Journal of High Energy Physics, Gravitation and Cosmology, 2026, 12(4), 2025-2041
https://www.scirp.org/journal/jhepgc
ISSN Online: 2380-4335
ISSN Print: 2380-4327

Consciousness as Resonant Structured Information: A Classical Field Hypothesis with a Phenomenological 64-State Model

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How to cite this paper: Butto, N. (2026) Consciousness as Resonant Structured Information: A Classical Field Hypothesis with a Phenomenological 64-State Model. *Journal of High Energy Physics, Gravitation and Cosmology*, **12**, 2025-2041.
https://doi.org/10.4236/jhepgc.2026.124100

Received: March 25, 2026
Accepted: August 30, 2026
Published: September 2, 2026

Abstract

The explanatory gap between neural information processing and subjective experience remains unresolved. This article presents the Field-Encoded Resonant Information Model (FERIM), a constrained and falsifiable hypothesis in which information is physically instantiated in the spatial, spectral, phase, polarity, and temporal organization of electric and magnetic fields. At the biological scale, all core predictions are formulated within classical electrodynamics: endogenous electromagnetic fields generated by charge and current dynamics are treated as measurable carriers of structured information and as possible contributors to recurrent organism-level integration. Quantum field theory is invoked only as the standard microscopic foundation of electromagnetism; the model predicts no specifically quantum informational effect unless a nonclassical observable is independently demonstrated. A bipolar-vortex-inspired six-mode architecture is retained only as a phenomenological latent-state compression. If six effective modes are empirically identified and each is bistable, the resulting classical configuration space contains $2^6 = 64$ states. This number is neither a physical necessity nor evidence for consciousness; the six-mode model must outperform alternative model sizes prospectively. Resonant coupling is represented by a calibrated, normalized index combining spatial overlap, spectral matching, phase locking, and field orientation. Self-related causal closure is operationalized through bidirectional, state-dependent information transfer between field patterns and organismal variables such as memory, valuation, autonomic regulation, report, and action. The framework specifies staged experiments, model-comparison procedures, pilot-derived smallest effects of interest, and explicit rejection criteria. FERIM should therefore be evaluated by predictive performance and causal intervention, not by the ontological provenance of the 64-state architecture.

Keywords

Consciousness, Information, Magnetic Field, Electromagnetic Field, Resonance, Coherence, Classical Field Theory, Self-Related Causal Closure, Phenomenological Model, 64-State Architecture

1. Introduction

Modern neuroscience has identified reproducible correlates of conscious level and content, including recurrent processing, global availability, causal integration, and state-dependent oscillatory coordination [1]-[7]. These findings explain important functional properties of consciousness but do not, by themselves, establish whether a distributed physical variable contributes causally to the unity and availability of conscious content. FERIM does not claim to derive subjective experience from first principles. Its narrower objective is to formulate a testable physical-organizational bridge between field-encoded information, mode-selective coupling, recurrent biological integration, and conscious access.

The central premise is that information is abstract at the descriptive level but physically instantiated whenever it has causal consequences. In a living nervous system, charge separation, ionic current, membrane voltage, dendritic geometry, synaptic activity, and coordinated cellular currents generate electric and magnetic fields. Distinguishable organismal states may therefore be represented not only by firing rates or connectivity but also by the geometry, spectrum, phase structure, polarization, and temporal correlations of those fields. The information is not an extra substance hidden inside the field; it is the distinguishable organization of the field itself [8]-[11].

FERIM makes four claims of increasing specificity. First, endogenous electromagnetic fields contain decodable information about neural and bodily states. Second, frequency-, phase-, geometry-, and polarity-dependent field-matter coupling may contribute causally to selective integration. Third, conscious access requires not only field encoding and resonance but recurrent global availability and self-related causal closure. Fourth, a six-mode, bipolar-inspired state space may provide a useful phenomenological compression of some field dynamics. The first three claims define the core theory. The fourth is optional and must survive direct comparison with alternative reduced-order models.

This revision responds to six persistent concerns. The bipolar topology is explicitly demoted from physical foundation to phenomenological hypothesis generator; Hilbert-space notation is removed from the classical core; the resonance index is justified as a serial transfer-efficiency approximation and empirically calibrated; self-related causal closure is assigned measurable proxies; rejection thresholds are derived from pilot reliability, power analysis, and a preregistered smallest effect size of interest; and quantum field theory is restricted to background ontology unless nonclassical evidence is obtained.

