Quantum Measurement as Coherence Reconfiguration in Aetherium

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Abstract

The quantum measurement problem arises from the tension between the linear, deterministic evolution of quantum states and the emergence of single, definite outcomes in measurement. Standard formulations introduce collapse postulates or interpretive overlays but provide no physically grounded mechanism for outcome selection within a single world. The Aetherium framework resolves this tension by introducing a pre-geometric substrate whose intrinsic property is **coherence**, constrained by the **resonant structure of the substrate**. Quantum states are coarse-grained descriptions of coherence patterns, and measurement corresponds to a **coherence-reconfiguration event** in which the combined system–apparatus coherence aligns with a resonance-compatible configuration. Decoherence stabilizes this configuration by redistributing coherence across many degrees of freedom, while probabilities arise from the relative stability of resonant attractor states, yielding the Born rule as a structural consequence of the substrate's resonance architecture. This coherence-first ontology provides a single-world, realist, and local account of measurement that preserves the empirical success of quantum theory while eliminating collapse, branching, and observer-dependence. The result is a unified and physically meaningful foundation for understanding the quantum-to-classical transition.

1. Introduction

The quantum measurement problem remains one of the most persistent conceptual challenges in modern physics. Quantum theory describes microscopic systems through a linear, deterministic evolution governed by the Schrödinger equation. Yet when a measurement is performed, this smooth evolution appears to give way to a discontinuous transition in which a single, definite outcome is realized. The standard formalism offers no physical mechanism for this transition, no criterion for when it occurs, and no explanation for why only one outcome is observed. Collapse postulates, observer-dependent rules, and interpretive overlays attempt to bridge this gap, but none provide a unified, realist account of how classical definiteness emerges from quantum superposition.

This tension is not merely philosophical. It reflects a structural incompleteness in the ontology underlying quantum theory. The wavefunction is treated simultaneously as a tool for predicting measurement outcomes and as a physical descriptor of microscopic systems, yet neither role explains how definite outcomes arise in a single world. Decoherence theory clarifies why interference between branches becomes negligible, but it does not explain why one branch is realized. Many-worlds interpretations preserve unitarity by allowing all outcomes to occur, but at the cost of proliferating classical worlds and leaving the Born rule unexplained. Hidden-variable theories restore determinism but require nonlocal dynamics that strain compatibility with relativity.

The Aetherium framework addresses this foundational gap by introducing a coherence-first ontology. In this view, the fundamental substrate of physical reality is a pre-geometric medium whose intrinsic property is **coherence**. This substrate is not a field, not a dynamical agent, and not a container of information. Instead, it possesses an **intrinsic resonant structure** that determines which coherence configurations are permissible, stable, or dynamically favored. Quantum states arise as coarse-grained descriptions of these coherence patterns, and measurement corresponds to a **coherence-reconfiguration event** in which the combined system–apparatus coherence aligns with a resonance-compatible configuration. Decoherence stabilizes this configuration, and probabilities emerge from the relative stability of resonant attractor states.

This coherence-based ontology provides a single-world, realist, and local account of measurement that preserves the empirical success of quantum theory while eliminating collapse, branching, and observer-dependence. It reframes the measurement problem not as a failure of quantum dynamics, but as a consequence of lacking the correct underlying ontology.

Before turning to the technical development, it is helpful to summarize the conceptual structure of the Aetherium framework. The following overview distills the core ideas that guide the remainder of the paper.

Conceptual Summary: A Coherence-First Ontology

Coherence is the fundamental primitive of the Aetherium framework. The substrate of physical reality is a pre-geometric structural medium whose intrinsic property is **coherence**, not energy, information, or field excitation. This substrate possesses an **intrinsic resonant structure** that determines which coherence configurations are permissible, stable, or dynamically favored. Nothing propagates or collapses within the substrate; instead, coherence evolves within the constraints set by this resonant structure.

Quantum states are coarse-grained descriptions of coherence patterns. Superposition reflects multiple coherence configurations that the substrate can temporarily support. **Entanglement** arises from shared resonance-compatible coherence across spatially separated regions, without requiring nonlocal influence.

Measurement is a **coherence-reconfiguration event**. When a system interacts with a macroscopic apparatus, the combined coherence must align with one of the substrate's resonance-compatible configurations. These configurations act as **resonant attractor states**, and the measurement outcome is the stable coherence pattern that the substrate can support under the constraints imposed by the apparatus.

