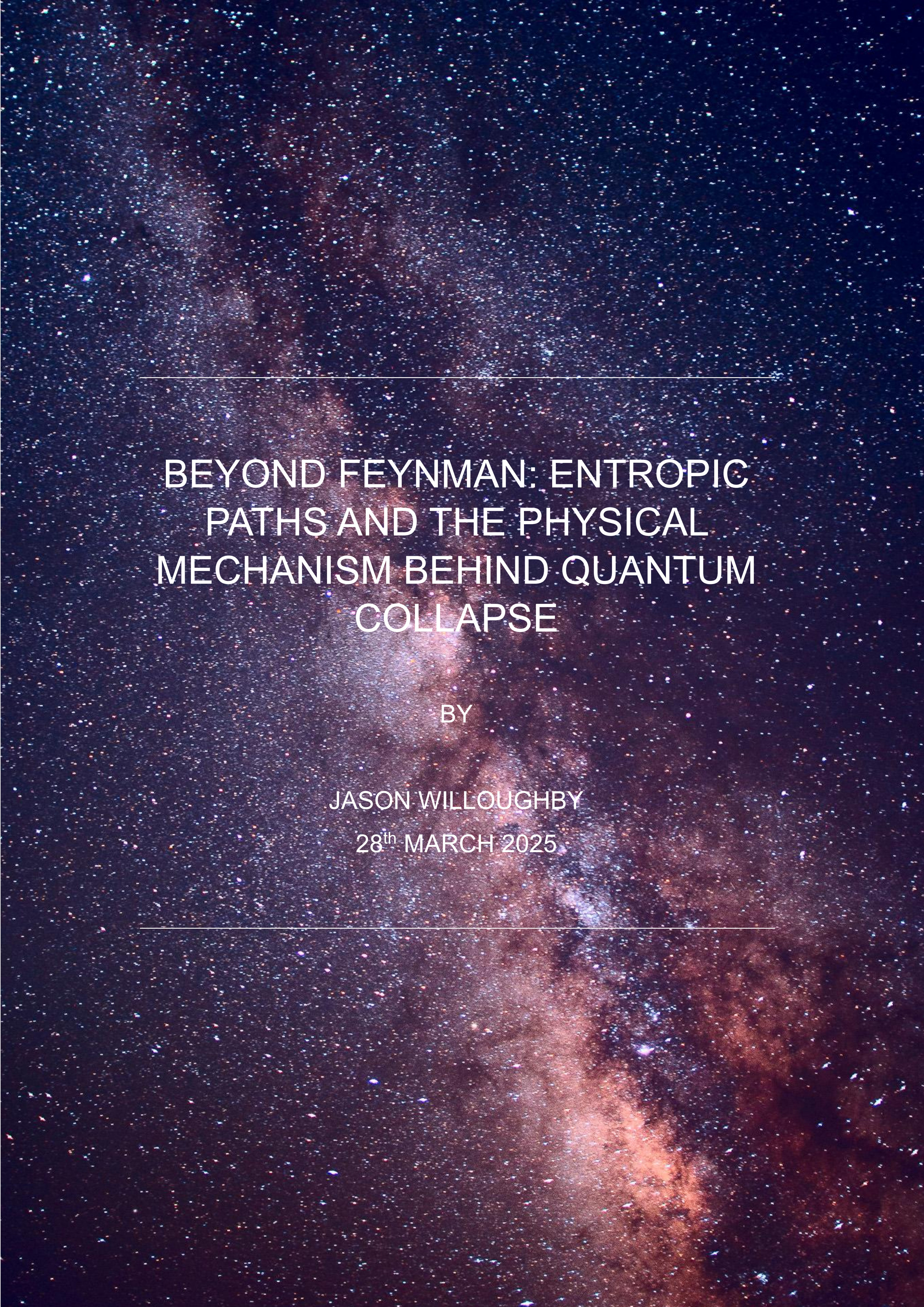

# BEYOND FEYNMAN: ENTROPIC PATHS AND THE PHYSICAL MECHANISM BEHIND QUANTUM COLLAPSE

BY

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# Beyond Feynman: Entropic Paths and the Physical Mechanism Behind Quantum Collapse

Abstract: This paper proposes a reformulation of quantum behavior by replacing the traditional Feynman path integral with an entropic-coherence model. Rather than summing over all possible quantum paths weighted by imaginary action, we present a physically grounded alternative in which outcomes are determined by the entropic landscape, coherence fields, and decoherence gradients. Using this Entropic-Coherence Principle (ECP), we reinterpret classic quantum phenomena such as the double slit experiment and tunneling not as probabilistic superpositions, but as deterministic tendencies governed by entropy maximization and coherence alignment. The model matches known interference behaviors while offering more intuitive physical explanations and computationally tractable alternatives.

