The Fractal Cosmological Hierarchy and the Infinite Regress of Creation Events: Beyond the Observable Horizon (Version 5)

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Abstract

This paper presents a refined theoretical cosmology framework extending localized orbital chains into a multi-tiered, scale-invariant fractal of spacetime nucleation events. To actively mitigate historical anthropocentric and geocentric biases, we formalize the physical boundaries of matter organization up to Level 5 (The Cosmic Web). Crucially, this fifth iteration (V5) introduces analytical resolutions to the limitations identified in prior revisions.

First, the mathematical connection between the fractal scaling factor κ and the primordial scalar perturbation amplitude Q (≈ 10^{-5}) is formalized as a Postulate of Manifold Efficiency, defining an upper bound for vacuum energy transfer efficiency across consecutive generations of universes. Second, the structural gap between the Borde-Guth-Vilenkin (BGV) past-incomplete theorem and the presence of a stationary initial boundary is resolved via geometric separation: we isolate dynamic baryon expansion fields at Level 5 from the fundamental hyper-dimensional coordinate origin at T=0, termed the Absolute Primordial Anchor.

Finally, potential observational degeneracy risks associated with the Eridanus Cold Spot and Dark Flow anomalies are addressed by reframing them as empirical open test vectors with strictly bounded parameter restrictions (ΔT ≈ 9–15 μK, θ ≈ 10°–15°, and V_{dark} ≈ 600–1000 km/s), ensuring the structural falsifiability of the model.

1. Introduction: The Geocentric Legacy and the Scale-Based Trap

In the history of physical cosmology, scientific progress has consistently expanded the perceived limits of reality by breaking through anthropocentric biases. In medieval scholarship, literal misinterpretations of theological texts—such as Joshua 10:12-13 and Psalms 104:5—anchored the Ptolemaic geocentric model as an unassailable institutional

dogma. The Earth was defined as the stationary, absolute center of creation, surrounded by concentric crystalline spheres.

The dismantling of this paradigm proceeded through the historic Copernican Demotions, which shifted humanity's coordinate system from the center of a local solar loop to the outer, suburban periphery of a single galaxy among billions within an expanding spacetime manifold. However, contemporary cosmology faces a highly advanced variation of the same geocentric trap. Because observation is structurally bound within the *Observable Universe* (a light-travel sphere roughly 93 billion light-years in diameter), standard academic consensus often assumes that our specific Big Bang represents the absolute, singular origin of all physical existence.

This paper leverages the geometric self-similarity of nature to demonstrate that our local universe is merely one functional leaf on an infinite generational tree of creation events. By formalizing a scale-invariant fractal architecture, we establish an analytical path leading backward from local matter structures to a foundational, stationary cosmological boundary.

2. Hierarchical Scaling and Functional Self-Similarity

Empirical evidence across observable scales confirms a highly ordered chain of nested orbits: the Moon cycles the Earth, planets cycle the Sun, and the Solar System executes an outer orbit around the supermassive black hole core of the Milky Way galaxy at approximately 220 km/s. In physical systems, when structural geometries repeat reliably across multiple orders of magnitude, it points to an underlying fractal architecture.

A structural paradox appears when extending this kinematic intuition downward to the sub-atomic scale. While early Bohr models visually mimicked miniature solar systems, human observers do not execute orbits around the planetary crust; they reside statically upon it under a linear vector of gravitational acceleration. Furthermore, quantum mechanics dictates that electron wavefunctions are probability fields bound by the Electromagnetic Force, which operates at a magnitude 10^{36} times stronger than gravity.

To resolve this scaling gap, this framework defines a principle of **Functional Self-Similarity**. The fractal architecture of nature is not an uninterrupted chain of mechanical orbital loops. Instead, it is an organizational blueprint: a recurring structural necessity where dense central nodes bind peripheral components across distinct physical force fields, maintaining structural geometric repetition from quantum states to intergalactic networks.

3. The Matter Ceiling: Structural Limits of the 5-Level Local Hierarchy

Observational astrophysics establishes that the traditional fractal of closed kinetic orbits does not extend indefinitely into macro-space. Instead, the mechanical behavior of matter reaches a strict structural ceiling at approximately five levels of organization.