Decoherence stabilizes the selected configuration by redistributing coherence across many degrees of freedom, making alternative patterns dynamically inaccessible. **Probabilities** arise from the **relative stability** of resonant attractors, yielding the Born rule as a structural consequence of the substrate's resonance architecture.

Classicality emerges because macroscopic systems correspond to high-coherence, low-susceptibility structures that align with stable resonant modes. **Time** itself is the ordering of coherence transitions within the substrate's resonant structure.

In this coherence-first ontology, the measurement problem dissolves. There is no collapse, no branching, no hidden variables, and no observer-dependence — only coherence evolving within the resonant structure of the substrate.

This work develops a coherence-first ontology for quantum measurement and focuses exclusively on the conceptual and structural implications of treating coherence as the fundamental primitive of the Aetherium substrate. The framework is intentionally minimalist: it does not introduce new dynamical equations, specify a microphysical model of the substrate, or attempt to derive spacetime geometry or cosmological evolution in full detail. Empirical consequences are discussed only at a high level, and identifying concrete experimental signatures is left for future work. The aim of this paper is therefore foundational rather than predictive: to articulate a coherent ontology, clarify the mechanism of measurement, and establish the structural basis for classicality and probability, while leaving quantitative modeling and observational tests to subsequent studies.

In the Aetherium framework, the substrate is understood as a **structural ontological primitive**, not a physical field or medium embedded within spacetime. It does not propagate, carry energy, or evolve according to dynamical equations. Instead, it provides the **pre-geometric constraint architecture** that determines which coherence configurations are permissible or stable. Spacetime, locality, and classical dynamics emerge from coherence patterns that are compatible with this resonant structure. The substrate is therefore **ontic but non-mechanistic**: it is the foundational condition that shapes coherence without acting as a causal agent, and it is not situated "in" spacetime because spacetime itself arises from the coherence it constrains.

2. The Standard Quantum Measurement Problem

The quantum measurement problem arises from a structural inconsistency within the standard formulation of quantum theory. Between measurements, a system evolves according to the linear, deterministic Schrödinger equation. During measurement, however, the same system is postulated to undergo a discontinuous, stochastic transition into a single outcome. These two dynamical rules—unitary evolution and projection—are mathematically incompatible and conceptually unresolved. The formalism provides no physical mechanism for this transition, no criterion for when it occurs, and no explanation for why measurement yields a single result rather than a superposition of possibilities.

This tension is often framed as a conflict between the **mathematics of quantum theory** and the **definiteness of classical experience**. A quantum state may evolve into a superposition of macroscopically distinct configurations, yet only one outcome is ever observed. Decoherence theory explains why interference between branches becomes negligible, but it does not explain why one branch is realized. Decoherence suppresses interference; it does not select outcomes. The formalism therefore predicts the appearance of classicality without providing a mechanism for classical definiteness.

Interpretations of quantum theory attempt to resolve this tension in different ways. **Collapse models** introduce new dynamical terms that force wavefunction reduction, but these additions lack independent empirical support and often conflict with relativistic constraints. **Many-worlds interpretations** preserve unitarity by allowing all outcomes to occur in parallel branches, but at the cost of proliferating classical worlds and leaving the Born rule unexplained. **Hidden-variable theories** restore determinism but require nonlocal dynamics that strain compatibility with relativity. **Observer-centric interpretations** shift the problem to epistemology, making measurement dependent on knowledge or experience rather than physical structure.

What unites these approaches is that each attempts to modify, reinterpret, or supplement the quantum formalism to reconcile unitary evolution with definite outcomes. Yet none provide a physically grounded account of why measurement yields a single, stable result in a single world. The core difficulty is that the standard formalism lacks an ontology capable of explaining how classical definiteness emerges from quantum superposition.

The Aetherium framework addresses this gap by introducing a coherence-first ontology. In this view, the fundamental substrate of physical reality is a pre-geometric structural medium whose intrinsic property is **coherence**, constrained by the **resonant structure of the substrate**. Quantum states are coarse-grained descriptions of coherence patterns, and measurement corresponds to a **coherence-reconfiguration event** in which the combined system–apparatus coherence aligns with a resonance-compatible configuration. This provides a realist, single-world, and local account of measurement that preserves the empirical predictions of quantum theory while eliminating collapse postulates, branching universes, and observer-dependent mechanisms.

