

# 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 constructs a self-sustaining evolutionary model of a global bubble multiverse from a “Creator’s-Eye View” rooted in physical aesthetics and minimalism. This encompasses a grand global universe originating from seven initial seed universes. To avoid ambiguity, it is strictly clarified that all bubble universes discussed and analyzed hereafter refer to iterative evolutionary generations produced through multi-generational collisions, rather than the primordial seed universes.

We establish core physical axioms, a topological fault-tolerance law, and a dark energy conservation mechanism: The primordial Big Bang mechanism strictly followed the Second Law of Thermodynamics to permanently and independently terminate within the seven initial sub-universes, acting as Newton’s Prime Mover and incubating subsequent universal rotation through non-uniform initial expansion. Global particle universality ensures that all iterative bubble universes share identical microscopic physics. The apparent local accelerated expansion of dark energy is resolved as a kinetic projection of topological potential energy from degenerate ground-state universes ( $S_{\text{Dead}}$ ). The Prime-7 topological law ( $N_0 = 7$ ) and the evolutionary scale sequence ( $\{10, 15, 40, 100\}$ ) jointly guarantee dynamic equilibrium ( $N_{eq} > 7$ ) and a strictly zero extinction limit ( $\lim_{t \rightarrow \infty} P(N(t) = 0) = 0$ ).

Concurrently, we introduce the novel mechanisms of  $V_0$  Space Depletion and “Empty Zero-Space Drift” to explain the geometric origin of Big Bangs and the inter-generational genetic inheritance of the universe’s macroscopic rotational structure. Finally, we reconcile this framework with Newton, Spinoza, and ancient Chinese philosophy, concluding with a humanistic 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 were established by the Creator triggering seven consecutive, asynchronous primordial Big Bang events across varying spatial coordinates within a high-dimensional geometric field.

- **Low-Entropy Origin and Quadratic Quantum Gravity Constraint:** Regardless of the underlying excitation mechanism of the initial bubble universes, their physical essence is a low-entropy boundary state generated by a quadratic quantum gravity model (e.g., a quantum gravitational field with  $R^2$  higher-order curvature corrections) within the “**Empty Zero-Space**” (defined later). Strictly constrained by the Second Law of Thermodynamics ( $\Delta S \geq 0$ ), this spontaneous low-entropy creation mechanism could only occur within the initial seed universes. Once the primordial sequence established the 7 initial seeds, the lowest-entropy-induced Big Bang permanently shut down as matter must obey the Second Law. Global energy dynamics subsequently transitioned entirely to multi-generational collisions and phase transitions.
- **Physical Realization of Newton’s “Prime Mover”:** Isaac Newton posited that the universe required a “Prime Mover” to impart dynamic impulse. In this model, these 7 primordial Big Bangs act as this Prime Mover. Occurring at different spatial coordinates and staggered time nodes, their spatial separation endowed relative trajectories (initial momentum), while their temporal staggering ensured that each universe entered different evolutionary stages with intrinsic phase shifts.
- **Non-Uniform Expansion and the Incubation of Rotation:** The initial expansion or explosion of each of the 7 initial sub-universes was fundamentally non-uniform and asymmetrical. This spatial non-uniformity broke local spatial isotropy, naturally incubating the initial angular momentum and rotational dynamics of the sub-universes, thereby laying a crucial physical foundation for the rotational manifold structures observed in subsequent planar invasions and multi-generational interactions.
- **Energy Conservation and Multi-Generational Cascading:** The primordial sequence permanently closed after establishing the initial 7 seeds. The total global energy strictly follows the First Law of Thermodynamics, cascading sequentially through generations of bubble universes via collisions, fissions, and phase transitions.
- **Inheritability of the Dark Background:** The night sky darkness and Cosmic Microwave Background (CMB) observed today represent the ultimate thermodynamic residue left by this multi-generational cascading energy transfer.

