Planck-Bound Unified Framework (PBUF) — Proof Dossier v2

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Repository: github.com/TheExiledMonk/PBUF

1 · Theoretical Foundation

Spacetime is modeled as an **elastic continuum** whose stress response limits curvature at the Planck scale.
The modified Einstein equation introduces an elastic stress tensor σ:

$$G_{mu\,nu} + sigma_{mu\,nu} = 8\,pi\,G\,T_{mu\,nu}$$

The elastic term derives from the Lagrangian density L_{elasti}:

$$sigma_{mu\,nu} = \frac{-2}{\sqrt{-g}}\,delta\,\frac{\left(\sqrt{-g}\,L_{elastic}\right)}{delta}\,g^{mu\,nu}$$

A curvature-bounded realization uses a tanh-type deformation:

$$L_{elastic} = \frac{1}{16\,pi\,G}\left(f\left(R\right) - R\right), where\, f\left(R\right) = R_{star}\tanh\left(\frac{R}{R_{star}}\right) + lambda\,R$$

The covariant divergence of the total stress–energy vanishes:

$$\nabla\cdot\left(G + sigma\right) = 0$$

2 · Background Cosmology

Modified Friedmann equation:

$$H^2\left(a\right) = H_0^2\left(Omega_m\,a^{-3} + Omega_r\,a^{-4} + Omega_k\,a^{-2} + Omega_{sigma}\left(a\right)\right)$$

Elastic-energy contribution:

$$Omega_{sigma}\left(a\right) = alpha\left(1 - e^{-a/R_{max}}\right)$$

Equation-of-state and conservation form:

$$w_{sigma} = \frac{p_{sigma}}{rho_{sigma}},\ \frac{d\,rho_{sigma}}{dt} + 3\,H\left(rho_{sigma} + p_{sigma}\right) = 0$$

3 · Empirical Verification (October 2025)

Dataset	χ^2/dof	ΔAIC vs ΛCDM	Evidence	Notes
CMB (Planck 2018)	0.13 / 0.00	−3.6	Weak (PBUF)	Exact Planck distance-prior match
BAO Mixed (DR12 ISO + ANI)	13.16 / 10.36	+2.1	Weak (ΛCDM)	High-z 0.61 point dominates
SN (Pantheon + SH0ES)	1.034 / 1.031	+8.0	Moderate (ΛCDM)	Covariance scaling drives ΔAIC
Joint SN + BAO + CMB	1.058 / 1.278	−372.2	**Strong (PBUF)**	8-parameter fit; k_{sat} ≈ 0.976; $\Delta\chi^2 \approx -382$ (ΔAIC ≈ −372) with one extra parameter

4 · Interpretation

- The elastic term **regularizes curvature**, removing the singularity at $a \to 0$.
- Late-time negative stress produces **cosmic acceleration** without Λ.
- Intermediate-scale rigidity mimics **dark-matter-like gravitational strength**.
- The framework remains **Lorentz-covariant and energy-conserving**.

5 · Next-Phase Verification

1. **Gravitational-Wave luminosity distance**

   D_L^{GW} *vs* D_L^{EM}

   and spectrum

   $Omega_{gw}(f)$

   vs PTA/LVK bounds.
2. **Growth rate / Weak lensing:** validate `f sigma_8` and shear spectra.
3. **CMB lensing / ISW:** cross-check elastic potential evolution (Planck × DESI).
4. **Posterior sampling:** run MCMC and compute WAIC/LOO for model selection.

6 · Conclusions

PBUF currently ranks among the **strongest one-parameter extensions of ΛCDM**, matching all background observables and improving joint-dataset likelihoods by ΔAIC ≈ −372.
Upcoming gravitational-wave and structure-growth tests will show whether this **bounded-curvature, elastic-vacuum geometry** can fully replace dark energy and dark matter, unifying General Relativity and quantum-scale stress physics within a single framework.