3. Coherence as the Fundamental Ontology

The Aetherium framework begins by replacing the ambiguous ontology of standard quantum theory with a single, well-defined primitive: **coherence**. In this view, coherence is not a property of a wavefunction, nor a feature of information, nor a statistical descriptor. It is the **fundamental ordering principle** of a pre-geometric substrate that underlies all physical phenomena. Everything that appears in quantum theory—superposition, entanglement, interference, and measurement—arises from how coherence evolves within this substrate.

The substrate itself is not a field, not a medium that propagates signals, and not a container of information. Instead, it possesses an **intrinsic resonant structure** that determines which coherence configurations are permissible, stable, or dynamically favored. This resonant structure is not a list of states or a record of past events; it is a structural condition that shapes the evolution of coherence.

In the Aetherium framework, the substrate is described as a **pre-geometric constraint architecture** because it provides the structural conditions that shape coherence *prior to* the emergence of spacetime, geometry, or dynamical laws. "Pre-geometric" indicates that the substrate is not situated within space or time; rather, space and time arise from the coherence patterns it supports. "Constraint architecture" means that the substrate defines the **allowable modes of coherence**, much like how the shape of a resonant cavity determines its vibrational modes. These constraints are not dynamical forces or propagating influences; they are **structural permissions and prohibitions** that specify which coherence configurations are stable, metastable, or dynamically suppressed. Coherence evolves within this architecture, and the familiar features of physics—locality, classicality, measurement outcomes, and even spacetime geometry—emerge from the subset of coherence patterns that are compatible with the substrate's intrinsic resonant structure.

Within this ontology, a quantum state is a **coarse-grained representation** of an underlying coherence pattern. The wavefunction does not describe a physical wave in spacetime; it encodes the resonance-compatible coherence structure of a system. Superposition reflects the substrate's ability to support multiple coherence configurations simultaneously, while entanglement arises from shared resonance-compatible coherence across spatially separated regions. No nonlocal influence is required, because coherence is not localized in the way classical fields are. Instead, entangled systems share a single coherence structure that spans the relevant degrees of freedom.

This coherence-first ontology also reframes the role of dynamics. The Schrödinger equation describes how coarse-grained coherence patterns evolve when unconstrained by measurement interactions. It is not a fundamental law of motion but an emergent description of coherence evolution within the resonant structure of the substrate. When a system interacts with a macroscopic apparatus, the combined coherence must reconfigure to align with a resonance-compatible configuration. This reconfiguration is the physical process underlying measurement.

By grounding quantum behavior in coherence constrained by the resonant structure of the substrate, the Aetherium framework provides a clear and unified ontology. It eliminates the need for collapse postulates, branching universes, hidden variables, and observer-dependent mechanisms. Coherence is the only primitive, and the resonant structure of the substrate is the only constraint. Measurement, classicality, and probability emerge naturally from this foundation.

4. Measurement as Coherence Reconfiguration

In the standard formulation of quantum theory, measurement is treated as a special process requiring a discontinuous projection of the wavefunction. In the Aetherium framework, measurement is not a special rule but a **natural consequence of how coherence evolves within the resonant structure of the substrate**. The key insight is that measurement corresponds to a **coherence-reconfiguration event**: a transition in which the combined coherence of the system and apparatus aligns with one of the substrate's resonance-compatible configurations.

When a microscopic system interacts with a macroscopic apparatus, their coherence structures become coupled. The apparatus, by virtue of its size and internal complexity, imposes strong constraints on the coherence patterns it can support. These constraints arise from the **intrinsic resonant structure of the substrate**, which determines which large-scale coherence configurations are stable and which are dynamically suppressed. The interaction forces the combined system–apparatus coherence to evolve toward one of these **resonant attractor states**.

A resonant attractor is not a classical state in the traditional sense. It is a **stable coherence configuration** that the substrate can support under the constraints imposed by the apparatus. Each attractor corresponds to a potential measurement outcome. The measurement result is simply the attractor into which the coherence settles. No collapse occurs; no branching into parallel worlds is required. The transition is continuous at the level of coherence, even though it appears discontinuous at the level of coarse-grained quantum states.

