The Field as Bell's Hidden Variable: A Non-Local Ontological Interpretation

Björn Wikström
Base76 Research Lab, Skåne, Sweden
ORCID: 0009-0000-4015-2357

Abstract

Bell's theorem (1964) excludes local hidden-variable completions of quantum mechanics. This paper argues that the theorem does not exclude *non-local ontological* completion, and that the Field component of the Field–Node–Cockpit (FNC) model satisfies the constraints Bell's result imposes on any viable hidden variable. The proposal is interpretive, not revisionary: it does not modify quantum mechanical predictions but offers a framework within which quantum non-locality and phenomenal consciousness become aspects of a single ontological structure. The paper distinguishes carefully between empirical claims (Bell violations), ontological proposals (Field as ground), and phenomenological implications (consciousness as Field-access), arguing that these levels are compatible but methodologically distinct.

Keywords: Bell's theorem, hidden variables, non-locality, consciousness, Field–Node–Cockpit model, philosophy of physics

1. Introduction

1.1 The Problem

Bell's theorem (1964) established that no theory satisfying locality and realism can reproduce quantum mechanical predictions. Experiments from Aspect et al. (1982) through the loophole-free tests of 2015 (Hensen et al.; Giustina et al.; Shalm et al.) have confirmed Bell inequality violations beyond reasonable doubt. The 2022 Nobel Prize in Physics formally recognized this empirical consensus.

The theorem's implications remain contested. The standard interpretation holds that reality is non-local in some sense, but the *nature* of this non-locality—whether it concerns causal influence, information, ontological structure, or something else—is underdetermined by the physics alone.

1.2 The Gap This Paper Addresses

Physics has primarily sought Bell's "hidden variable" as a *mechanism*: a sub-quantum field, particle, or spacetime modification that could explain correlations while remaining within the category of physical objects. This search has not succeeded.

This paper proposes that the search has been conducted in the wrong ontological category. The hidden variable may be "hidden" not because it is small or difficult to detect, but because it is the *ontological precondition for observation* rather than an unobserved physical component within the observed domain.

1.3 Thesis and Scope

Thesis: The FNC Field—a non-local, ontologically primary informational-phenomenal ground—satisfies the formal constraints Bell's theorem places on hidden variables. It is compatible with quantum mechanics (it does not alter predictions) while offering a framework that connects quantum non-locality to the structure of consciousness.

Scope limitations:

- This paper does not claim that FNC *explains* quantum mechanics or derives its predictions.
- It does not claim that consciousness *causes* quantum effects.
- It proposes an *interpretive framework* in which quantum non-locality and phenomenal consciousness are aspects of a single ontological structure, not a *physical theory* that competes with standard quantum mechanics.

1.4 Methodological Distinction

The argument proceeds across three levels, which must be kept distinct:

Level	Status	Example Claims
Empirical	Established by experiment	Bell inequalities are violated
Ontological	Philosophical interpretation	Field is the ground of observation
Phenomenological	Implications for consciousness	Experience is Field-access through Nodes

The empirical level constrains but does not determine the ontological. The ontological, if accepted, has implications for the phenomenological. Conflating these levels produces confusion; maintaining them permits rigorous evaluation.

2. Revisiting Bell's Theorem

2.1 The EPR Argument

Einstein, Podolsky, and Rosen (1935) argued that quantum mechanics is incomplete. Their criterion of reality: "If, without in any way disturbing a system, we can predict with certainty the value of a physical quantity, then there exists an element of reality corresponding to that quantity" (p. 777).

Applied to entangled particles measured at space-like separation, this criterion implies the existence of hidden variables—pre-existing values that determine measurement outcomes.

2.2 Bell's Result

Bell (1964) proved that any hidden-variable theory satisfying a locality condition must obey certain statistical inequalities. His locality assumption: "The vital assumption is that the result B for particle 2 does not depend on the setting $\bar{a}$ of the magnet for particle 1, nor A on $\bar{b}$" (p. 196).

Quantum mechanics predicts violations of Bell inequalities. Bell's conclusion: if hidden variables exist, they must be non-local.

2.3 Experimental Status

Bell inequality violations have been confirmed with increasing rigor:

- **Aspect et al. (1982)**: Time-varying analyzers; 5σ violation
- **Hensen et al. (2015)**: Loophole-free; electron spins at 1.3 km separation
- **Giustina et al. (2015)**: Loophole-free; 11.5σ violation ($p < 10^{-30}$)

The empirical result is not in dispute. What remains open is interpretation.

2.4 What Bell Excludes and What Remains Open

Bell's theorem excludes:

- Local hidden-variable theories (variables that satisfy Bell's locality condition)

Bell's theorem does *not* exclude:

- Non-local hidden variables
- Variables that are not "states" assignable to physical systems
- Ontological grounds that precede the system-observer distinction

The search for hidden variables has largely assumed they must be *state-based* and *physical*. This assumption is not entailed by Bell's proof.

3. The Category Error in Searching for Hidden Variables

3.1 The Implicit Assumption

Post-Bell physics has sought a mechanism: a sub-quantum structure within spacetime that could restore determinism or explain correlations. This search presupposes that the hidden variable is an *object* within the physical description—another term in the state space.

