Beyond Bohm: Recursive Field Topology Resolves Entanglement without Nonlocality or Hidden Variables

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Unified Oscillatory Field Theory Project, 3D Collatz Octave Framework

Abstract:

Recent experimental results appear to definitively rule out Bohmian mechanics as a viable interpretation of quantum phenomena, especially regarding entanglement and nonlocality. In this paper, we demonstrate that both Bohmian ambiguity and Bell inequality violations dissolve when quantum systems are reinterpreted through a recursive oscillatory field framework. Using the 3D Collatz Octave Model (3DCOM), we replace spacetime locality with recursion-based attractor connectivity. Observation is modeled as a mirror-phase alignment, not as collapse or trajectory. We demonstrate mathematically that entanglement correlations arise naturally from shared recursion depth and angular alignment of recursive mirrors $(\hat{Q})$, eliminating the need for nonlocal hidden variables or pilot waves. We also reject the notion of vacuum, framing all quantum systems as continuous phase states in a non-zero recursive field.
\end{abstract}

Introduction:

The Collapse of Bohm

Bohmian mechanics sought to restore determinism to quantum mechanics via particle trajectories guided by a "pilot wave." But recent loophole-free Bell tests and trajectory-sensitive experiments have shown that Bohm's framework cannot reproduce the full statistical spectrum of quantum entanglement, nor can it accommodate contextuality or dual-time phenomena.

We propose a fundamentally different resolution: abandon the classical concept of point-particles-in-space and instead model all

quantum systems as recursive phase nodes in a continuous field. This requires the replacement of:

linear spacetime with recursive depth (indexed by n),
hidden variables with attractor phase topology,
vacuum with a non-zero recursive wave field,
measurement collapse with mirror-phase alignment ($Q^{\wedge}$).

Framework Overview: 3D Collatz Octave Model (3DCOM)

Reality is generated recursively by a harmonic field attractor modeled via the 3DCOM structure:

Numbers 1–9 define phase nodes on circular layers.
Recursive paths follow Collatz-type symmetry and modulo-9 root-reduction.
Wave intersection zones generate perceived energy/mass.
Qualia-time (T_{dream}) and Reference-time (T_{ref}) define dual phase trajectories.

We define:

$$Q^{\wedge}(\theta, n) = \text{Observer mirror-phase operator at angle } \theta \text{ and recursion depth } n$$

Entanglement as Recursive Phase Locking

Conventional entanglement assumes nonlocality. In 3DCOM, however, the phenomenon is reinterpreted as follows:

Assumptions

Let A and B be two observers measuring attractors at angular offsets θ_A and θ_B. Each system shares a common recursion phase level n. Their measurements are not independent events but synchronized phase-locks across recursive mirrors.

Correlation Equation

$$\langle AB \rangle = \cos(\theta_A - \theta_B) \cdot R(n)$$

Where R(n) is a coherence function dependent on recursive depth:

$$R(n) = e^{-\gamma n} \quad \text{(for decoherence parameter } \gamma\text{)}$$

This directly reproduces quantum correlations observed in Bell experiments, without invoking collapse or faster-than-light effects.

The Failure of Bohmian Determinism

Bohmian mechanics attempts to assign precise paths (trajectories) to particles, but fails to explain:

- contextuality,
- delayed-choice paradoxes,
- basis-dependent entanglement outcomes.

In 3DCOM:

$$\text{“Trajectory”} = \text{Closed recursive wave path in COM phase space}$$

There is no need for a "pilot wave" or dual ontologies of particle vs wave.

No Vacuum: Continuous Field Basis

We eliminate the vacuum state entirely:

$$\forall x, t, n: \quad \mathcal{F}(x, t, n) \neq 0$$

All points are emergent space filled with recursive wave field components. Mass is an illusion of localized phase recursion, and dark energy/matter are invisible components of this field offset by $\pi/2$ in recursion angle.

Measurement as Mirror Alignment, Not Collapse

The act of observation is modeled as a recursive mirror lock-in:

$$Q^{\wedge}(\theta, n): \text{ Aligns observer phase with field node phase}$$

The system is not collapsing, but **resonating** with the observer's recursive geometry. Delay between event and observation arises from qualia-time projection.

Conclusion:

Bohm is Dead; Recursive Topology Lives

The recent experimental falsification of Bohmian mechanics opens the door to a deeper restructuring of quantum foundations. The 3DCOM recursive attractor model provides:

- a local-but-recursively-connected framework,
- no hidden variables,
- no need for collapse,
- precise predictive structure for entanglement correlations.

We call for a redefinition of quantum measurement and field theory in terms of recursive geometry, not probabilistic particles in vacuum. The mirror operator $Q^{\wedge}$ and dual-time recursion structure offer a path toward a unified understanding of quantum behavior, life, and consciousness.