

The Light-Speed Boundary Hypothesis

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Abstract

This hypothesis proposes that the speed of light (c) is not merely a physical speed limit but the ontological boundary between existence and nonexistence. At or beyond $v = c$, no time, space, mass, entropy, or causality exists. The Big Bang, in this model, was not an explosion within space, but the first and only rupture of this light-speed boundary — the moment when structured being emerged from absolute null-state. This hypothesis offers a boundary-based mechanism for the emergence of spacetime and proposes that subsequent breaches (e.g., mass accelerated to $v = c$) may give rise to new universes. It reframes cosmogenesis as a singular act of structured energy intruding into lawless nothing.

1. Introduction

Standard cosmology describes the Big Bang as the rapid expansion of space from an initial singularity. Yet it does not explain *why* that singularity occurred. Nor does it account for what, if anything, preceded time, energy, or physical law. This hypothesis introduces a new foundational postulate: that the speed of light defines not only a boundary in relativity, but the very edge of being. Beyond it lies a domain not of vacuum, but of absolute nothingness — devoid of laws, dimensions, and mathematics. The Big Bang is reinterpreted as the crossing of this light-speed threshold by structured energy into a null zone, triggering the emergence of spacetime.

2. Core Hypothesis

Reality begins only when three conditions are violated:

- Velocity drops below $v = c$
- Time becomes non-zero ($\tau > 0$)
- Structure intrudes upon the lawless null

Formally:

$$\text{Existence} = \begin{cases} \text{False, } v \geq c \\ \text{True, } v < c \end{cases}$$

The Big Bang is the moment this transition occurred:

$$\tau = t \cdot \sqrt{1 - \frac{v^2}{c^2}} \Rightarrow 0 \text{ as } v \rightarrow c$$

This boundary crossing is not an event in time — it is the **origin of time itself**.

3. Supporting Scientific Foundations

- **Special Relativity:** Time halts at $v = c$. Proper time $\Delta\tau = 0$ implies a timeless boundary condition.
 - **General Relativity:** Space and time emerge from the presence of mass-energy. No mass implies no spacetime curvature.
 - **Thermodynamics:** Entropy cannot evolve where time is absent. Thus entropy is undefined at $v = c$.
 - **Quantum Physics:** Quantum emergence may require a spacetime substrate — but this hypothesis argues that the substrate itself formed *from* the light-speed boundary.
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4. The Null-State and Boundary Structure

Let \mathcal{N} denote the null-state: a domain where $t = 0$, $m = 0$, $E = 0$, and laws do not apply.

The Big Bang is defined as the first structured energy to cross from \mathcal{N} into \mathcal{U} :

$$\text{If } m \neq 0, v = c, E \in N, \Rightarrow N \rightarrow U_{\text{new}}$$

This transition is a rupture, not a fluctuation. It defines the light-speed boundary $\partial\mathcal{N}$ as:

$$\partial N = \{x \in \mathbb{R}^4 \mid v = c\}$$

5. Recursive Universe Genesis

Once this model is accepted, it implies the potential for multiple universes. If mass from within a universe were somehow accelerated to $v = c$, and thus crossed back into \mathcal{N} , it could create a new causal region.

The energy condition:

$$E = \gamma mc^2 \rightarrow \infty \text{ as } v \rightarrow c$$

If this infinite energy enters the lawless null, it may generate:

- A new spacetime metric
- New constants
- A causally disconnected universe

This is a **recursive genesis mechanism**, not unlike baby universes — but based on **ontological boundary rupture**, not internal evolution.

6. Metaphysical Interpretation

Where most models rely on quantum fluctuations or multiverse inflation, this hypothesis assumes nothing exists beyond $v = c$. There is no backdrop of quantum foam. No pre-existing laws. Thus:

- There is no law *against* faster-than-light speed
- There is no conservation of energy in \mathcal{N}
- **Anything introduced into it becomes the seed of structure**

This removes the need for initial conditions, fine-tuning, or eternal inflation.

7. Implications

- The Big Bang was a boundary event, not an explosion
 - Time, space, and energy are the results of one boundary violation
 - The speed of light is not a constant of physics alone — it is a **causal perimeter**
 - New universes may emerge if that boundary is crossed again
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8. Proposed Tests and Extensions

- **Entropy Horizon Modeling:** Explore $\lim_{v \rightarrow c} dS/dt$
 - **Mathematical Field Extension:** Map $\mathcal{N} \rightarrow \mathcal{U}$ using distribution theory
 - **Null-to-Being Diagrams:** Visualize the causal bubble forming from nothing
 - **Black Hole Analogy:** Investigate whether black hole interiors approximate \mathcal{N}
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9. Philosophical Considerations

If nothing existed before the Big Bang, not even math, then the emergence of logic itself must be part of the rupture. This invites reconsideration of:

- Whether physical law is emergent, not eternal
 - Whether reality is a rule system born from its own violation
 - Whether crossing $v = c$ is not just a physical act, but a *creative* one
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10. Integration with the Observer Threshold and Jellfold Hypotheses

The Light-Speed Boundary Hypothesis defines the **origin of spacetime** as a rupture through the $v = c$ boundary into a lawless null. Once this rupture forms a causal bubble, the universe evolves internally. This is where the **Observer Threshold Hypothesis** and **Jellfold Hypothesis** become relevant.

- The **Observer Threshold Hypothesis** proposes that classical moments — including time itself — only emerge at observation points where light, gravity, and measurement intersect. This mechanism operates **within** the spacetime bubble created by LSBH.
- The **Jellfold Hypothesis** describes the **entangled substrate** into which collapse ripples propagate. It defines the **structural topology** of the universe once spacetime exists.

Together, these three hypotheses form a layered cosmology:

- LSBH explains **how the universe began**
- Jellfold describes **what the universe is made of**
- Observer Threshold defines **when and where reality becomes classical**

Each model is valid on its own, but together they offer a more comprehensive view of emergence, structure, and collapse.

11. Conclusion

The Light-Speed Boundary Hypothesis reframes the origin of the universe as a one-time rupture through the edge of being. Instead of beginning in a singularity, we began at the moment structured energy crossed into a state of pure non-being. This redefines cosmology not as a story of inflation, but as the first crossing into time itself.

By integrating this model with the **Observer Threshold Hypothesis** and **Jellfold Hypothesis**, a unified framework emerges: the universe begins at the boundary (LSBH), takes form within an entangled fluid (Jellfold), and expresses reality through collapse thresholds (Observer Threshold). This layered model offers a new path toward reconciling quantum physics, relativity, and cosmology — one rooted in emergence rather than assumption.