2. Scope, Ontology, and Core Definitions

2.1. Information Is Physically Instantiated in Field Organization

Shannon information quantifies distinctions and uncertainty but does not specify semantic meaning, conscious experience, or a carrier [8]. Landauer's principle and subsequent work in information physics emphasize that information processing is implemented through physical states and transformations [9]-[11]. FERIM therefore adopts a carrier-dependent ontology: an informational pattern can influence a biological system only insofar as it is instantiated in matter, energy, boundary conditions, or a measurable field variable.

For the core hypothesis, the relevant field variables are the electric field $E(r,t)$ and magnetic flux density $B(r,t)$, generated by charge density $\rho(r,t)$ and current density $J(r,t)$. Their source dependence is summarized by the relevant Maxwell relations

$$\nabla \cdot E = \rho / \varepsilon_0, \quad \nabla \times B = \mu_0 J + \mu_0 \varepsilon_0 \, \partial E / \partial t. \tag{1}$$

Equation (1) does not imply that the field is independent of the tissue that generates it. FERIM treats tissue and field as a coupled physical system. The empirical question is whether field-level variables contribute explanatory or causal information beyond simpler descriptions based only on local activity, synaptic connectivity, or total power.

2.2. Classical Electromagnetic Core and Quantum-Field Background

All core equations, predictions, and experimental designs in FERIM treat endogenous electromagnetic fields classically, as is standard in electrophysiology, magnetoencephalography, and neural field modeling. Quantum field theory supplies the microscopic foundation of electromagnetism, but this fact alone does not imply quantum computation, long-lived neural entanglement, vacuum-mediated cognition, or a nonlocal consciousness field. In the core model, information is said to be present in a magnetic or electromagnetic field when distinct source or organismal states produce distinguishable, decodable field configurations.

A fully microscopic description of the same electromagnetic configuration would ultimately be a state of the quantized electromagnetic field. FERIM uses this statement only as ontological continuity between classical and quantum descriptions. No quantum informational contribution is predicted unless a nonclassical observable—such as an experimentally validated coherence time, squeezing, entanglement witness, or contextual statistic—survives appropriate controls and improves prediction beyond a classical open-system model. The rapid-decoherence objection and proposed protected degrees of freedom remain empirical questions, not assumptions of the present model [12] [13].

2.3. Operational Definition of Consciousness

Within FERIM, a conscious content is operationally defined as a temporally continuous, differentiated, and globally available organism-level state in which a selected field-encoded informational pattern participates in recurrent causal interaction with sensory models, memory, valuation, bodily regulation, report, and action selection. Four components are necessary: physical encoding, selective coupling, recurrent global integration, and self-related causal closure.

This definition does not equate consciousness with information, electromagnetic fields, resonance, or integration alone. A radio receiver may encode and selectively amplify information without being conscious. FERIM adds the requirement that the selected pattern enters a bounded, self-maintaining system in which the pattern changes the future state of the same organism through memory-dependent interpretation, valuation, autonomic regulation, or action, and is in turn modified by those organismal variables.

3. Phenomenological Six-Mode Compression

3.1. Status and Epistemic Role of the Topology

The bipolar vortex topology is not presented as an established consequence of the Standard Model, classical electrodynamics, or a completed theory of neural fields. Pattern-forming systems can display low-dimensional modes, symmetry breaking, multistability, and reduced-order dynamics, but these general facts do not uniquely derive six modes or two triplets [14]. Earlier publications by the author proposed a three-vortex unit and a complementary bipolar organization [15]-[17]. In the present article, those papers establish only the historical provenance of the hypothesis; they are not treated as independent validation of the topology.

The six-mode architecture is therefore defined as a phenomenological latent-state model inspired by bipolar organization. Its value lies solely in predictive compression: it must summarize measured field dynamics, generalize to held-out observations, and outperform alternative models with comparable complexity. The model has no privileged ontological status merely because it yields 64 configurations. If four, five, seven, eight, or a continuous latent model performs better, the six-mode architecture must be revised or abandoned.

A vortex is used here only in the broad dynamical-systems sense of a mode with circulation, phase winding, or rotational flux. FERIM does not assert that neural tissue contains the elementary-particle vortices proposed in earlier work. Any future physical derivation would require explicit field equations, boundary conditions, stability analysis, energy scales, and a demonstration that a six-mode bipolar manifold emerges over biologically relevant timescales.

