ANNALS OF THE CHRYSENE FORMALISM

AI-AUGMENTED PEER-REVIEWED | VOL. 1, NO. 1 | AUGUST 2026

AI-AUGMENTED PEER-REVIEW:

Geometric Quantization of Molecular Quantum Transport: The CohBit Chrysene Architecture for Ambient-Temperature Quantum-Classical Transduction

Compiled by the Editorial Office

Annals of the Chrysene Formalism

Schaper Systems Press

Paper ID:	ACF-1.1-009
Issue:	Volume 1, Number 1
AI-Augmented Review Tier:	Level 1
AI-Augmented Review Focus:	Internal Consistency Assessment
Submission Date:	2026-08-09
Acceptance Date:	2026-08-09
Online Publication Date:	2026-08-19
Document Version:	v1.0
Last Audited:	Initial Publication

Citation: Schaper, C. D. (2026). Geometric Quantization of Molecular Quantum Transport: The CohBit Chrysene Architecture for Ambient-Temperature Quantum-Classical Transduction. *Annals of the Chrysene Formalism*, 1(1), 98–112. https://chrysene.com/index.php/acf/article/view/9

Review Scope and Objective

Prior to submission, this article underwent a Level 1 AI-Augmented review. Under Level 1, the author conducted an AI-augmented review of the manuscript, using review instructions provided by the editorial committee that restrict the AI system's task to identifying mathematical and logical flaws. Under Level 1, the AI-augmented review may also issue specific recommendations on how to correct identified flaws.

Upon submission, the editorial board evaluated the manuscript using the same review instructions provided to the author, in order to confirm the author-side findings. Human review was used to judge whether the manuscript adhered to the principles of the Chrysene Formalism, and whether it was grounded in the invariant chemistry that forms the axiomatic framework and tensorial space of the Chrysene Formalism. A more rigorous tier of AI-augmented peer review is currently in development and is being implemented for papers that will be published soon. It is anticipated that Level 1-reviewed papers will be subject to future audit, and, where warranted, updated versions of the manuscript may be issued.

Disclosure of AI Use

The author claims the use of AI in the development and writing of the manuscript.

AI-Augmented Review Procedure

This submission was evaluated under the journal's basic Level 1 AI-augmented review protocol, consisting of two independent stages:

(1) **Author-Side Draft Check.** During manuscript preparation, the author employed an AI-augmented review system to screen the draft for mathematical and logical flaws prior to submission.
Model(s) used: Gemini 3.1 Pro (Extended); Grok 4.6.

(2) **Editorial Meta-Review.** Following submission, the editorial office conducted a second, independent check for mathematical and logical flaws, also using AI-augmentation, to verify consistency with the foundational formalism prior to acceptance.
Model(s) used: Grok 4.6.

Review workflow: Sequential hand-off (author-side): Gemini 3.1 Pro (Extended) conducted an initial AI-augmented review pass on the draft; Grok 4.6 then drafted the author's replies incorporated into this review record. Editorial meta-review conducted independently using Grok 4.6.

Scope of Review

AI-augmented review at this tier evaluates internal consistency, notational coherence, and alignment with previously established results in the formalism. It does not constitute independent verification of novel mathematical claims by a subject-matter expert, and it does not certify that a cross-field analogy invoked in the manuscript (e.g. between a result native to one field and the formalism's invariants) is mathematically valid beyond the level of internal consistency and stated falsifiability. Readers evaluating a specific applied claim in this paper are encouraged to consult a domain specialist in the relevant field.

Editorial Board & Review Committee Summary

Recommendation: Accept with Minor Revisions

The revised manuscript presents a coherent and carefully qualified algebraic framework for dual-channel molecular quantum transport on a discrete, non-commutative manifold. The migration from continuous Euclidean models to the Chrysene Instantiation Space $\mathcal{I}_C$, the elevation of the Stark Tuning Operator as the primary switching mechanism, the hierarchical treatment of phonon mitigation, and the explicit acknowledgment of open quantitative problems constitute a substantial improvement over earlier drafts.

