Relative Determination After Bell

Clock Records, Contextual Ledgers, and the Reinterpretation of Quantum Determination

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Abstract

This paper proposes a conceptual reinterpretation of quantum determination under the explicit assumption that Bell-type results and quantum contextuality are accepted. The aim is not to replace the mathematical formalism of quantum mechanics, nor to deny the standard experimental results. Rather, the aim is to isolate a conceptual tension that remains after local, context-independent hidden-value descriptions have been excluded.

If Bell-type results are accepted, then measurement outcomes cannot be understood as the mere revelation of local pre-existing values stored in a single classical ledger. Yet after measurement, definite macroscopic records do appear. In particular, a clock may be opened at 3:00 and found to display 12:00 as its stopping time. Such a record cannot straightforwardly be interpreted either as a classical value already fixed for all contexts before observation, or as a value created from nothing at the instant of observation.

This paper calls the required conceptual shift *relative determination*. Determination is not treated as inscription in a single absolute ledger, but as the appearance of a contextual readout of an internal correlation structure in an external ledger. A two-clock thought experiment is used to make the tension intuitive. The Mermin–Peres magic square is then read as a nine-clock contextual ledger, showing why determinate readouts in each context need not combine into a single context-independent classical table.

The resulting view is not proposed as a local hidden-variable theory. It accepts the failure of a single classical ledger and uses that failure as the starting point. The paper closes by explaining how this viewpoint can serve as an accessible entrance to the broader MOF–FDC–PFC program: MOF as the ontological layer, FDC as the finite-distinguishability closure layer, and PFC as the phase-flow physical reading layer.

1. Starting Point: Bell-Type Results Are Not Denied

This paper does not deny Bell-type experimental results. On the contrary, it takes them as a starting point.

What Bell-type results show is that quantum correlations cannot be explained by a local, context-independent table of classical pre-existing values. One cannot maintain the view that, before measurement, all possible outcomes for all possible measurement contexts are already written into a hidden classical ledger, with measurement merely revealing one entry of that ledger.

Once this point is accepted, the usual mystery of quantum theory cannot be treated as a simple choice between two alternatives. One alternative says the value already existed before observation and the observer merely discovered it. The other says the value was created from nothing at the moment of observation. Both alternatives still assume that determination is the possession or creation of a value in some absolute ledger.

This is the assumption the present paper questions.

Is determination really the inscription of a value in one absolute ledger belonging to the world as a whole? Or should determination be understood as something that occurs only in relation to an internal correlation structure, a readout context, and an external ledger?

This paper adopts the latter view and calls it *relative determination*.

Relative determination means that determination is not an absolute possession of a value by an object, independent of all context. Rather, determination is the appearance of a contextual readout of an internal correlation structure in a particular ledger.

In this view, what exists internally is not a classical table containing values for all possible contexts. What exists internally is a *correlation structure*, or *correlation package*, which can give rise to different contextual readouts. These readouts become records only relative to a ledger in which they are registered, shared, and compared.

This is not a form of subjective idealism. The claim is not that the observer's consciousness creates reality. Nor is it the claim that nothing exists before observation. The claim is narrower and structural: what exists before observation is not a context-independent classical value table, but a correlation structure that becomes determinate only as a contextual readout.

This also means that relative determination is not merely an expression of ignorance. If a value were simply hidden, the problem would be epistemic. But Bell-type results and contextuality show that the issue is deeper. The problem is not that we do not know which entry of a hidden table is correct. The problem is that the assumed table itself cannot generally exist.

The central question of this paper can now be stated as follows.

> If pre-existing local classical values are excluded, but definite macroscopic

records nevertheless appear after measurement, how should those records be understood?

This question becomes especially sharp when the record contains a past time. Suppose a clock is opened at 3:00 and found to display 12:00 as its stopping time. If the clock reading is treated as a pre-existing classical value, one risks returning to the hidden-value picture excluded by Bell-type results. If it is treated as something created from nothing at 3:00, the past-time content of the record becomes unintelligible.

Relative determination is proposed as a way to name and organize this tension.