3.2. Phenomenological Bistability

Let q_i denote the signed amplitude or orientation of the i-th empirically identified effective mode. Near a symmetry-breaking bifurcation, a double-well Landau potential can represent bistability phenomenologically

$$V_i(q_i) = -(a_i/2)q_i^2 + (b_i/4)q_i^4, \quad a_i > 0, b_i > 0 \tag{2}$$

The stable minima occur at $q_i = \pm\sqrt{a_i/b_i}$. When within-well fluctuations are small relative to the barrier and the dwell time exceeds the measurement window, the continuous variable may be coarse-grained as

$$\sigma_i = \operatorname{sign}(q_i) \in \{-1, +1\} \tag{3}$$

Equations (2) and (3) demonstrate mathematical sufficiency, not physical necessity. The bistable description is acceptable only if candidate modes show reproducible bimodality, transition dynamics, dwell-time stability, and out-of-sample predictive value. Otherwise, a continuous-state or multistate representation should be used.

3.3. Conditional 64-State Architecture

If six effective modes are identified and each is adequately represented as bistable, the classical configuration space is

$$\Omega_6 = \{-1, +1\}^6, |\Omega_6| = 2^6 = 64 \tag{4}$$

The number 64 is therefore contingent on two empirically vulnerable modeling choices: six modes and binary coarse-graining. It is not evidence for consciousness, a universal code, or an embryological event. The architecture is a candidate data-compression scheme.

For a bipolar partition $A = (1, 2, 3)$ and $B = (4, 5, 6)$, the total polarity is

$$P = \sum_{i=1}^{6} \sigma_i \in \{-6, -4, -2, 0, +2, +4, +6\} \tag{5}$$

The two triplet polarities are

$$P_A = \sigma_1 + \sigma_2 + \sigma_3,\ \ P_B = \sigma_4 + \sigma_5 + \sigma_6,\ \ P_A, P_B \in \{-3, -1, +1, +3\} \tag{6}$$

Equation (5) yields seven polarity sectors with degeneracies 1, 6, 15, 20, 15, 6, and 1; Equation (6) yields sixteen ordered inter-pole classes. These partitions are prospective statistical hypotheses. They must be specified before outcome inspection and compared with matched-complexity random partitions, smooth latent manifolds, hidden Markov models with different state counts, and continuous dynamical models.

3.4. Classical Interpretation Only

The core architecture is entirely classical: the system occupies one effective configuration or a probability distribution over configurations. Hilbert-space notation is deliberately omitted because it adds no empirical content to the present theory and may incorrectly suggest six physical qubits. Quantum formalism belongs only to a future extension if nonclassical observables are directly demonstrated. Until then, all state estimation, transition modeling, and causal predictions must be formulated with classical stochastic dynamics.

4. Field Encoding of Information

4.1. Endogenous Electromagnetic Fields as the Accessible Carrier

Neural and non-neural tissues generate endogenous electric and magnetic fields through transmembrane currents, synaptic currents, action potentials, volume conduction, and coordinated charge movement. Electroencephalography and local field potentials sample the electric consequences of these processes; magnetoencephalography and optically pumped magnetometry sample magnetic consequences. Electromagnetic field theories of consciousness ask whether reciprocal field-matter coupling contributes to integration rather than merely correlating with it [18]-[21].

FERIM's claim is narrower than the statement that the electromagnetic field is consciousness. The field is proposed as a physically distributed medium in which information about coordinated neural and bodily states is encoded. Conscious manifestation, in turn, depends on how field organization interacts with recurrent neural and organismal dynamics. Neither field nor tissue is declared sufficient in isolation.

4.2. Mode Representation and Decodability

A measured electric or magnetic field may be represented by a finite mode decomposition

$$F(r,t)=\sum_a c_a(t)B_a(r)\mathrm{e}^{-i\omega_a t}+\eta(r,t),\quad F\in\{E,B\} \tag{7}$$

Here, $B_a(r)$ is a normalized spatial mode, $c_a(t)$ is a time-dependent coefficient, ω_a is a characteristic angular frequency, and $\eta(r,t)$ denotes noise and unmodeled activity. The notation $B_a(r)$ denotes a basis pattern and should not be confused with magnetic flux density $B(r,t)$. In applications, an alternative symbol may be used to prevent ambiguity.

