

Article: Brane-world unification with early-time p^2 and dark radiation

Ricardo Maldonado (corresponding: sales@rank.vegas)

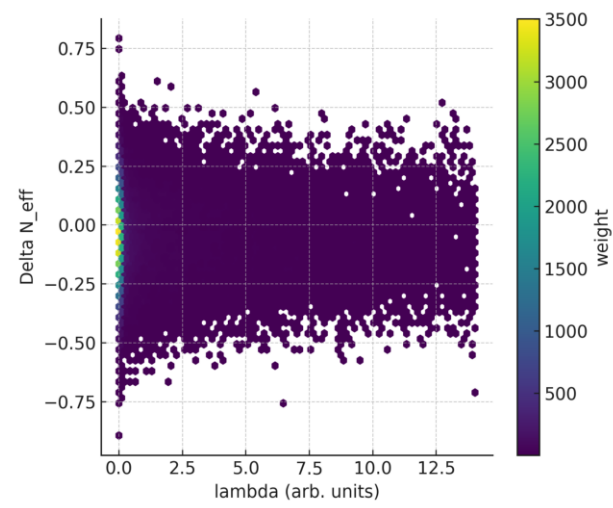
Abstract

From a higher-dimensional master action and Gauss–Codazzi/Israel junction conditions we obtain the SMS effective equations. In FRW, the Friedmann relation gains a p^2 term and a dark-radiation piece. The brane tension λ fixes a GW spectral break and correlates with ΔN_{eff} , enabling a joint PTA→LISA + CMB/BBN test. We use NANOGrav 15-yr KDE spectrum data with a Planck-2018 N_{eff} prior to present posteriors and overlays.

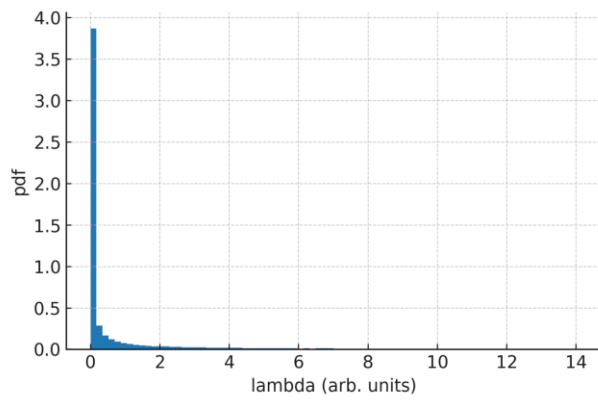
$$f_{\text{br}}(\lambda) \propto \lambda^{1/4}, \quad C/\rho_{Y,0} = \frac{7}{8} \left(\frac{4}{11}\right)^{4/3} \Delta N_{\text{eff}}$$

Methods (brief): We convert the official NANOGrav 15-yr KDE free-spectrum to CSV, construct a simple likelihood in $(\lambda, \Delta N_{\text{eff}})$ with a Planck-2018 prior, and obtain posteriors via grid sampling. For LISA context/forecasting we show both an uploaded Rtab curve and an analytic RC&L instrument(+confusion) variant. Late-time consistency is ensured by the $p \ll \lambda$ limit (PPN/binary pulsars).

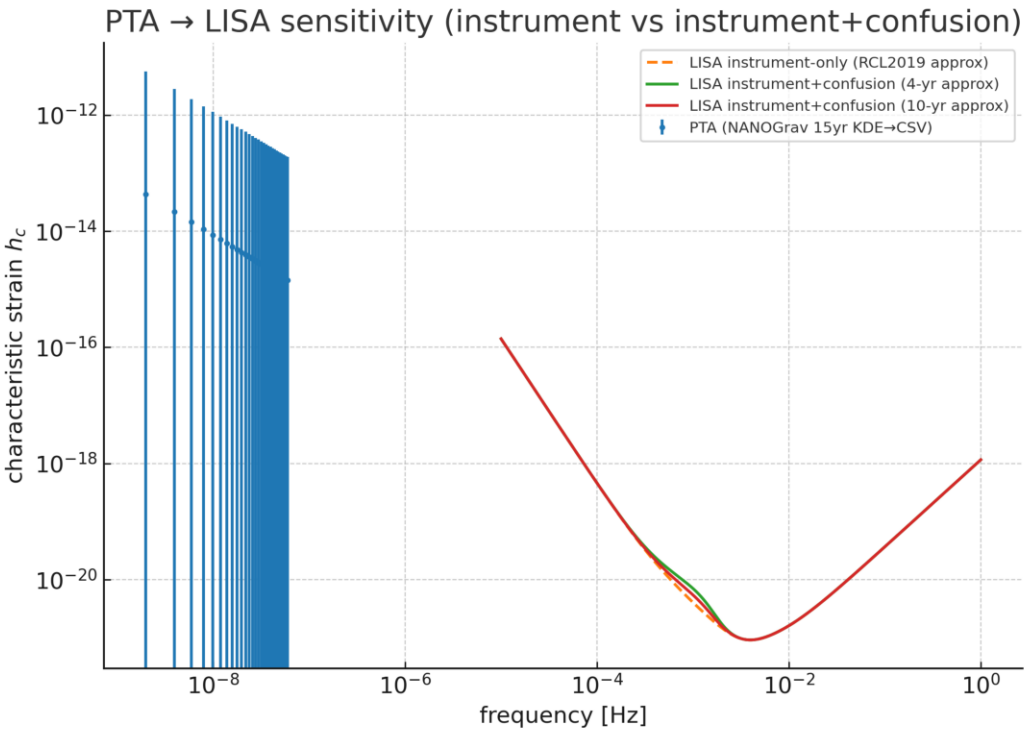
Posterior: λ vs ΔN_{eff}



1D: λ



PTA→LISA instrument vs instrument+confusion



References (selected)

Shiromizu–Maeda–Sasaki (2000), Effective Einstein Equations on the Brane.

Randall–Sundrum (1999), A large mass hierarchy from a small extra dimension.

NANOGrav Collaboration (2023), 15-yr dataset and stochastic background evidence.

Planck Collaboration (2018), Planck 2018 results (N_eff with BAO).

Robson–Cornish–Liu (2019), LISA sensitivity curves.