Referee Audit II

Manuscript

Coarse Transport, Central Twist, and Finite-Scale Coercivity for Yang–Mills Wilson-Tube Hamiltonians: Physical Wilson-Channel Reduction and Exact Ultraviolet–Infrared Leakage

Overall verdict

The manuscript has passed the second referee-grade audit. The general theorem remains conditional on an explicit finite-scale comparison package, but the paper now contains a complete end-to-end `SU(2)` Peter–Weyl Galerkin application verifying every component of that package and producing a strictly positive resolved coercivity constant. The paper is mathematically and rhetorically in a substantially stronger position than the pre-witness draft.

Recommendation: suitable for submission to the *Journal of Mathematical Physics* after the author inserts the preferred affiliation and corresponding email address and performs a final personal prose proofread.

1. Independent witness verification

The Galerkin calculation was recomputed independently from the exact rational matrices at 100-decimal-digit precision. The largest residual among the eigenvalue equations, projection identity, block orthogonality, Gram reconstruction, and exact block decomposition was below

$$6 \times 10^{-101}.$$

The independently verified constants are:

Quantity	Verified value
Ground energy `E_0`	0.726377103195316826224577109...
First excited energy `E_1`	1.834876148944763504667311628...
Second excited energy `E_2`	3.188746747859919669108111263...
Vacuum-survival singular value	0.878680870599102631865536579...
Electric capture tail	0.071107747486602787670483166...
Gram scalar `G`	0.767023760604178478865605627...
Physical magnetic recompression	1.401653943641106164741524174...
Maximum physical extraction coefficient	0.537550939458639244302142071...
Complete infrared constant	0.947907632145655620857456169...
Ultraviolet constant	1.254266312052676850202762166...
Exact mixed/reference leakage	0.416309692765242931777482670...
Determinant margin	1.015614849647625947687025120...
Resolved coercivity constant `\widehat\kappa_G`	0.657490679870653423390141874...
Exact Galerkin spectral gap	1.108499045749446678442734519...

The resolved theorem certifies approximately 59.31% of the exact Galerkin spectral gap.

2. Witness-to-package verification

Condition	Galerkin realization	Status
A1	Exact Hermitian Galerkin Hamiltonian and complete interacting ground projection	Verified
A2	Strict two-vertex graph, complete graph-lowest projection, and isometric raw Wilson frame	Verified
A3	Nonzero survival after exact vacuum removal; positive survival singular value	Verified
A4	Whole-eigenspace electric capture, positive Gram operator, and positive ultraviolet exclusion	Verified
A5	Canonical magnetic recompression on the physical frame and positive physical edge extraction	Verified
A6	Positive calibrated physical-channel constant; residual infrared block vanishes	Verified
A7	The sole canonical magnetic cell is assigned to the interior class	Verified
A8	Exact reference leakage is computed and is nonzero	Verified
A9	Transported-cell identities are vacuous because the transported class is empty	Verified
A10	The finite Peter–Weyl window is unital and involution invariant	Verified
Final determinant condition	Positive determinant margin and positive resolved coercivity constant	Verified

The example is not block diagonal. Its nonzero mixed term arises entirely from ordinary reference-band mixing, so it genuinely exercises the revised three-part leakage architecture.

3. Principal theorem audit

The principal theorem now has a noncircular dependency chain:

1. construction of the canonical finite Hamiltonian;

2. construction of coarse transport and detected graph data;
3. vacuum-orthogonal electric form restriction;
4. exact vacuum removal and finite electric capture;
5. Gram-normalized physical channel construction;
6. physical magnetic recompression, extraction, and calibration;
7. exact reference–transport–collar mixed-block decomposition;
8. complete vacuum reduction;
9. sharp two-block coercivity theorem.

No preferred vacuum vector, vacuum–graph alignment, prior finite electric support of the raw channel, or exact electric block closure is used.

4. Global claim audit

The manuscript consistently distinguishes three levels of assertion:

- **General theorem:** conditional on a finite comparison package whose inputs are explicitly identified.
- **Galerkin witness:** an exact theorem application to the displayed finite Peter–Weyl Galerkin Hamiltonian.
- **Untruncated/continuum theory:** not claimed; extension would require a separate tail-stability and no-leakage argument.

The abstract, introduction, appendices, and final scope statement now agree on these limitations. No continuum, Poincare-covariant, or relativistic Yang–Mills mass-gap claim is made.

5. Exposition audit

Completed changes:

- shortened abstract;
- added a four-item main-contributions subsection;
- added a notation guide;
- added a compact package-verification table in the Galerkin appendix;
- added outward-rounded numerical intervals sufficient to certify every strict inequality;
- replaced unsupported numerical assertions with a reproducibility statement;
- cited every bibliography entry used in the manuscript;
- retained the full matrices in the computational appendix rather than overloading the introduction.

6. Submission-format audit

A one-column AIP/REVTeX version was compiled with the `aip,jmp,preprint,onecolumn` options. It contains:

- title and author;
- concise abstract and keywords;
- MSC codes;
- acknowledgments;
- conflict-of-interest declaration;
- single-author CRediT contribution statement;

- data availability statement;
- code availability statement;
- appendices and references in submission order.

Both the reference manuscript and the JMP submission manuscript compile without undefined references, LaTeX warnings, or overfull boxes.

7. Remaining author-supplied metadata

The following were deliberately not invented:

- preferred institutional affiliation;
- corresponding author email address;
- ORCID, if desired;
- repository DOI or public archive identifier for the supplementary computation package.

The current JMP source uses `\noaffiliation`. Replace that line and add `\email{...}` before submission.

8. Final recommendation

The paper no longer presents only a conditional architecture plus raw mechanism witnesses. It now presents:

general physicalization theorem + exact mixed-block analysis + complete computational theorem witness

No further foundational reconstruction is indicated by this audit. The remaining work is author metadata, repository deposition if desired, and a final personal proofread before upload.