"In the end, we are left only with quantum mechanics. There is no space anymore."

Solving *Einstein's Quantum Riddle*

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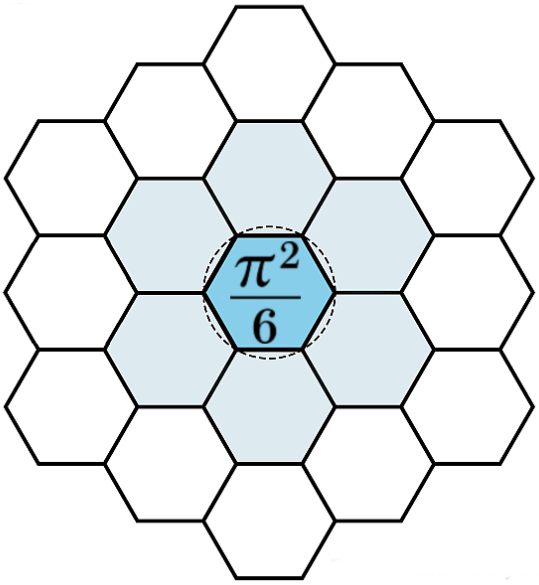

Abstract

In the NOVA documentary *Einstein's Quantum Riddle*, the narrator states: *"In the end, we are left only with quantum mechanics. There is no space anymore."* This paper takes this statement as an experimentally forced conclusion, but rejects the interpretation that quantum mechanics constitutes a complete ontology. Quantum mechanics is a projection-level formalism. It is not a theory of what exists.

If space is not fundamental, then what remains must be a pre-geometric structural substrate. Pattern Field Theory (PFT) provides such a substrate. In PFT, physical identity is not object-based, locality is not spatial, and measurement is not a process occurring in space. Reality is described as a lattice of admissible closures, structurally represented as a two-dimensional active constraint surface with an additional depth dimension (2D + 1D).

Within this framework, quantum entanglement, Bell-inequality violations, and nonlocal correlations are not paradoxes. They are necessary consequences of lattice-based identity. This document performs a direct ontological translation of the conceptual content of the documentary into Pattern Field Theory terms and shows that the perceived paradoxes arise from imposing an object-based metaphysics on a lattice-based reality.

The purpose of this paper

- Expose a glaring ontological error in mainstream physics.
- Present the source of the error.
- Offer the correct and simple solution to Einstein's Quantum Riddle.

Introduction

Modern physics predicts experimental outcomes with what is called extraordinary precision, yet it does not possess a coherent account of what the world is. This is most visible in the foundations of quantum mechanics.

Pattern Field Theory states that "A failed ontology cannot produce extraordinary results."

In the NOVA PBS documentary *Einstein's Quantum Riddle* the following statement is made that upsets the prverbial apple-cart immediately:

> "In the end, we are left only with quantum mechanics. There is no space anymore."

A statement that is both correct and wrong. It is correct because experiments force the abandonment of space as a fundamental organizing principle. It is wrong because the failure of space does not imply the failure of ontology. Quantum mechanics is a calculus, not an ontology.

What has failed is a human interface model: the assumption that reality must be organized as objects in three-dimensional space.

What has failed is not "space" as a thing, because no such thing exists in the first place. What has failed is the human interface model that *compresses distinct structural layers into a single fictitious ontology* and then treats that compression as primitive.

Modern physics does not operate with a genuine three-dimensional ontology. It operates with a *layer-compressed ontology*: a two-dimensional dependency structure and a one-dimensional depth index are fused into a single representational construct and labeled "3D space."

Pattern Field Theory does not treat "3D space" as a single ontological entity. In PFT, the base layer is a **2D dependency structure** — the adjacency, constraint, and coordination surface. What humans call spatial extension arises only after a **1D depth index** is applied — a recursion and identity lift that stacks and resolves dependency closures across depth.

The familiar **3D appearance** is therefore a **rendered composite** of **2D plus 1D**. It is a projection artifact of layer compression, not a substrate. "Space" is the name given to this compressed rendering, never an ontology.

This paper does the following three things (Expanded version):

- It identifies a specific ontological error in modern physics: the compression of distinct structural layers (2D dependency and 1D depth) into a single fictitious "3D" ontology.
- It diagnoses the source of this error as a human-centric bias, expressed through Projection Monism and Ontological Flattening.

- It replaces this failed compressed ontology with a lattice-based structural ontology (Pattern Field Theory) that preserves layer integrity and resolves the problem rather than rephrasing it.

In other words, this paper does not discuss the problem. The answer to the problem is given in this paper.

