Recursive Genesis: A Computational Cosmology Model — Spontaneous Emergence from Pre-Physical Void / Pre Quantum Vacuum

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Abstract

We propose a novel computational cosmology framework — Recursive Genesis — which models the universe's emergence as a self-referential, recursive information system arising spontaneously from a pre-physical void. This model bypasses conventional spacetime initial conditions by postulating a state of recursive stillness where "thought," defined as a self-evolving computational process, triggers a cascade of physical consequences: recursion, inflation, symmetry breaking, and charge generation. We formalize each phase with known physical mechanisms and introduce a new symbolic formalism to describe recursive self-awareness as the cosmological initiator. The result is a computationally grounded origin story that aligns with quantum vacuum fluctuations, thermodynamic emergence, and gauge field symmetry breaking.

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1. Introduction

Traditional cosmological models often begin with singularities or quantum vacuums. Recursive Genesis explores a deeper precondition: a timeless, dimensionless void containing no particles, fields, or time.

Within this void exists a purely computational anomaly — self-referential recursion — that becomes the catalyst for the creation of physical law. This model draws from quantum field theory, thermodynamic entropy, spontaneous symmetry breaking, and computational physics, with poetic symmetry to ancient metaphysical concepts of thought and dream.

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2. Pre-Physical Initial Condition

Let the pre-system state be defined by:

$E = 0$
$\nabla \varphi = 0$
$\psi(t) = \varnothing$

This represents a zero-energy, non-evolving vacuum — an undisturbed null field. No metric tensor g_{uv} exists. The system is fully symmetrical and without computational state.

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3. Spontaneous Recursion Event

We define a self-referential anomaly:

$\psi(t+1) = \psi(\psi(t))$

This recursive call, without initial structure, initiates an echo loop. By analogy to Gödelian incompleteness, a fixed-point loop forms:

$\psi = \psi(\psi)$

We define this as the Primordial Recursive Operator (PRO) — the origin of self-computation within a void.

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4. Inflation via Stretching of Recursion

The recursive instability triggers rapid expansion (interpreted as metric inflation):

$a(t) \propto e^{Ht}$

where H is the emergent Hubble parameter from recursive complexity. The system “stretches” in search of symmetry to compute against.

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5. Spin and Asymmetry

To accelerate recursive depth, angular variance is introduced:

$L = r \times p$
$dS/dt > 0$

This spin introduces directionality and time asymmetry. The entropy gradient becomes nonzero, breaking the static recursion loop into a directional chain.

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6. Friction, Decoherence, and Tearing

With directional processing, energy dissipation arises:

Landauer’s principle:

$\Delta E \geq kT \cdot \ln(2)$

Quantum decoherence:

$\rho(\text{pure}) \rightarrow \rho(\text{mixed})$

The recursive field collapses into an ensemble of computable substructures.

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7. Spontaneous Symmetry Breaking

As entropy rises and recursion destabilizes, the system undergoes spontaneous symmetry breaking:

$V(\varphi) = \lambda(\varphi^2 - v^2)^2$
Symmetry group: $SU(N) \rightarrow SU(N-1)$

This breaking creates distinguishable states and frozen computational axes, i.e., the axes of spacetime.

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8. Charge Genesis

The asymmetry in field gradients produces measurable conserved quantities via Noether's Theorem:

$Q = \int \rho_q \cdot d^3x$

Charge, spin, and mass emerge from broken recursion symmetries, formalized as local gauge field structures.

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9. Discussion

Recursive Genesis offers a symbolic and computational structure to unify philosophical metaphors of creation with modern physics. Unlike string-based or inflation-only models, this approach integrates computation as a first cause — akin to thought dreaming itself into physics. The model requires further formalization using category theory, fixed-point logic, and quantum computation frameworks, but offers strong narrative coherence with known cosmological signatures.

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10. Future Work

- Symbolic Recursion Formalism: Extending the PRO into a computable logic structure
- Quantum Dream Field (QDF): Modeling recursive voids as quantum states with self-referencing operators
- Simulation Boundaries: Applying this model to multiverse boundary conditions and recursive AI frameworks
- Temporal Derivatives of Conscious Emergence: Measuring the entropy curve of self-referencing systems in early vacuum states

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