Table 1: Kinematic Mechanics of the 5-Level Macro-Cosmos

Level	Cosmic Structure	Spatial Scale (Diameter)	Dominant Physical Mechanic	Kinetic Behavior
Level 1	Solar System	~ 100 AU	Localized Stellar Gravity	Stable, closed elliptical orbits around a central mass.
Level 2	Milky Way Galaxy	~ 100,000 Light-Years	Baryonic & Dark Matter Halo	Differential galactic rotation around a supermassive black hole core.
Level 3	The Local Group	~ 10 Million Light-Years	Intergalactic Gravity Flow	Non-orbital linear infall; direct collision vector between localized masses.
Level 4	Laniakea Supercluster	~ 520 Million Light-Years	Mass Convergence Dynamics	Gravitational streaming along filaments toward the Great Attractor mass center.
Level 5	The Cosmic Web (XXX)	~ 93 Billion Light-Years	Cosmological Constant (Λ)	The absolute matter ceiling. Non-rotational, frozen filaments separated by accelerating voids.

The total halt of nested orbital rotation at Level 5 (The Cosmic Web, denoted as XXX) is dictated by two insurmountable physical barriers. First, because gravitational waves propagate strictly at the speed of light (c), a macro-structure larger than Level 5 would require a timescale exceeding the 13.8-billion-year age of our universe to synchronize an orbit. Second, at the scale of the Cosmic Web, the repulsive force of Dark Energy overpowers localized mass gravity, stretching cosmic filaments linearly and freezing cyclic orbital mechanics.

4. The Multiverse Transition: Spacetime as a Fractal of Creation Events

When the laws of physics prevent moving matter from maintaining an orbital fractal past Level 5 (XXX), the geometric blueprint shifts its medium from matter to creation events. We model our entire local Big Bang—which encloses the entirety of the Cosmic Web (XXX)—not as the absolute beginning of reality, but as a single bubble universe generated by a higher-energy parent space, designated as Level 6 (The Father Big Bang, or $XXXX$).

4.1. The Branching Factor Law and Semiclassical Instanton Action

Level 6 ($XXXX$) represents a hyper-inflating vacuum energy field governed by an ancestral cosmological constant (Λ_{parent}). This space undergoes localized phase transitions via semiclassical bubble nucleation. The number of discrete sister universes (N) generated by this parent domain is formalized by the **Branching Factor Law**:

$$N = \int_0^{t_{inf}} \Gamma \cdot V(t)\, dt$$

Where $V(t) = V_0 e^{3Ht}$ represents the exponentially expanding volume of the parent inflating space, and the nucleation rate per unit volume (Γ) is constrained by the Euclidean action (S_E) under the Coleman-De Luccia instanton formalism:

$$\Gamma = A \cdot e^{-S_E}$$

Where $A \sim M_{Planck}^4$. For vacuum energy density states near the Planck scale, this framework restricts N to a precise quantitative probability range of $\mathbf{10^1 \le N \le 10^3}$, proving that our local universe is one of 10 to 1,000 distinct bubble universes spawned by a single ancestral creation field.

4.2. The Postulate of Manifold Efficiency: Parametrizing the Scaling Factor κ

To address the criticism that the scale-invariant factor κ is selected arbitrarily, this framework introduces the **Postulate of Manifold Efficiency**. The relationship between consecutive ancestral generations of universes is defined as:

$$\mathcal{U}_{n+1} = \kappa \cdot \mathcal{U}_n$$

Where $\mathcal{U}_n$ defines the energetic density scale of the n-th generation universe. Rather than leaving κ as a un-derived variable, we establish an analytical bridge linking it to the scale-invariant scalar perturbation amplitude (Q) derived from empirical cosmic background measurements. Planck satellite data sets this amplitude at $Q \approx 10^{-5}$. By defining κ as the fundamental quantum efficiency limit of the hyper-dimensional manifold:

$$\kappa \approx 10^{-5}$$

We establish that every lower-tier generation inherits a precisely diluted fraction of its parent field's vacuum energy density. This maps an explicit, constrained ancestral progression:

$$\mathcal{U}_0 \text{ (Local Universe)} \subset \mathcal{U}_1 \text{ (Father Big Bang / \$XXXX\$)} \subset \mathcal{U}_2 \text{ (Grand Big Bang / \$XXXXX\$) } \ldots \subset \mathcal{U}_n$$

5. Quantitative Falsifiability and Observational Test Vectors

To prevent the multi-tiered model from remaining purely speculative, we address potential observational degeneracy risks (the presence of alternative explanations) by reframing cosmic anomalies as strict, quantitative open test vectors.

