

ORTHOGONAL REVIEW RECORD

*The Encoded Stack: A Frame-Indexed Base-Four
Structure on the $\mathbb{Z}^3$ -Fibrated Chrysene Network, its
Sequence Algebra, and the Set-Up for Survival*

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REVIEW SCOPE

This file is the Pass 7 review record of Article 44. It is not a section of the paper. The architecture is the five-stage pipeline of [Sch26b, §4.3]. The admissibility criterion is $F_{\text{adm}} = M \cap C \cap H$ [Sch26b, Def. 2]. The case-study format is criticism, revision,

verification [Sch26b, Def. 3]. Stages four and five operate on the outcomes of the first three. There is no author-reply section.

Scope of Review

Rigorous multi-pass orthogonal review, not a Level-1 screen. Mathematics asks whether every statement labelled [A] or [D] is proved at the strength claimed. Concordance asks whether the paper contradicts [Sch26c] or [Sch26a], adds an axiom, or discharges a deferred target. Chemistry asks whether molecular readings are typed [E] and kept out of proofs. Targeted verification re-checks the six ledger defects. Meta-review treats the final manuscript as controlling.

Compiled disposition

Accepted. The Pass 7 record finds that the manuscript satisfies $F_{\text{adm}} = M \cap C \cap H$ at the level of certainty available from this review. No material criticism remains unresolved. One proof-clarity sentence in Proposition 3.4 is recommended and optional. Three [E] items in Appendix B are submitted for a chemistry ruling; the record states that they do not block mathematical publication and that the chemical-admissibility guarantee is not claimed until they are ruled.

Optional repair

Optional, at the author’s discretion. After the C_{2h} element table in the proof of Proposition 3.4, clause (iii), add: “Since $\Pi_{\mathfrak{C}} \leq \Pi_{\mathfrak{C}}^{\text{emb}}$ and every element of $\Pi_{\mathfrak{C}}^{\text{emb}}$ acts orientation-preservingly on P_n , the same holds for every element of $\Pi_{\mathfrak{C}}$.” The proof is logically complete without the sentence.

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1. OVERVIEW

This document records the five-stage orthogonal review of the paper against $F_{\text{adm}} = M \cap C \cap H$. The three disciplinary stages are deliberately disjoint. Targeted verification and meta-review do not generate an independent score.

Verdict. The manuscript satisfies $F_{\text{adm}} = M \cap C \cap H$. One minor proof-clarity improvement is recommended (optional); one concordance note is recorded for information; no material criticism remains unresolved. The paper is accepted for publication subject to the optional improvement being applied at the author's discretion.

2. STAGE M — MATHEMATICAL REVIEW

Stage M — mathematics only

Question: is every statement labelled [A] or [D] proved from the stated hypotheses, at the correct strength? [T] and [E] items are not evaluated here. Forty-three theorem-level environments in Sections 3–9 and Appendix A were scanned. All carry [A] or [D]. Verdict: pass. No statement requires weakening or correction.

Finite claims, computationally verified. Exhaustive enumeration over the four-element alphabet Σ_v , the twenty-four elements of $\text{Aff}(\Sigma_v)$, and the $4^3 = 64$ words of the $N = 3$ witness.

- **PASS Prop. 4.4 (registry canonical).** $D(m)$ is unchanged under global flip; verified on all $2^6 = 64$ marker assignments.
- **PASS Thm. 4.7 (terminal invariant).** G -orbits equal the reg-fibres $\{FF, BB\}$ and $\{FB, BF\}$.
- **PASS Prop. 4.8 (complementation).** τ fixes $\{FF, BB\}$, $\tau\rho$ fixes $\{BF, FB\}$, ρ fixes nothing; uniqueness confirmed.
- **PASS Prop. 4.9 (coordinate form).** $\tau(b_1, b_2) = (b_1, b_1 + b_2)$ and $\rho(b_1, b_2) = (b_1, b_2 + 1)$ verified for all four letters.
- **PASS Thm. 5.4 (multiplication determined).** Exactly one of the three $GF(4)$ structures has prime subfield equal to $\ker(\text{reg})$; forced identity $\mathbf{1} = BB$.
- **PASS Thm. 5.5 (no-go).** G has no element of order 3; eight order-3 elements exist in $\text{Aff}(\Sigma_v)$, none in G .
- **PASS Cor. 5.6 (Frobenius).** $\tau(x) = x^2$ in the determined $GF(4)$ structure; residual ambiguity is $\{BF, FB\}$.
- **PASS Lem. 4.10 (normal form).** $W(\varphi, w) = (\prod_j \iota_{\mathbf{k}_j}(\sigma_{j+1}))u^{N-1}$ for all 64 words on the witness.
- **PASS Prop. 4.17 (injective).** Sixty-four words give sixty-four distinct operators; the counterfactual collapses to four.
- **PASS Prop. 4.14 (direction).** $W(\varphi, w) \neq W(\varphi', w)$ when $\varepsilon \mapsto -\varepsilon$.

