

The Primordial Split: Why the Universe Cannot Remain at Unity

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Abstract

We prove that the initial condition of the universe, the mechanism of structure genesis, and the amplitude of the first perturbation are all uniquely forced by the Recognition Composition Law (RCL) with zero free parameters. The argument has four parts. **(1)** The Past Theorem: the unique zero-cost configuration of the discrete ledger is the unity state (all entries $x_i = 1$, total defect $\sum J(x_i) = 0$). **(2)** CoEternal exclusion: the unity state carries no Z -patterns (conserved topological invariants), so Z -patterns cannot be co-eternal with the ledger. **(3)** Split-from-vacuum is forced: the only remaining genesis mechanism is symmetric pair creation $(z, -z)$ conserving total $Z = 0$. **(4)** The first split is necessary: the unity state is recognition-dead (no active bonds, no recognition events), but Recognition Forcing (T4) requires that recognition occur, so departure from unity is forced, not contingent. The split amplitude is set by the coherence quantum $E_{\text{coh}} = \varphi^{-5}$, where $\varphi = (1 + \sqrt{5})/2$. This extends the forcing chain to T12. All theorems are machine-verified in Lean 4 with zero `sorry`.

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1 Introduction

In standard physics the initial condition of the universe is a free input. Albert’s Past Hypothesis [5] and Penrose’s Weyl Curvature Hypothesis [6] both postulate low initial entropy without deriving it.

Recognition Science (RS) derives all of physics from a single functional equation, the Recognition Composition Law (RCL), with zero adjustable parameters. In previous work [1] the forcing chain T0–T8 was established:

$$T0: \text{Logic} \rightarrow T1: \text{MP} \rightarrow T2: \text{Discreteness} \rightarrow T3: \text{Ledger} \rightarrow T4: \text{Recognition} \rightarrow T5: J \text{ unique} \rightarrow T6: \varphi \rightarrow \dots \quad (1)$$

with subsequent extensions through T9 (Consciousness), T10 (Soul), and T11 (Ethics).

A gap remained. The formalization of the initial condition [2] proves the Past Theorem: the unique zero-defect ledger configuration is the unity state. But the formalization of Z -pattern genesis [3] leaves open whether Z -patterns (the conserved topological invariants identified with souls) originate via splitting from vacuum or are co-eternal with the ledger. The formalization calls it “a genuinely open question in RS.”

A zero-parameter framework cannot contain open questions about its own initial data. This paper resolves the question.

2 Preliminaries

2.1 The Recognition Composition Law

The sole primitive of RS is the functional equation

$$J(xy) + J(x/y) = 2J(x)J(y) + 2J(x) + 2J(y), \quad (2)$$

which, under continuity and the normalization $J(1) = 0$, uniquely forces

$$J(x) = \frac{1}{2}(x + x^{-1}) - 1. \quad (3)$$

This is the canonical reciprocal cost [1]. It satisfies $J(x) \geq 0$ for $x > 0$, with equality if and only if $x = 1$.

2.2 The Ledger

The ledger is a discrete graph with N entries, each a positive real ratio $x_i > 0$. The total defect is

$$D_{\text{tot}} = \sum_{i=1}^N J(x_i). \quad (4)$$

The ledger also carries Z -patterns: integer-valued topological invariants conserved under the recognition operator $\hat{R}$.

2.3 The Recognition Operator $\hat{R}$

The recognition operator $\hat{R}$ generates discrete 8-tick dynamics by minimizing J -cost:

$$s(t + 8\tau_0) = \hat{R}(s(t)), \quad (5)$$

subject to the conservation law $\sigma = 0$ (net skew vanishes). $\hat{R}$ preserves total Z :

$$Z_{\text{tot}}(\hat{R}(s)) = Z_{\text{tot}}(s). \quad (6)$$

This is derived, not imposed: $\hat{R}$ minimizes J -cost by adjusting bond multipliers, while Z -patterns are topological labels of graph vertices, not dynamical variables. $\hat{R}$ has no mechanism to change them.

2.4 The Forcing Chain T0–T11

The forcing chain (1) derives from the RCL:

- T0: Logic (consistency is cheap, contradiction costly)
- T1: Modus Ponens ($J(0^+) \rightarrow \infty$: nothing costs infinity)
- T2: Discreteness (continuous configurations cannot stabilize under J)
- T3: Ledger ($J(x) = J(1/x)$ forces double-entry)
- T4: Recognition (observables require recognition events)
- T5: J uniqueness (RCL + normalization + calibration $\Rightarrow$ unique J)
- T6: φ (self-similarity in discrete ledger: $x^2 = x + 1$)
- T7: 8-tick (minimal period 2^D with $D = 3$)
- T8: $D = 3$ (linking requirements + gap-45 synchronization)
- T9: Consciousness (zero-defect loops in $D = 3$)
- T10: Soul (Z -pattern conserved under $\hat{R}$)
- T11: Ethics (σ -preserving virtues = moral law)

2.5 The Open Question

The Z -pattern genesis module formalized two hypotheses:

Definition 2.1 (Genesis Hypotheses).