The theoretical architecture is internally consistent, the tone is appropriately measured, and the inclusion of model-Hamiltonian estimates together with a comparison against experimental benchmarks in molecular electronics strengthens the manuscript's credibility. The remaining issues are primarily matters of clarification, quantitative anchoring, and minor polishing rather than fundamental flaws in the logical structure.

Reviewer 1 (AI-Augmented): Molecular Electronics & Quantum Transport

1. Residual inter-channel coupling and the Zero-Divisor Theorem

Critique: The combination of C_{2h} symmetry with hard Dirichlet boundaries and Ricci-curvature singularities is elegant. However, the model-Hamiltonian illustration in Section 7 shows that any finite t_{cross} immediately produces a non-zero residual coupling.

Recommendation: In the statement of Theorem 1 (or in a short remark immediately following it), explicitly note that the algebraic vanishing of the coupling holds strictly in the ideal limit, while realistic substitution patterns and packing are expected to leave a small but finite residual matrix element whose magnitude must be bounded by first-principles calculation.

Author's Reply

A Remark has been added immediately after the proof of Theorem 1. It states that the algebraic vanishing $\Psi_{\text{SD}} \otimes \Psi_G = \Psi_\emptyset$ holds in the ideal limit, while realistic substitution patterns and packing are expected to leave a residual inter-channel matrix element that must be quantified by first-principles calculation.

2. Hierarchical phonon suppression and λ_{eff}

Critique: Theorem 13 lists four distinct mechanisms whose joint action is asserted to drive $\lambda_{\text{eff}} \to 0$. The comparison section correctly acknowledges that experimental reorganization energies for chrysene-sized molecules lie in the 0.10–0.25 eV range and that no laboratory system has yet demonstrated device-scale ambient coherence.
Recommendation: Add one clarifying sentence in the proof of Theorem 13 (or in the subsequent coherence bound) stating that the numerical suppression factors required to reach the claimed coherence times remain phenomenological and await mode-resolved electron-phonon matrix elements computed for the actual substituted geometry.

Author's Reply

The final sentence of the proof of Theorem 13 has been revised to note that the numerical suppression factors required to reach the coherence times of Theorem 14 remain phenomenological and await mode-resolved electron-phonon matrix elements for the substituted geometry.

3. Stark shifts versus experimental gate fields

Critique: The model calculation and the literature benchmarks are consistent in magnitude. A brief remark noting the practical constraint of dielectric integrity under the required local fields would further ground the discussion.
Recommendation: Add a brief remark noting this practical constraint.

Author's Reply

A short Remark has been inserted after the proof of Theorem 6. It observes that the predicted Stark shifts are consistent with literature magnitudes, while noting that dielectric integrity and conformational stability under the required local fields remain to be verified experimentally.

Reviewer 2 (AI-Augmented): Mathematical Physics & Non-Commutative Geometry

4. Status of the discrete Ricci-curvature argument

Critique: The appeal to combinatorial Ricci-curvature singularities at $sp^2 \to sp^3$ terminations supplies a topological rationale for impedance mismatch. The argument is currently qualitative.
Recommendation: Either (a) cite a concrete discrete-geometric reference that quantifies the curvature jump for this class of terminations, or (b) add a short clause acknowledging that the curvature singularity provides a symmetry-based selection rule whose quantitative suppression factor is not yet computed.

Author's Reply

A clarifying clause has been added in Section 2.1 where the Ricci-curvature singularity is introduced. It states that the curvature gradient supplies a topological rationale for impedance mismatch, while the quantitative suppression factor for the present geometry remains an open question.

5. Scope statement and open problems

Critique: The abstract and conclusion already list the principal open problems with admirable clarity. The new comparison section further improves the manuscript's balance.
Recommendation: In the final paragraph of the comparison section, consider adding a single forward-looking sentence that prioritizes the two most urgent computational tasks (residual orbital overlaps under realistic substitution and mode-resolved EPC matrix elements) so that subsequent work can be focused.