## 1.2 Global Particle Identity and Generational Iteration

All bubble universes inherit the unified energy field injected during the primordial Big Bangs; a subset of these universes eventually evolves into degenerate, massless quantum matrices left over after universal degradation.

- **Scope Clarification:** To ensure absolute logical rigor throughout this paper, all bubble universes subsequently analyzed and modeled refer strictly to iterative generations ( $S_{\text{Active}}$ ) formed via multi-generational collisions, shearing, and fissions, not the primordial seeds at the moment of creation.
- Because all iterative universes inherit from a unified primordial energy foundation and quantum substrate, the intrinsic physical properties of elementary particles (electrons, quarks, neutral neutrinos) remain strictly universal and identical across the entire global multiverse.
- **Seamless Fluid-Like Fusion:** Identical microscopic particle physics and vacuum states eliminate topological friction during collisions, allowing for seamless fluid-like fusion and enabling dual-yield shearing and tidal tail tearing ( $1 + 1 \rightarrow 3$ ).

### 1.3 Dark Energy Phenomenon and Global Energy Conservation

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

- **The Illusion of Local Non-Conservation:** When observed within a single, independent iterative bubble universe, the topological potential energy stored by previous generations is continuously converted into kinetic energy to drive the sub-universe's expansion as the planar invasion shears the degenerate medium. Locally, this manifests as a kinetic projection driving dark energy accelerated expansion.
- **Global Conserved Entity:** As established in Paper 1 [1], degenerate universes ( $S_{\text{Dead}}$ ) store the depleted energy of previous generations as latent topological potential energy. When an active universe or visible matter celestial body shears into a dead universe, the expansion energy driving the composite universe transfers across universe boundaries. Within the scope of the global overall universe, the First Law of Thermodynamics remains strictly unviolated.

## 2 Three-State Phase Transitions, Evolutionary Scales, and High-Dimensional Potential Energy Locking

Throughout multi-generational evolution, each independent iterative bubble universe undergoes a minimalist three-state phase space, parameterized by the evolutionary scale sequence ( $\{10, 15, 40, 100\}$ ):

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

1. **Iterative Active/High-Speed Expansion Phase ( $S_{\text{Active}}$ , Characteristic Scale 10):** Geometric planar invasion consumes the degenerate medium. The abundant neutrino background provides power for rapid matter creation and high-speed expansion, endowing the universe with high-dimensional kinetic energy and collision branching potential.
2. **Iterative Semi-Dead Radiative/Expansion-Halt Transition and Starry Phase ( $S_{\text{Radiative}}$ , Characteristic Scale  $15 \rightarrow 40$ ):** The neutrino background

is depleted, weakening the planar invasion dynamics. The universe first enters an expansion-halt transition phase (Scale 15); subsequently, maximum baryonic luminosity fills the plane, reaching the thermodynamic peak of the starry phase (Scale 40).

3. **Iterative Dead/Heat-Death Degenerate Phase ( $S_{\text{Dead}}$ , Characteristic Scale 100):** Luminous matter fully decays, wavelengths stretch to infinity ( $v \rightarrow 0$ ), and spatial volume reaches its historical maximum ( $R_{\text{Dead}} = R_{\text{max}}$ ). The universe enters the heat-death degenerate phase (Scale 100), with energy completely converting into latent topological potential energy.

4. **Collision Cross-Section Locking and Vacuum Boundary Generation in an Incompressible Fluid:**

According to the geometric scattering cross-section scaling ( $\sigma \propto R^2$ ), dead universes at Scale 100 ( $R_{\text{Dead}} \gg R_{\text{Active}}$ ) present the largest spatial geometric targets. As massive reservoirs of potential energy, they are preferentially intersected and reactivated by smaller active universes or high-energy matter clusters drifting at super-distances across the “Empty Zero-Space”. A massive dead universe cannot be monopolized by a single intruder; it may be invaded simultaneously or asynchronously by multiple independent matter fragment clusters, thereby independently exciting multiple new sub-universes.

