**The Light-Speed Cycle Hypothesis**

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**Abstract**

The Light-Speed Cycle Hypothesis proposes that the universe is not on a path toward eternal expansion or thermal death, but toward a second encounter with the light-speed boundary that originally birthed it. As cosmic acceleration continues, spacetime asymptotically approaches the speed of light. At the boundary v=c, time, space, entropy, and causality dissolve. This hypothesis suggests that the universe will ultimately dissolve into non-being — the same null-state from which it emerged — and that this re-entry may catalyse a new Big Bang, establishing a cyclical cosmology governed by light-speed rupture events.

**1. Introduction**

Contemporary cosmology acknowledges the accelerating expansion of the universe, attributed to a phenomenon termed dark energy. Various models predict different outcomes: heat death, Big Rip, or eternal inflation. However, none reinterpret the expansion as a return trajectory toward the same condition that began the universe. This hypothesis builds on the Light-Speed Boundary Hypothesis, proposing that the universe began when structured energy crossed from the null-state (v = c) into being (v < c). Now, it continues by positing that the universe is accelerating back toward v = c, closing the loop.

**2. Core Hypothesis**

Existence is bounded between two light-speed transitions:

Existence=

At v = c, proper time τ → 0, causality halts, and spacetime dissolves. Just as the universe emerged from this threshold, it may ultimately return to it.

**3. Dark Energy as Echo of Rupture**

Rather than a force pushing outward, dark energy may be interpreted as the remaining inertia or curvature recoil from the original light-speed rupture. It is not a static cosmological constant but a dynamic echo — the universe accelerating not from within, but being pulled back toward the speed-of-light boundary it once crossed.

**4. Mathematical Boundary Conditions**

As the universe accelerates:

v(t) →c

Then:

* τ=t⋅ →0
* dS/dt→0 (entropy ceases)
* ∂U→N (causality dissolves)

The final condition mirrors the first: spacetime ceases not through collapse, but through vanishing differentiation — a return to the null.

**5. The Light-Speed Cycle**

This model defines cosmogenesis as a closed loop:

1. **Null-State** (N): v=c, no time, no mass
2. **Rupture**: Structured energy crosses into being
3. **Expansion**: Time, entropy, causality evolve
4. **Return Trajectory**: Acceleration continues v → c
5. **Dissolution**: Universe reverts to null
6. **New Rupture**: Recursive Big Bang

This is a **light-speed cycle**, not a multiverse or inflation cascade — it is the same universe rhythmically pulsing into and out of existence.

**6. Implications**

* The universe has a terminal state: v = c
* Time and entropy are temporary, bounded phenomena
* The cosmos is not infinite, but cyclically emergent
* There is no need for infinite inflation or eternal fine-tuning

**7. Proposed Tests**

* Measure asymptotic behaviour of cosmic acceleration
* Explore whether entropy shows logarithmic slowdown
* Reinterpret dark energy as metric recoil
* Model causal disconnection near v ≈ cv

**8. Philosophical Considerations**

If the universe ends as it began — at v = c — then existence is not linear, but **recursive**. Being arises not from randomness but from rupture. The arrow of time bends not toward infinity, but toward the same wall it emerged from. There, it resets.

**9. Conclusion**

The Light-Speed Cycle Hypothesis closes the arc of the Light-Speed Boundary Hypothesis. It reframes the fate of the universe not as decay, but as return — a full cycle from being to non-being and back again. In this model, the universe is a finite, measurable breath through the threshold of light.