Author's Reply

The final paragraph of the Comparison section now identifies the two most urgent computational tasks: (i) first-principles residual orbital overlaps under realistic substitution and packing, and (ii) mode-resolved electron-phonon matrix elements for the longitudinal channel in the presence of the interstitial scaffold.

6. Minor terminological consistency

Critique: A few residual phrases ("definitive logic-switching mechanism," "strictly orthogonal square lattice") still carry a slightly stronger rhetorical charge than the surrounding axiomatic text.
Recommendation: Softening these to "principal" and "algebraically orthogonal under the stated idealizations" would improve uniformity of tone.

Author's Reply

The concluding sentence of Theorem 6 now reads "principal voltage-controlled switching mechanism." References to a "strictly orthogonal square lattice" have been revised to "algebraically orthogonal square lattice under the stated idealizations."

Supplementary Note (AI-Augmented): Feasibility Assessment of the CohBit Architecture, Beyond the Manuscript

This note records a balanced evaluation of whether the physical ideas underlying the CohBit architecture could, in principle, support a functioning (even if low-performance, noisy, and slow) system capable of feedback-based calculation (sensor input → computation → actuator output), memory retention, and weight updating (learning). The assessment is independent of the formal claims of the paper and is offered for the review history.
Positive View — Limited but Physically Plausible Capability. Several core physical ingredients are already demonstrated in molecular electronics and organic neuromorphic devices:

- **Switching and calculation primitives.** Electrostatic gating of molecular orbitals (Stark effect) and resonant tunneling are experimentally established. Single-molecule transistors and molecular junctions routinely exhibit on/off behaviour, rectification, and bias-dependent conductance. A cruciform molecule with partially orthogonal pathways could, in principle, support rudimentary two-input analog operations.
- **Memory.** Charge trapping, redox-based resistance switching, and conformational bistability have been observed in molecular and organic systems. Co-facial stacking or a floating molecular island can produce hysteretic conductance, providing a physical basis for analog weight storage. Even noisy, multi-level, slowly relaxing states can serve as rudimentary memory.
- **Learning / weight update.** If the trapped charge or redox state can be modulated by the same signals that flow through the data channel

(or by a separate control pulse), a form of local, Hebbian-like or spike-timing-dependent update is physically possible. Organic memristive crossbars already demonstrate simple online learning, albeit with high variability and limited endurance.

- **Feedback loop at low performance.** A slow, noisy, low-precision sensor–compute–actuator loop does not require ballistic coherence or terahertz speeds. Many early neuromorphic and molecular prototypes operate in this regime. If the lattice can produce a measurable conductance change that depends on both an input signal and a stored weight, and if that conductance can drive a downstream molecular or nano-scale actuator, then a closed feedback loop is not forbidden by physics.

A rudimentary, low-performance version that performs simple analog calculations, stores imperfect weights, and allows slow adaptation therefore sits within the same broad physical space as existing molecular electronics and organic neuromorphic experiments. Absolute isolation, perfect orthogonality, and room-temperature phase coherence are not required for this minimal functionality.

Negative View — Serious Obstacles and Current Unreality. Several elements central to the CohBit vision face severe physical and practical barriers:

- **Ambient coherence and hierarchical phonon control.** Real molecular wires and junctions lose phase coherence on femtosecond-to-picosecond timescales at room temperature. The proposed multi-layer suppression (Fröhlich selection rules + Ricci reflection + Anderson localization in a peptide scaffold + Caldeira–Leggett continuum) that drives $\lambda_{\text{eff}} \to 0$ has no experimental demonstration. Without a substantial reduction in effective electron-phonon coupling, ballistic or coherent multi-node calculation remains unrealistic.
- **Channel isolation.** Perfect (or even strong) orthogonality between longitudinal and transverse pathways is difficult once electrodes, solvent, packing disorder, and conformational fluctuations are present. Residual crosstalk is the norm. The Zero-Divisor ideal is a useful theoretical limit, not a currently achievable device property.
- **Scaling and addressing.** Moving from a single molecule or dimer to a functional crossbar with reliable individual-node addressing, low parasitic paths, and stable operation remains a major materials-science and fabrication challenge. Yield, variability, and interconnects are unsolved problems even for far simpler molecular systems.
- **Stable, controllable learning.** Reliable, non-destructive, and repeatable modulation of molecular charge or redox states under ambient conditions is difficult. Drift, stochastic switching, limited endurance, and environmental sensitivity typically dominate.

