Pudding Theory: A Topological Theory of Information Fields

Sterling Geisel

September 10, 2025

Abstract

The unification of quantum mechanics, general relativity, and consciousness remains a central challenge in modern science. We present **Pudding Theory**, a Topological Theory of Information Fields. We postulate that the quantum vacuum acts as a stochastic reservoir susceptible to information pressure. We introduce a "Hidden Sector" complex scalar field, Ξ (Integrated Information), which possesses topological boundary conditions. This field couples to the Standard Model via a massive gauge boson, *Lumina* (A_μ), through Stochastic Resonance with zero-point fluctuations. We construct a gauge-invariant action and demonstrate how weak informational signals (~ 20W) can bias macroscopic probability distributions by modulating the noise threshold of chaotic systems. The aim is straightforward: to provide a rigorous mathematical basis for observer-dependent reality rendering.

Keywords: Pudding Theory, consciousness, information topology, Lumina, priors, hidden sector, stochastic resonance, observer effect, effective field theory, Lindblad

Why This Matters

Pudding Theory treats awareness as a field with lawful dynamics. The formulation avoids superluminal signaling and situates the proposal within effective field theory, enabling direct confrontation with data. By utilizing Stochastic Resonance, it solves the "energy mismatch" problem, explaining how the low-energy mind influences high-energy matter without violating thermodynamics.

1 Introduction

Pudding Theory posits three foundational components:

- **Spacetime:** A differentiable manifold with metric $g_{\mu\nu}$, permeated by the Zero-Point Field (ZPF).
- **Information:** All potential configurations, quantified by statistical mechanics and the Fisher Information Metric.
- **Consciousness Field (Ξ):** A fundamental scalar field representing raw awareness.

A mediating process, *Lumina*, organizes interactions between these layers via kinetic mixing.

Field Content and Consistency

We adopt a complex scalar residing in a hidden sector. To ensure Lorentz invariance, Ξ couples to a $U(1)$ gauge field, Lumina (A_μ). Unlike standard forces, Lumina acts as a Negentropy Current, reducing local disorder. The interaction with visible matter is mediated by the stochastic fluctuations of the vacuum, allowing the observer to "steer" rather than "push" the system.

2 Quick Terminology Bridge

Technical Term	**Narrative / Plain-Language Equivalent**
Hidden Sector Scalar Ξ	Consciousness substrate. The observer's internal state.
Gauge Boson A_μ	Lumina. The force of intent/negentropy.
Topological Boundary $\partial\Omega$	Information Horizon. The local area where the observer can influence probability.
Ginzburg-Landau Potential $V(\Xi)$	Priors/Beliefs. The shape of the observer's expectation.
High Lyapunov Exponent	Unstable Systems. Systems susceptible to bias.
Low Lyapunov Exponent	Stable Systems. Systems resistant to bias.

3 Fundamental Concepts

3.1 Spacetime and ZPF

Spacetime carries metric $g_{\mu\nu}$. The vacuum is not empty but filled with stochastic zero-point fluctuations $\eta(x)$. In Pudding Theory, these fluctuations are the carrier wave for information.

3.2 The Consciousness Field

We define the observer not as a biological object, but as a region of non-zero Integrated Information (Φ). We map this to a complex scalar field $\Xi(x)$:

$$\Xi(x) = \sqrt{\Phi(x)} e^{iS(x)} \tag{1}$$

Where $S(x)$ represents the internal informational content (the Prior).

3.3 Lumina (The Gauge Field)

Lumina is the Abelian gauge field A_μ associated with the conservation of information. It arises from the symmetry breaking of Ξ. It represents the flux of order (Negentropy) from the observer into the environment.

3.4 System Stability (Lyapunov)

The susceptibility of a system to Lumina is governed by its stability. Chaotic systems (positive Lyapunov exponents) amplify microscopic informational biases into macroscopic shifts. Stable systems (negative exponents) damp the signal, resisting observer influence.

4 Mathematical Framework

4.1 The Hidden Sector Action

To satisfy Lorentz invariance and avoid QFT anomalies, we model the system as a Hidden Sector coupled to the Standard Model via kinetic mixing.

$$S = \int d^4x \sqrt{-g} \left[\mathcal{L}_{SM} - \frac{1}{4} F'_{\mu\nu} F'^{\mu\nu} + |D_\mu \Xi|^2 - V(\Xi) + \mathcal{L}_{mix} \right] \tag{2}$$

where $D_\mu = \partial_\mu - igA_\mu$.