- **PASS Thm. 6.13 (frame invariant).** $D(m)$ invariant under flip; $D(m) = D(m')$ iff $m' \in \{m, m+1\}$; orbit map injective on orbits; 20 orbits = 20 classes of $[D]$; verified on 64 strings.

Infinite-dimensional claims.

- **PASS Prop. 3.4 (non-collapse).** Three-clause proof. Clauses (i) and (ii) follow from the definition of R . Clause (iii) uses $\Pi_{\mathcal{C}} \leq \Pi_{\mathcal{C}}^{\text{emb}}$ [Sch26c, Eq. (747)] and $\Pi_{\mathcal{C}}^{\text{emb}} \sim_{O(3)} C_{2h}$ (A2), then checks all four elements of C_{2h} . Subgroup inclusion is stated in the proof text.
- **PASS Thm. 4.11 (sequence dependence).** Existence: two words with the same multiset but different order have distinct elementary tensors in the normal form, distinguished by non-proportionality ($H_{\text{ord}}(\text{i})$). Attribution: with $u = \text{id}$ and $H_{\text{ord}}(\text{ii})$, the product lies in $\mathfrak{P}_{\mathcal{C}}$ and is order-blind.
- **PASS Thm. 6.4 (transport conditions).** (i) $\Rightarrow$ (ii): conjugation by T maps stabilisers of registry partitions; inclusion is equality because $|G| = |G'| = 4$. (ii) $\Rightarrow$ (iii): conjugation preserves the property of having no fixed point, then G' -uniqueness (Prop. 4.8 applied to G') identifies c' . (iii) $\Rightarrow$ (i): equivariance maps orbits to orbits.
- **PASS Prop. 9.5 (tracial blindness).** $\omega(W^*AW) = \omega(AWW^*) = \omega(A)$ by traciality; W is unitary by Prop. A.13.
- **PASS Prop. 9.8 (datum satisfies A12).** Injectivity of j_{str} : words recovered from $s \cdot 4^N$ by base-four expansion (Prop. 3.15). Admissibility: $C_1 < \tau_1$ iff count = 1.

Proof-clarity recommendation (optional). **NOTE Prop. 3.4, clause (iii), proof line 6.** The sentence “By [Sch26c, Eq. (747)] one has $\Gamma_{\mathcal{C}} \leq \Gamma_{\mathcal{C}}^{\text{emb}}$, hence $\Pi_{\mathcal{C}} \leq \Pi_{\mathcal{C}}^{\text{emb}}$ ” establishes the subgroup inclusion and is present. The subsequent check of all four C_{2h} elements concludes that every element of $\Pi_{\mathcal{C}}^{\text{emb}}$, and hence of $\Pi_{\mathcal{C}}$, acts orientation-preservingly on P_n .

Recommended bridging sentence, not required:

Since $\Pi_{\mathcal{C}} \leq \Pi_{\mathcal{C}}^{\text{emb}}$ and every element of $\Pi_{\mathcal{C}}^{\text{emb}}$ acts orientation-preservingly on P_n , the same holds for every element of $\Pi_{\mathcal{C}}$.

M verdict. **PASS** All 43 theorem-level statements are mathematically valid at the strength claimed. No statement requires weakening or correction.

3. STAGE C — CONCORDANCE REVIEW

Stage C — concordance only

Question: does the paper contradict any prior statement of [Sch26c] or [Sch26a]? Does it introduce a thirteenth axiom? Does it incorrectly claim to discharge a deferred target? Verdict: pass.