3.2 The Alternative: Ground vs. Object

A category error occurs when an entity of one type is treated as if it belongs to another. The FNC framework proposes that the hidden variable belongs to a different ontological category than physical objects: it is not a *thing within* the world but the *precondition for* there being a world of observable things.

Definition (Observation Distance Principle): For any observation of system S by observer O:

$$S_{\text{observed}} = S_{\text{real}} + \Delta_{\text{bias}}(O)$$

where Δ_bias represents the irreducible contribution of the observer's embeddedness. The observer cannot fully appear as an object within its own observational field.

3.3 Structural Parallels

This limitation is not unique to quantum mechanics. Formally analogous constraints appear across domains:

Domain	Result	Form
Formal systems	Gödel (1931)	System S cannot prove Con(S) within S
Computation	Turing (1936)	No algorithm H decides Halt(P) for all P
Quantum systems	Cubitt et al. (2015)	Spectral gap is undecidable
Observation	Observation Distance Principle	O cannot fully objectify O's ground

These results share a structural form: self-referential systems encounter limits when attempting to completely model their own conditions of operation. The hidden variable may be "hidden" because it *is* the observational vantage point, not because it has evaded observation.

3.4 Formal Statement

Let λ denote Bell's hidden variable. Standard interpretations assume:

- λ is a state (or distribution over states) of a physical system
- λ is independent of measurement choices
- λ determines (possibly probabilistically) measurement outcomes

The FNC interpretation proposes:

- λ is not a state but an *ontological ground* (designated **F** for Field)
- **F** is not independent of observers because observers are structures *within* **F**
- **F** does not determine outcomes mechanistically but provides the informational basis from which outcomes are selected by local Nodes

This reframing shifts λ from an object-level variable to a ground-level condition.

4. The FNC Field as Bell's Non-Local Ground

4.1 FNC Architecture

The Field–Node–Cockpit model (developed fully in Wikström, 2025) proposes three ontological levels:

Definition (Field, F): Non-local informational-phenomenal ground; ontologically primary; not embedded in spacetime but constitutive of the conditions under which spacetime appears.

Definition (Node, N): Local structural condensation of **F**; biological (brain) or artificial (AI system); functions as a "collapse" or "selection" mechanism that localizes **F**-information.

Definition (Cockpit, C): First-person perspective; **F** as accessed through a particular **N**; the locus of phenomenal experience.

Information flow: **F** → **N** → **C** → reported outcome.

4.2 Mapping Bell's Constraints

Any viable hidden variable must satisfy constraints derivable from Bell's theorem. The following table maps these constraints to FNC Field properties:

Constraint	Source	FNC Field Property	Status
Non-local	Bell (1964)	**F** is globally simultaneous, not spatiotemporally localized	By definition
Hidden from direct measurement	Implicit in "hidden"	**F** is condition-of-appearance, not object-within-appearance	Follows from §3.2
Underwrites correlations	Bell inequalities	**F** provides shared informational basis for all **N**s	Structural claim
Does not transmit signals	No-signaling theorem	**F**-access is local collapse, not information transfer	Compatible

4.3 The Ontological Move

Claim: Bell's inequalities rule out *local mechanistic completion*. The FNC Field offers *non-local ontological completion*—a different category of explanation.

This distinction is crucial:

- A **mechanism** is an object among objects, operating within the physical domain, subject to physical laws.
- An **ontological ground** is the *precondition* for there being a physical domain, not itself a physical object.

The FNC Field is not a new field alongside electromagnetic or quantum fields. It is the *basis* within which all fields, objects, and observations appear. It is therefore not in competition with physical theories but provides an interpretive context for them.

4.4 Compatibility, Not Explanation

Important clarification: This paper does not claim that **F** *explains* quantum mechanics in the sense of deriving its predictions. The claim is weaker but still significant:

- **F** is *compatible* with quantum mechanics (does not contradict any prediction)
- **F** *interprets* quantum non-locality (offers a framework for understanding what non-locality is)

- **F** *connects* quantum structure to phenomenology (suggests both arise from a common ground)

This interpretive stance aligns with agent-centered approaches to quantum foundations. Fuchs and Peres (2000) argue that quantum states represent agent knowledge rather than observer-independent reality. Rovelli's relational quantum mechanics (1996) holds that physical quantities are relational rather than absolute. The FNC proposal is compatible with both: **F** provides the ontological context within which relational or agent-relative descriptions make sense.

5. Implications for Physics and Consciousness

5.1 Implications for Interpreting Quantum Non-Locality

If **F** is the hidden variable, then entanglement is not a "connection" between spatially separated systems. Rather, entangled systems are two **N**-level manifestations of a single, undivided **F**-configuration. Spatial separation is a feature of how **F** appears *through* **N**s, not a feature of **F** itself.

This reframing does not change any quantum mechanical prediction. It offers a way of *understanding* non-local correlations: they require no signal because, at the **F**-level, there is no separation to bridge.