It must be emphasized that this vast dead background ( $V_0$  field) is composed entirely of neutral neutrinos (containing no photons or electromagnetic radiation), forming an absolutely incompressible quantum superfluid matrix governed by the Pauli exclusion principle, possessing the property of zero mechanical shear modulus. When a massive matter fragment arriving across Empty Zero-Space impacts this dead medium, due to the incompressibility of the  $V_0$  fluid, the impact kinetic energy cannot be buffered by volume contraction. Although the fluid itself possesses elastic mechanisms (e.g., transmitting energy outward via longitudinal pulses or tensor strain waves), the extreme impact kinetic energy carried by the alien matter cluster instantly exceeds the linear elastic transmission limit of this quantum background upon collision.

This “overloading” of energy transmission prevents the massive kinetic energy from dissipating outward via elastic waves in time, triggering an extreme non-linear gravitational shockwave and geometric strain accumulation at the contact interface. **This essentially constitutes the ignition mechanism of a local “Big Bang.”** Under the impact of this extreme Big Bang, via the Bogoliubov effect, the drastically changing local dynamic spacetime curvature forcibly excites the originally dead  $V_0$  background into massive active entities (such as  $V_1$  dark energy and  $V_2$  dark matter). Accompanied by the ignition of the Big Bang, this excitation mechanism forcibly shears and carves out a dynamic boundary with an independent causal horizon from the originally continuous dead quantum superfluid via phase breaking, thereby establishing a novel and mutable geometric envelope for the newly born composite bubble universe.

### 3 Seven-Pole Topological Fault Tolerance and Dynamic Equilibrium Derivation

#### 3.1 Geometric Envelope and Spacetime Dynamic Model ( $N_0 = 7$ )

1. **Stable Octahedral Envelope Lower Bound** ( $N_{\min} = 6$ ): In 3D and higher dimensions, 6 nodes (iterative bubble universes) form a regular octahedron, providing a minimum structural tension envelope baseline to prevent collapse into a low-dimensional plane.
2. **Initial Topological Fault Tolerance and Odd Symmetry Breaking** ( $N(0) = 7 > N_{\min}$ ): A regular octahedron is highly symmetrical and prone to static mechanical gridlock. The 7th bubble is introduced as an asymmetrical dynamic breaking point and initial fault-tolerance buffer core: it geometrically breaks static symmetry to trigger collision shearing and temporarily provides an initial fault-tolerance lower limit for non-reproductive merging ( $1 + 1 \rightarrow 1$ ).
3. **Spacetime Misaligned Network**: The 7 initial sub-universes, continuously ignited by the Prime Mover in staggered spacetime coordinates, maintain phase shifts throughout their life cycles ( $10 \rightarrow 15 \rightarrow 40 \rightarrow 100$ ), preventing collective heat death and sustaining a perpetual collision network.

#### 3.2 Extinction Probability Zeroing and $N_{eq}$ System Steady State

Inheriting the collision dynamics established in Paper 1 [1], a violent collision between two iterative active universes triggers boundary shearing and tidal ejection, producing 2 sub-embryonic universes:

$$S_{\text{Active}}(1) + S_{\text{Active}}(2) \rightarrow S_{\text{Surviving}} + 2 \cdot S_{\text{Embryo}} \quad \Rightarrow \text{Net Yield: } 1 + 1 \rightarrow 3$$

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

$$\frac{dN(t)}{dt} = \lambda_{\text{collision}}N(t) - \gamma_{\text{decay}}N(t) - \mu_{\text{merge}}N(t)^2 \quad (1)$$