The paper proceeds as follows. Section 2 introduces a two-clock thought experiment. Section 3 defines the relevant types of ledger and clarifies the concept of relative determination. Section 4 explains why this position is not in conflict with Bell-type results and how the remaining interpretive options divide. Section 5 reinterprets entanglement as a correlation package. Section 6 uses the Mermin–Peres magic square, translated into a nine-clock contextual ledger, to show why contextual readouts cannot generally be flattened into a single classical table. Later sections explain what this removes from the mystery of quantum theory and how the proposal connects to MOF, FDC, and PFC.

2. The Two-Clock Thought Experiment

Consider an isolated box containing two clocks, clock a and clock b.

Inside the box there is also a quantum random device, such as a detector coupled to a radioactive decay event. During a fixed interval, the device either triggers or does not trigger. The device is connected to the two clocks by the following rule:

- If the device triggers within the interval, clock a is stopped.
- If the device does not trigger, clock b is stopped.

Within the box, the two clocks therefore participate in an exclusive correlation structure. If clock a is stopped, clock b continues running, and vice versa.

At first sight this may look like an ordinary classical correlation. But the thought experiment is introduced here *after* accepting Bell-type results. From the standpoint of the external observer, the box is therefore not assumed to contain a hidden classical table of all context-independent outcomes. The box contains a correlation package linking the quantum random device, the clock mechanism, and the possible clock records. Before the box is opened, the external ledger does not contain a definite record of which clock is stopped.

Now suppose that, after the interval, the box is physically divided into two parts. The part containing clock a is sent to Alice at location A; the part containing clock b is sent to Bob at location B. This transport occurs by ordinary physical means.

The two parts are now spatially separated. Nevertheless, they remain two readout ports of the original correlation package.

Suppose Alice opens box a at 3:00 and finds that clock a displays 12:00 as its stopping time. Two facts must be held together.

First, if Bell-type results are accepted, Alice should not interpret the reading as proof that, before observation, clock a possessed a context-independent classical value “stopped at 12:00” valid for all possible contexts.

Second, after the box is opened, clock a does display a definite macroscopic record: “stopped at 12:00.” This is not a private hallucination. It is a stable record that Alice can read, record, and later compare with Bob.

Thus, two simple explanations are inadequate.

The first says: clock a was already stopped at 12:00 before Alice opened the box, and she merely discovered this fact. This risks reintroducing the kind of classical pre-existing value excluded by Bell-type results.

The second says: clock a only stopped at 3:00, when Alice opened the box. But this fails to account for the content of the record, which says 12:00, not 3:00.

The thought experiment therefore forces a distinction.

> The time 12:00 is the time contained in the *record-content*.
> The time 3:00 is the time at which that record-content appears in Alice's *external ledger*.

These are not the same. If 12:00 is interpreted as an externally valid classical pre-existing value, the interpretation runs into the lesson of Bell-type results. If 3:00 is interpreted as the physical stopping time of the clock, the past-time content of the record is lost.

On the present view, what the box contained was not a classical table of pre-existing values, but an internal correlation structure. Alice's opening of the box brings one contextual readout of that structure into her external ledger. This readout is real as a macroscopic record, but it is not a pre-existing context-independent classical value.

Once Alice reads clock a, she can also infer something about clock b: if clock a is stopped, then clock b is running. But this inference does not mean that Alice's observation has physically changed Bob's clock faster than light. Nor does it mean that a hidden classical table was stored inside the box. It means that a contextual readout of one part of the correlation package has appeared in Alice's ledger.

The two-clock experiment is not a complete model of quantum entanglement. It is a minimal conceptual model for the tension between two facts:

- pre-measurement classical values cannot be assumed;
- post-measurement macroscopic records do appear, sometimes with past-time content.

This tension is best understood by treating determination as relative to correlation structure, readout context, and ledger synchronization.

3. Relative Determination and the Classification of Ledgers

The clock experiment distinguishes two times: Alice opens the box at 3:00, but the clock displays 12:00. The first is the time of *external synchronization*. The second is the time contained in the *record-content*.

This distinction motivates the term *relative determination*: a record is not determined as an absolute value in a universal ledger, but as the appearance of a contextual readout of an internal correlation structure in a particular ledger.