This perspective also clarifies the role of decoherence. Decoherence does not select an outcome; it stabilizes the outcome that coherence has already aligned with. As coherence flows into the degrees of freedom of the apparatus and environment, alternative configurations become dynamically inaccessible. Decoherence therefore acts as a **stabilizing mechanism**, not a selection mechanism. The selection arises from the resonance-compatibility constraints of the substrate itself.

Importantly, this process is **local** and **single-world**. The reconfiguration of coherence occurs within the resonant structure of the substrate, which is defined at each point by local constraints on permissible coherence patterns. There is no need for nonlocal influence, hidden variables, or observer-dependent rules. The measurement outcome is determined by the structural compatibility between the system–apparatus interaction and the substrate's resonance architecture.

By interpreting measurement as coherence reconfiguration, the Aetherium framework provides a physically grounded mechanism for the emergence of definite outcomes. It preserves the empirical predictions of quantum theory while eliminating the conceptual tensions associated with collapse, branching, and observer-dependence. Measurement becomes a natural, structural process governed by the intrinsic resonant structure of the substrate.

5. Decoherence, Pointer States, and Classicality

Decoherence is often presented as the key to resolving the measurement problem. By dispersing phase information into the environment, decoherence suppresses interference between components of a quantum superposition, making the system appear classical. However, decoherence alone does not explain why a single outcome is realized. It explains why alternatives do not interfere, but not why one alternative becomes actual. In the Aetherium framework, decoherence plays a crucial but secondary role: it **stabilizes** the outcome selected by the substrate's resonant structure, but it does not determine which outcome occurs.

To understand this distinction, it is essential to recognize that decoherence operates on **coarse-grained coherence patterns**, not on the underlying coherence itself. When a system interacts with an environment, coherence flows into many degrees of freedom, making certain configurations dynamically inaccessible. This process suppresses interference between macroscopically distinct patterns, but it does not select a single pattern. Decoherence therefore explains the *appearance* of classicality but not its *origin*.

In the Aetherium ontology, the origin of classicality lies in the **intrinsic resonant structure of the substrate**. Macroscopic systems correspond to coherence configurations that align with **stable resonant modes**—patterns that the substrate can support robustly under perturbation. These stable modes function as **pointer states**, not because they are singled out by environmental monitoring, but because they are **resonance-compatible**. The environment reinforces this stability by redistributing coherence in ways that suppress transitions to incompatible modes.

During measurement, the combined system–apparatus coherence must reconfigure to align with one of these stable resonant modes. Decoherence then stabilizes the selected mode by dispersing coherence into the environment, making alternative configurations dynamically inaccessible. The pointer basis is therefore not imposed by the environment alone; it is determined by the **resonant structure of the substrate**, with decoherence acting as the mechanism that locks the system into the resonance-compatible configuration.

This perspective also clarifies why classicality is so robust. Macroscopic objects are composed of many degrees of freedom whose coherence patterns strongly align with stable resonant modes. Their susceptibility to superposition is extremely low because alternative coherence configurations are not resonance-compatible. Classicality is therefore not an emergent illusion but a **structural consequence** of the substrate's resonance architecture. Decoherence ensures that once a classical configuration is selected, it remains stable over time.

In summary, decoherence does not solve the measurement problem by itself. It explains why interference disappears, but not why a single outcome is realized. The Aetherium framework provides the missing ingredient: the **resonant structure of the substrate**, which determines the stable coherence configurations that correspond to classical outcomes. Decoherence then stabilizes these configurations, completing the transition from quantum superposition to classical definiteness.

6. Born Rule and Probabilities as Coherence Weights

In standard quantum theory, the Born rule is introduced as an additional postulate: the probability of obtaining a particular measurement outcome is given by the squared amplitude of the corresponding component of the wavefunction. Although empirically successful, this rule lacks a physical derivation within the formalism. Interpretations that preserve unitarity, such as many-worlds, struggle to justify the Born rule without circular reasoning, while collapse models must insert it by hand. The Aetherium framework provides a natural explanation by grounding probabilities in the **resonant structure of the substrate**.

Within this ontology, the substrate's resonant structure determines which coherence configurations are **stable**, **metastable**, or **dynamically suppressed**. When a quantum system interacts with a macroscopic apparatus, the combined coherence must reconfigure into one of the substrate's **resonance-compatible attractor states**. Each attractor corresponds to a potential measurement outcome. The likelihood of settling into a particular attractor is determined by how strongly the system's initial coherence aligns with that resonant mode.