A field carries information about source condition A only when field features permit reliable discrimination among source states. The relevant quantity is therefore not field intensity alone but decodable statistical dependence, which may be quantified by mutual information

$$I(A;F)=\sum_{a,f}p(a,f)\ln\left[p(a,f)/\left(p(a)p(f)\right)\right] \tag{8}$$

Equation (8) must be estimated with bias correction, cross-validation, and surrogate or permutation controls. If proposed informational states cannot be decoded from the field beyond artifacts, common inputs, and simpler neural variables, the claim that the field carries those distinctions is unsupported.

5. Resonant Selection and Empirical Calibration

5.1. Resonance as Mode-Dependent Susceptibility

Resonance is defined as a selective change in receiver response when spectral, spatial, phase, or polarity characteristics of a field pattern match the receiver's dynamical susceptibility. It is not a synonym for harmony, similarity, or unexplained correlation. In the first-order model, four normalized compatibility terms are defined.

Spatial overlap is

$$\Lambda_a S = \left| \int X * S(r) \cdot B_a(r) \mathrm{d}^3 r \right|^2 \Big/ \left(\|X_S\|^2 \|B_a\|^2 \right),\ 0 \le \Lambda_a S \le 1 \tag{9}$$

Spectral matching is approximated by a Lorentzian susceptibility

$$L_a S = \gamma_S^2 \Big/ \left[\left(\omega_S - \omega_a \right)^2 + \gamma_S^2 \right],\ 0 \le L_a S \le 1 \tag{10}$$

Phase locking is

$$C_a S = \left| \left\langle \exp\left\{ i\left[\varphi_S(t) - \varphi_a(t) \right] \right\} \right\rangle_t \right|,\ 0 \le C_a S \le 1 \tag{11}$$

Polarity or vector-orientation matching is

$$M_a S = \left[1 + \cos\left(\theta_a S \right) \right] \big/ 2,\ 0 \le M_a S \le 1 \tag{12}$$

5.2. Justification of the Composite Resonance Index

The original unweighted product was heuristic. FERIM now treats the composite index as a separable, serial transfer-efficiency approximation. If spatial access, spectral susceptibility, phase compatibility, and orientation compatibility act as approximately independent gates through which a signal must pass, the total transmitted fraction is the product of the component efficiencies. To preserve normalization while allowing unequal contributions, the proposed index is a weighted geometric mean

$$\begin{aligned} R_a S = \exp\left[w\Lambda \ln\left(\Lambda_a S \right) \right] + wL \ln\left(L_a S \right) + wC \ln\left(C_a S \right) \\ + wM \ln\left(M_a S \right),\ w\Lambda + wL + wC + wM = 1 \end{aligned} \tag{13}$$

Equation (13) is the logarithmic form of a weighted geometric mean and is dimensionless and bounded between 0 and 1; if any required gate is zero, R_aS is defined as zero. It is neither a probability nor an energy. Equal weights define the preregistered null version. The weights may subsequently be estimated on a training dataset under nonnegativity and sum-to-one constraints, then fixed before evaluation on held-out data. The multiplicative form is rejected if additive, interaction-rich, or mechanistic transfer-function models generalize better.

5.3. Measurement and Calibration

The spatial patterns $B_a(r)$ and receiver modes $X_S(r)$ can be estimated from source-localized EEG/MEG, intracranial recordings, optically pumped magnetometers, or anatomically constrained electromagnetic models. Frequencies and damping widths are estimated by spectral fitting; phase locking is estimated with bias-corrected circular statistics; and orientation matching is calculated from measured or modeled field vectors. Because inverse solutions are uncertain, confidence intervals should propagate source-localization and model uncertainty.

For a continuous response Y—such as decoding accuracy, perturbational complexity, autonomic change, behavioral performance, or report probability—the incremental contribution of resonance can be estimated by a preregistered nested model

$$Y = \beta_0 + \beta_R R_a S + \beta_P \,\text{Power} + \beta_D \,\text{Distance} + \beta_N \,\text{NeuralCovariates} + \varepsilon \tag{14}$$

The core resonance claim is supported only if β_R is stable across resampling, improves held-out prediction, and remains non-negligible after matched-energy, sensory, connectivity, and artifact controls. A fitted association alone is insufficient; at least one matching variable must also be manipulated causally while other variables are held constant.