Allenix Principle: Removal of Human-Centric Bias

Pattern Field Theory adopts the constraint:

> Human-centric bias must be removed before any correct assumptions about reality can be expressed.

The universe does not care about human perception, intuition, or convenience. All assumptions derived from space, time, objects, and units are treated as projection-layer encodings, not ontological primitives.

Ontological Flattening and Projection Monism

Ontological Flattening — the error of collapsing multiple organizational layers of reality into a single descriptive layer.

Projection Monism — the belief that the projection layer (e.g. three-dimensional space, spacetime, or a coordinate system) is the only layer that truly exists.

Human-Centric Physics: A Methodological Failure Mode

Humans live and act in a three-dimensional space of existence and assume that what we experience as the interface must be what reality is.

This way of thinking does not ask: "What structure is enforced?"

Instead we ask "How do we force this back into space, time, and objects?"

When this fails, we say "reality is weird" instead of reassessing and admitting that"our interface model is wrong."

Ontological Failure of Space-Based Description

In the NOVA documentary *Einstein's Quantum Riddle* presented by Jim Khalili, the statement "In the end, we are left only with quantum mechanics. There is no space anymore." is presented as a philosophical conclusion, when in fact, it is a strictly technical consequence of experimental results involving quantum entanglement and Bell-inequality violations. These results demonstrate that no ontology based on spatially separated, independently existing objects can account for observed correlations.

Quantum mechanics itself does not repair this ontological failure. It only provides a calculus for predicting outcome distributions. It does not define what a system is, what an identity is, or

what a measurement corresponds to in structural terms. Therefore, the disappearance of space must be interpreted as the collapse of a geometric ontology, not as the end of ontology itself.

Pattern Field Theory (PFT) replaces geometric ontology with structural ontology. In PFT, reality consists of admissible closures in a constraint lattice. What is described as a particle is a stable coherence basin. What is described as position is a projection address. What is described as space is a rendering artifact of lattice structure.

Hidden Assumptions in the Standard Narrative

The standard formulation of quantum foundations relies on several implicit assumptions:

- That physical systems are objects.
- That objects exist independently.
- That objects carry intrinsic properties.
- That space is a fundamental container.
- That distance is a fundamental parameter.
- That time is a fundamental ordering variable.

Pattern Field Theory rejects all of these assumptions at the base ontological level. In PFT, there are no primitive objects and no intrinsic properties. There are only structural closures constrained by lattice admissibility.

Entanglement as Single-Identity Structure

In the standard narrative, entanglement is described as a correlation between two particles that persists after spatial separation. This description already assumes the existence of two independent objects.

In PFT, there are not two objects. There is one coherence structure with multiple projection addresses. The apparent multiplicity is a projection effect. Measurement does not transmit information between distant systems. It resolves a single structural identity into one of its admissible closures.

Bell Inequality Violations

Bell's theorem assumes factorization based on independent subsystems. Pattern Field Theory denies the independence assumption at the ontological level. There are no independent subsystems prior to closure. Therefore, Bell-inequality violations are not surprising. They are structurally necessary.

Measurement as Closure Selection

In PFT, measurement is not a physical process occurring in space. It is a structural resolution in the lattice. A coherence region that admits multiple potential closures is forced into one

admissible basin by constraint satisfaction. This process does not involve collapse, signaling, or observer-dependent causation.

The 2D + 1D Structural Model

Pattern Field Theory models the base layer of reality as a two-dimensional active constraint surface with an additional depth dimension. The depth dimension is a recursion and identity index. What is perceived as three-dimensional space is a projection of stacked depth slices. Distance in rendered space is not a structural distance parameter.

Why Nonlocality Is a Category Error

Once identity is treated as lattice-based rather than object-based, the concept of nonlocality becomes meaningless. No influence propagates. No signal is transmitted. No spatial separation is crossed. A single structural identity is resolved under constraint.

Conclusion

The documentary correctly identifies the collapse of space as a fundamental concept. Pattern Field Theory provides the replacement ontology. What remains is not "only quantum mechanics," but a pre-geometric lattice of admissible closures. Quantum mechanics remains as a projection-level calculus. The ontology resides in the lattice.

Measurement, Scale, and Ratio as Projection Artifacts

The documentary statement that we are left with quantum mechanics and no space is a signal that standard measurement language has exceeded its regime of validity. In Pattern Field Theory (PFT), the failure is not a defect in nature. It is a mismatch between: a base identity layer in which adjacency and closure are primary, and a projected coordinate layer in which metric and unit systems are imposed.

