

Matthew Corbelli

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PROFESSIONAL SUMMARY

Research mathematician with a PhD from UC Davis and peer-reviewed publications in mathematical physics. Expertise in braided tensor categories, topological phases, superselection theory, and quantum lattice systems, with a track record of translating advanced mathematical physics into clear, step-by-step reasoning. Eager to apply mathematical expertise and hands-on Lean 4 experience to AI-driven theorem proving and formal methods research.

TECHNICAL SKILLS

Physics & Mathematics: Quantum lattice systems, C^* -algebras, braided tensor categories, topological phases, superselection theory, FQHE, operator algebras, computational complexity

Formal Methods: Lean 4, mathlib (merged contributor), theorem proving, formal verification

Programming: Python, Lean 4, PyTorch, Java, JavaScript, SAS

Tools: Git, Spring Boot

RESEARCH EXPERIENCE

Graduate Researcher (PhD) | University of California, Davis | 2022 – 2025

- Developed mathematical models of topological phases and anyon statistics in many-body infinite-volume quantum lattice systems using C^* -algebras and braided tensor categories, requiring multi-step deductive reasoning across abstraction layers.
- Established bounds on Hall conductance quantization by characterizing the superselection sector structure of the associated tensor category; published in *Reviews in Mathematical Physics* (2025), DOI: 10.1142/S0129055X24610075.
- Extended existing lattice system frameworks to incorporate on-site symmetries and fermionic operators; results available as preprint arXiv:2510.23790 and ISBN 9798290647647.
- Collaborated with researchers at UBC (Bachmann), UC Davis (Fraas), and Kyoto University (Ogata).

INDEPENDENT PROJECTS

Lean Mathlib Contribution | 2026

- Contributed to Lean's official mathlib library: wrote DirectLimit instances for star-algebraic structures with supporting lemmas; PRs #38308 and #38672 merged into main branch, advancing infrastructure for C^* -algebra applications.

PUBLICATIONS & PREPRINTS

Bachmann, Corbelli, Fraas, Ogata. "Tensor Category Describing Anyons in the Quantum Hall Effect and Quantization of Conductance." *Reviews in Mathematical Physics* (2025). DOI: 10.1142/S0129055X24610075.

Corbelli, M. "On Symmetry-Compatible Superselection Structures for Product States in 2D Quantum Spin Systems." Preprint, arXiv:2510.23790 (2025).

EDUCATION

PhD, Mathematics | University of California, Davis | 2025

Dissertation: Braided Tensor Categories Describing Anyons in Quantum Lattice Systems: Symmetries, Fermions, and the Fractional Quantum Hall Effect

Funded in part by the National Science Foundation (DMS-2407290)

MS, Mathematics | University of California, Davis | 2021

BS, Mathematics (Minor: Computer Science) | University of California, Davis | 2018

INDUSTRY EXPERIENCE

Backend Software Engineer | VSP Vision Care | 2018 – 2019

- Developed and maintained enterprise-scale backend services in Java/Spring Boot for insurance processing workflows.