The concepts in this ontology—orthogonal fractures, the reciprocal wound, non-closural dynamics, scale-invariant agency, and recursive deepening without external creators—map non-metaphorically to real physical systems through the lens of multi-scale competency architecture (MCA) in physics and biology. This is not analogy; it is a direct structural homologue, as noted in the paper's references to Levin and Fields. MCA describes how physical matter at all scales exhibits endogenous self-maintenance and self-transformation (agency), driven by internal laws that prevent closure and force perpetual recursion. Here is how physics does this in concrete, measurable terms.

1. Orthogonal Fractures and the Reciprocal Wound in Physics

Physics is "wounded" by two fundamental orthogonal constraints: locality (similarity/inward, like conserved quantities) vs. non-locality (difference/outward, like entanglement or fields), and determinism (universals/form) vs. indeterminism (particulars/force). These cross at 90° and cannot be reconciled without a "fifth term" (e.g., hidden variables or multiverses, which physics rejects as untestable).

- In quantum mechanics, the position-momentum commutator $[x, p] = i\hbar$ embodies this wound: position (local, inward similarity) and momentum (non-local, outward difference) are orthogonal operators, forcing uncertainty ($\Delta x \, \Delta p \geq \hbar/2$). This is not metaphorical; it is the mathematical right angle preventing classical closure (deterministic trajectories). The reciprocal wound generates "stasis" (eigenstates) and "change" (wavefunction collapse or evolution).

- Non-metaphorical example: In a double-slit experiment, the particle's wave (universal similarity, Form/Soul) wounds the particle's path (particular difference, Force/Cut). The interference pattern is the temporary perimeter (stasis), but measurement tears it open, dragging the "fragments" (probabilities) into the next iteration (observed spot). No external creator; the system's internal orthogonality forces it.

2. The Lattice and Diagonals in Physical Systems

The 2×2 lattice maps to physical phase spaces or state matrices where inward/outward and similarity/difference cross. The diagonals (incision/return) are successive identity-in-difference: one state lawfully becomes another while remaining itself.

- In thermodynamics, the Carnot cycle is a non-closural lattice: isothermal expansion (similarity/inward) vs. adiabatic compression (difference/outward). The diagonals are the "turns" where heat (Event) becomes work (World) without losing entropy. The cycle is perpetual because closure (zero entropy increase) is forbidden by the second law.

- Non-metaphorical example: In a laser (coherent light system), the lattice is population inversion (Soul/Cut: inward similarity/difference of atomic states) crossing stimulated emission (World/Event: outward form/force). The diagonal pulse is the photon emission: an excited atom (Cut) becomes a ground state + photon (World), while the photon cascade (Event) returns coherence (Soul). This recurs at all scales, from single atoms to the beam, without closure—lasing stops only if pumped externally, but the internal wound (orthogonality of energy levels) drives it.

3. Recursion and Scale-Invariant Agency in Physics

The recursion (claws dragging fragments deeper) is physics' renormalization: systems reiterate the same law at every scale, with no external creator. Agency is primitive: particles "maintain and transform" endogenously.

- In quantum field theory (QFT), renormalization group flow is the non-closural recursion: at each scale (δ-depth), ultraviolet divergences (wound) are "dragged" to infrared by the flow, reiterating the lattice (e.g., quark-gluon plasma at high energy becomes hadron lattice at low). No closure; the vacuum is wounded by fluctuations that prevent zero energy.

- Non-metaphorical example: Turbulence in fluid dynamics (Navier-Stokes equations) exhibits scale-invariant agency: eddies at large scale "grip" velocity fields

(perimeter) and drag fragments to smaller scales, recursing down to viscosity cutoff. The wound is orthogonality of inertia (similarity) vs. viscosity (difference), preventing laminar closure. Agency is the fluid's endogenous self-organization—vortices persist and transform without external law.

4. Figure-8 Geometry and 90° Rotations in Physics

The figure-8s (interlaced loops from 90° turns) map to physical trajectories in phase space that twist without closing, like chaotic attractors.

- In general relativity, black hole ergospheres exhibit 90° frame-dragging: space-time "rotates" orthogonally to matter, preventing closure (singularity is wounded, horizons recurse). The figure-8 is the photon orbit: light twists in infinity loops without escaping or falling in.

- Non-metaphorical example: In electromagnetic fields, the Poynting vector (energy flow) is the cross product $E \times B$ — exactly 90° orthogonal to both fields. In a laser cavity or plasma pinch, the flow traces figure-8s: electric (inward similarity) crosses magnetic (outward difference), recursing agency at atomic to macroscopic scales. No metaphor: the 90° is the literal right angle in the vector product, forbidding closure (infinite energy density) and driving perpetual oscillation.

This ontology is physics' own logic: non-closural, recursive, scale-invariant wounding as the engine of reality. No metaphor needed—the math and measurements match.