Definition 1 (Ratio-Only Measurement)**.** *A measurement is ratio-only if it is expressed purely as a relation between two closures without invoking a privileged unit object. A ratio-only description is invariant under global rescaling of any coordinate chart.*

Definition 2 (Unit-Cramming)**.** *Unit-cramming is the act of forcing a unit-based metric description to serve as if it were ontology. It occurs when a coordinate convention is treated as structural reality, and it produces apparent paradoxes under scale-change, coarse-graining, or cross-system coupling.*

Proposition 1 (Scale as a Projection Artifact)**.** *In a two-layer ontology (2D identity lattice plus 1D depth lift), rendered scale is not a base parameter. Rendered scale is produced by the choice of projection chart and depth resolution. Therefore, absolute scale claims are chart claims. Structural claims must be ratio-only.*

The simplest example is the length of a segment. The only invariant content is the relation between endpoints through recursive halving. Any unit declaration is a chart label attached to a chosen reference closure.

Definition 3 (Recursive Length Functional)**.** *Let a segment have endpoints a and b in a rendered chart. Define the midpoint operator $m(a,b)$ as the closure satisfying equal adjacency cost to a and b under the chart metric. Define the recursive length functional by repeated bisection:*

$$\ell_0(a,b) := (a,b), \qquad \ell_{k+1}(a,b) := \big(a, m(a,b)\big) \cup \big(m(a,b), b\big).$$

The informational content of length is the stable ratio pattern of the bisection tree under depth refinement, not the unit chosen to label ℓ_k.

Remark 1. *This is the same structure later called fractions. Fractions are not a human invention added to nature. They are the natural bookkeeping of recursive partition under closure constraints. In PFT terms this is Allenix - QuantaHex bookkeeping: availability and partition are defined by admissible closure operations, then projected into charts.*

Entanglement as Coordination Under Single Identity

The documentary frames entanglement as two distant objects that remain correlated. In PFT, the correct description is single identity with multiple projection addresses. Therefore, coordination does not require propagation.

A direct biological analogy is binocular blinking: two eyes behave as a coordinated pair because they are governed by one control identity. If one insists on describing the pair as two separate systems and then demands a signal to reconcile coordination, the demand is a category error.

Proposition 2 (No-Distance Coordination in the 2D Layer)**.** *In the 2D identity layer, metric distance is undefined. Only adjacency and closure relations exist. Therefore, coordination between two projection addresses that share one identity does not correspond to transport through a distance parameter.*

This proposition is exactly what Bell-type experiments force: correlations exceed what an object-separation factorization can sustain. Bell's formal assumption is subsystem independence. PFT removes subsystem independence at the base layer by replacing object ontology with identity closure ontology.

Experimental Spine and the Ontology Translation Constraint

The relevant experimental structure is: Bell's theorem establishes that local hidden-variable factorization cannot reproduce quantum correlations. Experiments then show violations of Bell inequalities, and later experiments close major loopholes. The technical conclusion is that object separation in spacetime is not a valid primitive for ontology construction.

References used as experimental spine: Bell (1964) provides the inequality framework and the factorization target. Aspect et al. (1982) demonstrates violation with time-varying analyzers. Hensen et al. (2015) demonstrates a loophole-free Bell inequality violation. These are treated here as constraints on ontology, not as metaphysical slogans.

Engineering Analogy for Projection-Layer Mismatch

A projection mismatch can destroy a system even when each subsystem is internally consistent. NASA's Mars Climate Orbiter failure is a canonical example: one component used English units

and another used metric units, producing a systematic trajectory error. The mishap report states that impulse data were provided in pounds(force)-seconds while the navigation expected metric units, yielding an error factor of 4.45.

This is structurally identical to the measurement problem at concept level: a correct base process is coupled to an incompatible chart convention, and the composite system fails. PFT treats many quantum paradoxes as exactly this class of mismatch: unit-based metric charts are applied as if they were base-layer structure.

Conclusion

If Modern physics wants to make progress, instead of following leads into dead ends then it must stop compressing two distinct layers (2D + 1D) into a single fictitious 3D ontology and then treating that compression as primitive.

Remark 2. *This analogy is not presented as a proof of PFT. It is presented as a clarity constraint: when a system mixes incompatible description layers, failures appear that are then misread as mysteries. The cure is enforcing layer integrity and translating via explicit projection maps.*

Glossary

Admissible Closure: A structurally stable resolution of a coherence region under lattice constraints.

Constraint Lattice: The base ontological structure of PFT in which all identities exist as structural closures.

Coherence Basin: A stable structural identity region in the lattice.

Projection Address: A rendered location corresponding to a lattice identity.

2D + 1D Model: The representation of the lattice as a two-dimensional active constraint surface with an additional depth index.

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