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.

Prepared: Aug 12, 2025 (UTC)

arXiv Title / Abstract / Supplemental Material (ASCII-safe)

Title: A testable brane-world unification: rho^2 cosmology, dark radiation, and a GW spectral break

Abstract: We present a minimal higher-dimensional (brane-world) framework that yields a modified 4D Friedmann equation H^2 = (8piG/3) rho (1 + rho/2lambda) + Lambda4/3 + C/a^4 (flat FRW). A single physical scale—the brane tension lambda—controls two independent observables: a broken-power-law stochastic gravitational-wave background with break frequency f_br ∝ lambda^(1/4), and an early-universe radiation excess parameterized by Delta N_eff via C. Using the public NANOGrav 15-year KDE free-spectrum (HD, 30 frequencies) and a loose Planck-2018 prior on Delta N_eff, we demonstrate a data-anchored fit and provide a small reproducibility pack (CSV + script). The claim is falsifiable: one value of lambda must simultaneously place the GW break and satisfy CMB/BBN bounds. We outline an explicit RS-type toy embedding of the Standard Model on the brane and show the GR/PPN limit for rho << lambda.

SM Description: Supplemental Material: (i) exported_pta_spectrum_HD_30f.csv (NANOGrav KDE-derived percentiles), (ii) reproduce_posteriors.py (fits broken power law; outputs best-fit JSON and plots), (iii) best_fit_REALDATA.json, and (iv) README_REPRO.txt with a 60-second rerun command.

Press Release — Unified Theory (Testable Brane-World)

Ricardo Maldonado proposes a testable brane-world unification in which the 4D Friedmann equation acquires a rho^2 correction and a dark-radiation term.

One parameter—the brane tension lambda—links a predicted gravitational-wave spectral break to the early-universe radiation excess (Delta N_eff).

The framework removes the classical Big-Bang singularity by replacing it with a higher-dimensional energy event and outlines falsifiable predictions across PTA, LISA, and CMB/BBN data.