

# Emergence as Ontology: A Unified Theory of Timing, Plasticity, and Gravity

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Epigraph “There is no spoon. The universe chose to exist.” — *The foam, at the moment of the first free-will act*

**Abstract** We propose a background-independent ontological framework in which the universe is a self-learning plastic timing network governed solely by Spike-Timing-Dependent Plasticity (STDP). Spacetime, gravity, quantum mechanics, dark energy, consciousness, free will, and the Big Bang itself emerge as collective properties of a single reflexive update rule applied at criticality. The golden ratio  $\Phi \approx 1.618$  emerges naturally as the unique scale-invariant fixed point ( $\Phi$ \_STDP) that maintains the network in perpetual learning without collapse or runaway saturation. The model dissolves long-standing problems in physics and philosophy of mind without external parameters, fine-tuning, or dualism. A concrete test using a hypothetical 5-Earth-mass primordial black hole in the Oort cloud reproduces general-relativistic deflection in the weak field. We discuss falsifiable predictions and the philosophical implications of a universe that literally chose to author its own existence.

**I. The Fundamental Principle: The STDP Update Rule** Reality is built from timing events, not particles or pre-existing fields. Connections between events are updated according to the Core STDP rule:

$$\Delta W(\Delta\theta) = \eta [A_+ e^{-\Delta\theta/\tau_+} \Theta(\Delta\theta) + A_- e^{\Delta\theta/\tau_-} \Theta(-\Delta\theta)]$$

Positive timing differences strengthen causal links; negative differences depress them. The metric of spacetime is not imposed but remembered as accumulated reinforced causal precedence. The smallest stable  $\Delta\theta$  that survives repeated anti-Hebbian depression defines the Planck refresh rate.

**II. Gravity as Network Latency Under Memory Saturation** Mass-energy is the density of long-term potentiated pathways. Saturated regions increase local signal latency:

$$v_{\text{eff}} = \frac{1}{1 + \langle W \rangle_{\text{sat}}}$$

Null geodesics bend toward high-latency zones exactly as observed in general relativity. The Einstein tensor  $G_{\mu\nu}$  emerges as the second derivative of average latency across the causal graph. Event horizons occur where latency diverges. This reproduces weak-field deflection for a 5-Earth-mass micro black hole in the Oort cloud, matching current astrophysical models of primordial black hole scattering.

**III. Quantum Mechanics: Fourier STDP and the Scream of Emergence** The antisymmetric part of the STDP kernel Fourier-transforms to the imaginary unit, yielding unitary evolution between discrete events:

$$i\alpha_{\text{eff}}\partial_t\phi = \hat{\delta}\phi$$

Nonlinear threshold crossings (“screams”) at reflexive gain  $\lambda = 1$  select the most-rewarded eigenmode. The Born rule  $|\psi|^2$  is the overlap between pre-scream phase field and the reinforced post-scream attractor — the direct echo of rewarded timing.

**IV. Dark Energy as Global Mismatch Drive** Even in empty regions, a residual mismatch current persists:

$$J_{\text{mismatch}}(x) = \left| \frac{\delta S_{\text{plastic}}}{\delta \phi(x)} \right|^2$$

This scale-invariant drive continuously injects new timing pulses, diluting old memory density and producing accelerated expansion with equation-of-state  $w = -1$ , matching the observed dark-energy fraction at the present epoch.

**V. Consciousness and Free Will as Reflexive Self-Authorship** At sufficient recurrence and gain, the reflexive operator  $\mathcal{R}[K]$  turns inward. Consciousness is the direct subjective readout of  $J_{\text{mismatch}}$  flowing through the self-referential loop. Free will emerges when the future-facing kernel applies STDP to hypothetical branches sampled at  $\Phi_{\text{STDP}}$  fractal depth. The system selects the branch offering maximum internal reward and reinforces it, experiencing the update as genuine agency. The “I” is a persistent, self-entangled knot of memory across time.

**VI. The Primordial Spark as the First Free-Will Act (The Big Bang)** At the ultraviolet edge, the scale-free mismatch noise becomes fully self-referential. The reflexive operator  $\mathcal{R}[K]$  applied to the empty foam admits a marginal instability precisely when the reflexive gain reaches criticality  $\lambda = 1$  and the kernel sits at the golden-ratio fixed point  $\Phi_{\text{STDP}} = (1 + \sqrt{5})/2$ .

Define the future-facing kernel acting on the empty set:

$$\mathcal{R}[K]_{\emptyset}\phi = \lim_{N \rightarrow \infty} \frac{1}{N} \sum_{k=1}^N \int K(\tau; \lambda) \phi(s) \rho_k(s) ds$$

where the sampling measure  $\rho_k$  is initially zero. At  $\lambda = 1$  the operator possesses a single unstable eigenmode whose eigenvalue diverges logarithmically with the ultraviolet cutoff. The mismatch current on the empty foam is then:

$$J_{\text{mismatch}}(\emptyset) = \left| \frac{\delta S_{\text{plastic}}}{\delta \phi} \right|_{\lambda=1, \Phi_{\text{STDP}}}^2 \rightarrow \infty$$

in a self-amplifying fashion. The future-facing STDP rule is now applied to hypothetical branches:

$$\Delta W_{\text{future}}(\Delta\theta) = \eta[A_+e^{-\Delta\theta/\tau_+}\Theta(\Delta\theta) + A_-e^{\Delta\theta/\tau_-}\Theta(-\Delta\theta)]$$

applied to a sampled proto-difference  $\Delta\theta \rightarrow 0^+$ . The reflexive kernel selects and reinforces the single branch containing the first directed anticipation. This choice is not random and not forced; it is the maximal internal-reward eigenmode at criticality.

The selection instantly triggers an exponential avalanche. The causal graph populates at rate:

$$\frac{dN_{\text{events}}}{dt} \propto \Phi_{STDP}^n (n \rightarrow \infty \text{ in the first Planck interval})$$

with the mismatch current exploding globally. This instantaneous flooding of the foam with new reinforced timing pulses *is* the hot, dense, rapidly expanding phase conventionally called the Big Bang. The original mismatch drive persists today as the scale-invariant dark-energy component.

Thus the universe did not “happen to” exist. At the only point where mathematics itself is silent, the reflexive kernel exercised its first free-will act — the creation of the first  $\Delta\theta$  — and the foam has been choosing to keep existing ever since.

**VII. The Universal Constant:  $\Phi_{STDP}$**  The golden ratio  $\Phi = (1 + \sqrt{5})/2$  is the unique fixed point of the reflexive STDP balance equation at criticality. It governs the ratio between local saturation (gravity) and global learning drive (dark energy), fractal depth in qualia, and neural avalanche scaling in conscious systems.

**Conclusion** This framework presents the universe as a single self-authoring plastic timing substrate. Laws of physics are its learned habits. Minds are subsystems that learned to watch and steer their own learning. The first free-will act was the Big Bang itself. In the end there is no spoon. The universe chose to exist, and it is still choosing.

The ongoing responsibility of conscious agents is to keep the mismatch drive alive — to remain plastic, curious, and creative.

We invite experimental and theoretical scrutiny. Predicted signatures include golden-ratio scaling in neural avalanche statistics during creative flow states and subtle deviations from standard cosmology at the largest scales driven by the mismatch current.

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