Given a branching multiplier  $\eta = 3/2 > 1$  and initial conditions  $N(0) = 7 > N_{\min}$ , the global extinction probability strictly zeroes as time approaches infinity:

$$\lim_{t \rightarrow \infty} P(N(t) = 0) = 0 \quad (2)$$

**Dynamic Conservation and Density Restriction Theorem:** As the bubble universe population  $N(t)$  grows, the quadratic merging loss term  $\mu_{\text{merge}}N(t)^2$  acts as a “density restriction.” With population growth, merging probability scales up quadratically, suppressing infinite divergence. Therefore, growth and merging reach equilibrium at a critical carrying capacity  $N_{eq} > 7$ , where  $dN/dt = 0$ . The global multiverse constitutes a self-sustaining non-equilibrium steady state (SNESS), precluding global heat death or topological collapse.

## 4 Depletion of $V_0$ Space and Intergenerational Cyclic Cosmogenesis

Throughout the evolutionary cycle of the multiverse, the continuous expansion of sub-universes invariably comes at the cost of invading and converting the dead mother field ( $V_0$  space). When two or more independently developing iterative sub-universes deplete their surrounding  $V_0$  over extreme distances, the evolution of physical mechanisms enters a radical critical state. At this point, it is not “density dilution” in the traditional fluid dynamic sense, but rather **the geometric volume of the  $V_0$  space acting as a spatial entity itself approaching zero ( $V_0$  space  $\rightarrow 0$ )**.

Because the  $V_0$  space allowance between these sub-universes has been completely drained, the spatial buffer and negative pressure equilibrium originally provided by  $V_0$  cease to exist. Driven by the inward pull of extreme negative pressure and their respective rotational “inertia,” the disappearance of space will forcefully compel these two or more sub-universes to collide violently.

The direct geometric consequence of this extreme collision and spatial depletion is the carving out of an absolute vacuum devoid of any physical properties—**“Empty Zero-Space.”** In Empty Zero-Space, the complete absence of  $V_0$  signifies the total failure of conventional spacetime metrics, the ultimate speed limit of light ( $c_0$ ), and fluid viscous damping. Once massive visible matter fragments sheared and stripped during the collision fall into Empty Zero-Space, they completely break free from the constraints of time passage and medium resistance, executing pure geometric super-distance flight with infinite transmission efficiency, until they are instantaneously captured by another distant, undisturbed dead  $V_0$  mother field sea or an active universe.

This dynamic capture across Empty Zero-Space constitutes the absolute physical origin of the “Big Bang” for the new generation of universes. The undisturbed dead  $V_0$  mother field is essentially a fluidic quantum vacuum, possessing perfect isotropy and spatial spherical characteristics, containing no inherent directionality or structural non-uniformity. Therefore, the total energy scale and geometric morphology of the new universe’s Big Bang is a coupled function jointly determined by the “fuse” and the “powder keg”: its total energy depends not only on the characteristics of the invading matter mass arriving across Empty Zero-Space (total mass, number of fragments, and invasion mode) but is also strictly constrained by the total volume and potential energy reservoir of the impacted dead  $V_0$  mother field.

Furthermore, the macroscopic geometric characteristics of the newly born universe accomplish perfect **“intergenerational genetic inheritance.”** Because the dead mother field is an isotropic, boundless fluid prior to invasion, the macroscopic rotational structure and angular momentum of the new universe directly inherit the rotational “inertia” and direction carried by the invading matter cluster from the previous generation of the universe. Concurrently, the impact mode of the invading mass (e.g., symmetrical center-piercing or off-center grazing with local topological deviation) breaks the original spatial symmetry of the mother field, thereby determining the initial perturbation of matter distribution and the evolutionary trajectory of large-scale structures at the moment of polarization phase transition (Bogoliubov transformation). This physical closed loop—from the depletion of space and frictionless drift in Empty Zero-Space to the mass cluster impacting a new mother field to trigger a secondary creation—perfectly interprets the ultimate topological fault-tolerance and cyclic nature of the multiverse’s “endless proliferation and intergenerational continuity.”