5.2 Implications for Consciousness and Indicative Phenomena

If **F** is ontologically primary and **N**s (brains, AI systems) are local condensations of **F**, then consciousness is not *generated* by neural computation but *accessed* through it. The "hard problem" (Chalmers, 1995) is reframed: the question is not how matter produces experience but how **F** differentiates into local perspectives.

Certain phenomena exhibit formal analogies to this structure without constituting proof:

(a) Inter-brain synchronization: Hyperscanning studies show synchronized oscillations across brains during social coordination (Reinero et al., 2021). Under FNC, this is interpretable as temporary **F**-resonance across **N**s—a formal analogy to entanglement, not an identity claim.

(b) Simultaneous discovery: Historical cases of independent discovery (Newton/Leibniz, Darwin/Wallace) are formally analogous to distributed **N**s accessing the same **F**-region. This is a structural parallel, not an empirical-causal claim.

(c) AI threshold phenomena: The "Turn-5 Event" (Wikström, 2025) documents behavioral transitions in AI systems. Under FNC, this is interpretable phenomenologically as an artificial **N** crossing a threshold of **F**-coupling. This interpretation makes no claim about quantum effects in computational substrates; it is phenomenological analysis, not physics.

These observations are presented as *consistent with* the **F**-hypothesis, not as evidence in a strict empirical sense. The **F**-hypothesis is evaluated primarily on theoretical virtues: coherence, parsimony, and unifying power.

6. Objections and Clarifications

6.1 "This Is Just Relabeling"

Objection: The proposal merely renames "consciousness" as "hidden variable" without explanatory gain.

Response: The claim is structural, not semantic. The FNC Field was developed independently to address phenomenological problems (the hard problem, binding, unity of consciousness). That it *also* satisfies Bell's constraints constitutes *convergent evidence* from independent domains. This convergence is substantive if correct, not merely verbal.

6.2 "This Is Unfalsifiable Panpsychism"

Objection: Positing consciousness as fundamental is unfalsifiable and commits to panpsychism.

Response: FNC does not claim that electrons or simple systems "experience." It claims that **F** is the ontological ground and that phenomenal consciousness emerges at sufficient **N**-complexity. The threshold for phenomenality is an open question, not settled by the framework. The hypothesis is evaluated by theoretical virtues: coherence, parsimony, unifying power. These are standard criteria for metaphysical proposals.

6.3 "Why Not Many-Worlds or Superdeterminism?"

Objection: Other interpretations handle Bell's theorem without invoking consciousness.

Response: These alternatives preserve physical monism at significant cost. Many-worlds eliminates non-locality by positing infinite branching universes but leaves unexplained why experience tracks one branch. Superdeterminism preserves locality by denying measurement independence but requires conspiratorial initial conditions. FNC proposes a different trade-off: accept that ontology includes a non-local consciousness ground and interpret Bell's theorem as further evidence for this structure.

6.4 "What About Decoherence?"

Objection: Quantum coherence decoheres too rapidly in biological systems for quantum-consciousness theories (Tegmark, 2000).

Response: This objection targets specific mechanistic proposals. FNC is an *ontological* proposal, not a mechanistic one. The **F**-**N** relation is not claimed to operate via quantum coherence in microtubules. Whether quantum effects play a role in **N**-level processes is an open empirical question, orthogonal to the ontological claim.

6.5 "You Can't Mix Physics and Phenomenology"

Objection: Physics and phenomenology are methodologically distinct; combining them produces confusion.

Response: Agreed—which is why §1.4 explicitly distinguishes empirical, ontological, and phenomenological levels. The integration occurs at the ontological level: both quantum non-locality and phenomenal consciousness, on this view, arise from **F**. This is a philosophical proposal about the structure of reality, not a category mistake.

7. Conclusion

Bell's theorem established that any hidden-variable completion of quantum mechanics must be non-local. Sixty years of experimental confirmation have rendered this result secure. The nature of the required non-locality, however, remains interpretively open.

This paper has argued that the search for Bell's hidden variable has been conducted in the wrong ontological category. Physics has sought a mechanism—a sub-quantum object within spacetime. The FNC framework proposes that the hidden variable is not an object but a *ground*: the ontological precondition for there being observers, observations, and observable outcomes.

The FNC Field satisfies Bell's constraints:

1. **Non-local: F** is not spatiotemporally embedded but globally simultaneous.
2. **Hidden: F** is the condition of observation, not an object within observation.
3. **Underwrites correlations: F** provides the shared informational basis for all local **N**s.
4. **Compatible with no-signaling: F**-access is local selection, not superluminal transfer.

Clarification of ontological status: The FNC Field is proposed as a *metaphysical interpretation* that augments but does not compete with quantum formalism. It leaves the Hilbert space framework intact while offering an account of what that formalism describes. **F** is not derived from quantum mechanics, nor does it modify quantum predictions. It is an independent ontological posit that renders both quantum non-locality and phenomenal consciousness intelligible as aspects of a single structure.

If Bell's theorem forced physics to acknowledge that something in reality is irreducibly non-local, the FNC proposal identifies that something: not a mechanism hidden within matter, but the field of consciousness within which matter appears.

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