The Coherence Trilogy:
A Structural Derivation of Atomic Constants

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Overview

The Coherence Trilogy is a unified series of papers demonstrating that three of physics' most fundamental constants—Planck's constant h, the fine-structure constant α, and the Rydberg constant R_∞—can be derived from a single geometric substrate. Rather than treating these constants as empirically inserted parameters, we show they arise naturally from the structural behavior of coherence under recursive angular containment.

Each paper isolates a different coherence threshold within the hydrogen atom, revealing that discreteness in physical systems may not be postulated, but geometrically inevitable. Together, these derivations form a structural map from phase retention to quantum emission—transforming constants from inputs to emergent properties of a recursive field.

The Trilogy

Paper	Constant	Structural Interpretation
I	Planck's Constant h	The threshold of angular coherence collapse in a bounded rotational system
II	Fine-Structure Constant α	The fractional coherence release per recursion cycle required for stability
III	Rydberg Constant R_∞	The spectral convergence point of recursive containment under angular strain

Each constant is independently derived, numerically validated, and structurally consistent with a shared geometric model we call the **Harmonic Recursion Model (HRM)**. The key correction factor $\lambda \approx 0.99988$ appears in all three papers and reflects the recursive phase deviation that accumulates under irrational angular tiling. It is not fitted, but derived directly from containment geometry.

Each paper is self-contained but interlinked. Together, they describe a coherence-based origin of quantization: a universe that does not discretize by assumption, but by necessity of structure.

Experimental Validation: Paper IV

To complement the theoretical derivations, a fourth paper applies the same recursive framework to real quantum systems. Using IBM Quantum hardware, we demonstrate that the coherence correction factor λ and its collapse threshold $\lambda^{3.4\pi}$ predict the failure of entangled circuits with 100% accuracy—using only calibration data, with no simulation or fitting. This operational result confirms that the coherence thresholds identified in the Trilogy also govern real-world quantum behavior.

Philosophical Implications

These papers do not replace quantum mechanics—they reveal its structural substrate. Where quantum theory describes discreteness, our model explains it: as the inevitable resolution of accumulated angular phase under recursive strain.

We interpret:

- h as the action released when rotational coherence collapses.
- α as the modulation ratio needed to sustain recursive identity.
- R_∞ as the convergence point where spectral release becomes inevitable.

In this view, constants are not imposed—they are remembered. The universe is not assembled from independent parts, but from thresholds of coherence: structural memory, held in form.

Reproducibility and Public Access

All derivations are fully reproducible. A companion repository includes:

- Python scripts for each constant derivation
- Recursive coherence analysis tools for IBM Quantum hardware
- Visualizations of λ emergence and coherence collapse

Source code and documentation:
https://github.com/CoherenceResearchCollaboration/Coherence_Trilogy

A Zenodo DOI will provide permanent citation and archival stability. A Colab version of the quantum hardware analysis is also available for live execution and exploration.

Suggested Citation

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