MATHAUDIT / DETAILED REPORT

Correctness, proof completeness, and novelty audit

Dimension estimates for the set of points with non-dense orbit in homogeneous spaces

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Paper	arXiv:1710.04898v2
Source version	Submitted 25 August, 2019; v1 submitted 13 October, 2017; announced October 2017.
Audit date	August 19, 2026
Prompt	Standardized prompt
Novelty cutoff	October 13, 2017
Paper license	arXiv non-exclusive distribution license
Scope	Statements, proofs, and novelty only

Important limitation. AI-generated analysis. This report is not a correctness certificate or a substitute for expert scrutiny. A Correct status may coexist with yellow typos or minor formal corrections that do not affect substantive soundness. It means that this audit found no unresolved substantive error under the stated criteria; it is not formal verification and should remain open to expert challenge and correction.

SUMMARY

01	Statements	Correct
02	Proofs	Correct
03	Novelty	No non-novelty findings

01 / STATEMENTS

Statements

Correct

The dimension estimates for trajectories avoiding a co-bounded target, their compact-space corollary, the leafwise effective-equidistribution theorem, and the weighted badly approximable application are correct as stated.

Theorems 1.1 and 1.3: Quantitative dimension drop for nondense trajectories

Pages 3–4 and 8–17 · Theorems 1.1, 1.3, and 4.1 · arXiv:1710.04898v2

Correct

Effective equidistribution gives a uniform positive proportion of each tessellation domain whose next translate enters the inner target. Iterating the resulting Bowen-box cover and converting boxes to metric balls yields the logarithmic codimension bound in Theorem 1.3. The stable/central and unstable local product decomposition then transfers this leafwise bound to X, with the injectivity-radius and inner-core hypotheses transforming exactly as required for Theorem 1.1.

Corollary 1.2: Neighborhood-avoidance estimate in the compact case

Pages 3 and 9–10 · Corollary 1.2 and its proof · arXiv:1710.04898v2

Correct

Applying Theorem 1.1 to $U = \partial_r S$ at scale $r/2$ gives a numerator containing $\mu(\partial_{r/2} S)$. Compactness supplies a uniform ball-volume lower bound, and for an embedded k-submanifold the tubular-neighborhood estimate gives $\mu(\partial_{r/2} S) \gg r^{\dim X - k}$. These substitutions produce both displayed conclusions.

Theorem 1.4: Weighted badly approximable systems have the announced codimension bound

Pages 4 and 22–25 · Theorem 1.4 and Section 8 · arXiv:1710.04898v2

Correct

Lemma 8.1 identifies $\mathrm{Bad}_{\mathbf{i},\mathbf{j}}(c)$ with lattices avoiding the weighted cusp at radius $\varepsilon = c^{1/(m+n)}$. The weighted cusp has measure comparable to $\varepsilon^{m+n} = c$, and Proposition 8.3 shows that its inner core retains this order at a radius proportional to a fixed power of ε. Substitution into Theorem 1.3 gives $\operatorname{codim} \mathrm{Bad}_{\mathbf{i},\mathbf{j}}(c) \gg c/\log(1/c)$ with the asserted dependence of constants.

02 / PROOFS

Proofs

Correct

The mixing-to-EEP argument, Bowen-box covering iteration, local-product reduction, and weighted-cusp estimates are correct and complete. Four printed notation, word, or symbol slips have uniquely determined local corrections and do not lower the proof status.

Sections 2–6: Effective equidistribution and the iterated covering argument

Pages 5–17 · Theorem 2.5, Theorem 4.1, and supporting lemmas · arXiv:1710.04898v2

Correct and complete

Exponential mixing is smoothed at scale $e^{-\beta t}$ with the exponents balanced to produce EEP. Tessellation domains remove boundary losses when successive Bowen covers are multiplied. Proposition 5.1 supplies a uniform lower measure for the good portion, and Lemma 6.4 converts each final Bowen box into metric balls at radius $re^{-k\lambda_{\max}t}$. The limiting covering exponent is precisely the claimed Hausdorff-dimension loss.

Lemma 7.2 and Section 7: Injectivity-radius control and weighted horospherical EEP

Pages 18–22 · Lemma 7.2 and Theorem 7.1 · arXiv:1710.04898v2

Correct and complete

For successive-minimum vectors $v_1, \ldots, v_d$, Minkowski's second theorem and the lattice determinant bound give the dual coefficient of v_d norm $O(1/\|v_d\|)$. The transvection fixing $v_1, \ldots, v_{d-1}$ and sending v_d to $v_d + v_1$ is therefore $O(\delta(x)^{d/(d-1)})$ from the identity, proving the upper injectivity-radius bound. Quantitative nondivergence and the decomposition $g_t = a_t b_t$ then give the required uniform EEP estimate for the weighted subgroup.

Expansion-rate notation: The contraction exponents are written as eigenvalues of ad_{g_1}

Pages 10 and 15 · definitions of $\lambda_{\max}$ and λ_0 · arXiv:1710.04898v2

Typo

The element g_1 belongs to the group, so ad_{g_1} is not the infinitesimal adjoint map whose positive eigenvalues give the factors $e^{-\lambda t}$ used in the Bowen-box estimates. Let $D = \frac{d}{dt}\big|_{t=0} g_t$ and replace these occurrences by $\mathrm{ad}(D)|_{\mathfrak{p}}$; equivalently, define the rates as the logarithms of the eigenvalues of $\mathrm{Ad}(g_1)|_{\mathfrak{p}}$. The conjugation formulas immediately following the definitions already use exactly these rates, so this is a unique notation repair and no estimate changes.

Equation (3.6): The comparison constant is inverted

Page 9 · Equation (3.6) and the following parenthesis · arXiv:1710.04898v2

Typo

The proof sets $C' = 2C$ when replacing $\log(4/r) + \log(1/\mu)$ by $\log(1/r) + \log(1/\mu)$. Since $r < 1/4$, the first denominator is at most twice the second, so the needed lower-bound constant is $C' = C/2$ (or any smaller positive constant), and the displayed comparison sign in the parenthesis must be reversed accordingly. This is a local coefficient correction; the theorem requires only an unspecified positive uniform constant.

Proof of Corollary 1.2: Codimension is bounded below, not above

Page 9 · two sentences following Equation (3.6) · arXiv:1710.04898v2

Typo

The prose twice says that the exceptional set has Hausdorff codimension at most the displayed positive quantity, while the formulas and the conclusion use a lower bound. Replace at most by at least in both sentences. No displayed inequality or subsequent deduction changes.

Proof of Theorem 4.1: The final Bowen-ball radius repeats the iteration index

Page 17 · paragraph preceding Equation (6.8) · arXiv:1710.04898v2

Typo

The cover is once described as using balls of radius $re^{-k\lambda_{\max}k}$. The conjugation time is kt, and the preceding and following denominator formulas both use $re^{-k\lambda_{\max}t}$. Replace the final k in the exponent by t; the covering count and dimension limit are already computed with the corrected radius.

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:1710.04898v2

arXiv acknowledgement

Thank you to arXiv for use of its open access interoperability. This service was not reviewed or approved by, nor does it necessarily express or reflect the policies or opinions of, arXiv.

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.