Minimalist Cosmology, Particle Universality, Topological Fault-Tolerance, and Eternal Self-Sustenance in a Bubble Multiverse

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Abstract

As a direct sequel to *Emergent Cosmology of a Two-Phase Planar-Invasion Bubble Universe* [1], this paper establishes a self-sustaining global multiverse model—encompassing a grand **Global Universe** composed of seven initial seed universes—from a "Creator's-Eye View" of physical aesthetics and minimalism. To avoid ambiguity, it is explicitly emphasized that all bubble universes discussed and analyzed hereafter strictly refer to their *iteratively evolved generations* produced through multi-generational collisions, rather than the initial seed universes. We formulate the core physical axioms, a topological fault-tolerance law, and a dark energy conservation mechanism: the primordial Big Bang mechanism permanently and individually ceased across the seven initial child universes in strict accordance with the Second Law of Thermodynamics, serving as Newton's Prime Mover with non-uniform initial expansions seeding subsequent cosmic rotation; global particle universality ensures that all iterative bubble universes share identical microscopic physics; apparent local dark energy acceleration is resolved as the kinetic energy projection of topological potential energy transferred from degenerate ground-state universes (S_{Dead}); and the Prime-7 topological law ($\mathcal{N}_0 = 7$) together with evolutionary scale sequences ($\{10, 15, 40, 100\}$) guarantees a dynamic equilibrium ($N_{\text{eq}} > 7$) and a strictly zero extinction limit ($\lim_{t\to\infty} P(N(t) = 0) \equiv 0$). Finally, we reconcile this framework with Newton, Spinoza, and ancient Chinese philosophy, concluding with a humanist affirmation of Philosophical Optimism and cosmic grace.

1 Physical Axioms

1.1 Primordial Low-Entropy Big Bangs, Quadratic Quantum Gravity, and Newton's Prime Mover

The initial boundary conditions of the Global Universe are established by 7 continuous, spatiotemporally asynchronous Big Bang events triggered in the high-dimensional geometric field by the Creator (the cosmic entity).

- **Low-Entropy Origin and Quadratic Quantum Gravity Constraint**: Irrespective of the underlying trigger mechanism of epigenetic generation, the physics of the initial bubble universe is fundamentally a low-entropy boundary state generated via quadratic quantum gravity models in the vacuum. Governed strictly by the Second Law of Thermodynamics ($\Delta S \geq 0$), this spontaneous low-entropy creation mechanism can occur exclusively in the initial seed universes. Subsequently, the primordial Big Bang mechanism permanently and individually ceased across the seven initial child universes in strict accordance with the Second Law of Thermodynamics. Global energy dynamics then transition entirely to multi-generational collisions and phase changes.

- **Physical Realization of Newton's "Prime Mover"**: Sir Isaac Newton posited that the universe requires an initial "Prime Mover" to impart dynamic impulse [2]. In our model, these 7 primordial Big Bangs serve as this Prime Mover. Occurring at distinct spatial coordinates and staggered temporal nodes, spatial separations impart relative trajectories (initial momentum), while temporal staggering ensures that individual universes enter distinct evolutionary phases with intrinsic phase shifts: the high-speed expansion era (scale 10), the star-shining era during

the transition towards expansion halting (scale 15 to 40), and the heat-death/degenerate/death era (scale 100).

- **Inhomogeneous Expansion and Rotation Seeding**: The initial expansion or explosion of each of the 7 initial child universes is fundamentally non-uniform and asymmetrical. This spatial inhomogeneity breaks local spatial isotropy, naturally seeding the initial angular momentum and rotational dynamics of the child universes. This lays the crucial physical foundation for the rotating manifold structures (such as the rotating scimitar-like manifold) observed during subsequent planar invasions and multi-generational interactions [1].
- **Energy Conservation and Multi-Generational Cascade**: The primordial sequence permanently closes after establishing the initial 7 seed universes. The total global energy strictly obeys the First Law of Thermodynamics, cascading sequentially through generations of colliding, splitting, and phase-transitioning bubble universes.
- **Hereditary Nature of the Dark Background**: The nocturnal dark sky and Cosmic Microwave Background (CMB) observed today represent the ultimate thermodynamic residual inherited through generations of cascading energy transfer.

1.2 Global Particle Universality and Multi-Generational Iteration

All bubble universes inherit from the unified energy field injected during the primordial Big Bangs; a subset of these universes eventually evolves into the degenerate, massless quantum matrix (ρ_ν^{bg}) remaining after cosmic degradation.

> **Scope Clarification**: To ensure absolute logical rigor throughout this paper, all bubble universes analyzed, derived, and modeled in subsequent chapters strictly refer to **iterative generations** (S_{Active}) produced through multi-generational collisions, shearing, and division, rather than the initial seed universes.

