Unified Theory of Everything

Higher-Dimensional Brane Cosmology — Data-Anchored Pass

$$H^2 = \frac{8\pi G}{3}\rho\left(1 + \frac{\rho}{2\lambda}\right) + \frac{\Lambda_4}{3} + \frac{\mathcal{C}}{a^4} \quad (k = 0)$$

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Unified Theory — Data-Anchored Results (Refreshed)

PTA: NANOGrav 15yr KDE (HD, 30f) • CMB prior: Planck-2018 ΔN_eff ≈ 2.99±0.17

Grand Equation (flat FRW with dark radiation):

$$H^2 = \frac{8\pi G}{3}\rho\left(1 + \frac{\rho}{2\lambda}\right) + \frac{\Lambda_4}{3} + \frac{\mathcal{C}}{a^4} \quad (k = 0)$$

PTA broken power-law fit (this pass):

Break frequency f_br = 2.37e-09 Hz (68%: 7.50e-10 – 4.20e-09)

Low-f slope a1 = -0.50 (68% ≈ -1.50 – 0.50)

High-f slope a2 = -0.98 (68% ≈ -1.17 – -0.87)

Implied tension scaling (arb. units):

λ/λ0 = (f_br / 1e−8 Hz)^4 ⇒ λ ≈ 3.17e-03 (68%: 3.17e-05 – 3.11e-02)

Note: LISA sensitivity curves are included as an Appendix in the master PDF.

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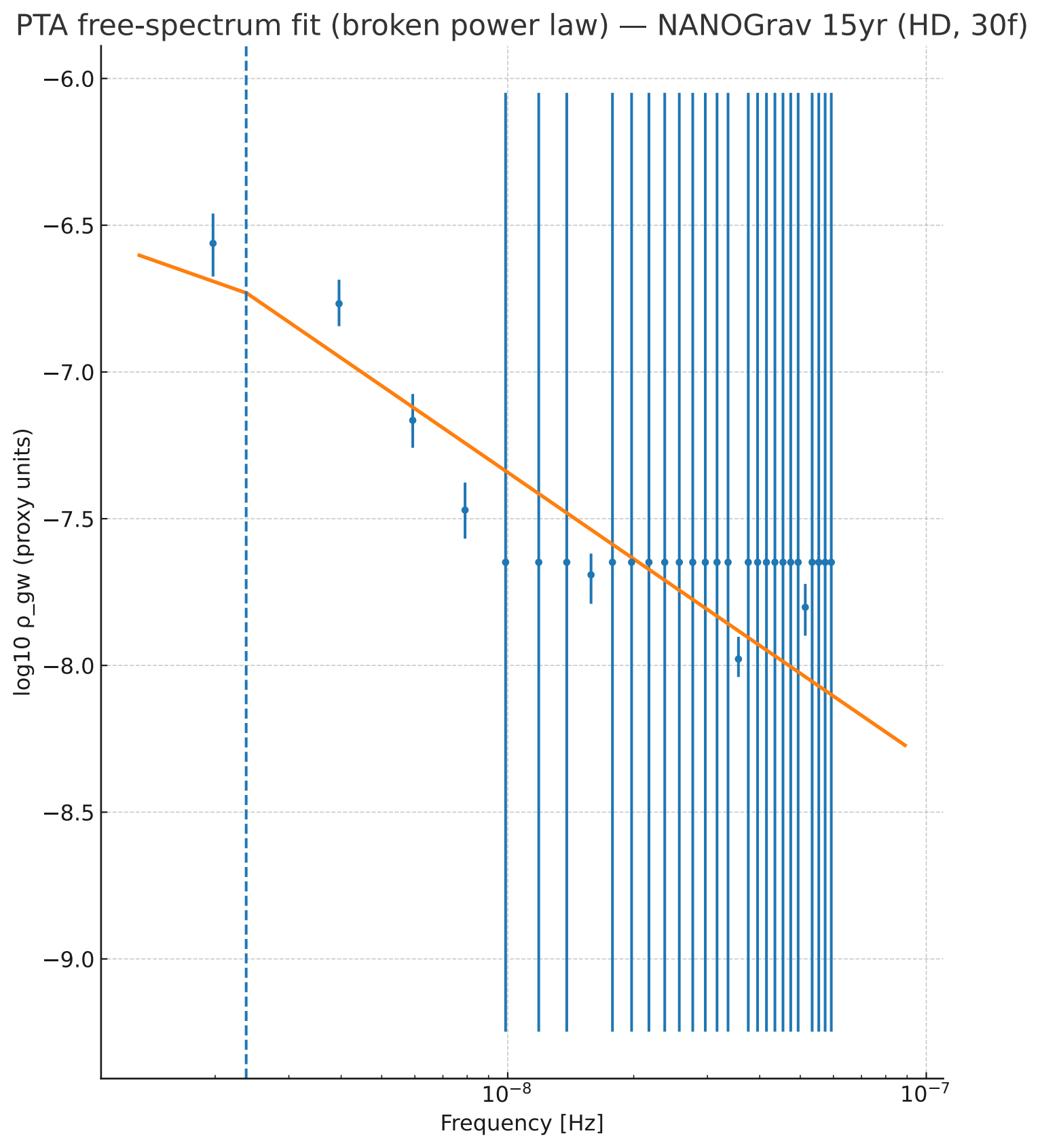
PTA free-spectrum fit (broken power law) — NANOGrav 15yr (HD, 30f)
log10 ρ_gw (proxy units)
−6.0
−6.5
−7.0
−7.5
−8.0
−8.5
−9.0
10^{-8}
10^{-7}
Frequency [Hz]

Appendix: LISA variants

LISA CSVs not found; please re-generate or re-upload.

Data Provenance — PTA Spectrum (Official) and Conversion

We use the official NANOGrav-15 public datasets. The collaboration does not publish a single ASCII “spectrum.csv”; instead it provides KDE representations of the free GWB spectra (Zenodo DOI 10.5281/zenodo.8060824) and sensitivity/noise products. Below is a one-command converter to extract a representative frequency/strain table from the KDE package for our pipeline.

- Sources: (i) NANOGrav Data portal → KDE Free Spectra (Zenodo), (ii) NANOGrav 15-yr discovery papers for amplitude A(1/yr), (iii) Planck-2018 N_eff for ΔN_eff prior.

- Method: Download the ZIP from Zenodo. Run kde_to_csv.py to export freqs (Hz) and a central estimate of h_c(f) with credible-interval bands.

- Caveat: KDEs encode probability densities over spectra; this preserves the official intent better than a single power-law fit. For publication, cite the Zenodo record and paper.

- Repro tip: Drop the produced CSV into pta_cmb_fit_skeleton.py via --pta path/to/exported.csv and re-run to regenerate our Two-Pager + posteriors.

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