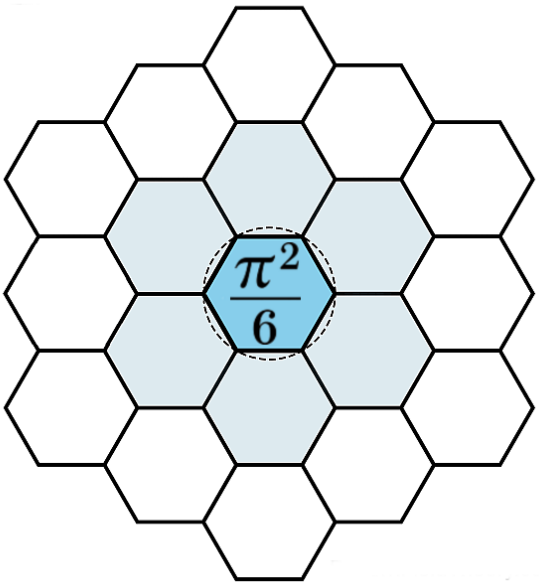
Pattern Field Theory
Ontological Foundations and Coherent Identity

Expanded Depth Series: Paper 1

James Johan Sebastian Allen
PatternFieldTheory.com

January 6, 2026



Abstract

Pattern Field Theory (PFT) is a structural framework proposing that physical reality is grounded not in particles or probabilistic primitives, but in coherent identity sustained within patterned fields. This paper establishes the ontological foundations of PFT by replacing particle-based ontology with coherence-based identity and by introducing *coherons* as the fundamental stable entities of physical description. Identity is treated as a structural invariant defined in model space, prior to observation and independent of measurement formalism.

The framework is geometry-first and structure-driven, emphasizing internal expansion and increasing depth rather than external extension or global boundary conditions. Quantum phenomena such as interference, stability, and apparent particle behavior are treated as consequences of coherence alignment rather than wave–particle duality. The paper situates PFT within the broader landscape of unification attempts, including lattice-based approaches and exceptional mathematical structures such as the E8 lattice, while maintaining a distinct prime-indexed and depth-oriented construction.

This document is written to be instructional and as stand-alone as possible. Subsequent papers in the Expanded Depth Series increase depth and specificity while preserving the original axioms and direction of Pattern Field Theory.

1 Series Lead-In

This paper is the first in the **Expanded Depth Series** of Pattern Field Theory. It establishes the ontological and definitional ground upon which subsequent papers develop structural mathematics, stability mechanics, chemical identity, and interaction dynamics. Each paper in the series is written to be as stand-alone as possible, while also forming a coherent instructional corpus when read sequentially.

2 Expanded Acronyms and Notation

- **PFT** — Pattern Field Theory
- AOL — Allen Orbital Lattice
- PAL — Phase Alignment Lock
- $\mathbb{Z}[\omega]$ — Eisenstein integers, with ω a primitive cube root of unity
- **Model Space** — the formal structural space in which identities are defined
- **Observed Space** — the domain of empirical appearance and measurement
- **Depth** — internal structural differentiation without external scale extension

Symbols and notation are introduced explicitly at first use and reiterated in the Glossary.

3 Orientation and Scope

This paper is a foundational document. It does not assume prior knowledge of Pattern Field Theory, nor does it rely on interpretive frameworks external to its own construction. The intent is not to reinterpret existing physical theories, but to replace their ontological primitives where those primitives are structurally insufficient.

Modern physics is divided between extraordinary predictive formalisms and unresolved ontological questions. Quantum mechanics predicts with precision while remaining conceptually unstable regarding identity, localization, and measurement. Classical mechanics offers clarity of objects and motion while failing at fundamental scales. Particle concepts persist largely by convention, despite incompatibility with interference, nonlocal correlation, and field-based dynamics.

The purpose of this paper is to establish a coherent alternative: a framework in which identity, stability, and interaction arise from structured fields and coherence relations rather than from point-like entities or probabilistic postulates.

Scope Boundary

This document restricts itself to ontology and identity. It does *not* derive chemical behavior, interaction laws, or cosmological dynamics. Those developments appear in later papers of the Expanded Depth Series. This restriction is intentional: ontological clarity must precede dynamics.

4 The Structural Failure of Particle Ontology

Particles occupy a privileged position in the historical development of physics. From classical mechanics through quantum field theory, they have served as assumed carriers of identity, mass, charge, and interaction. Yet at no stage have particles been successfully defined as coherent ontological primitives.

In classical mechanics, particles are idealized point entities with well-defined trajectories. This idealization fails in quantum mechanics, where localization, continuity of motion, and identity persistence cannot be simultaneously maintained under the same primitive assumptions. The introduction of wave–particle duality does not resolve this failure; it alternates between incompatible descriptions.

In quantum field theory, particles are reinterpreted as excitations of underlying fields. While this move improves mathematical consistency, it does not restore ontological clarity. Excitations are not persistent identities; they are context-dependent manifestations of field states. The particle concept remains as a convenient label rather than a structural necessity.

