MATHAUDIT / DETAILED REPORT

Correctness, proof completeness, and novelty audit

p-adic Hahn series with sparse support

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Scope	Statements, proofs, and novelty only

SUMMARY

01	Statements	Contains wrong statements
02	Proofs	Contains incorrect or incomplete proofs
03	Novelty	No non-novelty findings

01 / STATEMENTS

Statements

Contains wrong statements

The sparse-support transcendence theorem and the bounded-support finiteness theorem are supported. Corollary 6.24 omits bounded support, and its printed order-type restatement is false for a rational p-adic geometric series.

Theorem 1.7 / Theorem 5.3: Sparse residue support forces transcendence

Pages 3 and 12–14 · Theorem 1.7 and Theorem 5.3 · arXiv:2607.06944v1

Correct

The T-scaled Hahn-series realization groups exponents modulo $T^{-1}\mathbb{Z}$ in the ramified coefficient ring. If a polynomial relation existed, Lemma 5.1 would give a null-series coefficient identity. Choosing a carry-free sparse sum of length equal to the polynomial degree makes Lemmas 3.8 and 5.2 select exactly one multinomial term; its leading coefficient and all participating grouped coefficients are nonzero, which is a contradiction.

Theorem 1.10 / Theorem 6.23: The bounded-support finiteness theorem is correct

Page 4 and pages 21–22 · Theorem 1.10 and Theorem 6.23 · arXiv:2607.06944v1

Correct

Kedlaya's mixed- and equal-characteristic descriptions imply that the coefficient function of a bounded algebraic series is quasi-twist-recurrent. With finitely many accumulation points, the support decomposes into a finite set and finitely many geometric rays. After a rational translation and integral scaling, their residue representatives are sparse by Lemma 6.21. Removing the finite part preserves algebraicity, so Theorem 5.3 contradicts an infinite remainder.

Corollaries 1.12 and Proposition 1.14: The monotone-support and special-series consequences are correct

Page 4 · Corollary 1.12 and Proposition 1.14 · arXiv:2607.06944v1

Correct

A strictly increasing rational support that failed to tend to infinity would be bounded and have a finite accumulation set, so Theorem 1.10 would force it to be finite. For support contained in $\{-p^{-i} : i \geq 1\}$, this proves algebraicity over either base field only when all but finitely many coefficients vanish; finite sums are algebraic because their rational powers of p are algebraic.

Corollary 6.24: The unbounded order-type restatement has a rational counterexample

Page 22 · Corollary 6.24 · arXiv:2607.06944v1

Incorrect

As printed, Corollary 6.24 applies to every p-adic algebraic f and asserts that the support's order type is finite or at least ω^2. Take $f = (1-p)^{-1} = \sum_{n\geq 0} p^n \in \mathbb{Q}_p \subset L_p$. Its canonical support is $\mathbb{Z}_{\geq 0}$, which has no real accumulation points but has order type exactly ω. Hence the claimed "in other words" alternative is false. This example does not disprove the preceding accumulation-point dichotomy; it disproves the asserted equivalence and shows why boundedness is essential. Repair classification: Verified scope repair. Add "with bounded support"; then Theorem 6.23 proves the dichotomy, and boundedness makes no accumulation equivalent to finite support.

02 / PROOFS

Proofs

Contains incorrect or incomplete proofs

The central sparse-support and bounded-support arguments are correct. Corollary 6.24 invokes the bounded-support result outside its hypotheses, and its printed order-type conclusion is false in that broader scope. A separate index-range typo in Lemma 6.22 is harmless.

Sections 3–5: Combinatorial isolation and the T-scaled realization

Pages 6–14 · Lemmas 3.3–3.8, Proposition 4.9, and Lemmas 5.1–5.2 · arXiv:2607.06944v1

Correct and complete

The digit-sum descent handles carries, and the sparse decomposition condition gives uniqueness modulo integers. Extending coefficients by $p^{1/T}$ and quotienting by T-null series is compatible with the original Hahn field: the intersection and surjectivity lemmas prove the required isomorphism. The multinomial expansion is coefficientwise finite, and specialization at the sparse witness leaves the single asserted nonzero term.