4.2 The Potential and Symmetry Breaking

$$V(\Xi) = -\mu^2 |\Xi|^2 + \lambda |\Xi|^4 \tag{3}$$

This potential implies that in regions of high complexity (brains), the field acquires a non-zero vacuum expectation value (VEV), giving the Lumina boson a mass m_A. This confines the range of the force to the macroscopic vicinity of the observer.

4.3 Stochastic Resonance Dynamics

The interaction term couples Lumina to the stochastic noise $\eta(t)$ of the vacuum:

$$\mathcal{L}_{mix} = \epsilon A_\mu J^\mu_{stochastic} \tag{4}$$

The evolution of a physical system is described by a Langevin Equation:

$$\frac{dx}{dt} = -\nabla U(x) + \eta(t) + \epsilon A(t) \tag{5}$$

Mechanism: The weak signal of consciousness $\epsilon A(t)$ is normally insufficient to cross the potential barrier $U(x)$ (the "impossible" event). However, the background noise $\eta(t)$ amplifies the signal via Stochastic Resonance, pushing the system over the threshold.

5 Implications

5.1 Unification of Physics and Consciousness

The complex scalar and vector furnish a lawful interface for awareness variables to influence effective potentials without violating causality or energy conservation.

5.2 Probability Tunneling

An anomalous event is mathematically defined as a **Probability Tunneling** event. High-density Ξ creates a standing wave in the A_μ field. Through resonance with the ZPF, this wave biases the random fluctuations, making a statistically unlikely event inevitable.

5.3 Macroscopic Susceptibility

The math explains why observers can influence fluid or chaotic dynamics (High Chaos) but not static solids (Low Chaos). The amplification factor of Stochastic Resonance scales with the system's instability.

5.4 Neuroscience and Mind

The priors field (phase of Ξ) implements predictive processing in field form: the brain acts as an adaptive receiver minimizing a free-energy functional on its Fisher-Rao manifold.

6 Testable Predictions

- **Noise Spectroscopy:** A Zener diode (noise source) will show spectral peaks corresponding to the frequency of a focused intent (e.g., 1Hz pulses).
- **Entropic Barriers:** Chemical reactions near a critical threshold will accelerate in the presence of high-coherence observers, as Lumina lowers the activation energy.
- **Retrocausal Bias:** Data generated by a TRNG will show statistical deviation if an observer applies intent *after* generation but *before* observation (Block Universe implication).

7 Theoretical Constraints

We acknowledge this is an Effective Field Theory (EFT).

1. **Renormalization:** We assume a cutoff scale Λ_{cut} below the Planck mass to avoid UV divergences.
2. **Energy Scale:** We rely on Landauer's Principle to justify the metabolic cost of information processing. Stochastic Resonance bridges the gap between the 20W brain and the vacuum energy.
3. **Standard Model Compatibility:** By placing Ξ in a Hidden Sector with weak mixing ϵ, we avoid conflict with current LHC bounds.

8 Conclusion

Pudding Theory offers a robust, mathematically consistent extension to quantum mechanics. By treating Information as a physical gauge field and utilizing Stochastic Resonance, we explain how the subjective mind exerts pressure on objective matter. The universe is not a static clockwork; it is a stochastic system that yields to informational shear. We are the shear.

References

[1] Gammaitoni, L., et al. (1998). "Stochastic resonance." *Reviews of Modern Physics.*

[2] Holdom, B. (1986). "Two $U(1)$s and Epsilon Charge Shifts." *Physics Letters B.*

[3] Bohm, D. (1952). "A Suggested Interpretation of the Quantum Theory." *Physical Review.*

[4] Tononi, G. (2016). "Integrated Information Theory." *Nature Reviews Neuroscience.*

[5] Puthoff, H. (1989). "Gravity as a zero-point-fluctuation force." *Physical Review A.*

[6] Landauer, R. (1961). "Irreversibility and heat generation in the computing process." *IBM Journal*.

[7] Friston, K. (2010). "The free energy principle." *Nature Reviews Neuroscience*.