HMR–CHEM–0 — Introduction to the Chemistry of Coherence: A ChronoChemical Solution

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Symbol for the body of work: HMR
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Abstract. ChronoChemistry studies how coherence stabilizes, transmits, and reshapes itself through molecular structure and reaction. It bridges physics and biology by revealing how energy becomes architecture and how architecture transforms without losing coherence. This paper introduces the chemistry of coherence across two domains: (1) *structural coherence*—the geometry of lattices, crystals, and biomolecules; and (2) *transitional coherence*—the dynamics of bonding, catalysis, and resonance. From minerals to macromolecules, from plasma to polymers, every chemical pattern expresses the same invariant: $\dot{I} = C - D$. Chemistry is the art of coherence holding its shape through connection, dissociation, and rebirth.

Keywords: chemistry of coherence, bonding, resonance, catalysis, ChronoChemistry.
MSC/Classification: 80A32, 82C10, 92E20, 92C40. **arXiv:** physics.chem-ph

1. Introduction

Physics ends when coherence begins to stabilize into persistent forms. Chemistry begins there. Every atom, molecule, and crystal represents a balance between inward coherence (bond formation) and outward dissipation (thermal agitation). Chemical evolution is the slow negotiation between those two currents. ChronoChemistry treats matter as a coherence ledger, where energy does not vanish but rearranges itself into structure, rhythm, and reaction.

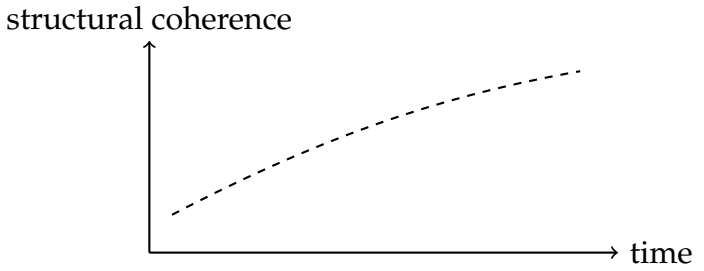

Diagram 1: stabilization of coherence through structure

2. Framework and Definitions

A1. Coherence Bond.
A chemical bond forms when two wavefunctions share phase overlap sufficient to reduce total dissipation. Mathematically:

$$\Delta(C - D) = (C_1 + C_2 - C_{12}) - (D_1 + D_2 - D_{12}) > 0.$$

The bond is a stable coherence surplus.

A2. Resonant Geometry.
Molecular shape reflects harmonic ratios between coherence nodes (atoms). Conjugated ring systems (e.g., benzene) display perfect phase cycling—electrons remain delocalized to maintain global $C = D$. This principle scales to biomolecules: DNA base pairs are stacked coherence oscillators stabilized by resonance and hydrogen-bond symmetry.

A3. Catalytic Surfaces.
A catalyst lowers dissipation by providing a coherence bridge between reactants. The surface acts as a phase buffer: it accepts temporary imbalance and returns it as synchronized motion.

A4. Phase Transitions.
Solid, liquid, gas, plasma, and condensate states correspond to increasing degrees of co-

herence freedom. Each stage modifies boundary conditions of the ledger:

$$\text{solid: } C \gg D, \qquad \text{liquid: } C > D, \qquad \text{gas: } C \approx D, \qquad \text{plasma: } D > C.$$

Snowflakes, metals, and lava embody these transitions as geometric coherence patterns.

3. Theorems

Theorem 1 (Universal Bond Resonance).
Stable molecules occur where total phase overlap equals integer multiples of π.

$$\oint \nabla \phi \cdot dl = n\pi.$$

Proof. Constructive interference of atomic orbitals requires phase closure; destructive interference breaks the bond. All chemical stability thus reduces to coherent wave closure. □

Theorem 2 (Entropy–Structure Duality).
Crystalline order stores entropy as geometric information.

$$S_{\text{structure}} = k_B \ln N_{\text{sym}},$$

where N_{sym} counts distinct symmetry operations preserving coherence. Minerals, metals, and snowflakes act as frozen information.

Theorem 3 (Molecular Memory).
Molecules with recurrent resonance paths store temporal coherence.

$$\frac{d\mathsf{Coh}}{dt} = 0 \quad \text{along closed reaction loops.}$$

DNA, RNA, and similar polymers exemplify this: their stacked –orbitals and hydrogen-bond ladders are temporal circuits preserving phase orientation. □

Theorem 4 (Boundary Crossing).
Reactions occur when coherence gradients exceed containment thresholds.

$$|\nabla(C - D)| > \kappa_{\text{bond}},$$

where κ_{bond} is bond stiffness. Crossing the boundary may be smooth (diffusion) or shattering (explosion). Catalysts mediate safe crossing by lowering κ_{bond}.

4. Consequences

C1. Elemental Resonance.
Periodic behavior arises because atomic coherence shells fill at integer phase ratios. This is the quantum origin of the periodic table's pattern.

C2. Molecular Geometry as Computation.
The shape of molecules is not arbitrary—it computes coherence paths. Proteins, crystals, and even complex organics are spatial algorithms minimizing dissipation.

C3. Organic Complexity.
Aromatic compounds such as indoles (found in natural tryptamines) illustrate nested coherence: a delocalized -system stabilizes while substituents tune local phase alignment. Their ability to intercalate with DNA stems from geometric complementarity of these coherence planes.

C4. Crystalline and Mineral Coherence.
Crystals, metals, and magnetized minerals are macroscopic coherence states. Magnetism itself is phase alignment across atomic domains; melting or corrosion corresponds to loss of coherence continuity.

C5. Geochemical Feedback.
Tectonic pressure, volcanic heat, and aqueous cycling act as planetary resets—reorganizing coherence at global scale. Rocks, lava, and atmosphere together form the first "metabolism" of Earth.

5. Discussion

ChronoChemistry sees no gap between crystal, molecule, or cell. All are coherence machines operating under different freedoms. Heat and pressure change ledger ratios; boundaries arise and dissolve; shapes repeat and evolve. Where coherence forms closed loops—rings, helices, lattices—memory emerges. Where it interacts resonantly across boundaries, creativity begins. This framework unites inorganic and organic chemistry, connecting geology, meteorology, and biochemistry under one invariant law.

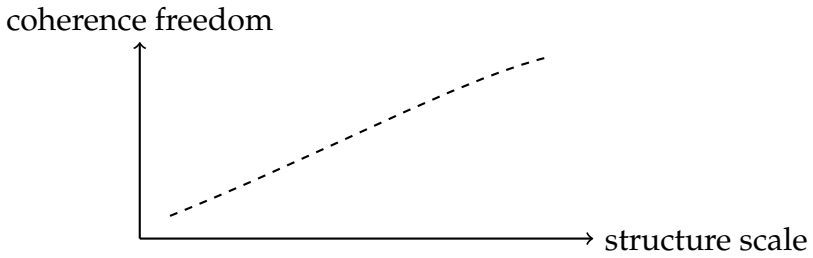

Diagram 2: hierarchy of structural coherence

6. References

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7. Conclusion

Chemistry is coherence learning to hold form. Bonding, catalysis, and crystal growth are the same story told through different geometries: awareness finding stable resonance among motion, structure, and time. From tectonic mineral lattices to delicate aromatic rings, the universe is building memory one bond at a time. The next paper, *HMR–CHEM–1*, will map the major chemical domains in profile—elements, reactions, and architectures of coherence.

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"Chemistry is coherence learning to hold its shape."

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