

Correctness, proof completeness, and novelty audit

Convex hulls of random walks, hyperplane arrangements, and Weyl chambers

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Scope	Statements, proofs, and novelty
Important limitation. AI-generated analysis. This report is not a correctness certificate or a substitute for expert scrutiny.	

SUMMARY

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

Statements

Contains wrong statements The distribution-free absorption theorems and the hyperplane-section theorems are correct.

One ancillary sentence in Remark 3.2 is false without an essentiality assumption: a linear arrangement can have a zero constant characteristic coefficient. The false sentence is not used in the marked Theorem 3.3–Lemma 3.5 chain.

Remark 3.2: Strict positivity fails for nonessential linear arrangements

Journal page 894 · Remark 3.2

Incorrect · **verified scope repair**

The remark says that the entire coefficient sequence $a_0, \dots, a_n$ of every linear arrangement is strictly positive. For the type- A_{n-1} arrangement $x_i = x_j$ in $\mathbb{R}^n$, the characteristic polynomial has a factor t , so $a_0 = 0$; the paper’s own equation (34) exhibits that factor. Replace strict positivity by nonnegativity, or assume the arrangement is essential. The parity identity in equation (32), Theorem 3.3, and Lemma 3.5 do not need the stronger claim.

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Theorems 1.1–1.3 and 2.3, 2.7, 2.10: The absorption-probability formulas have the correct symmetry and general-position hypotheses

Journal pages 881–892 · main random-walk and bridge theorems

Correct

The type A , B , and D formulas use the appropriate exchangeability or signed-exchangeability action, and their polynomial coefficients are indexed with the correct parity. The assumptions ensure that boundary absorption has probability zero, so the Weyl-chamber counts transfer to convex-hull nonabsorption without an omitted boundary term.

Theorem 3.3 and Lemma 3.5: The marked hyperplane-section claims are correct

Journal pages 894–896 and 913–914 · Theorem 3.3, Lemma 3.5, and proof

Correct

For a codimension- d subspace in general position, the number of arrangement regions it meets is twice the alternating-parity sum of characteristic coefficients stated in Theorem 3.3. Lemma 3.5 gives the needed upper comparison for an arbitrary subspace and equality in general position. These are the exact claims imported into Kabluchko’s projection paper.

Proofs

Correct The proofs of the random-walk, bridge, and Weyl-chamber formulas were checked across the complete article.

The group-orbit counting, characteristic-polynomial restrictions, and approximation from arbitrary to general-position subspaces are coherent. No gap affecting a theorem was found.

Lemma 3.1 and Theorem 3.3: Restriction of the characteristic polynomial gives the advertised region count

Journal pages 893–896 · Lemma 3.1 and proof of Theorem 3.3

Correct

The rank of every restricted subarrangement is truncated at the section dimension. Substitution into Whitney’s formula gives equation (31), and Zaslavsky’s region evaluation gives the parity sum. The separate one-dimensional convention is treated explicitly and agrees with equation (32).

Lemma 3.5: The perturbation argument preserves every chamber already met

Journal pages 913–914 · proof of Lemma 3.5

Correct

A point in each chamber met by the original subspace is chosen away from all hyperplanes. Nearby general-position subspaces still meet small neighborhoods of those finitely many points, so they meet at least the same chambers. Density of general-position subspaces supplies the perturbation. Equality follows when the original subspace itself is in general position.

Sections 4–6: The geometric and probabilistic translations are mutually consistent

Journal pages 896–916 · Weyl chambers, proofs of the main theorems, and general-position verification

Correct

The linear maps from increment coordinates to partial sums identify nonabsorption with a union of Weyl chambers intersecting a kernel. Exchangeability makes orbit probabilities equal, and the kernel hypotheses are exactly the arrangement general-position conditions proved in Section 6. The type- D extra endpoint is carried through consistently.

Novelty

No non-novelty findings No non-novelty findings.

METHOD

Exact-source disclosure

This audit evaluated only the linked journal version of record. An arXiv preprint, accepted manuscript, or later correction is not silently substituted for that source.

Sources checked

1. [Exact open version of record](#)

Audit instructions

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.
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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 $\dots$ for inline mathematics and $\dots$ 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