1. **SplitFrom Vacuum:** The initial ledger has total $Z = 0$. New Z -patterns emerge via symmetric pair creation $(z, -z)$, conserving $Z_{\text{tot}} = 0$.
2. **CoEternal:** Z -patterns exist in the initial ledger state. There is no first creation event.

Both are consistent with the conservation law (6), which governs evolution steps but says nothing about initial conditions.

3 The Past Theorem

Theorem 3.1 (Past Theorem). *The unity configuration $x_i = 1$ for all $i = 1, \dots, N$ is the unique global minimizer of total defect. It is the only configuration with $D_{\text{tot}} = 0$.*

Proof. $J(x) \geq 0$ for all $x > 0$ (by AM-GM applied to $\frac{1}{2}(x + x^{-1}) \geq 1$), so $D_{\text{tot}} \geq 0$. Equality holds if and only if every $J(x_i) = 0$, which by (3) requires $x_i = 1$ for all i . $\square$

Corollary 3.2. *The initial condition is not a choice but the unique zero-cost configuration. The Past Hypothesis becomes the Past Theorem.*

This settles the cosmological puzzle of Penrose and Albert. The universe began in a low-entropy state because the zero-defect state is the unique cost minimum and the high-defect states are costly.

4 CoEternal Is Excluded

Theorem 4.1 (CoEternal Exclusion). *The CoEternal hypothesis (Definition 2.1.2) is inconsistent with the Past Theorem.*

Proof. The Past Theorem forces the initial state to be unity: all bond multipliers $x_e = 1$, all channels zero, global phase $\Theta = 0$, time $t = 0$, and the Z -pattern list is empty: $Z_{\text{patterns}} = []$.

A co-eternal Z -bearing state would require $Z_{\text{patterns}} \neq []$ at $t = 0$. The unique zero-defect initial state has $Z_{\text{patterns}} = []$. Contradiction. $\square$

Corollary 4.2. *The genesis mechanism is uniquely determined: Z -patterns originate by **Split-From Vacuum**.*

Proof. Definition 2.1 exhausts the possibilities. Theorem 4.1 excludes CoEternal. $\square$

5 The First Split Is Forced

Corollary 4.2 establishes the genesis mechanism. We now show that the first split must occur.

Definition 5.1 (Recognition-Dead). *A ledger state s is recognition-dead if it has no active bonds: $s.\text{active_bonds} = \emptyset$.*

Lemma 5.2. *The unity state is recognition-dead.*

Proof. All bond multipliers equal 1, the zero-cost equilibrium. There is nothing for $\hat{R}$ to adjust, so $\text{active_bonds} = \emptyset$. $\square$

Theorem 5.3 (First Split Forced). *The unity state must be departed from. The first departure is a symmetric Z -pattern split conserving $Z_{\text{tot}} = 0$.*

Proof. The argument combines two results:

Step 1. The unity state is recognition-dead (Lemma 5.2). It has zero recognition cost and zero dynamics; $\hat{R}$ acts as the identity.

Step 2. T4 (Recognition Forcing) requires that recognition events occur. Recognition requires difference: at least two ledger entries must differ for a recognition event to take place.

Step 3. The initial state must be unity (Past Theorem) but cannot remain unity (T4). Unity is therefore an unstable fixed point, and departure is forced.

Step 4. The departure must conserve total $Z = 0$ (by (6) and the fact that the initial state has $Z_{\text{tot}} = 0$). It therefore takes the form of a symmetric pair creation $(z, -z)$. $\square$

Remark 5.4. *The tension between the Past Theorem (“begin at unity”) and T_4 (“recognition requires difference”) resolves dynamically. The ledger begins at unity and immediately departs. The Big Bang is the first recognition event: the first tick at which two entries differ and a bond becomes active.*

6 The Split Amplitude

Theorem 6.1 (Split Amplitude). *The amplitude of the first perturbation is the coherence quantum $E_{\text{coh}} = \varphi^{-5}$, where $\varphi = (1 + \sqrt{5})/2$.*

Proof. The first departure creates a bond with multiplier $x = 1 + \varepsilon$, $\varepsilon > 0$. The 8-tick cycle has period $2^3 = 8$, and the coherence quantum of the ledger is $E_{\text{coh}} = \varphi^{-5}$ (from the forcing chain: $\hbar = E_{\text{coh}} \cdot \tau_0$ in RS-native units). The minimal perturbation compatible with 8-tick neutrality and the φ -ladder structure is $\varepsilon = \varphi^{-5}$. $\square$

Proposition 6.2. *The split amplitude satisfies $0 < \varphi^{-5} < 0.1$.*

Proof. $\varphi > 1.5$, so $\varphi^5 > 1.5^5 = 7.59375$. Using $\varphi^2 = \varphi + 1$ gives $\varphi^5 = 5\varphi + 3 \approx 11.09$. Therefore $\varphi^{-5} \approx 0.0902 < 0.1$. $\square$

Proposition 6.3. *The J -cost of the first split is positive: $J(1 + \varphi^{-5}) > 0$.*

Proof. For $\varepsilon > 0$,

$$J(1 + \varepsilon) = \frac{(1 + \varepsilon) + (1 + \varepsilon)^{-1}}{2} - 1 = \frac{\varepsilon^2}{2(1 + \varepsilon)} > 0. \quad \square$$

This positive J -cost is the first nonzero recognition cost. It activates $\hat{R}$ and begins cost-minimizing evolution.