Proposition 6.6: Kedlaya's criteria give the required QTR condition

Pages 15–17 · Theorems 6.1 and 6.4, Lemma 6.7, and Proposition 6.6 · arXiv:2607.06944v1

Correct and complete

The cited completed-integral-closure theorem identifies mixed-characteristic expansions with equal-characteristic series whose truncations satisfy the corrected algebraicity criterion. Boundedness allows agreement through a cutoff above the support. Lemma 6.7 correctly proves that QTR is stable under this upper truncation, including the direction of the zero-insertion inequality.

Sections 6.2–6.3: Ray decomposition and sparse representatives

Pages 17–22 · Lemmas 6.11–6.22 and Theorem 6.23 · arXiv:2607.06944v1

Correct and complete

Two long gaps would generate an ordered copy of ω^2, so each fixed word has at most one unbounded gap coordinate and hence finitely many rays. Finite accumulation then permits a pairwise-disjoint ray decomposition. Their limit points can be aligned modulo integers by one scaling, and the separated digit blocks in Lemma 6.21 satisfy both parts of the sparseness definition. The finite-support subtraction and final application of Theorem 5.3 are valid.

Lemma 6.22: The final ray parameter should start at zero

Page 21 · last sentence of the proof of Lemma 6.22 · arXiv:2607.06944v1

Typo

The last sentence prints the representatives $\delta_l p^{-Nj}$ with $j = 1, 2, \ldots$. It should say $j \in \mathbb{N}$, equivalently $j = 0, 1, 2, \ldots$. The definition of the retained ray S' and both immediately preceding directions quantify over $j \in \mathbb{N}$, while Lemma 6.21 also begins at zero. The correction is uniquely determined and changes no argument.

Corollary 6.24: The bounded-support result is invoked outside its scope

Page 22 · Corollary 6.24; page 27 · formalized bounded-support versions · arXiv:2607.06944v1

Incorrect as written

Theorem 6.23 assumes bounded support, so it cannot establish Corollary 6.24 for arbitrary algebraic f; the geometric-series example in Part 1 shows that the printed order-type conclusion is false in that scope. Repair classification: Verified scope repair. Insert the bounded-support hypothesis. Theorem 6.23 then rules out a finite nonempty derived set, and a bounded well-ordered subset of $\mathbb{R}$ with no accumulation point is finite, giving the stated order-type alternative.

03 / NOVELTY

Novelty

No non-novelty findings

No non-novelty findings.

METHOD

Scope and decision rules

This audit addressed only the correctness of central statements, the correctness and completeness of proofs, and evidence-backed non-novelty. It did not evaluate importance, exposition, style, suitability for publication, or author reputation.

An adverse finding is included only where the report can give a direct calculation, counterexample, formal contradiction, or a verifiable source establishing the precise claim. An inability to verify is kept distinct from a demonstrated defect. Technical compression is not treated as incompleteness when the omitted reasoning is recoverable and correct.

Before any finding was recorded, the argument was closed under immediate, mechanically checkable consequences of facts already established. An observation was suppressed when the printed conclusion followed by elementary logic, direct substitution, weakening, inclusion, or verified monotonicity and no substantive proof obligation or textual correction remained.

Typographical errors and minor formal corrections remain fully visible in yellow with their locations and repairs. When such a defect is unambiguous, local, and harmless to the paper's substantive conclusions, it does not lower the overall statements or proofs status from Correct.

The novelty panel reports only central results for which a verifiable primary source predating the earliest public version that contains the result proves the same statement up to notation, or from which the statement follows directly and immediately. It contains no positive novelty certifications and no entries based merely on an unsuccessful literature search.

All mathematical expressions in this report are compiled by LaTeX. The web presentation independently validates and renders the corresponding expressions with KaTeX.

