Matthew Corbelli

matthew.corbelli@gmail.com • linkedin.com/in/matthewcorbelli

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. Eager to leverage abstract algebraic modeling and Python-based experimentation in mechanistic interpretability or AI safety research.

TECHNICAL SKILLS

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

Quantum Computing: The toric code, Grover's algorithm

Programming: Python (NumPy, SciPy, Matplotlib), Java, Lean, JavaScript, SAS

Tools: Git, Spring Boot

RESEARCH EXPERIENCE

Graduate Researcher (PhD) | University of California, Davis2018 – 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.
- 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 solo preprint arXiv:2510.23790 and ISBN 9798290647647.
- Collaborated internationally with researchers at UBC (Bachmann), UC Davis (Fraas), and Osaka University (Ogata).

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).

INDEPENDENT PROJECTS

Lean Mathlib Contribution | 2026

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

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.