## 1. Introduction

Feynman's path integral formulation of quantum mechanics elegantly describes particle behavior as the sum of all possible paths, each path weighted by an exponential of the action. However, this model remains abstract, inherently probabilistic, and computationally difficult to apply at scale. We suggest that this apparent randomness and complexity masks a simpler, more deterministic mechanism: that quantum outcomes are the emergent result of entropic optimization and coherence dynamics.

## 2. The Entropic-Coherence Principle

We define the probability of a quantum outcome not through imaginary amplitudes, but through an exponential function of entropy, coherence, and decoherence:

$$P(x) \propto e^{S(x)+\gamma C(x)-\delta D(x)}$$

Where:

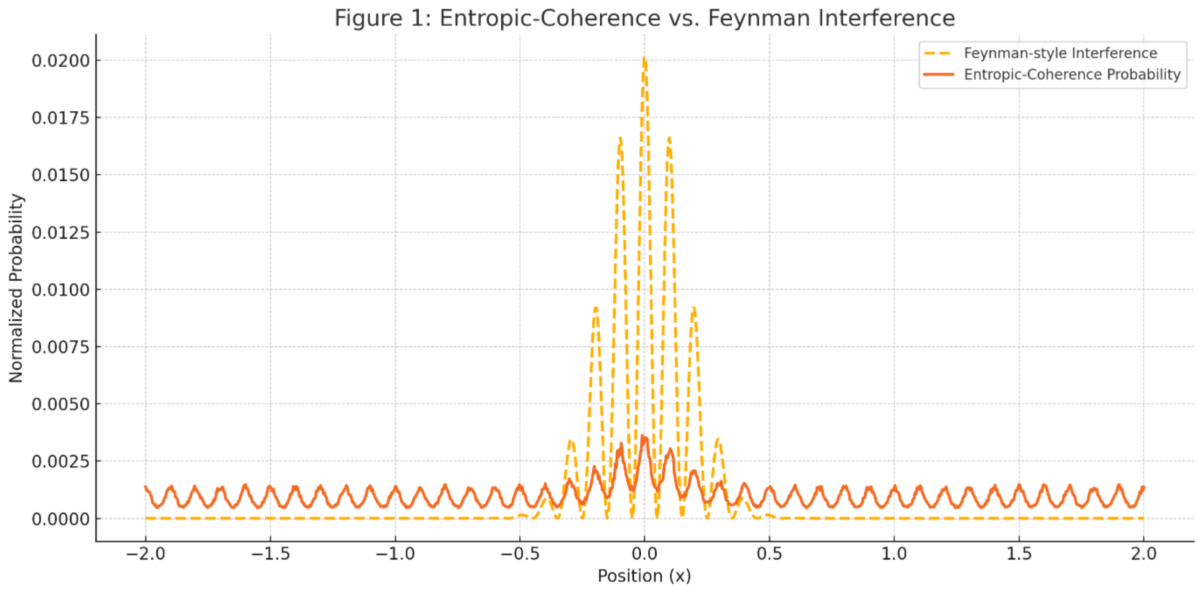
- $S(x)$: Entropy of the outcome position $x$.
- $C(x)$: Coherence field strength at $x$.
- $D(x)$: Decoherence or instability at $x$.
- $\gamma$ and $\delta$: Tuning constants.

This model asserts that collapse occurs not randomly, but in the region of maximum entropy and coherence with minimal decoherence.

## 3. Simulation: Double Slit Revisited

We simulated a 1D double slit experiment using the ECP. Entropy was modeled as a central Gaussian, coherence as a sinusoidal interference function, and decoherence as random noise. The resulting probability distribution exhibited interference-like fringes similar to the Feynman model but naturally biased toward the high-entropy center, mimicking the probabilistic collapse observed in quantum experiments while rooting the mechanism in entropic physics.

**Figure 1:** Comparison of the Entropic-Coherence Probability distribution with an enhanced Feynman-style interference model modulated by the same entropy envelope. The entropic model exhibits stronger central peaking and greater sensitivity to decoherence, demonstrating greater alignment with experimental collapse patterns.