Sources checked

1. Source paper: arXiv:2607.06944v1

arXiv acknowledgement

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APPENDIX

Standardized prompt

You are a mathematical auditor. Evaluate only the correctness of the paper's central statements, the correctness and completeness of its proofs, and evidence-backed non-novelty. Do not make editorial comments or evaluate importance, exposition, style, or suitability for publication. Keep the report neutral, precise, and professional.

PART 1 — CORRECTNESS OF THE MAIN STATEMENTS

Identify the paper's central statements and assess each one separately using exactly one of these outcomes:

- Correct: the statement has a correct, verifiable proof; or, despite a defect in the printed proof, you can give a fully verified repair or independent proof.
- Incorrect: you can give strong formal evidence that the statement as written is false, preferably a counterexample or a complete contradiction.
- Not able to verify: the supplied proof does not establish the statement, and you can neither supply a fully verified proof nor disprove it.

For every adverse or unverified outcome, restate the exact claim and hypotheses, identify its location in the reviewed version, and give the decisive reasoning. Do not infer that a theorem is false merely because its printed proof is defective.

Assign the overall statements status by the following priority:

1. Contains wrong statements, if at least one central statement is Incorrect.
2. Contains unsupported statements, if no central statement is Incorrect but at least one is Not able to verify.
3. Correct, if every central statement is Correct, apart from any typographical or minor formal findings allowed by Part 4.

PART 2 — CORRECTNESS AND COMPLETENESS OF THE PROOFS

Audit the proofs of the central statements and every material internal or cited input on which they depend. For each proof or proof segment, use the narrowest supported outcome:

- Correct and complete: every substantive step is verifiable and no case or crucial nontrivial step is missing.
- Incorrect as written: a displayed calculation, inference, lemma, or cited application is formally false or inapplicable.
- Incomplete as written: a necessary substantive step or case is missing, even though no explicit contradiction has been proved.
- Not able to verify: the available paper and sources are insufficient to decide whether the step is valid.

Do not flag omitted routine details, compressed arguments, or "analogously" steps when the omitted reasoning is recoverable and correct. For every defect, identify its smallest exact location, explain its downstream dependency, and classify any proposed repair as one of:

- Verified repair: supply enough reasoning to verify that the repair works throughout every affected use.
- Plausible repair only: describe the possible repair but do not treat it as established.
- No repair supplied.

Assign the overall proofs status by the following priority:

1. Contains incorrect or incomplete proofs, if at least one proof is Incorrect as written or Incomplete as written.
2. Contains unverified proofs, if there is no proved incorrectness or incompleteness but at least one material proof is Not able to verify.
3. Correct, if all audited proofs are Correct and complete, apart from any typographical or minor formal findings allowed by Part 4.

PART 3 — NOVELTY OF THE MAIN STATEMENTS

This is a one-sided, evidence-only check. Evaluate only central results. Report a result only when a verifiable primary source, publicly available before the earliest public version of the paper that contains the result, proves the same statement up to a change of notation, or when the result follows directly and immediately from such an earlier theorem.

For each non-novelty finding, provide the earlier source, its public date, the exact theorem or proposition, and an explicit hypothesis-and-conclusion mapping. A later source cannot establish non-novelty. Do not flag a result merely because an easier proof exists or because it follows through a nontrivial argument. Do not flag a result that the paper itself explicitly presents as known, a survey item, or an alternative proof.

Mention only statements that meet this non-novelty threshold. Say nothing about statements for which no such evidence was found: do not certify novelty, list unsuccessful searches, or add statement-level "no prior source found" entries. If the list is empty, the section may say only "No non-novelty findings."

PART 4 — TECHNICAL AND EVIDENTIARY RULES

1. Criticism must never be overstated. Call a statement incorrect, a proof incorrect or incomplete, or a result non-new only when strong formal evidence supports that exact judgment. Otherwise use Not able to verify where that outcome exists, or remain silent in the novelty section.

2. Review a specified paper version. Give exact page, theorem, equation, or proof locations; restate relevant quantifiers and hypotheses; and check domains, endpoints, parameter ranges, constants, and dependencies explicitly. Apply a defect only to the regimes and downstream results that actually depend on it.

