Related Work

The idea that spacetime may possess elastic or emergent properties has been explored in several distinct theoretical directions, though none in the specific, self-calibrating form proposed in the Planck-Bound Unified Framework (PBUF).

Elastic and strained–state cosmologies.
A family of models dating back to Tartaglia and collaborators treats the cosmic medium as a four-dimensional elastic continuum whose strain energy can mimic dark energy.
The *Strained-State Cosmology* (SSC) framework [Tartaglia 2011; Levrino & Tartaglia 2012] introduces stress–strain terms in the Einstein–Hilbert action to generate late-time acceleration, while related analyses such as *The Mechanics of Spacetime* (Tenev & Horstemeyer 2016) describe the universe as an "elastic hyperplate."
These studies are conceptually close to PBUF in assigning an intrinsic stiffness to spacetime, but they typically operate at the level of analytic cosmological solutions or qualitative fits to the Hubble diagram.
None of them derive or calibrate a single universal *elastic-saturation constant* from the cosmic microwave background (CMB) and propagate it unchanged through the full suite of cosmological probes.

Emergent- and entropic-gravity approaches.
Verlinde's emergent-gravity model (2016) and later entropic-force formulations also ascribe additional "elastic" response to spacetime, interpreted as a macroscopic manifestation of microscopic information degrees of freedom.
While these frameworks reproduce galaxy-scale dark-matter phenomenology, they do not furnish a unified background + growth pipeline anchored by CMB distance priors, nor do they offer a single empirically calibrated parameter comparable to PBUF's ksat.

Modified-gravity and dark-energy extensions.
Recent work within the mainstream cosmological community—quintessence, scalar–tensor, f(R), and other dynamic-dark-energy (DDE) models confronted with DESI BAO, CMB, and supernova datasets—focuses on additional fields or time-varying equations of state rather than on geometric elasticity [e.g. DESI Collab 2024; Arjona et al. 2024; Ishak et al. 2023].
These frameworks provide valuable comparison baselines but remain phenomenological, relying on multiple free parameters to describe late-time acceleration.

Distinctive contribution of PBUF.
The Planck-Bound Unified Framework extends this landscape by introducing a *finite rigidity* of spacetime at the Planck scale that saturates curvature and eliminates singularities.
It preserves the low-curvature limit of General Relativity, requires only one new dimensionless constant ksat, and—unlike previous elastic or emergent models—**derives that constant directly from CMB distance priors**.
Once calibrated, the same ksat is propagated to supernova, BAO, cosmic-chronometer, and growth-rate datasets within a unified empirical pipeline.

This allows for a strict AIC/BIC comparison between ΛCDM and PBUF across all major cosmological probes, yielding statistically comparable or superior fits without any dataset-specific tuning.