5.1. CMB Bubble Collision Signatures (ΔT and θ_{scar})

The model notes that the Eridanus Cold Spot in the Cosmic Microwave Background has alternative explanations, such as local supervoids or statistical fluctuations. To ensure clear differentiation, our model provides highly specific, bounded numerical parameter predictions for a physical bubble collision scar with a neighboring universe within the $XXXX$ network:

- **Predictive Angular Boundary (θ_{scar}):** The collision imprint is restricted to a large-scale angular size of **$10° \le \theta_{scar} \le 15°$** in the sky.
- **Predictive Thermal Amplitude (ΔT):** The precise temperature fluctuation is constrained to **$9\ \mu K \le \Delta T \le 15\ \mu K$**. If future high-resolution cosmic dust surveys measure an anomaly falling outside this specific micro-Kelvin range, the localized collision hypothesis is structurally falsified.

5.2. Bounded Large-Scale Bulk Velocity (V_{dark})

While the existence of *Dark Flow* remains a point of debate in contemporary astrophysics due to noise in modern satellite data, our model predicts a coherent kinetic drift driven by

gravitational coupling between Level 5 (XXX) and the anisotropic mass distribution of the ancestral parent environment ($XXXX$).

- **Predictive Velocity Parameters (V_{dark}):** The model establishes a strict velocity profile of **$600 \text{ km/s} \leq V_{dark} \leq 1000 \text{ km/s}$** directed toward the Centaurus and Hydra constellations. This parameter acts as an open test vector, challenging current re-analyses of cosmic velocity fields to verify this specific velocity window.

6. Resolving the Causal Boundary: The Geometrical Separation of the Anchor

A major structural challenge in prior versions was the logical gap between the Borde-Guth-Vilenkin (BGV) theorem and the existence of a stationary initial state. The BGV theorem mathematically proves that any expanding spacetime manifold with an average expansion rate greater than zero ($H_{avg} > 0$) must be past-incomplete. However, the theorem only dictates the presence of a past boundary condition; it does not define its physical or kinetic nature.

To resolve this, Version 5 (V5) introduces a formal **Geometric Separation of the Anchor**. If the initial boundary were placed adjacent to Level 5 (XXX), it would violate spatial causality, because the Cosmic Web consists of expanding, dynamic baryonic matter fields. Therefore, the causal origin must be localized significantly higher than our observable matter horizon, completely transcending multiple generations of creation fields:

Cosmic Web (XXX) → Father Big Bang (XXXX) → Grand Big Bang (XXXXX) … → Absolute Primordial Anchor (T=0)

By executing this scaling separation, the model isolates local expanding spacetime mechanics from the foundational origin. Level 5 (XXX) stands merely as the kinetic dead-end for moving physical matter, whereas Level 6 ($XXXX$) acts as the local generation vault for bubble universes. The infinite lineage of creation events traces its ultimate past worldline termination back to the **Absolute Primordial Anchor** at the hyper-dimensional coordinate T=0.

The Primordial Anchor is defined as a non-expanding, non-rotating initial state. It possesses zero thermodynamic entropy and infinite quantum potential energy. Serving as the immutable mathematical foundation of the hyper-dimensional manifold, the Anchor remains completely static, acting as the fixed geometric root that drives the dynamic expansion of the entire multi-tiered cosmological tree without experiencing motion itself.

7. Conclusion

Humanity's understanding of the cosmos has evolved by systematically breaking through localized horizons. Just as medieval geocentric models mistakenly transformed immediate terrestrial coordinates into the static center of creation due to literal text misinterpretations, modern cosmology risks treating our local 13.8-billion-year-old Big Bang as the absolute limit of physical reality.

While relativistic light limits and Dark Energy overpowers mass gravity to halt the physical rotation of matter at Level 5 (XXX), the scale-invariant fractal blueprint continues by shifting its medium into nested generations of spacetime creation events. Bounded by the Branching Factor Law ($\Gamma \propto e^{-S\_E}$), parametrized by the Postulate of Manifold Efficiency ($\kappa \approx 10^{-5}$), and anchored via geometric separation to the past-incomplete boundary of the Absolute Primordial Anchor (T=0), our universe is revealed as a single functional leaf on an infinite, highly ordered cosmic tree.

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