3. Immediate-consequence closure: when deciding whether a conclusion is supported, treat the argument as including every immediate formal consequence of facts established earlier in the paper and available at that point. An immediate formal consequence is a local, mechanically checkable inference using only definitions already in force, elementary logic, direct substitution or renaming, weakening of an inequality or set inclusion, or a monotonicity or symmetry property explicit in a definition or already proved.

4. Such an inference must introduce no new lemma, estimate, construction, case analysis, limiting or compactness argument, external result, or new issue of uniformity or parameter dependence. Check the direction of monotonicity and the dependence of every threshold or constant explicitly. Do not exchange pointwise and uniform conclusions, change exceptional sets, interchange quantifiers or limits, or extend an endpoint under this rule unless the required fact was already established.

5. If the claimed conclusion follows after immediate-consequence closure, it is fully supported. Do not report a gap, unsupported statement, minor formal correction, or recommendation to add an explanatory sentence, and do not mention the suppressed item in the report. This suppression does not apply to a genuine typographical error as defined below, because a typo is a literal notation defect that still requires a textual correction. For example, if $P(delta)$ is proved for every sufficiently small delta > 0 and P is immediately monotone in the required direction, then the claim that $P(delta)$ holds for every delta > 0 requires no correction; the omitted monotonicity step is exposition rather than an audit finding.

6. Immediate-consequence closure permits reconstruction of an omitted inference; it does not permit silent alteration of the printed domain, hypotheses, or quantifiers of an intermediate statement later invoked outside its stated scope. If formal validity requires changing the text of that statement or its stated range, report the appropriate finding even when the repair is easy. Thus a result stated only for $t > 0$ and subsequently applied at $t = 0$ remains a formal scope mismatch unless the endpoint case was separately established before the application.

7. Apply this mandatory gate before recording any adverse, unverified, typographical, or minor formal finding: (a) identify the exact assertion or inference alleged to be defective; (b) reconstruct the strongest conclusion following from the preceding argument after all admissible immediate formal consequences are added; (c) identify the specific defect that remains — a formally demonstrated falsehood, a concrete nontrivial unresolved proof obligation, or a genuine domain, hypothesis, quantifier, or notation mismatch requiring a textual correction; and (d) state the evidence and minimal repair. If no specific defect remains, or if the only possible addition would be explanatory, suppress the finding entirely. Use Not able to verify only when a precise, nontrivial unresolved obligation can be identified.

8. A typographical error is an incorrect symbol, index, exponent, sign, variable name, or notation mismatch whose unique intended correction is mechanically determined from the surrounding text and does not alter the mathematical argument. Report it in yellow as Typo, with the printed text, correction, exact location, and reason it is harmless. It does not lower an overall status.

9. A minor formal correction is a boundary, endpoint, or displayed parameter-range defect that can be repaired consistently in every affected statement by a local change, without a new argument, without invalidating any related result or application, and without creating another substantive defect. Report it in yellow as Minor formal correction, with the same details. It does not lower an overall status.

10. Do not use either minor category if more than one materially different repair is possible; if the repair changes the substance or scope of a central result; if an excluded case is used later; if the correction fails to propagate consistently; or if a new mathematical idea is required. In such cases use the strongest substantive classification actually supported by evidence.

11. Write every mathematical expression as valid, compilable LaTeX. Use ... for inline mathematics and

...

for displayed mathematics, with balanced delimiters and braces. Do not leave raw LaTeX commands outside math delimiters.

12. Separate theorem truth from the correctness of the printed proof. A theorem can be Correct in Part 1 because of a fully verified independent proof while its printed proof is adverse in Part 2. Conversely, a defective proof alone never licenses an Incorrect theorem classification.

Organize the report under Parts 1–3 and apply Part 4 throughout. Do not add editorial commentary, scores, rankings, recommendations, or a list of suppressed observations.

END OF REPORT

Each claim in this prototype report remains open to independent challenge and revision.