Because all iterative universes inherit from a unified primordial energy base and quantum substrate, the intrinsic physical properties (mass, spin, charge, and coupling constants) of fundamental particles (electrons, quarks, Majorana neutrinos N_R) are strictly universal and identical across the Global Multiverse.

- **Seamless Fluidic Merging**: Identical microscopic particle physics and vacuum states remove topological friction during collisions, allowing seamless fluidic merging and enabling pair-production shearing and tidal-tail tearing ($1 + 1 \to 3$) [1].

1.3 Dark Energy Phenomenon and Global Energy Conservation [1]

Building upon the topological energy-storage framework established in Paper 1 [1], the apparent paradox of dark energy is resolved as follows:

- **Illusion of Local Non-Conservation**: Observed within a single standalone iterative bubble universe, as the planar invasion cuts through the degenerate medium, stored topological potential energy from prior generations is continuously converted into internal acceleration [1]. This manifests locally as the kinetic energy projection driving dark-energy-accelerated expansion.
- **Global Conservation Entity**: As established in Paper 1 [1], a degenerate universe (S_{Dead}) stores the exhausted energy of prior generations as latent topological potential energy. When a live universe cuts into the degenerative universe, the expansion energy driving the combined universe is transferred across cosmic boundaries. Globally, the First Law of Thermodynamics remains strictly inviolate.

2 Three-State Phase Space, Evolutionary Scales, and Potential Lock-In

During multi-generational evolution, each individual standalone iterative bubble universe traverses a minimalist three-state phase space, parameterized by the evolutionary scale sequence $\{10, 15, 40, 100\}$:

$$\mathcal{S} \in \{S_{\text{Active}}, S_{\text{Radiative}}, S_{\text{Dead}}\}$$

1. **Iterative Active State / High-Speed Expansion Stage (S_{Active}, Characteristic Scale 10)**: The geometric plane invades and consumes degenerate media. Plentiful neutrino backgrounds fuel rapid matter creation and high-speed expansion (scale 10), endowing the universe with high-dimensional kinetic energy and collision-branching potential.

2. **Iterative Metastable Radiative State / Expansion-Halting Transition and Star-Shining Stage ($S_{\text{Radiative}}$, Characteristic Scale $15 \to 40$)**: Neutrino backgrounds deplete, weakening planar invasion dynamics. The universe first enters the expansion-halting transition stage (scale 15); subsequently, maximum heavy-baryon luminosity fills the plane, reaching the thermodynamic peak of the star-shining stage (scale 40).

3. **Iterative Degenerate Ground State / Heat-Death Degenerate Death Stage (S_{Dead}, Characteristic Scale 100)**: Luminous matter decays completely, wavelengths stretch to infinity ($\nu \to 0$), and spatial volume reaches its historical maximum ($R_{\text{Dead}} = R_{\max}$). The universe enters the heat-death degenerate death stage (scale 100), where energy is fully converted into latent topological potential energy [1].

4. **Collision Cross-Section Lock-In and Quantum Vacuum Boundary Generation**: According to geometric scattering cross-section scaling, $\sigma \propto R^2$, degenerate universes at scale 100 ($R_{\text{Dead}} \gg R_{\text{Active}}$) present the largest spatial capture targets. Acting as vast potential energy targets, they are preferentially intersected and reactivated by smaller, high-energy active universes (scale 10, S_{Active}). Owing to the immense scale of these degenerate universes, diverse bubble universes of varying types and quantities can randomly intersect them at different epochs, giving rise to distinct, newly combined bubble universes. This multi-site stochastic interaction fundamentally prevents any single bubble universe from dominating and evolving into a monolithic main global universe. Furthermore, the vast degenerate background of light neutrinos and weak photons (the nocturnal dark sky) forms a degenerate matrix governed by the Pauli exclusion principle and quantum statistics. When an active universe equipped with a strong gravitational field intersects this medium, subsequent to long-term internal evolution, the gravitational field induces vacuum polarization and non-linear instability (phase transition) within the Fermi sea. Through the Bogoliubov effect, this interaction forcefully carves out an independent boundary possessing a causal horizon from the continuous quantum background, thereby establishing a new and variant boundary of the newly combined bubble universe.

3 The Prime-7 Topological Law and Dynamic Equilibrium Proof

3.1 Geometric Envelope and Spatiotemporal Dynamics ($\mathcal{N}_0 = 7$)

1. **Octahedral Structural Envelope Floor ($\mathcal{N}_{\min} = 6$)**: In three/higher dimensions, 6 nodes (iterative bubble universes) form a regular octahedron, providing the minimal structural tension envelope floor to prevent collapse into a lower-dimensional plane.

2. **Initial Topological Fault-Tolerance and Symmetry Breaking ($N(0) = 7 > \mathcal{N}_{\min}$)**: A 6-node regular octahedron is highly symmetric and prone to static mechanical deadlock. Introducing a 7th bubble serves as an asymmetric dynamic core: geometrically breaking static symmetry to trigger collision cutting, and transiently offering an initial fault-tolerance floor ($N(0) - 1 \geq \mathcal{N}_{\min}$) against non-reproductive merging ($1 + 1 \to 1$).