The persistence of particle language produces recurring conceptual pathologies:

- identity dependent on measurement context,
- collapse rules without structural mechanism,
- interference incompatible with point entities,
- nonlocal correlation without an ontological substrate.

These are not anomalies; they are consequences of adopting particles as primitives.

Pattern Field Theory rejects particles as fundamental and instead asks a prior question: *what must exist for identity to persist at all?*

5 Pattern and Field as Ontological Primitives

Pattern Field Theory adopts *pattern* and *field* as primitives. A pattern is not a mere visual regularity or statistical feature; it is a structural identity that persists under transformation within a constraint space. A field is not introduced as a background medium but as the minimal relational substrate required for patterns to exist, interact, and maintain coherence.

The primitive move in PFT is therefore:

1. replace point-entity ontology with pattern-identity ontology,
2. treat fields as the relational substrate of identity,
3. treat coherence as the stability condition of identity,
4. define measurement as an interaction between coherent identities.

This paper formalizes these primitives sufficiently to support later constructions, including the Allen Orbital Lattice (AOL), Phase Alignment Lock (PAL), and chemical identity recurrence.

6 Identity as a Structural Invariant

In PFT, identity is not created by observation. Identity is a structural invariant defined in model space. Observation is an interaction that can reveal, mask, or constrain identity, but cannot serve as its ontological source.

We therefore require a model-space notion of identity that:

- persists under interaction,
- admits stable equivalence classes,
- supports interference without duality,
- does not depend on classical trajectories.

The next section introduces coherence as the stabilizing principle enabling persistent identity without particle primitives, preparing the formal definition of coherons.

7 Model Space, Observed Space, and the Representation Map

Pattern Field Theory separates the *structural* domain in which identity is defined from the *observational* domain in which measurements occur.

Definition 1 (Model Space)**.** *Let $\mathcal{M}$ denote* model space*. $\mathcal{M}$ is the domain of structural identity in PFT, independent of any particular measurement apparatus. Objects in $\mathcal{M}$ are coherence-identities.*

Definition 2 (Observed Space)**.** *Let $\mathcal{O}$ denote* observed space*. $\mathcal{O}$ is the domain of empirical appearance: detector events, instrument readouts, and measurement records.*

Definition 3 (Representation Map)**.** *A measurement context induces a representation map*

$$\Pi_{\mathsf{ctx}} : \mathcal{M} \to \mathcal{O},$$

which maps a model-space identity to an observed-space appearance. In PFT, apparent "particle behavior" is a property of Π_{ctx} and boundary constraints, not an ontological primitive.

This separation is mandatory for ontological clarity: identity is defined in $\mathcal{M}$; observation is a context-dependent projection into $\mathcal{O}$.

8 Coherence as a Structural Quantity

PFT treats coherence as the stability condition for identity. To avoid metaphor, coherence is defined as a structural property of a field-state on a constraint graph.

Definition 4 (Coherence Field-State)**.** *Let $G = (V, E)$ be a constraint graph (later specialized to* AOL*). A field-state is a function*

$$\psi : V \to \mathbb{C}.$$

Definition 5 (Coherence Functional)**.** *Let* $\theta_v := \arg(\psi(v))$ *and let* $w_{uv} \geq 0$ *be edge weights. Define the coherence functional*

$$\mathcal{C}(\psi) := \sum_{(u,v)\in E} w_{uv} \cos(\theta_u - \theta_v).$$

High coherence corresponds to phase-aligned structural consistency across constraints.

Remark 1. *This is not a probability.* ψ *is used here as a compact representation of relational phase structure. Probability enters only when a particular* Π_{ctx} *is chosen and a specific empirical statistics model is imposed.*

9 The Coheron as a Coherence-Identity Mode

The coheron replaces particle primitives. It is defined as a stable duplex curvature identity on a constrained lattice.

Definition 6 (Constraint Operator)**.** *Let* $\mathcal{H} := \ell^2(V)$ *and define a constraint operator on* G *by*

$$(\mathsf{L}\psi)(v) := \sum_{u\sim v} w_{uv}(\psi(v) - \psi(u)),$$

a weighted graph Laplacian. This operator encodes structural coupling constraints.