6. Self-Related Causal Closure

6.1. Conceptual Definition

Self-related causal closure is the requirement that a selected field-network pattern both influences and is influenced by variables that define the future state of the same bounded organism. These variables include memory state, predictive context, valuation, autonomic regulation, action readiness, overt behavior, and subjective report. The term closure does not imply thermodynamic isolation or complete causal independence from the environment. It denotes a recurrent causal loop in which information is evaluated relative to the organism's own prior state, boundaries, needs, and possible actions.

This criterion distinguishes organism-level conscious processing from passive detection. A field pattern is self-related when its effect on future behavior or regulation depends on the organism's prior memory, goals, interoceptive condition, or learned model, and when those self-state variables feed back to modify the subsequent field pattern.

6.2. Operational Proxy

Let F_t denote a multivariate field-state representation, and X_t denote a vector of self-related organismal variables, including memory, valuation, autonomic state, action readiness, and report. Let U_t contain measured external inputs and nuisance variables. Directional information transfer can be estimated using normalized conditional mutual information, closely related to transfer entropy [22]. Field-to-self transfer is

$$\tilde{T}_{F\to X}(\Delta) = I\left(F_t; X_{t+\Delta} \mid X_t, U_t\right) / H\left(X_{t+\Delta} \mid X_t, U_t\right) \tag{15}$$

Self-to-field transfer is

$$\tilde{T}_{X\to F}(\Delta) = I\left(X_t; F_{t+\Delta} \mid F_t, U_t\right) / H\left(F_{t+\Delta} \mid F_t, U_t\right) \tag{16}$$

A normalized Self-Related Closure Index is then defined as the geometric mean of the two directed terms

$$\mathrm{SRCI}(\Delta) = \sqrt{\left[\tilde{T}_{F\to X}(\Delta)\tilde{T}_{X\to F}(\Delta)\right]},\quad 0 \le \mathrm{SRCI} \le 1 \tag{17}$$

Equation (17) operationalizes reciprocal dependence without claiming that transfer entropy alone establishes mechanistic causality. Estimation should use state-space or nonlinear models, time-reversed and phase-randomized surrogates, common-driver controls, and perturbations that selectively alter F_t or X_t. An alternative confirmatory implementation may use cross-validated Granger-causal prediction, dynamic causal modeling, or intervention-based mediation, provided the directionality criterion is retained.

6.3. Linking Closure to Conscious Access

Conscious access C may be modeled as a binary or graded outcome predicted jointly by field decodability D_F, resonance R, global integration G, and self-related closure

$$\text{logit}\,\Pr(C=1)=\beta_0+\beta_D D_F+\beta_R R+\beta_G G+\beta_S\,\text{SRCI}+\beta_Z Z \tag{18}$$

Here, Z denotes preregistered covariates such as arousal, task difficulty, stimulus strength, motor preparation, and baseline performance. FERIM predicts that the full model should generalize better than models containing activation, total power, or connectivity alone. Perturbational complexity and related measures of jointly integrated and differentiated activity provide useful benchmarks for G but are not identified with consciousness by definition [23].

7. From Field-Encoded Information to Conscious Manifestation

7.1. Necessary but Not Sufficient Conditions

Field encoding and resonance are necessary components of FERIM but are not sufficient for consciousness. Many nonconscious systems encode and selectively respond to information. Conscious manifestation additionally requires differentiated global availability, recurrent stabilization, temporal continuity, and measurable self-related causal closure. A candidate content becomes conscious when its field-network pattern is available to multiple systems—including perception, working memory, valuation, autonomic regulation, report, and action—and these systems recurrently influence the pattern that selected them.

7.2. Unity and Differentiation

A distributed field offers a candidate physical medium for unity because it is defined over an extended spatial domain, whereas a modal structure preserves differentiation. Unity must not be equated with maximal synchrony: pathological hypersynchrony reduces informational diversity. The relevant regime is metastable coherence—transient coordination among selected modes while alternatives remain differentiated [24]-[27]. FERIM predicts that conscious content will be associated with field patterns that jointly show decodability, controlled causal efficacy, global integration, and self-related closure, rather than merely high amplitude or global phase locking.