The Born rule emerges from the **relative coherence weight** of these attractor states. The squared amplitude $|\psi_i|^2$reflects the degree to which the system's coherence overlaps with the resonance-compatible configuration associated with outcome i. In other words, probabilities are not epistemic uncertainties or combinatorial branch counts; they are **structural resonance weights** determined by the substrate's intrinsic architecture. The more resonance-compatible a coherence configuration is, the more likely it is to be selected during the reconfiguration process.

This interpretation resolves several long-standing issues. First, it avoids the circularity of deriving the Born rule from decision theory or rationality arguments, as in many-worlds approaches. Second, it eliminates the need to insert the rule as an ad hoc postulate, as in collapse models. Third, it provides a physical basis for probability in a single-world ontology, without invoking branching universes or observer-dependent mechanisms. The Born rule becomes a natural consequence of the substrate's resonant structure and the coherence dynamics that operate within it.

This resonance-based account also explains why probabilities remain stable across repeated measurements. The substrate's resonant structure is not altered by individual measurement events; it encodes the **structural constraints** that govern all coherence reconfigurations. As a result, the coherence weights associated with each outcome remain consistent across trials. This stability underlies the reproducibility of quantum statistics without requiring hidden variables or ensemble interpretations.

By grounding the Born rule in the resonance-constrained coherence dynamics of the Aetherium substrate, this framework provides a physically meaningful account of quantum probability. Probabilities arise from the structure of the substrate itself, not from ignorance, collapse, or branching. They reflect the inherent stability of resonance-compatible coherence configurations, completing the coherence-based resolution of the measurement problem.

7. Comparison with Major Interpretations

The measurement problem has motivated a wide range of interpretations of quantum theory, each attempting to reconcile unitary evolution with the emergence of definite outcomes. While these approaches differ in ontology and emphasis, they share a common limitation: none provide a physically grounded mechanism for outcome selection within a single-world, local framework. The Aetherium model addresses this gap by introducing a coherence-first ontology in which measurement corresponds to a **coherence-reconfiguration event** constrained by the **resonant structure of the substrate**. This section contrasts Aetherium with the major interpretative families.

7.1 Copenhagen and Operational Approaches

Copenhagen-style interpretations treat the wavefunction as a predictive tool rather than a physical entity. Collapse is an epistemic update, not a physical process. While operationally successful, these interpretations leave the mechanism of outcome selection undefined. **Aetherium differs fundamentally:** measurement is a **physical reconfiguration of coherence**, not an update of knowledge.

7.2 Many-Worlds and Branching Interpretations

Many-worlds interpretations preserve unitarity by allowing all outcomes to occur in parallel branches. This avoids collapse but introduces an enormous multiplicity of classical worlds and struggles to derive the Born rule without circularity. **Aetherium retains unitarity at the microscopic level but rejects branching.** Outcome selection arises from **resonant attractor states**, and probabilities reflect **coherence weights**, not branch counting.

7.3 Bohmian Mechanics and Hidden-Variable Theories

Bohmian mechanics introduces hidden variables and a guiding equation that determines particle trajectories. Although deterministic, this approach requires nonlocal dynamics that conflict with relativistic locality. **Aetherium avoids hidden variables entirely.** Entanglement correlations arise from **shared resonance-compatible coherence**, not superluminal influence.

7.4 Objective-Collapse Models

Objective-collapse theories modify the Schrödinger equation to force wavefunction reduction. These models introduce new parameters and stochastic dynamics but lack independent empirical support and often conflict with relativistic constraints. **Aetherium requires no modification of quantum dynamics.** Measurement outcomes emerge from **coherence alignment** with the substrate's resonant structure.

7.5 Relational and Observer-Dependent Interpretations

Relational, QBist, and information-theoretic interpretations treat measurement outcomes as observer-dependent or relational facts. These approaches shift the problem from ontology to epistemology. **Aetherium takes the opposite stance:** measurement outcomes are **observer-independent** because they correspond to resonance-compatible coherence configurations in the substrate.