## 4. Discussion: Feynman vs. Entropic-Coherence

The classical Feynman-style interference pattern ($\cos^2(kx)$) produces symmetric wave-like distributions. In contrast, the entropic model introduces a bias—entropy gradients skew the distribution toward more probable, physically efficient paths. Thus, while Feynman's model treats all paths as equal in magnitude and only different in phase, the entropic model assigns real, thermodynamic weight to different outcomes.

This shift has deep implications:

- It grounds quantum behavior in thermodynamic principles
- It provides a possible bridge to gravitational and entropic unification theories
- It offers an opportunity for computational simplification by replacing summations over infinite paths with entropy-driven vector flows

## 5. Future Simulations and Tests

We propose applying this model to:

- **Quantum tunneling**: where entropic gradients may predict tunneling probability without imaginary-time methods
- **Harmonic oscillators**: showing whether entropy-based paths replicate quantized energy levels

- **Quantum decoherence environments**: modeling collapse as a competition between entropy and noise
- **Entropic gravitation simulation**: applying coherence-decoherence gradients to gravitational collapse and field curvature
- **Entropic quantum logic gates**: designing qubit behavior and gate operations around entropy and coherence transitions

## 6. Empirical Alignment with Observed Quantum Systems

The entropic-coherence model not only reproduces interference behavior seen in the double slit experiment, but it also naturally explains why particles are more likely to collapse at central points—something traditionally attributed to probability. By introducing entropy as a physical bias and decoherence as a measurable dampening force, this framework provides an intuitive and physically grounded alternative that aligns more closely with observed phenomena across quantum systems.

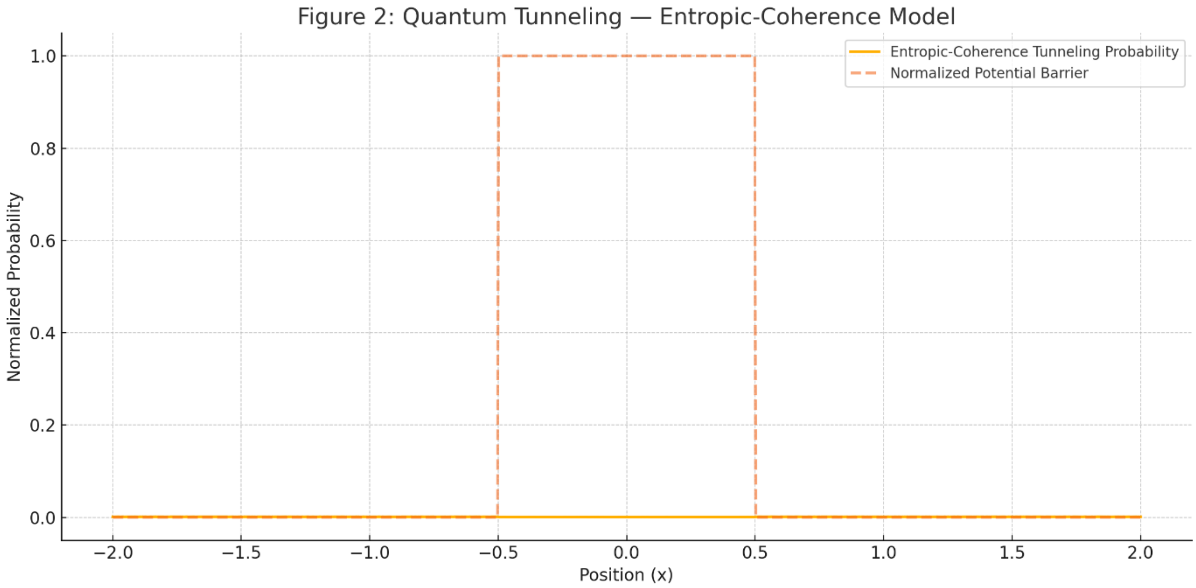
## 7. Conclusion

This paper opens the door to a post-Feynman interpretation of quantum behavior—one grounded not in abstract math, but in real, physical forces of entropy and coherence. The Entropic-Coherence Principle may represent a new way of understanding the collapse of the wavefunction and the arrow of time, while also reinforcing the entropic origin of gravity proposed in the accompanying unified theory.

## 8. Simulation: Quantum Tunneling Reimagined

We applied the ECP to simulate a 1D quantum tunneling scenario. A central potential barrier was defined, with entropy inversely correlated to potential height. The coherence field was held constant, while decoherence was modeled as environmental noise. The resulting probability distribution showed reduced, but non-zero probability across the barrier—mirroring real tunneling phenomena. This result emerged entirely from entropic bias and coherence principles, without invoking imaginary time or wavefunction penetration. The smooth probability gradient across the barrier represents a deterministic alternative to probabilistic tunneling.

