmed, Dodelson, Greene & Sorkin
first stochastic model of Λ(t), always of order the ambient density

2018 · Zwane, NA & Sorkin
fits Planck + BAO as well as ΛCDM, and eases the H_0 and Lyα-BAO tensions

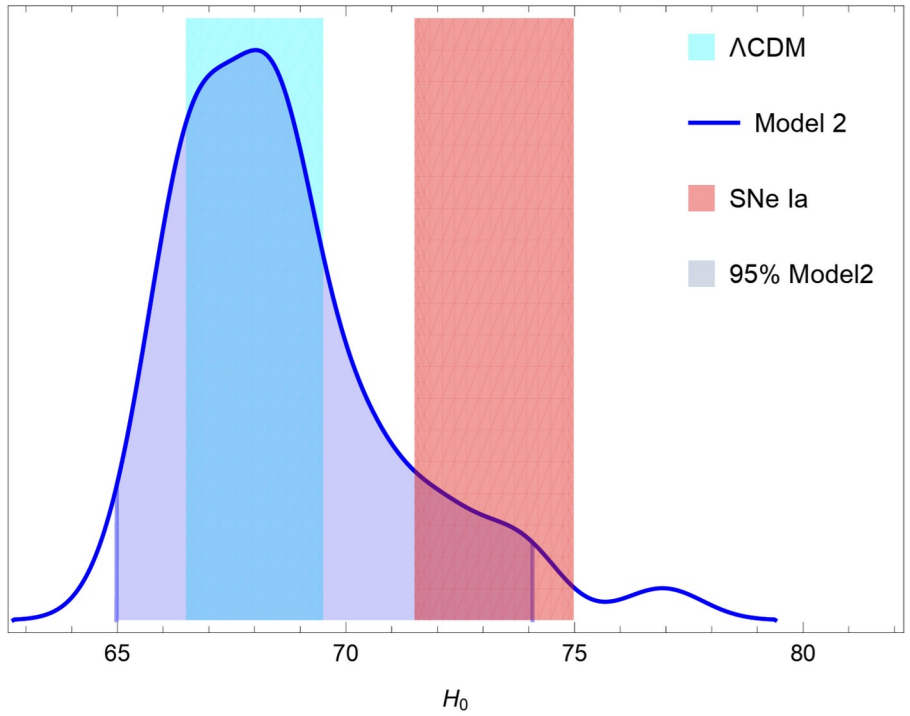
2023 · Das, Nasiri & Yazdi
today's H_0 and Ω_Λ are reachable, though not typical; CMB prefers a quieter Λ near recombination

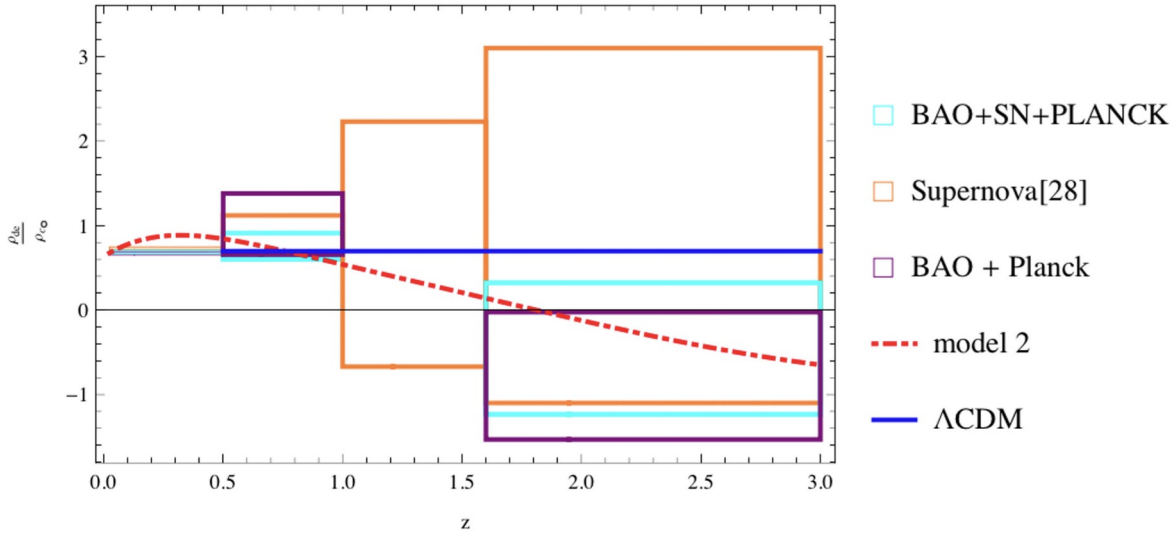
2025 · DESI DR2
2.8–4.2σ preference for evolving dark energy

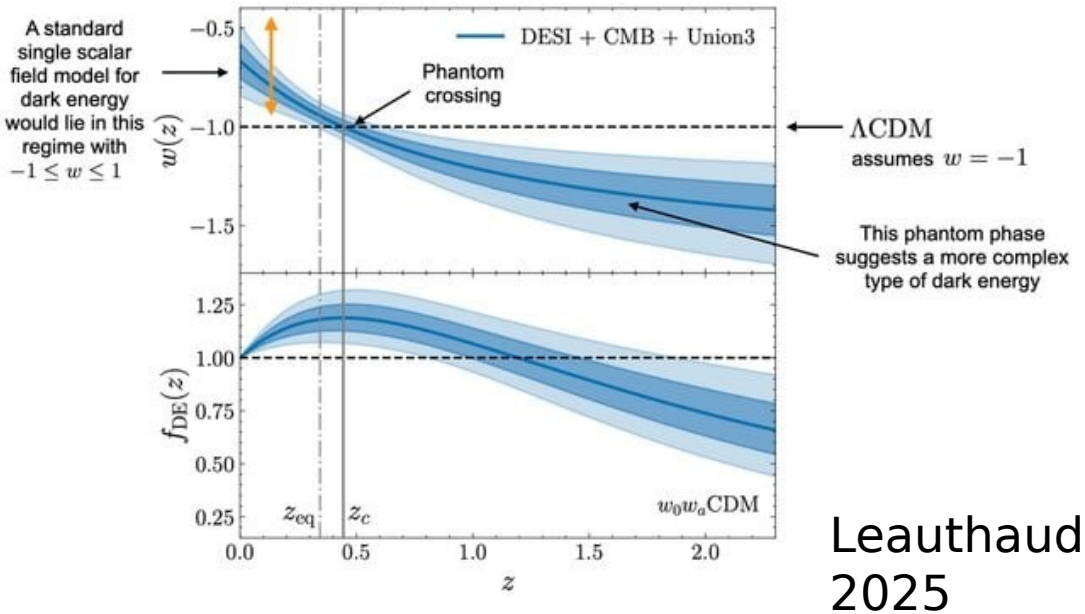
2026 · Next
can Everpresent Λ fit the new CMB and BAO data?

$\Omega_{DE}(z)$ is a random field, like a CMB map — high-redshift dark energy will tell

Hubble and DESI tensions







Leauthaud & Riess 2025

Rafael’s Λ is still ever-present.

Thank you, Rafael.

Rafael D. Sorkin · 1945–2026