7.3. Explanatory Scope

FERIM explains how physically instantiated information might be selected, distributed, recurrently stabilized, and made causally available to a living system. It does not derive qualia from field equations and does not claim that SRCI logically entails subjective experience. The hard problem remains [28]. The model's contribution is empirical: it identifies field organization, resonance compatibility, and reciprocal organism-level closure as variables that can be compared with activation-only, connectivity-only, integrated-information, and computational accounts.

8. Relation to Existing Theories and Critical Objections

8.1. Global Neuronal Workspace and Recurrent Processing

Global workspace and recurrent-processing approaches explain conscious access through widespread availability and recurrent cortical interaction [1]-[3]. FERIM is compatible with these functions but adds a proposed biophysical implementation: field-compatibility variables may influence which distributed populations become effectively coupled. The differential prediction is that field geometry, phase, and susceptibility improve the prediction of access and report after controlling for firing rate, synaptic connectivity, and stimulus strength.

8.2. Integrated Information Theory

Integrated Information Theory emphasizes irreducible causal structure [4] [5]. FERIM does not identify consciousness with a single scalar and does not infer consciousness from integration alone. It predicts that effective causal integration may depend partly on the field modes through which distributed elements interact. The models can be compared by testing whether field variables and SRCI explain conscious distinctions beyond measures of effective connectivity or integrated information.

8.3. Predictive Processing

Predictive processing describes perception as hierarchical inference with precision weighting [29]. FERIM can interpret resonance as one possible biophysical implementation of precision: phase and frequency matching regulate gain and determine which priors or prediction errors influence global dynamics. This conservative interpretation requires no external or nonlocal information field.

8.4. Electromagnetic Field Theories

Electromagnetic field theories propose that endogenous fields contribute to conscious integration or causation [18]-[21]. Their principal challenges are epiphenomenality, weak coupling, insufficient specificity, and difficulty separating fields from the currents that generate them. FERIM addresses these objections by requiring reciprocal perturbation, source-state decoding, matched-energy controls, explicit neural covariates, and held-out model comparison. Correlation between EEG/MEG and conscious state is not sufficient.

8.5. Quantum Approaches and Decoherence

Quantum theories seek a nonclassical basis for unity or state selection [30]. FERIM neither assumes nor excludes such a contribution. The classical electromagnetic model is the default because macroscopic neural signals are ordinarily well described by classical open-system dynamics and because rapid decoherence is a serious constraint [12] [13]. Quantum formalism becomes relevant only if a reproducible nonclassical observable changes a biological prediction. Standard quantum field theory as the microscopic substrate of electromagnetism does not, by itself, count as such evidence.

8.6. Functionalist, Eliminativist, and Panpsychist Objections

A functionalist may argue that field variables merely redescribe computation. FERIM accepts this as a genuine falsification risk: the model earns independent status only if field-level variables make causal or predictive contributions not reducible to computational state, connectivity, or current source density. Eliminativist and illusionist accounts may deny that a separate phenomenal mechanism is required [31] [32]. FERIM does not refute those positions conceptually; it asks whether current functional accounts omit a field-level causal variable. The model is not panpsychist: field-encoded information is widespread, but consciousness is attributed only to systems satisfying the additional integration and self-related closure criteria.

9. Experimental Program and Statistical Decision Rules

9.1. Staged Research Program

Field encoding: determine whether conscious or cognitive conditions are decodable from electric and magnetic field configurations beyond total power and conventional neural summaries.

Resonance calibration: manipulate frequency, phase, geometry, or polarity one factor at a time under matched-energy and active-sham conditions; estimate the weights in Equation (13) on training data and test them on held-out data.

Self-related closure: measure bidirectional field-organism information transfer using Equation (17), then perturb memory, valuation, autonomic state, or field configuration to test directionality.

Phenomenological architecture: compare the six-mode binary model with continuous latent models and alternative state counts using preregistered out-of-sample criteria.

Quantum necessity: only after classical models are exhausted, test a specified nonclassical observable with loophole controls and determine whether it contributes independent predictive value.

9.2. Pilot Calibration, Power, and Smallest Effect Size of Interest

The earlier fixed thresholds were useful as examples but lacked theoretical or empirical justification. In the revised framework, numerical rejection boundaries are not universal constants. An exploratory pilot phase first estimates measurement reliability, within-participant variability, source-localization uncertainty, artifact rates, and the response range obtainable without nonspecific sensory or thermal effects. These quantities define a smallest effect size of interest (SESOI) based on measurement resolution and the minimum change considered biologically or behaviorally meaningful. The SESOI, analysis model, and stopping rule are then preregistered before confirmatory data collection.