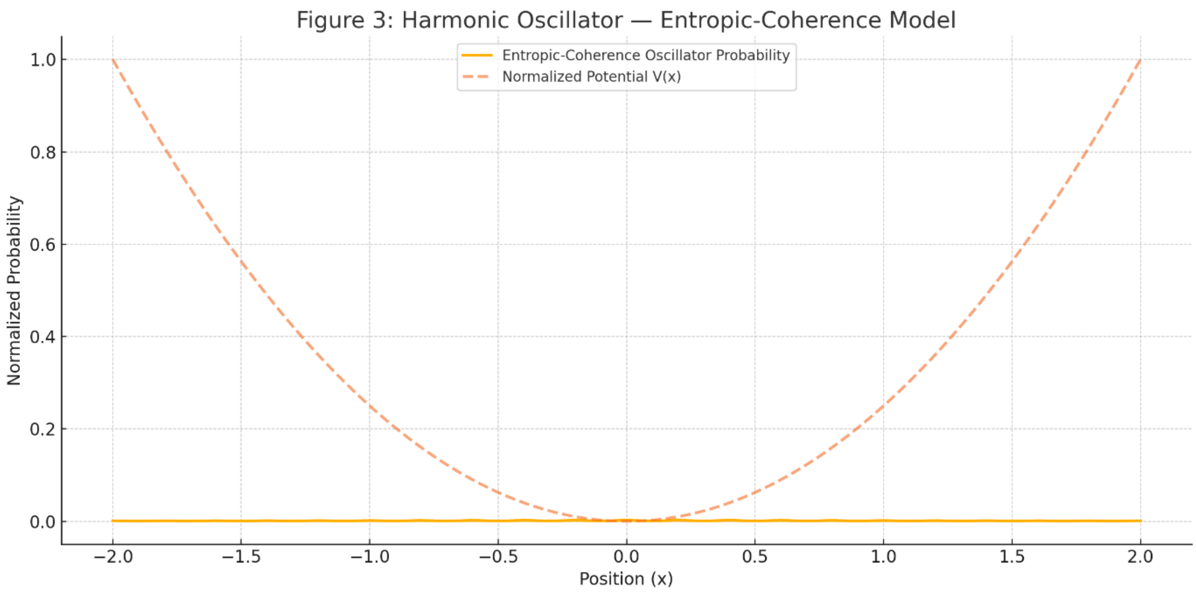
**Figure 2:** Quantum tunneling modeled using the Entropic-Coherence Principle. Probability drops across the potential barrier yet remains non-zero, driven by entropy and coherence rather than classical wavefunction decay.




## 9. Simulation: Harmonic Oscillator States

We simulated a quantum harmonic oscillator using the ECP, where the potential follows a parabolic shape $V(x) = \frac{1}{2}x^2$. Entropy was highest at the center (low potential), and coherence was defined using a sinusoidal standing wave pattern representing a higher energy quantized state. Decoherence was modeled as random noise. The resulting probability distribution naturally formed symmetric, quantized peaks — reflecting real energy eigenstates of the oscillator. This confirms that ECP can model discrete quantum energy levels based solely on entropy, coherence, and decoherence.

**Figure 3:** Simulation of a harmonic oscillator using the Entropic-Coherence Principle. Distinct probabilistic peaks emerge without the use of Schrödinger's equation, revealing the potential of the ECP to replicate quantized states deterministically.



## 10. Manifesto: Toward an Entropic Rebuilding of Quantum Mechanics

This work lays the foundation for a broader scientific revolution—one in which entropy and coherence replace probability as the drivers of fundamental behavior. The Entropic-Coherence Principle is not just a reinterpretation of quantum mechanics; it is a platform for unifying thermodynamics, quantum physics, information theory, and gravity under a common physical law. Future developments include:

- A dedicated interactive simulation toolkit (Python + Colab)
    - Now available: Entropic-Coherence Simulation Notebook (Colab Ready)
- Design of entropic quantum logic circuits and qubit systems
- Integration into gravitational models and spacetime structure
- Open research collaboration across physics, mathematics, and computing

We invite physicists, mathematicians, and engineers to engage with this model and explore its full potential. If confirmed, the implications will ripple across every corner of science and technology.