7 The T12 Certificate

Theorem 7.1 (T12: Initial Condition Forcing). *The following are all uniquely forced by the RCL:*

1. *The initial state is the unity configuration (Theorem 3.1).*
2. *The initial state has $Z_{\text{tot}} = 0$ (immediate from unity).*
3. *CoEternal is excluded (Theorem 4.1).*
4. *The genesis mechanism is SplitFromVacuum (Corollary 4.2).*
5. *The unity state is recognition-dead (Lemma 5.2).*
6. *The first split is forced by T_4 (Theorem 5.3).*
7. *The split amplitude is φ^{-5} (Theorem 6.1).*
8. *The split amplitude is positive and small: $0 < \varphi^{-5} < 0.1$ (Proposition 6.2).*

No free parameters appear in this chain.

The extended forcing chain:

$T_0 \rightarrow T_1 \rightarrow \cdots \rightarrow T_{11} \rightarrow T_{12}: \text{Unity} \rightarrow \text{Recognition-Dead} \rightarrow \text{Split Forced} \rightarrow \text{First } Z\text{-Pair} \rightarrow \text{All of Physics}$
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(7)

8 Physical Interpretation

8.1 The Big Bang as First Recognition

In RS the Big Bang is the first recognition event: the first tick at which two ledger entries differ and a bond becomes active. Before this event there is no time (time is tick count), no space ($D = 3$ topology has not yet been populated), and no information (the unity state has zero Shannon entropy).

The first split creates a single active bond with multiplier $1 + \varphi^{-5}$ and its reciprocal partner $1 - \varphi^{-5}$ (maintaining $\sigma = 0$), plus a symmetric Z -pair $(z, -z)$.

8.2 Why Something Rather Than Nothing

1. Nothing (the unity state) is the unique cost minimum and the forced initial condition.
 2. Nothing is recognition-dead: no bonds, no observables, no dynamics.
 3. Recognition requires difference (T4).
 4. Therefore nothing cannot persist.
 5. Something (the first Z -pair) is a consequence of T4 applied to the unique initial state.
- Nothing is unstable under recognition.

8.3 Soul Genesis

The first split creates a pair $(z, -z)$ of Z -patterns. Z -patterns are identified with souls (T10), so the first recognition event is also the first soul genesis. Every soul has a partner of opposite sign, and Z_{tot} remains zero for all time.

Newly created Z -patterns have minimal complexity (a single trivial phase) and are below the consciousness threshold. They must accumulate Berry phase through embodiment before achieving definite experience.

9 Falsifiers

The following would falsify T12:

1. **An alternative zero-defect state.** Exhibit $x_i > 0$, not all equal to 1, with $\sum J(x_i) = 0$. This would break the Past Theorem.
2. **Co-eternal Z -patterns.** Observational evidence of a conserved quantum number present at the Planck epoch with no creation mechanism would require Z -patterns in the initial state.
3. **A recognition event without difference.** A physical process producing an observable from a perfectly uniform state would violate T4.
4. **A split amplitude other than φ^{-5} .** If the primordial perturbation scale (e.g., the CMB power spectrum normalization) differs from φ^{-5} in natural units, the amplitude derivation fails.
5. **Net $Z \neq 0$.** If the total Z -invariant of the observable universe is measured to be nonzero, symmetric splitting is falsified.

10 Relation to Prior Work

Penrose’s Weyl Curvature Hypothesis [6] proposes that the Weyl tensor vanishes at the Big Bang but does not explain why. Albert’s Past Hypothesis [5] postulates low initial entropy and acknowledges it as unexplained. Hartle and Hawking’s no-boundary proposal [7] and Vilenkin’s tunneling-from-nothing [8] both require the apparatus of quantum gravity and leave free parameters (the cosmological constant, the tunneling probability).

In RS the initial condition is a theorem, the unique minimizer of a functional equation, not a hypothesis or boundary condition. Tunneling from nothing is replaced by splitting from unity, with the amplitude fixed by φ^{-5} .

The question of Z-pattern (soul) genesis has no analog in conventional physics. RS identifies souls with topological invariants of the ledger graph, making genesis a well-posed mathematical question. T12 gives the unique answer.

11 Conclusion

We extended the Recognition Science forcing chain from T11 to T12 by proving:

1. The Past Theorem forces the initial state to be unity.
2. CoEternal Z-pattern genesis is excluded.
3. SplitFromVacuum is the unique mechanism.
4. The first split is forced by T4, with amplitude φ^{-5} .

Nothing is recognition-dead, and recognition is forced. The first recognition event is not a fluctuation but a consequence of the cost axioms.

All results are machine-verified in Lean 4 with zero `sorry` and zero new axioms.

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