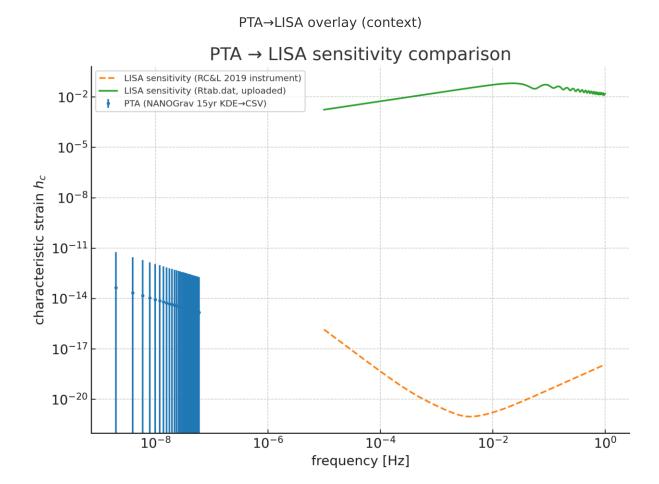
A testable brane-world unification: ρ² cosmology, dark radiation, GW break

We present a four-dimensional effective cosmology derived from a higher-dimensional brane setup. The resulting Friedmann equation contains a quadratic density term ($\rho^2/2\lambda$) and a dark-radiation contribution (\Box/a^4). A single parameter, the brane tension λ , controls a gravitational-wave spectral break f_br $\propto \lambda^{1/4}$ and correlates with ΔN_eff . Using the official NANOGrav 15-yr KDE spectrum (converted to CSV) with a Planck-2018 prior on $N_eff=2.99\pm0.17$, we compute posteriors and provide a model-data overlay. The framework reduces to GR in the late-time/weak-field regime (PPN/binary pulsars) while offering falsifiable early-universe signatures testable by PTA \rightarrow LISA and CMB/BBN.



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