Confirmatory sample size should be chosen to provide adequate power for detecting the SESOI and for equivalence testing. Absence claims should rely on confidence intervals or two one-sided equivalence tests rather than nonsignificant null-hypothesis tests [33]. Thresholds may differ across platforms, but they must be fixed before unblinding and justified from pilot data, theory, or instrument sensitivity—not chosen after observing the result.

Claim	Core Manipulation and Measurement	Supportive Result	Prespecified Rejection Rule
Field encoding	Decode randomized or naturally occurring conscious conditions from source-resolved E/B field features; compare with equal-complexity neural baselines.	Field features add stable held-out information beyond power, current-source summaries, and artifacts.	Reject the independent encoding claim when the incremental effect is statistically equivalent to zero within the preregistered SESOI and fails external replication.
Spectral selectivity	Vary frequency across matched and detuned conditions at constant waveform energy and comparable peripheral sensation.	A reproducible response curve follows the estimated susceptibility in Equation (10), and Equation (13) improves held-out prediction.	Reject the spectral component when the matched-detuned contrast is contained within the equivalence bounds and the resonance model does not outperform power-only models.
Phase dependence	Change relative phase while preserving frequency, geometry, and energy; use active sham and artifact removal.	Phase-specific changes in decoding, integration, behavior, or report replicate across datasets.	Reject the phase component when the circular effect is equivalent to zero within the SESOI and adds no held-out predictive value.
Spatial/orientation matching	Rotate field geometry or polarity while matching exposure, distance, and sensory conditions.	Responses follow the preregistered ordering predicted by Equations (9) and (12).	Reject the geometric component when the predicted ordering is absent, and an equal-complexity null or alternative model is favored prospectively.
Self-related closure	Measure and perturb reciprocal field-memory/valuation/autonomic/action loops; estimate Equation (17) with common-driver controls.	SRCI increases for conscious access and predicts future self-related behavior beyond stimulus and baseline state.	Reject the closure component when both directed terms are equivalent to zero or when effects disappear under intervention and surrogate controls.
Six-mode compression	Fit binary latent models with different mode counts and continuous alternatives to field-state transitions.	The six-mode model generalizes better with stable modes, bimodality, and interpretable transitions.	Reject the 64-state architecture when it fails to outperform matched-complexity alternatives in at least two independent datasets.
Quantum necessity	Measure a prespecified nonclassical observable in a candidate biological degree of freedom and compare classical versus quantum models.	A replicated nonclassical signature predicts biological or conscious variables beyond classical open-system models.	Retain the classical model when no nonclassical signature survives controls or when it adds no prospective explanatory value.

9.3. Measurement Platforms and Controls

Candidate platforms include simultaneous high-density EEG and MEG, optically pumped magnetometers, intracranial EEG when clinically available, transcranial alternating-current or magnetic stimulation with active sham, closed-loop phase-targeted stimulation, organotypic neural cultures, and anatomically constrained electromagnetic simulations. Magnetic measurements are especially relevant because they provide complementary access to current-generated field geometry, although inverse-problem uncertainty and sensor cross-talk must be quantified.

All primary hypotheses should be preregistered. Frequency, phase, orientation, state partitions, preprocessing, artifact rejection, nuisance variables, outcome measures, SESOI, and exclusion rules must be specified before unblinding. Analyses should include permutation tests, surrogate time series, sensitivity to preprocessing, uncertainty propagation, multiple-comparison control, and independent replication. The six-mode model must be compared with alternatives having the same effective flexibility.

10. Conditional Quantum-Field Extension

The core theory is classical. The statement that electromagnetic fields are, at the microscopic level, states of the quantized electromagnetic field is standard physical background and does not add a new prediction. FERIM therefore makes no core claim about vacuum fluctuations, entanglement, superposition, tunneling, or macroscopic quantum coherence in the brain. It also does not imply that information stored in a classical magnetic field has a special quantum-conscious character.

A quantum extension would require three elements: a specified biological degree of freedom; a measured nonclassical observable with a coherence time and coupling scale compatible with the biological process; and a prospective prediction that cannot be reproduced by a classical stochastic model. Only then would density operators, Hilbert spaces, or quantum information bounds become scientifically necessary. Until such evidence exists, classical electrodynamics and open-system noise models are the appropriate language for every test proposed in this article.