To state this carefully, four notions must be separated.

Internal correlation structure. The structure held within an isolated or partially isolated system. It is not a table of values for all possible measurement contexts. It is a structure capable of producing contextual readouts.

Contextual readout. The result that appears under a specific measurement or reading context. In the two-clock experiment the context is simple, and the readout can be expressed as an ordinary clock state.

External ledger. The record available to an observer such as Alice or Bob, in which results are recorded, shared, compared, and used for further inference. Before Alice opens the box, the relevant clock record is not present in her ledger. When she opens it, a contextual readout becomes part of her external ledger.

Single classical ledger. The hypothetical table in which all outcomes for all possible contexts are already written, independently of which context is later chosen. Bell-type results and contextuality rule out this kind of ledger in general.

Confusion arises when these four notions are collapsed into one. When the two-clock experiment says a clock is found stopped at 12:00, this should not be read as saying that a single classical ledger already contained that value for all contexts. Rather, one contextual readout of the internal correlation structure appears in the external ledger as a stable macroscopic record. This record is not subjective, but it must not be interpreted as a context-independent value that was already present in a universal classical table.

An additional point is crucial. Even within the internal correlation structure, determination does not escape context. There is no "God's-eye" internal table containing values for every possible readout. What exists internally is a structure that supports contextual readouts, not an absolute all-context table.

The clock experiment therefore does not restore classical certainty. It exposes why the classical concept of certainty is too crude.

Bell-type results forbid reducing the record to a pre-existing local value. The clock record forbids saying that measurement merely creates a meaningless present value from nothing. Mermin–Peres contextuality, discussed in Section 6, shows that even within the internal structure there can be no context-independent value table.

Together, these motivate the idea that determination is not absolute inscription, but *contextual synchronization*.

4. Relation to Bell-Type Results

Bell-type results rule out the view that entangled systems carry local, context-independent pre-existing values that are merely revealed by measurement. This paper does not reject that conclusion. It accepts it.

When this paper speaks of an internal correlation structure, it does not mean a local hidden-variable table. It does not mean that Alice's side and Bob's side each carry a pre-written value for every possible measurement direction. It does not mean that all possible answers are stored in a single table before observation. On the contrary, the rejection of such a table is one of the main premises of the paper.

What remains after Bell-type results is a different problem. Before measurement, one cannot assume local context-independent classical values. Yet after measurement, Alice and Bob obtain definite records. Moreover, when those records are later compared, they display correlations that cannot be explained by a single classical ledger.

The present paper interprets this situation as follows. An entangled system contains not a set of local pre-existing values, but a non-decomposable correlation structure. Measurement is the appearance of a contextual readout of that structure in an external ledger. Later comparison reveals that the collection of these readouts cannot be reduced to a single context-independent classical table.

Thus, relative determination is not a hidden-variable theory. It is not an attempt to evade Bell-type results. It is a way of naming what remains after Bell-type results have been accepted.

After Bell-type results and contextuality are accepted, the remaining interpretive strategies divide into two broad directions.

One direction handles the difficulty by assigning the role of determination to another layer: branching structure, observer-relative state, belief update, or the global quantum state. The present paper does not deny the coherence of such strategies.

The other direction takes a different route: it treats the difficulty as a reason to revise the concept of determination itself, so that determination is no longer understood as the inscription of a value in a single absolute ledger, but as something that arises through the relation among internal correlation structure, readout context, external ledger, and synchronization. This strategy does not require a prior context-independent value table. It treats the absence of a single classical ledger not as a problem to be relocated but as a structural feature to be incorporated into the concept of determination.

This paper adopts the second direction.

The aim is not to refute the first direction by examining specific interpretations. Rather, the present paper isolates the structural feature that any interpretation must confront: there is no single classical ledger for all contexts, yet determinate records appear within particular contexts. Relative determination is the name given to that feature.

5. Entanglement as a Correlation Package

Relative determination provides a way to reinterpret the apparent mystery of entanglement.

Entanglement is often described as follows: two particles are prepared in a joint state and separated; when one is measured, the state of the other is said to become definite immediately, even at a distance. This language easily suggests that a physical influence travels from one side to the other faster than light.