- C1. PASS No axiom introduced.** No axiom environment appears. Every new structure is a definition, hypothesis, or construction internal to A1–A12. Remark 2.3 states this and names the consequence for non-vacuity and acyclicity.
- C2. PASS Standing non-implication preserved.** $|\Sigma_{\mathfrak{C}}| = 4 \not\Rightarrow \Sigma_{\mathfrak{C}} \cong GF(4)$ [Sch26b, Eq. (2)] is preserved. Proposition 10.1(v) records $\Sigma_{\mathfrak{v}} \not\cong \Sigma_{\mathfrak{C}}$, which strengthens the separation without weakening the prior statement. Remark 7.7 explains why the present results do not bear on [Sch26c, Thm. 41].
- C3. PASS $\Sigma_{\mathfrak{v}}/\Sigma_{\mathfrak{C}}$ separation.** No claim is made that $\Sigma_{\mathfrak{v}} = \Sigma_{\mathfrak{C}}$. The identification is Hypothesis H_{Σ} , undischarged, and recorded as a target.
- C4. PASS [Sch26c, Thm. 41] not discharged.** Appendix B, Table 1, row 11 records “Not discharged.” The single pattern match on “Thm. 41...Sigma” in Appendix B is that table row.
- C5. PASS No other deferred target discharged.** Section 11 states this. The concordance table records Thm. 47 (emergent chirality) as not discharged. The chirality item is a target, not a result.
- C6. PASS Status labels complete.** All 43 theorem-level environments carry [A] or [D].
- C7. PASS H_{ord} in corrected form.** Clause (ii) requires pairwise commutativity of letter operators (the Pass 2 correction). The original inverted form is absent.
- C8. PASS H_{sec} present.** Added in Pass 4 after Theorem 8.4 was found vacuous without it. Present in Hypothesis 2.13 and named in Theorem 8.4.
- C9. PASS Non-implication (i) present.** Proposition 4.12 records that order dependence of a read word and noncommutativity of $\mathfrak{A}_{\mathfrak{C}}$ are independent. Without it the paper would appear to derive [Sch26c, Thm. 8].
- C10. NOTE Chemistry items in Appendix B.** Three items are submitted (marker sense, C_2 under full 2-phosphoethoxy substitution, substrate/catalyst assignment). Manual check confirms all three are present. No correction needed.
- C verdict. PASS** Concordant with [Sch26c] and [Sch26a]. No prior statement is contradicted, no axiom is introduced, and no deferred target is claimed as discharged.

4. STAGE H — CHEMISTRY AND DOMAIN REVIEW

Stage H — chemistry only

Question: are molecular interpretations typed [E] and absent from proofs? Are the Appendix B chemistry items the right ones to submit? Verdict: pass on segregation. Three [E] items remain for a chemistry ruling before a chemical-admissibility guarantee is claimed. They do not block mathematical publication.

- H1. PASS No [E] content inside proofs.** Scan of all 37 proof environments in Sections 3–9: zero occurrences of [E], Hypothesis H_{chem} , phosphoethoxy, bay

region, or chrysene inside a proof. Every chemical reading is in a remark outside the proof flow.

- H2. PASS Reaction-volume reading.** Remark 3.10 labels the vessel-as-reaction-volume reading [E] and states that the remark enters no proof.
- H3. PASS Catalyst/substrate assignment.** Remark 2.7 labels the s/c reading [E] and states that no chemical role is used in any proof.
- H4. PASS Marker reading.** Remark 3.6 labels the perimeter-orientation reading [E]. Proposition 3.4 is proved from the point-group symmetry of A_2 and Hypothesis H_{stack} alone.
- H5. PASS No energetic claim.** Remark 9.9 records $C_1 < \tau_1 \not\Rightarrow$ energetic sufficiency for initiation, citing [Sch26b, Eq. (3)] and [Sch26a, Rem. B.2].
- H6. Items submitted for chemistry review.** Resolution does not affect any mathematical result.
- Whether the oriented perimeter cycle of A_8 has a uniquely defined sense in a flat projection of the planar framework.
 - Whether the C_2 rotation remains in R for fully 2-phosphoethoxy-substituted chrysene.
 - Whether the 3,6,9,12-substituted unit is correctly identified as the substrate and the 2,5,8,11-substituted unit as the catalyst.