11. Speculative Extension beyond a Single Organism

The possibility that structured information might correlate across separated organisms is not part of the core model. Known channels—sensory exchange, electromagnetic leakage, vibration, chemical signals, shared timing, experimenter effects, and common environmental drivers—must be measured and controlled before an unknown mechanism is considered. Quantum entanglement cannot be invoked generically because it requires a specified preparation and measurement protocol and does not enable controllable superluminal information transfer.

Any future extension would need to identify a field, source equation, propagation law, coupling operator, expected range, shielding response, and coupling strength. Until such a model exists, the scientifically responsible position is agnosticism. Failure to observe separated-system effects would not refute the classical intra-organism FERIM model; a reproducible effect under rigorous controls would motivate a separate theory.

12. Limitations, Acceptance Criteria, and Conclusion

12.1. Limitations

1) The six-mode bipolar architecture is phenomenological and has not been derived from accepted fundamental physics or from a validated neural field equation.

2) The 64-state space may be mathematically coherent yet biologically irrelevant; it must outperform alternative state counts and continuous models prospectively.

3) Endogenous electromagnetic fields are unquestionably present, but their causal contribution to consciousness beyond the neural currents that generate them remains unproven.

4) The weighted geometric resonance index is a normalized operational scaffold, not a fundamental interaction law. Its weights and functional form require calibration and model comparison.

5) SRCI is a measurable proxy for reciprocal self-related dynamics, not a derivation of subjectivity. Transfer entropy and related measures remain vulnerable to hidden common causes and model misspecification.

6) The model does not derive qualia or explain why integrated self-related dynamics feel like anything from the first-person perspective.

7) All core predictions are classical. Quantum-field language should not be interpreted as evidence for macroscopic neural quantum coherence or a universal consciousness field.

8) Field and current-source variables are tightly coupled, making causal separation technically difficult and requiring perturbation, modeling, and convergent measurements.

9) No embryological cell-number correspondence is used as evidence or prediction.

10) Carrier-independent or nonlocal consciousness claims are excluded from the core model because no plausible mechanism or coupling scale is established.

12.2. Criteria for Provisional Support or Rejection

FERIM should receive provisional support only if four findings converge: field configurations contain reproducible and decodable information about conscious content; matched resonance variables causally modulate conscious access or integration under energy- and sensation-matched controls; self-related reciprocal information transfer predicts organism-specific future states; and the phenomenological six-mode architecture generalizes better than equally flexible alternatives. No single correlation is sufficient.

The core model should be revised or rejected if field variables add no prospective information beyond neural currents, connectivity, and conventional dynamics; if perturbations designed to alter field compatibility produce no effect within adequately powered equivalence bounds; if SRCI fails intervention and common-cause controls; or if the six-mode architecture does not outperform alternative representations. The quantum extension is unnecessary unless a replicated non-classical observable adds explanatory power beyond classical models.

12.3. Conclusions

FERIM proposes that information relevant to consciousness is physically present as an organized field structure rather than as an abstract code detached from matter. At the experimentally accessible biological level, the principal candidate carrier is the endogenous electric and magnetic field generated by the organism's own charge and current dynamics. Information resides in distinguishable field geometry, frequency spectrum, phase relations, polarity, and temporal correlations. A complete microscopic account of electromagnetism is quantum-field-theoretic, but this fact alone does not establish a quantum theory of consciousness; every core prediction in FERIM remains classical unless a nonclassical contribution is directly measured.

The bipolar six-mode architecture is retained only as a phenomenological compression and hypothesis generator. It does not derive consciousness, and the number 64 has no evidential privilege. Its scientific value depends on whether six bistable modes can be identified and whether the resulting state space predicts field transitions and conscious variables better than competing models. Conscious manifestation is proposed to require field encoding, calibrated resonance, global integration, temporal continuity, and self-related causal closure.

The central empirical question is therefore precise: does the organization of endogenous magnetic and electromagnetic fields contain and causally transmit information that contributes to conscious integration beyond what is explained by conventional neural variables alone? The model should be judged by preregistered prediction, causal perturbation, equivalence testing, model comparison, and independent replication—not by the intuitive appeal of resonance, vortices, or the number 64.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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