- **Sensor and actuator interfacing.** Translating a macroscopic sensor signal into a clean molecular-scale input, and converting a molecular conductance change into a useful actuator response, introduces additional transduction losses and noise that are often larger than the computational signal itself.

Taken together, these factors place a clean, coherent, high-isolation, ambient-temperature CohBit lattice of the kind envisioned in the ideal theory outside the realm of demonstrated reality. Even a modestly functional multi-node system would require breakthroughs in molecular design, phonon engineering, and integration that have not yet been achieved.

Overall Assessment. A minimal, low-performance, noisy version capable of simple feedback calculation, imperfect analog memory, and slow weight updates is not physically impossible. It would occupy the same experimental neighbourhood as existing molecular switches, organic memristors, and early neuromorphic prototypes. The basic physics of gating, charge storage, and hysteretic conductance does not forbid it. However, the specific combination claimed in the theoretical architecture—strong topological isolation, hierarchical suppression of electron-phonon coupling to near-zero, and useful ambient-temperature coherence across a lattice—is far beyond present experimental capability and faces substantial physical headwinds. At this early stage, the most realistic outlook is that CohBit-inspired molecular designs might eventually support rudimentary adaptive computation, while the full idealized lattice remains a long-term research target rather than a near-term engineering possibility. The honest position is therefore cautious optimism about limited functionality, combined with clear recognition that the more ambitious coherent and highly isolated version is not yet within reach.

Final Remarks from the Editorial Review Committee Chair

The editorial meta-review of this manuscript has been completed. Using the journal's AI-augmented evaluation protocol, the editorial office assessed the submission's alignment between its stated mathematical formalism and its applied engineering or scientific claims, and confirmed that the manuscript satisfies the journal's standard for internal consistency at this review tier. The manuscript's treatment of residual inter-channel coupling under the Zero-Divisor Theorem, hierarchical phonon suppression, Stark-shift consistency with experimental benchmarks, the status of the discrete Ricci-curvature argument, and the manuscript's own scope statement of open problems was found to be consistent throughout. The algebraic construction was noted as cleanly separated from its physical idealizations, with the primary and secondary mechanisms correctly ordered and experimental benchmarks supplying necessary context.

The manuscript is formally accepted for publication in the *Annals of the Chrysene Formalism*, Volume 1, Number 1.

Revision History

Version	Date	Notes
v1.0	2026-08-09	Initial publication.

Living Document Notice

As with any actively developing field, the mathematical and applied claims in this article are subject to periodic re-evaluation as the surrounding formalism matures and as the journal's AI-augmented review tooling advances. Consistent with standard scientific practice for provisional or fast-moving frameworks, this article and its review record may be re-audited by subsequent review systems, and a revised version bearing an updated review history may be issued to reflect developments in the field. Readers should consult the Revision History table above, and the journal's records, for the current version number and audit date of this article.

Editorial Disclaimer

The *Annals of the Chrysene Formalism* aims to develop the Chrysene Formalism through the application of advanced mathematics, using AI systems selected as well suited to this task. In pursuing this aim, it is possible that errors occur during the mathematical progression and analysis of the formalism, including within the review and editing process itself. However, the formalism is constructed within a multidisciplinary, horizontal framework that is grounded in a specific instantiation of molecular matter and its associated networks, an instantiation that is invariant and falsifiable. For this reason, the editorial office considers the formalism well suited to an AI-augmented approach, and anticipates that this approach will continue to be adapted as AI models and the surrounding mathematical understanding advance.