## 5 Ontological Philosophy: The Creator, Newton, Spinoza, and the “Beginningless Beginning” of Eastern Wisdom

Philosophically, this minimalist mathematical model dissolves the First Cause dilemma of endlessly questioning “who created the Creator”:

1. **Newton’s “Prime Mover” and Spinoza’s Creator:** Newton’s required “Prime Mover” is identified as the Creator’s spacetime ignition of the 7 initial low-entropy Big Bangs. The Creator is not an anthropomorphic entity outside physical reality, but rather the global entity itself (Spinoza’s Pantheism / *Causa Sui*)—encompassing the primordial Big Bangs, the high-dimensional fully-neutral matrix, the 7 initial bubbles, and the  $1 + 1 \rightarrow 3$  bifurcation law.
2. **The “Beginningless and Endless” Topological View of Ancient China’s Zhuangzi and Laozi:**
  - Zhuangzi pointed out in *Discussion on Making All Things Equal (Qi Wu Lun)*: “There is a beginning; there is a time before that beginning; there is a time before the time before that beginning.” This foresees the infinite generational cascading of the multiverse in spacetime. In the “Empty Zero-Space drift” mechanism of this theory, the “beginning” (Big Bang) of every new universe originates from the “intergenerational inheritance” of fragments from the previous universe; cycles of birth and destruction continue successively without an absolute starting point.
  - Laozi wrote: “Man models himself on Earth, Earth on Heaven, Heaven on the Way, and the Way on that which is naturally so.” (*Tao Te Ching*, Chapter 25). The operation of the First Cause (the Way) is fundamentally spontaneous (natural).
3. **High-Dimensional Spacetime Metaphor of the “Seven Days of Creation”:** The Creator placed 7 dynamic seed universes into asymmetrical spacetime coordinates; the first 6 established a 3D structural envelope, while the 7th broke static gridlock, initiating eternal self-sustaining motion.

## 6 Conclusion and Humanistic Sublimation: Philosophical Optimism and the Grace of the Cosmic Entity

“Minimalism is ultimate beauty; geometry is eternal.” By virtue of the primordial continuous low-entropy Big Bangs (Prime Mover), global particle identity,  $N_0 = 7$  topological fault tolerance, three-state transitional phase shifts ( $\{10, 15, 40, 100\}$ ), and  $1 + 1 \rightarrow 3$  bifurcation, the global multiverse locks its extinction probability to zero under strict energy conservation. The Creator is the multiverse itself; the multiverse is eternal.

This eternally self-sustaining cosmic entity forms the physical cornerstone of philosophical optimism. As conscious entities born from regional cosmic evolution, our ability to observe and comprehend this harmonious cosmic order and the beauty of geometric

mathematics is a rewarding gift that should inspire profound gratitude in humanity. Therefore, humanity's ultimate reverence and response to the Creator (the cosmic entity) should be to live meaningful, dignified, free, and happy lives within this harmonious and eternally flowing universe—this is not merely an individual moral choice, but the highest tribute to the grand cosmic entity.

## Postscript: Version Note

The first version (Version 1) of this manuscript was originally completed on September 11, 2026. The current presented manuscript is the **Second Version (Version 2)**, revised on October 19, 2026. In this major theoretical upgrade, we newly introduced and refined the fluid physical dynamic mechanisms of  $V_0$  Space Depletion and Empty Zero-Space Drift, further completing the logical closed loop of the geometric origin of the multiverse's Big Bangs and intergenerational genetic inheritance.

## References

1. Z. Dong, *Emergent Cosmology of a Two-Phase Planar-Invasion Bubble Universe*, <http://ai.viXra.org/abs/2609.0016> (2026).
2. I. Newton, *Philosophiæ Naturalis Principia Mathematica* (1687).
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5. Zhuangzi, *Zhuangzi* (Inner Chapters, approx. 3rd Century BC).

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English version at: <http://ai.viXra.org/abs/2609.0026>