

From Distinction to Emergent Continuum Geometry: Hierarchical Geometric Emergence and GR-Native Succession in Cosmological Pangaea

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Cosmological Pangaea Framework

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<https://osf.io/vf5cw/overview>

Abstract

The Cosmological Pangaea framework begins from the single irreducible primitive of Distinction (Axiom D: the bare capacity for A to differ from B). This axiom compels 3+1 spacetime dimensionality and three fermion generations through the Self-Reference Closure theorem. It further yields an explicit 24-cell/F4 primordial scaffold with combinatorial closure: a 576-flag incidence structure under move-based signed Z2 propagation, producing exactly 8 global solutions that reduce under the Weyl group $W(F4)$ to two inequivalent orbits. These structures form toroidal archives of symmetry-reduced distinction, termed the Cosmic Library.

Geometry-enforced primordial cuts from this scaffold generate GR-compliant branching. Irreversible Weyl excitation from an initial state of exactly zero gravitational entropy (enforced by spherical symmetry and Birkhoff's theorem on the finite Pangaea object) drives the thermodynamic arrow of time and geometric baryogenesis, satisfying all three Sakharov conditions with the sign of the asymmetry fixed by the direction of future-directed chirality. A scale-dependent crossover surface partitions dynamical entropic effects at galactic scales from geometric map behavior at larger scales. The zero-Weyl initial condition enforces the Flatness Theorem ($k=0$) and derives the present Hubble parameter parameter-free as $H_0 = c^3 / 2GM$, linking Hubble tension resolution and MOND scaling via the Verlinde relation and consistent bounce shift.

Flag-transition dynamics with residual coherence parameter ϵ generate spectral towers and emergent infrared behavior. Distinction preservation axiomatically forbids classical singularities, yielding non-singular ER-bridge throats and unitarity-preserving black-hole interiors through entropic holography. Long-term evolution proceeds through dimensional collapse of the entropy-gradient network to an eternal de Sitter horizon (Surface Death), preserving thermodynamic directionality via permanent Gibbons-Hawking temperature and entropy.

The framework supplies a combinatorially closed, distinction-derived pre-geometric UV substrate whose coarse-graining limit aligns structurally with continuum unification programs such as Geometric Unity's observerse. Strict GR-Razor eliminative auditing (pruning non-derivable structures) maintains high internal consistency scores (9.1-9.7/10). The result is a closed hierarchical stack from ontology to asymptotic physics under GR primacy.

Emergence Hierarchy

Distinction (Axiom D)

- ↓ Combinatorial Closure & Cosmic Library (24-cell / F4 scaffold)
- ↓ Primordial Cuts & GR-Compliant Branching
- ↓ Weyl Excitation from Zero Gravitational Entropy
- ↓ Geometric Baryogenesis & Thermodynamic Arrow
- ↓ Scale-Dependent Crossover & Flatness Theorem
- ↓ Parameter-Free H_0 / MOND Linkage
- ↓ Spectral Emergence & Non-Singular Geometry (ER Bridges)
- ↓ Entropy-Gradient Cosmology & Continuum Bridge
- ↓ Surface Death (Dimensional Collapse to de Sitter Horizon)

1. Methodological Foundation: GR-Razor and the Axiom for Succession

The framework adheres to strict eliminative discipline. Only structures compelled by internal constraints or GR field equations survive. Non-derivable but admissible models (e.g., Lava-Void) are pruned. This subtractive approach ensures parsimony and positions Cosmological Pangaea as methodological succession to frameworks requiring proliferation of fields, parameters, or sectors.

2. Ontological Substrate and Primordial Scaffold

Axiom D yields the Self-Reference Closure theorem, deriving 3+1 spacetime and three fermion generations from a ternary simplicial complex. The 24-cell self-dual polytope with F4 root system provides the low-entropy primordial scaffold. Its 576-flag incidence structure, governed by move-based signed Z_2 constraints, admits exactly 8 global solutions partitioning into two orbits under $W(F_4)$. This combinatorial closure supplies a reproducible, discrete pre-geometric UV substrate forming toroidal Cosmic Library archives.

3. Primordial Dynamics and Symmetry Breaking

Geometry-enforced cuts nucleate GR-compliant branching. Irreversible Weyl excitation from the zero gravitational entropy initial state ($C_{\text{mu}\nu\rho\sigma} = 0$ by Birkhoff symmetry) establishes the thermodynamic arrow. This same excitation imprints gravitational chirality, generating net chiral fermion asymmetry via the gravitational axial anomaly. Electroweak sphalerons convert the asymmetry, satisfying Sakharov conditions geometrically. The sign is fixed by the direction of Weyl growth aligned with the arrow.

4. Gravitational Phenomenology and Observational Linkages

A scale-dependent crossover surface separates regimes of dynamical entropic effects (small scales) from geometric map behavior (large scales). The zero-Weyl condition enforces the Flatness Theorem: conformal flatness implies $k=0$ in FLRW. From this, the Hubble parameter follows directly:

$$H_0 = c^3 / 2GM$$

where M is the total mass-energy of the observable universe. Combined with the Verlinde relation, this yields a parameter-free MOND scale a_0 approximately equal to $c \cdot H_0 / 2\pi$, with residuals consistent with LQC bounce quantization uncertainty.

5. Quantum Interface and Geometric Resolutions

Flag-transition dynamics with residual coherence ϵ (transfer operator $T_{mn} = \epsilon^{|m-n|} \cdot A_{mn}$) generate spectral towers and emergent infrared amplitudes. Distinction preservation forbids classical singularities, enforcing non-singular interiors and ER-bridge throats via Weyl backreaction in the Raychaudhuri equation. Black-hole information is preserved through entropic holography and distinction conservation.

6. Cosmological Evolution and Asymptotics

Entropy gradients drive structure formation. Long-term evolution culminates in four-phase dimensional collapse of the gradient network to an eternal de Sitter horizon (Surface Death). The horizon maintains permanent Gibbons-Hawking temperature and entropy, preserving the thermodynamic arrow indefinitely.

7. Relation to Geometric Unity and Program Status

The 24-cell/F4 scaffold and ϵ -deformed flag dynamics provide an explicit discrete UV substrate. Coarse-graining induces effective continuum bundle structures compatible with Geometric Unity's observer. The correspondence is hierarchical and structural rather than identificational.

The framework survives rigorous GR-Razor auditing and exhibits full vertical continuity. Primary remaining tasks are mathematical compression: explicit continuum limits of the transfer operator, renormalization of ϵ , quantitative amplitude derivations, and refined falsifiable predictions (CMB/BAO signatures, 21-cm contrasts, gravitational-wave echoes from non-singular interiors).