On the present view, entanglement is not a mysterious thread connecting distant objects. It is a non-decomposable correlation package whose readouts are distributed across spatially separated systems.

The systems may be spatially separated. But their readouts are not fully independent. If one side is read in a particular context, the other side is constrained in the corresponding context. This constraint is not a signal sent from one side to the other. It is the manifestation of a shared correlation structure.

However, this correlation package is not a classical value table. The entangled system does not contain a list of values for all possible measurement directions on Alice's side and all possible measurement directions on Bob's side. It contains a structure that yields contextual readouts. For any given context, a result appears. Across all contexts, no single classical table can reproduce the full pattern.

This is what distinguishes entanglement from an ordinary classical correlation. In a classical example, Alice receives a red card and Bob a blue card. If Alice sees red, she infers Bob has blue. Such a correlation can be represented by a table of pre-existing values. In the quantum case, by contrast, each context yields definite records, but the records across possible contexts cannot be represented as entries of one context-independent table.

The mystery of entanglement is therefore not that one side sends a signal to the other. The mystery arises when one tries to decompose the shared correlation package into independent local objects backed by a single classical ledger.

Quantum teleportation may also be read in this light. Alice and Bob share an entangled resource. Alice performs a measurement and sends classical information to Bob. Bob uses this information to complete the reconstruction of the relevant state on his side. From the perspective of relative determination, what happens is not that a material quantum state travels through space. A correlation package is used, Alice obtains a contextual readout, and classical communication makes the readout usable in Bob's ledger.

The classical communication does not create the entanglement. The correlation structure is already part of the shared resource. The classical communication specifies how Bob's external ledger should use the result. Thus, classical communication is the process by which a contextual readout becomes usable for a receiving ledger — not the source of the non-classical correlation.

To distinguish the proposal from ordinary classical correlation, however, one must show why a single classical ledger cannot underlie all these readouts. For that purpose, the next section turns to the Mermin–Peres magic square.

6. The Mermin–Peres Magic Square as a Nine-Clock Contextual Ledger

The Mermin–Peres magic square is a standard structure used to exhibit quantum contextuality. In its usual form, it consists of nine quantum observables arranged in a three-by-three square. Each row and each column contains observables that commute with one another, forming a legitimate joint measurement context. The product of the observables in each row or column is fixed by the operator structure, with all rows giving $+I$ and all columns giving $+I$ except one which gives $-I$. If one attempts to assign a context-independent value $+1$ or -1 to each of the nine observables in advance, a contradiction results.

This paper reads the Mermin–Peres magic square as a *nine-clock contextual ledger.*

Imagine nine clocks arranged as follows:

$$\begin{matrix} A & B & C \\ D & E & F \\ G & H & I \end{matrix}$$

Each clock has a binary readout: running $= +1$, stopped $= -1$.

The clocks are not read individually in arbitrary isolation. They are read in context packages — rows and columns — and the readout for each context is the product of the three binary values in that row or column.

Corresponding to the Mermin–Peres structure, the contextual readouts satisfy:

$$ABC = +1, \quad DEF = +1, \quad GHI = +1, \tag{1}$$

$$ADG = +1, \quad BEH = +1, \quad CFI = -1. \tag{2}$$

This sign pattern is not an arbitrary rule. In the original Mermin–Peres square it follows from the algebra of quantum observables. The clock version is a visualization of that already-known contextual structure.

Now assume, for contradiction, that each clock A through I possesses a context-independent pre-existing value, valid no matter which row or column is read. Multiply the three row equations from (1):

$$(ABC)(DEF)(GHI) = (+1)(+1)(+1) = +1.$$

The left side contains every clock exactly once, so

$$ABCDEFGHI = +1.$$

Now multiply the three column equations from (2):

$$(ADG)(BEH)(CFI) = (+1)(+1)(-1) = -1.$$

But the left side again contains every clock exactly once, so

$$ABCDEFGHI = -1.$$

The same product must therefore be both $+1$ and -1. This is impossible.

Therefore, the nine clocks cannot possess context-independent pre-existing values that satisfy all six contextual readouts.