H verdict. PASS All molecular content is segregated as [E] and absent from proofs. Three items are submitted for chemistry review. They do not block mathematical publication, and they must be resolved before the chemical-admissibility guarantee is claimed.

5. STAGE 4 — TARGETED VERIFICATION

Targeted verification of the six ledger defects

Each defect in Appendix B, Table 3, was checked for repair and independent re-examination. All six are repaired and verified.

No.	Defect	Repair	Verification
1	$H_{\text{ord}}(\text{ii})$ inverted	Pairwise commutativity (Pass 2)	PASS Prop. 4.12 attribution clause
2	Word operator at distinct sites	Reading-head form (Pass 2)	PASS Lem. 4.10 derives the normal form
3	Non-proportionality absent	Clause added to $H_{\text{ord}}(\text{i})$	PASS Rem. 4.19; proof of Prop. 4.18
4	H_{sec} absent	Added to the register (Pass 4)	PASS Rem. 8.3; proof of Thm. 8.4
5	Tracial-state blindness	Def. 9.7; target opened (Pass 5)	PASS Prop. 9.5; Rem. A.21
6	Bay-region marker fails C_2	Perimeter orientation (Pass 2)	PASS Rem. 3.5; proof of Prop. 3.4

Verdict. **PASS** All six defects repaired and explicitly verified. None is unresolved.

6. STAGE 5 — META-REVIEW

Meta-review of the controlling text

Each material criticism is classified resolved (R), partially resolved (P), unresolved (U), or no longer applicable (N). Of nine items: six resolved, two partially resolved, none unresolved, one no longer applicable.

Criticism	Status	Note
$H_{\text{ord}}(\text{ii})$ inverted	R	Clause revised; the attribution clause is the only source of order dependence
Word operator applied letters at distinct sites	R	Reading-head form adopted; normal form is a theorem, not the definition
Non-proportionality missing from $H_{\text{ord}}(\text{i})$	R	Added; Prop. 4.18 proof complete
H_{sec} absent; Thm. 8.4 vacuous	R	Added; equivalence in Thm. 8.4 is non-trivial
Tracial state blind to the word operator; A12 realization fails	R	Def. 9.7 interpolation realization added; target opened
Bay-region marker fails C_2 invariance	R	Perimeter orientation adopted; proof in Prop. 3.4(iii)
Proof clarity: $\Pi_{\mathfrak{C}} \leq \Pi_{\mathfrak{C}}^{\text{emb}}$ step implicit	P	Inclusion is stated; bridging sentence optional
Chemistry review items (three)	P	Submitted in App. B; do not block mathematical publication

Criticism	Status	Note
C4 pattern match (Thm. 41 “discharged” in App. B)	N	False positive; the match is on “Not discharged”

The two partially resolved items are the optional bridging sentence in Proposition 3.4, and the three [E] chemistry items. Neither is an unresolved mathematical criticism.

FINAL VERDICT

Pass 7 decision

Accepted. Subject to the optional proof-clarity sentence in Stage M , and pending a chemistry ruling on three [E] items in Appendix B. The paper satisfies $F_{\text{adm}} = M \cap C \cap H$ as defined in [Sch26b, Def. 2], at the level of certainty available from orthogonal-constraint review of a single manuscript. It does not retroactively certify any paper of the Volume 1, Number 1 corpus, in the manner of [Sch26a, Rem. 10.7].

REFERENCES

- [Sch26a] C. D. Schaper. *Annals of the Chrysene Formalism*, survey and restraint record cited as [Sch26a] in the Pass 7 report.
- [Sch26b] C. D. Schaper. The chrysene formalism as candidate mathematics and candidate biogenesis. *Annals of the Chrysene Formalism*, 1(2):476–488, 2026.
- [Sch26c] C. D. Schaper. The chrysene formalism revisited: a twelve-axiom foundation. *Annals of the Chrysene Formalism*, 1(2), 2026.

REVISION HISTORY

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v1.0	2026-10-06	Pass 7 record published with Article 44.

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