3. **Spatiotemporal Staggering**: The 7 initial seed universes, continuously ignited at staggered spatiotemporal coordinates by the Prime Mover, maintain phase shifts across their lifecycles ($10 \to 15 \to 40 \to 100$), preventing collective thermal death and sustaining a perpetual collision network.

3.2 Proof of Zero Extinction Probability and $N_{\mathbf{eq}}$ Steady State

Following the collision dynamics established in Paper 1 [1], the violent collision of two iterative active universes triggers boundary shearing and tidal ejection, generating 2 child embryonic universes:

$$\Gamma : S^{(1)}_{\text{Active}} + S^{(2)}_{\text{Active}} \longrightarrow S_{\text{Surviving}} + 2 \cdot S_{\text{Embryo}} \quad \Longrightarrow \text{ Net Yield: } 1 + 1 \to 3$$

The master rate equation governing total bubble population $N(t)$ is expressed as:

$$\frac{dN(t)}{dt} = \lambda_{\text{collision}} \cdot \Phi(N(t)) - \gamma_{\text{decay}} \cdot N(t) - \mu_{\text{merge}} \cdot N(t)^2$$

Given the branching multiplier $\eta = \frac{3}{2} > 1$ and initial condition $N(0) = 7 > \mathcal{N}_{\min}$, the global extinction probability strictly vanishes as time approaches infinity:

$$\lim_{t \to \infty} P(N(t) = 0) \equiv 0$$

Theorem of Dynamic Preservation and Density Constraint:
The quadratic merging loss term $\mu_{\text{merge}} \cdot N(t)^2$ acts as a "density constraint." As population $N(t)$ grows, merging probability scales quadratically, suppressing infinite divergence. Thus, population growth and merging balance at a critical equilibrium capacity $N_{\text{eq}} > 7$ where $\frac{dN}{dt} = 0$.
The Global Multiverse constitutes a Self-Sustaining Non-Equilibrium Steady State (SNESS), stably accommodating all three phase states (across scales 10, 15, 40, and 100) and precluding global heat death or topological collapse.

4 Ontological Foundations: Newton, Spinoza, and Ancient Eastern Thought

This minimalist model resolves the infinite regress of the First Cause problem:

1. **Newton's Prime Mover and Spinoza's God**: Newton's required "Prime Mover" is identified as the Creator's spatiotemporal ignition of the 7 initial low-entropy Big Bangs [2]. The Creator is not an anthropomorphic entity outside physical reality, but the global substance itself (*Spinoza's Pantheism / Causa Sui* [3]), encompassing the primordial Big Bangs, the high-dimensional neutral matrix, the 7 initial bubbles, and the $1 + 1 \to 3$ branching law.

2. **Topological Cyclic Views of Ancient Chinese Philosophers**:

   - **Zhuangzi** ($\sim$ 2300 years ago, *On the Equality of Things* [5]) stated: *"There is a beginning. There is a beginning before that beginning. There is a beginning before that beginning before beginning."* This anticipates the infinite generational cascade of the multiverse across space and time.
   - **Laozi** ($\sim$ 2500 years ago, *Tao Te Ching*, Ch. 25 [4]) wrote: *"Man conforms to the Earth, Earth to Heaven, Heaven to Tao, and Tao to Nature."* The operation of the Prime Cause (Tao) is inherently self-so (*Ziran*).

3. **Higher-Dimensional Metaphor of the 7-Day Creation**: The Creator places 7 dynamic seed universes at asymmetric spatiotemporal coordinates; the first 6 establish the 3D structural envelope, while the 7th breaks static deadlock to initiate perpetual self-sustaining motion.

5 Conclusion and Humanist Elevation: Philosophical Optimism and Cosmic Grace

"Minimalism is supreme beauty; geometry is eternity."

By virtue of the primordial continuous low-entropy Big Bangs (Prime Mover), global particle universality, the $\mathcal{N}_0 = 7$ topological fault-tolerance, three-state phase transitions $(10, 15, 40, 100)$, and $1 + 1 \to 3$ branching, the Global Multiverse locks its extinction probability to zero under strict energy conservation. The Creator is the multiverse itself; the multiverse is eternity.

This perpetually self-sustaining cosmic entity serves as the physical bedrock of **Philosophical Optimism**. As conscious entities born from local cosmic evolution, our ability to observe and comprehend this harmonious cosmic order and geometric-mathematical beauty is a privilege inspiring profound gratitude.

Therefore, the ultimate reverence and response to the Creator (the cosmic entity) is for humanity to live meaningful, dignified, and noble lives within this harmonious and perpetually flowing universe—this is not merely an individual moral choice, but a solemn tribute to the magnificent cosmic entity itself.

References

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