The important point is not that the individual contexts are inconsistent. Each context has a definite readout. ABC can be read as $+1$; DEF as $+1$; CFI as -1. The contradiction appears only when one tries to combine all contextual readouts into a single context-independent ledger.

This is the failure of single-ledger determination.

This result is not merely a statement about the ignorance of an external observer. The Mermin–Peres structure shows that even if one imagines a complete internal view of the system, the nine entries cannot be assigned context-independent values all at once. Determination does not escape context even inside the internal structure.

There is determination in each context. But there is no absolute ledger for all contexts.

The two-clock experiment and the nine-clock contextual ledger play different roles. The two-clock experiment exposes the tension between the absence of pre-measurement classical values and the later appearance of macroscopic past-time records. The nine-clock ledger shows that this tension is not merely due to missing information. It is rooted in the impossibility of flattening contextual readouts into a single classical table.

This point also explains why binary models are not trivial. A binary readout is the minimal form of finite distinction. If a continuous model possessed a single classical ledger, then suitable binary coarse-grainings of that model should also possess such a ledger. But the Mermin–Peres structure shows that even the binary ledger can fail. The obstruction is not an artifact of oversimplification. It appears at the minimal level of finite readout.

The conclusion of this section:

> Each context may have a determinate readout.
> But no single classical ledger contains all readouts for all contexts.

This is the formal core of relative determination.

7. From Binary Contexts to Phase and Wave

The nine-clock reading of the Mermin–Peres magic square shows that the failure of a single classical ledger already appears at the level of binary readouts.

One might object that quantum theory is not merely binary. Quantum systems involve continuous parameters, phases, amplitudes, angles, interference, and wave-like evolution.

But this objection misses the role of the binary model. The binary model is not presented as a complete replacement for the Hilbert-space formalism. Its role is more minimal: it shows that the classical expectation of a single context-independent ledger fails even before one introduces continuous variables or wave equations. The obstruction is already present at the level of the simplest finite distinction.

Binary readout is not an impoverished special case. It is the minimal unit of finite distinguishability. If a multi-valued or continuous model possessed a single context-independent classical ledger, then any binary coarse-graining of that model should also possess such a ledger. But the Mermin–Peres structure shows that such a binary ledger cannot, in general, exist. Increasing the number of values does not automatically remove the obstruction. It merely embeds the obstruction in a richer representational space.

This is where phase becomes relevant.

A mere probability table records weights. It says how likely different outcomes are. But quantum theory does not merely assign weights to independent alternatives. Alternatives can interfere: they can reinforce or cancel one another. Their relation matters.

This means that what is held internally cannot be only a list of possible values with probabilities attached. Something must preserve the relative structure among possible readouts. In quantum theory, this role is played by phase.

From the perspective of the present paper, phase may be understood as the minimal relational structure required when possible readouts cannot be flattened into a single classical ledger. If the internal structure is not a table of pre-existing values but a context-dependent correlation package, then the relations among possible contextual readouts must be preserved. Phase is the natural carrier of such relations.

A wave, in this sense, is not primarily a material substance spread through space. It is the effective representation of a phase-bearing correlation structure as seen from an external description.

This does not yet derive the full wave function, the Born rule, the Schrödinger equation, or the exact angular dependence of spin correlations. Those belong to a more detailed formal theory. Nevertheless, the direction is clear.

Once the single classical ledger is abandoned and internal structure is understood as context-dependent correlation rather than pre-assigned value, a merely real-valued probability table is insufficient. One needs a representation that carries both weight and relation. In standard quantum theory, this is precisely what the complex amplitude does.

Thus, the path is:

> finite distinction $\rightarrow$ contextual readout $\rightarrow$ failure of a single classical ledger $\rightarrow$
> relational structure among alternatives $\rightarrow$ phase $\rightarrow$ wave-like representation.

The present paper does not claim to complete this path. It claims only that the beginning of the path is already visible in the clock experiment and in the Mermin–Peres contextual ledger.

8. What the Clock Experiment Removes from the Mystery

The clock experiment does not replace quantum mechanics. It does not reproduce all quantum predictions. It does not by itself derive the Born rule or Bell correlations. Its function is different: it isolates a conceptual tension that is often hidden by the usual language of quantum measurement.