Definition 7 (Coheron (formal))**.** *A* coheron *is a pair* $(\psi^+, \psi^-) \in \mathcal{H} \times \mathcal{H}$ *such that*

$$\mathsf{L}\psi^{\pm} = \lambda\, \psi^{\pm} \quad \textit{and} \quad \theta_v^+ - \theta_v^- \in \{0, \pi\} \quad \forall v \in V,$$

with additional stability constraints imposed by PAL *(introduced below). The pair structure is the* duplex *requirement: an identity mode with locked complementary phase structure.*

Remark 2. *This definition makes "electron" language unnecessary. Observed electron-like phenomena correspond to specific stable coheron modes under specific* Π_{ctx} *and boundary conditions.*

10 Phase Alignment Lock as a Stability Constraint

Definition 8 (PALneutrality (prototype))**.** *Let* (ψ^+, ψ^-) *be a coheron on* G*. Define the local duplex phase error at* v*:*

$$\varepsilon(v) := \min_{k\in\{0,\pi\}} \left|(\theta_v^+ - \theta_v^-) - k\right|.$$

We say the coheron satisfies PAL*neutrality if*

$$\sum_{v\in V} \varepsilon(v) \leq \delta$$

for a fixed tolerance δ *determined by basin load and constraint strength.*

Proposition 1 (Stability implies interference structure)**.** *If a coheron* (ψ^+, ψ^-) *satisfies* PAL*neutrality and maximizes* $\mathcal{C}(\psi^+)$ *subject to boundary constraints, then its observed projection under a slit-type* Π_{ctx} *admits spatially alternating reinforcement and cancellation regions (interference structure) without invoking wave–particle duality.*

Remark 3. *The proposition is structural: alternating reinforcement/cancellation arises from constrained phase alignment across paths in* G*, not from ontological switching between particle and wave descriptions.*

11 Depth Expansion as Internal Differentiation

PFT treats growth as internal expansion through increasing depth, not extension into an external metric.

Definition 9 (Depth index)**.** *Let $d \in \mathbb{N}$ denote the depth index of a model construction. Depth increases when the constraint structure is refined by internal differentiation:*

$$G_d \prec G_{d+1},$$

meaning G_{d+1} introduces additional internal constraint relations while preserving identity equivalence classes already defined at depth d.

Proposition 2 (Depth preserves direction)**.** *If identity is defined as an equivalence class under a constraint-invariant signature at depth d, and refinement $G_d \prec G_{d+1}$ preserves that signature mapping, then depth increase changes resolution without changing ontological direction.*

12 Context: Lattices, E8, and Structural Unification

PFT sits within a family of structure-first approaches to unification. Exceptional symmetry constructions (including E8 lattice and root system methods) demonstrate that deep algebraic structure can organize physical regularities. PFT differs by taking prime-indexed recurrence and basin-constrained identity on $\mathbb{Z}[\omega] \setminus \{0\}$ as primary, with coherons as the identity primitive and PALas the stability rule.

This contextual statement is not an appeal to authority. It is a placement of PFT among serious structural programs, with explicit points of difference.

13 Coherence as the Stability Principle

Coherence in PFT is structural alignment within field constraints. It is not introduced as a statistical correlation nor as a probabilistic amplitude by default. Instead, coherence is the condition under which a pattern maintains identity through interaction and transformation.

PFT treats interference as a direct signature of coherence relations in the field substrate. The apparent "wave" behavior is not a competing ontology but the observable footprint of coherent identity interacting with constraints. The apparent "particle" behavior is not a primitive object but a stable identity mode under specific boundary conditions.

This reframing prepares a formal replacement of the electron and other particle primitives by coherence-identity modes (coherons).

14 Coherons: Definition and Ontological Role

Definition 10 (Coheron (informal lead-in))**.** *A* coheron *is a stable duplex coherence-identity mode: a persistent structural identity sustained by coherence relations within a patterned field substrate.*

This paper refines the coheron definition into a formal object suitable for later derivation on the Allen Orbital Lattice (AOL). The essential ontological requirement is that coherons serve as:

- the carrier of identity in PFT,
- the replacement of particle primitives (including the electron),
- the stability unit for chemistry and interaction,
- the object mapped into observed space as "particle-like" phenomena.

A full construction of coherons on the AOL, including PALstability conditions, appears in later papers. Here, the coheron is established as the necessary ontological primitive once particle ontology is removed.

15 Glossary (Early Terms)

This glossary is expanded throughout the paper and finalized at the end.

Pattern Field Theory (PFT)
A structural framework in which identity and physical law arise from patterned fields, coherence, and internal depth expansion rather than particle primitives.

Coheron
A stable duplex coherence-identity mode; the fundamental persistent identity primitive of PFT, replacing particle ontology.

Allen Orbital Lattice (AOL)
The prime-indexed hexagonal lattice structure used in PFT to represent identity, recurrence, basin capacity, and structured coherence constraints.

Phase Alignment Lock (PAL)
The stability constraint governing coherent identity configurations; introduced conceptually here and formalized in later papers.

E8 lattice
A highly symmetric exceptional lattice associated with the E_8 root system; referenced here for context in unification attempts, not adopted as PFT's primary structure.

Internal Expansion / Depth
Growth through internal differentiation and increasing structural resolution without external metric extension.

Document Timestamp and Provenance

This document is part of Pattern Field Theory (PFT) and the Allen Orbital Lattice (AOL). It establishes foundational ontology and coheron identity primitives used by subsequent papers in the Expanded Depth Series.