7.6 Summary of Distinctions

Across these interpretative families, Aetherium offers a unique combination of features:

- **Single-world realism** without collapse
- **Locality** without hidden variables
- **Definite outcomes** without branching
- **Probabilities** without epistemic assumptions
- **Classicality** as a stability property
- **Measurement** as resonance-guided coherence reconfiguration

By grounding quantum behavior in a resonance-constrained coherence ontology, Aetherium resolves the measurement problem in a way that is physically meaningful, mathematically consistent, and conceptually unified.

8. Discussion and Outlook

The Aetherium framework reframes the quantum measurement problem by grounding quantum behavior in a coherence-first ontology constrained by the **resonant structure of the substrate**. This shift resolves the conceptual tensions that arise when the wavefunction is treated as both a physical entity and a predictive tool. By identifying coherence as the fundamental primitive and measurement as a **coherence-reconfiguration event**, the framework provides a unified account of outcome selection, classicality, and probability within a single-world, local ontology.

This perspective also clarifies the nature of **entanglement**. In standard quantum theory, entanglement is often described as a nonlocal correlation between spatially separated systems. In the Aetherium ontology, entanglement arises from **shared resonance-compatible coherence** across multiple degrees of freedom. No superluminal influence is required; the coherence structure itself spans the relevant subsystems. Measurement on one part of an entangled system corresponds to a reconfiguration of the shared coherence, not a signal transmitted across space.

The framework also offers a natural account of **temporal ordering**. Time is not a background parameter but the ordering of coherence transitions within the substrate's resonant structure. Coherence evolves continuously, but measurement events correspond to discrete reconfigurations into resonance-compatible attractor states. This provides a structural basis for the arrow of time: coherence transitions are directionally constrained by the stability properties of the substrate's resonant modes.

These insights suggest broader implications for **cosmology**. If coherence is the fundamental primitive and spacetime emerges from coherence patterns constrained by the substrate's resonant structure, then the large-scale behavior of the universe may reflect the same principles that govern quantum measurement. Phenomena such as cosmic expansion, structure formation, and the emergence of classical spacetime geometry may be understood as manifestations of coherence dynamics at cosmological scales.

The Aetherium model also opens new avenues for **experimental and theoretical exploration**. Because measurement outcomes correspond to resonance-compatible coherence configurations, it may be possible to identify signatures of the substrate's resonant structure in precision experiments involving decoherence, entanglement, or macroscopic quantum systems.

In summary, the coherence-first ontology provides a unified, realist, and local account of quantum measurement that resolves the conceptual tensions of the standard formalism. By grounding quantum behavior in the resonant structure of the substrate, the Aetherium framework offers a coherent foundation for understanding measurement, classicality, probability, and the quantum-to-classical transition.

9. Conclusion

The quantum measurement problem has persisted for nearly a century because the standard formulation of quantum theory lacks a physically grounded ontology capable of explaining how definite outcomes arise in a single world. Collapse postulates, branching universes, hidden variables, and observer-dependent rules each address part of the problem but leave fundamental questions unresolved. The Aetherium framework resolves this tension by identifying **coherence** as the fundamental primitive of physical reality and grounding quantum behavior in the **resonant structure of the substrate**.

In this ontology, quantum states are coarse-grained descriptions of coherence patterns, and measurement corresponds to a **coherence-reconfiguration event** in which the combined system–apparatus coherence aligns with a resonance-compatible configuration. Decoherence stabilizes this configuration by redistributing coherence across many degrees of freedom, while probabilities arise from the relative stability of resonant attractor states. The Born rule is therefore not an added postulate but a structural consequence of the substrate's resonance architecture.

This coherence-first perspective provides a unified, realist, and local account of measurement that preserves the empirical success of quantum theory while eliminating collapse, branching, and nonlocal influence. It clarifies the nature of entanglement, reframes the role of decoherence, and explains the emergence of classicality as a stability property of resonance-compatible coherence modes. Time itself emerges as the ordering of coherence transitions within the substrate's resonant structure.

By grounding quantum behavior in a single, coherent ontology, the Aetherium framework dissolves the conceptual tensions that have long obscured the measurement problem. It offers a structurally complete account of outcome selection, classical definiteness, and quantum probability, while opening new pathways for integrating quantum foundations with cosmology and the emergence of spacetime. The result is a unified and physically meaningful foundation for understanding the quantum-to-classical transition and the structure of physical reality.

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Data and Code Availability

This work is conceptual and does not rely on external datasets or computational code. No data was generated or analyzed, and no code is associated with this manuscript.