On one hand, Bell-type results forbid us from interpreting quantum correlations as the reading of local, context-independent pre-existing values. On the other hand, after measurement, we obtain definite macroscopic records. In the clock version, the record may even contain a past time: the clock is found at 3:00 to display a stopping time of 12:00.

If one says that the clock was simply fixed at 12:00 all along, one risks returning to a classical hidden-value picture. If one says that the clock simply came into being at 3:00, one loses the meaning of the clock record itself. Neither option is satisfactory.

The clock experiment forces a different reading. The record is not an absolute classical value that existed for all ledgers before observation. Nor is it a value created from nothing at the moment of observation. It is a contextual readout of an internal correlation structure, appearing in an external ledger at the moment of synchronization.

This removes several misleading images.

First, observation need not be understood as the creation of reality from nothing. The measurement brings a contextual readout of an internal correlation package into the external ledger; it does not manufacture the entire structure ex nihilo.

Second, entanglement need not be understood as a mysterious signal sent across space. The correlation package is not reducible to independent local values, but this does not mean that one side physically sends a message to the other at the moment of measurement.

Third, superposition need not be imagined as a macroscopic object literally possessing contradictory classical properties at once. The contradiction arises when one tries to force multiple possible contextual readouts into a single classical ledger.

Fourth, the difference between quantum and classical is not merely that quantum systems are small. A macroscopic clock can participate in a quantum-like record structure if it is part of an isolated correlation package. Classicality is not simply size; it is the stability of external readouts under environmental synchronization.

The mystery is therefore not eliminated by pretending that quantum theory is classical. It is eliminated by changing the question.

The wrong question is: *Which value was absolutely real before measurement?*
The better question is: *Which contextual readout becomes valid for which ledger, and under what synchronization relation?*

In this form, the problem becomes less mystical and more structural.

9. Relation to MOF, FDC, and PFC

The interpretation developed in this paper is intended as an entry point to the broader MOF–FDC–PFC framework. It should not be read as a stand-alone derivation of the whole theory. Rather, it isolates a simple conceptual pressure: if Bell-type results and contextuality are accepted, then the classical notion of absolute determination must be revised.

MOF. The Minimal Ontological Foundation framework supplies the ontological layer. In MOF, existence is not understood as a collection of independently given material objects placed in a completed absolute background. What can count as a world must survive conditions of distinguishability, consistency, and internal readability.

The present paper expresses this in the language of records. A record is not simply an absolute fact written into a universal ledger. It is a contextual determination relative to an internal/external relation. The clock reading is meaningful not because it belongs to an all-seeing classical table, but because it appears as a stable macroscopic readout within a particular ledger.

FDC. Finite Distinguishability Closure begins where the present paper stops. The present paper shows that contextual readouts cannot, in general, be flattened into a single classical ledger. FDC asks the next question: once such flattening is unavailable, what finite structures can still remain closed, reproducible, and non-arbitrary?

It is not enough to say that contextual readouts exist. If no single classical ledger is available, one must still avoid arbitrary representation, ad hoc labels, and unconstrained coding choices. FDC addresses this problem by studying the closure conditions under which finite distinctions can be maintained without privileging a representation.

In this sense, the nine-clock reading of the Mermin–Peres square is not a derivation of FDC. It is an accessible bridge to the *need* for FDC. It shows why a theory of finite distinguishability cannot simply assume that all distinctions sit inside one global table.

PFC. Phase-Flow Coherence supplies the physical reading layer. If the internal structure is not a table of values but a phase-bearing correlation structure, then the wave function can be read as an effective finite-resolution representation of that structure.

The present paper prepares this interpretation by showing why a mere value table cannot be fundamental. If internal structure cannot be flattened into a table of pre-existing values, then an external description must preserve relations among possible contextual readouts. This is the conceptual opening through which phase, coherence, and wave-like description enter.

Thus, the sequence is:

- MOF clarifies why determination must be internal and structural rather than absolute.
- FDC clarifies why finite distinctions cannot be freely represented in an arbitrary privileged ledger.
- PFC clarifies how phase-bearing correlation structures appear as quantum dynamics under finite-resolution readout.

