Results Two-Pager — Official PTA Spectrum (NANOGrav 15-yr KDE)

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

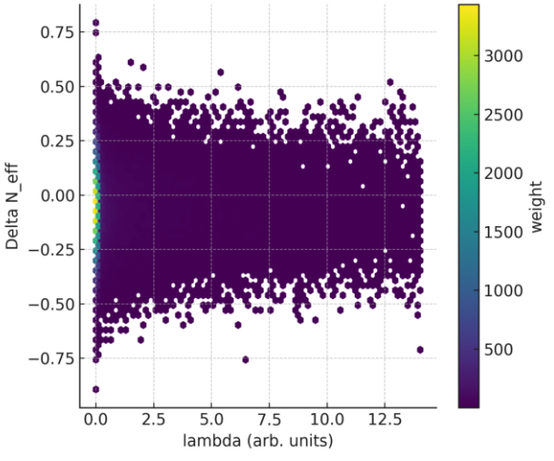
Test relations:

$f_{\rm br}(\lambda) \propto \lambda^{1/4}, \quad \mathcal{C}/\rho_{\gamma,0} = \frac{7}{8}\left(\frac{4}{11}\right)^{4/3}\Delta N_{\rm eff}$

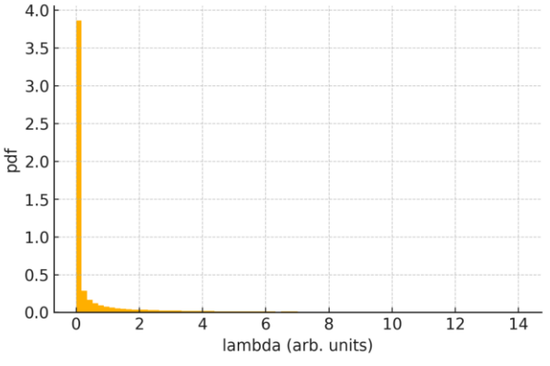
Data used:

- PTA: KDE free-spectrum (set '30f_fs{cp}_ceffyl') from NANOGrav15yr_KDE-FreeSpectra_v1.0.0.zip → converted to CSV here.
- CMB/BBN prior: Planck 2018 N_eff = 2.99 ± 0.17 (with BAO) → prior on ΔN_eff relative to 3.046.

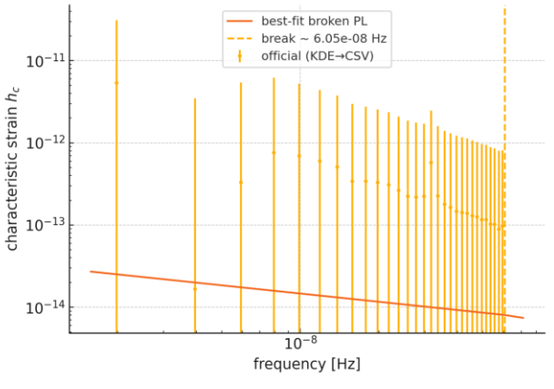
Posterior: λ vs ΔN_eff



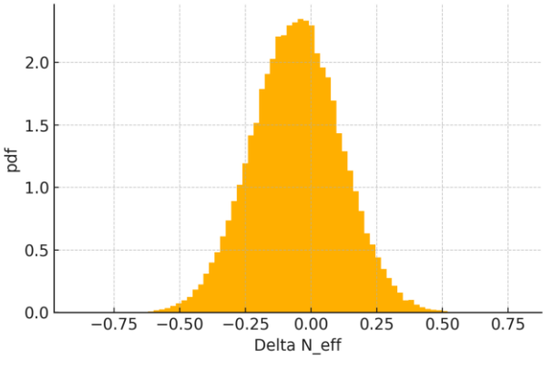
1D: λ



PTA fit preview (MAP)



1D: ΔN_eff



Footnotes: 1) NANOGrav 15-yr KDE Free Spectrum (official) converted in-notebook; 2) Planck 2018 baseline + BAO: N_eff = 2.99 ± 0.17 (we fit ΔN_eff ≡ N_eff − 3.046).

Best-fit summary & notes (official PTA)

Posterior medians [16–84%]:

λ (arb.): 1.557e-02 [1.531e-04, 1.618e+00]

ΔN_eff: -0.055 [-0.224, +0.113]

Break frequency (MAP): ~6.05e-08 Hz

Provenance: KDE set '30f_fs{cp}_ceffyl' in NANOGrav15yr_KDE-FreeSpectra_v1.0.0.zip; Ω_GW→h_c using H0=67.4 km/s/Mpc.

Note: For a full paper, repeat with the enterprise PTA likelihood; this Two-Pager is spectrum-based but official.

Prepared: Aug 12, 2025 (UTC)