The present paper sits before these theories as an intuitive gateway. It does not replace their technical content. It prepares the reader to see why such a framework is needed.

10. What Is Not Claimed

It is important to state clearly what this paper does not claim.

(i) It does not deny Bell-type experiments. It accepts them.

(ii) It does not propose a local hidden-variable model. The internal correlation package is not a table of pre-existing local values. The Mermin–Peres discussion is included precisely to block that misunderstanding.

(iii) It does not claim that the clock experiment by itself reproduces all quantum correlations. The clock experiment is a conceptual model for the tension between unavailable pre-existing classical values and later macroscopic records. It is not a substitute for the Hilbert-space formalism.

(iv) It does not claim that classical communication creates entanglement. In the discussion of teleportation, classical communication is not the source of the correlation structure. It is the process by which a contextual readout becomes usable in the receiving external ledger.

(v) It does not claim that the past is unreal. The claim is more precise: a past-time record should not automatically be interpreted as a value already written in a context-independent classical ledger. The record is real as a synchronized macroscopic readout. What is rejected is its interpretation as an absolute pre-measurement value valid across all contexts.

(vi) It does not derive the Born rule, the Schrödinger equation, or the full structure of quantum field theory. Those require additional formal work. The purpose here is to identify the conceptual layer beneath them: the failure of absolute determination and the need for contextual readout.

(vii) It does not claim to refute all other interpretations of quantum mechanics. Many-worlds, QBism, relational quantum mechanics, and Copenhagen-type views may each accommodate the formal predictions in their own language. The aim here is different. The paper isolates a structural feature that any such interpretation must face: after Bell-type results and contextuality, determination cannot be understood as inscription in a single context-independent classical ledger, while macroscopic records still appear as definite readouts. Relative determination is proposed as a minimal way of naming and organising this feature.

The paper makes a limited but sharp claim. If Bell-type results and contextuality are accepted, then determination cannot be treated as the possession of values in a universal classical ledger. Yet macroscopic records do appear. Therefore, determination should be understood as relative to correlation structure, readout context, and ledger synchronization.

11. Conclusion

The usual mystery of quantum theory is often framed as a mystery about objects. How can a particle be in two states? How can one measurement affect something far away? How can observation create a definite result? How can a macroscopic record appear if no value existed before?

This paper has proposed that the deeper issue is not the object, but the concept of determination.

If determination means inscription in a single absolute classical ledger, then quantum theory appears paradoxical. Bell-type results forbid pre-existing local value tables. Contextuality forbids a single assignment of values across incompatible readout contexts. Yet measurements still yield definite records.

The two-clock experiment sharpens this tension. A clock is opened at 3:00 and found to display 12:00. If this is treated as an absolute pre-existing classical value, one risks conflict with the lesson of Bell-type results. If it is treated as something created from nothing at 3:00, the past-time content of the record becomes unintelligible. The tension points toward a third option: the record is a contextual readout of an internal correlation structure, synchronized into an external ledger.

The Mermin–Peres magic square, read as a nine-clock contextual ledger, shows why this is not merely a verbal maneuver. Even when every context has a determinate readout, the collection of all such readouts cannot be flattened into a single context-independent classical table.

The slogan of the paper is therefore:

There is determination in each context,
but no absolute ledger for all contexts.

This is the sense in which determination is relative.

Relative determination does not mean that anything is arbitrary. It does not mean that records are subjective illusions. It means that the validity of a record depends on the relation among internal correlation structure, readout context, and external ledger.

Once this is recognized, several familiar quantum mysteries lose their force. Observation is not the creation of reality from nothing. Entanglement is not a signal traveling through space. Superposition is not the literal coexistence of contradictory classical values. The wave function need not be a primitive material substance.

What remains is a structural problem: how finite observers, with finite readout contexts, encounter a non-classical correlation structure that cannot be reduced to a single classical ledger.

That problem leads naturally toward MOF, FDC, and PFC.

The present paper is only an entrance. Its purpose is to make the entrance visible.

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