Cesai Li

Curriculum Vitae

Contact Information

Office Address: Department of Mathematics and Statistics
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Education

Ph.D. in Mathematics, Boston University 2024–present

Bachelor of Science in Mathematics, University of British Columbia 2020–2024
Graduated with Distinction

Research Interests

Mathematical physics, quantum field theory, factorization algebra, algebraic structures of quantum observables, applications of category theory and homological algebra in mathematical physics, quantum error correction, topological quantum error correction codes, graphical calculus (Penrose graphical notation, tensor networks, ZX calculus)

Research Experience

- **Preliminary Exam Reading Project**, Boston University 2025 Summer–Fall
  - Advisor: Brian Williams
  - Topic: *Topological field theories*
  - Studied functorial TQFT, quantum groups, Reshetikhin-Turaev invariants of 3-manifolds
  - Developed a Python program to calculate the Jones polynomial of a link from its diagram
- **Research Assistant**, University of Saskatchewan 2023 Summer
  - Advisor: Alex Weekes
  - Topic: *On the monopole formula and its generalizations*
  - Algebraic geometry, combinatorics, 3d $\mathcal{N} = 4$ Coulomb branches

Teaching Experience

- **Teaching Fellow** for CAS MA 242C Linear Algebra, BU 2025 Fall
- **Instructor of Record** for CAS MA 116 Statistics II, BU 2025 Summer 2
- **Instructor of Record** for CAS MA 116 Statistics II, BU 2025 Summer 1
- **Teaching Assistant** for MATH 100 Differential Calculus, UBC 2022 Fall

Honours and Awards

- Dean's Fellowship, Boston University 2024 Fall–2025 Spring
- The Canadian Federation of University Women Gaming Education Award 2023
- Dean's Honour List, University of British Columbia 2021

Certifications

- **Completion of the LPS Qubit Collaboratory Quantum Computing Summer Short Course 2025** AUG 2025
  Issued by Laboratory for Physical Sciences (LPS) Qubit Collaboratory
  - Quantum two-level systems, classical and quantum circuits, quantum algorithms, Qiskit, Quantum error correction, introduction to qubit types: semiconductor-based, neutral atom, superconducting, trapped ion

Community Involvement

- **Directed Reading Program Mentor**, Boston University 2025 Spring
  - Mentee: Zhengkai Li
  - Topic: *Complete classification of finitely generated abelian groups*
- **Volunteer Tutor**, UBC 2023 Fall–2024 Spring
  - Offered algebra and analysis tutoring to four undergraduate students in mathematics

Selected Coursework and Projects

- **Advanced Linear Algebra**, UBC
  - Generalized eigenspaces and Cayley-Hamilton, Jordan canonical form, linear operator theory
- **Mathematical Computing**, UBC
  - Python `NumPy`, `SciPy`, `Matplotlib`, Jupyter Notebooks, numerical methods in calculus and linear algebra
- **Computational Physics**, UBC
  - Solved, simulated, and visualized physical problems using Python `NumPy`, `SciPy`, `Matplotlib`
  - Collaborated with team members and presented results via Jupyter Notebooks
- **Commutative Algebra**, UBC
  - Local rings, free resolutions, Noetherian rings and modules, primary decomposition, integral dependence, homological algebra
- **Intermediate Experimental Physics I and II**, UBC
  - Collaborated with team members to design and conduct physical experiments including building a radio receiver and measuring the resonant frequency of an acoustic box
  - Collected experimental data using an oscilloscope and performed data analysis using Python
- **Quantum Mechanics**, UBC
  - Hermitian operators, Schrödinger equation, Hilbert space, probability densities
- **Intermediate Mechanics**, UBC
  - Particle kinematics in curvilinear coordinates, Lagrangian mechanics, two-body problem
- **Thermal Physics I**, UBC
  - Thermodynamics, basic statistical mechanics, and the interplay between them

Conferences and Workshops Attended

- Homotopical algebra in geometry, topology, and physics JUN 20-24, 2025
  at Northwestern University, Evanston, IL
- Physical Mathematics of QFT Summer School 2025 JUN 09-13, 2025
  at University of Massachusetts Amherst, Amherst, MA
- GTA: Philadelphia 2025 10th Annual Graduate Student Conference MAY 30-JUN 01, 2025
  in Algebra, Geometry, and Topology at Temple University, Philadelphia, PA
- New England Algebraic Topology and Mathematical Physics Seminar NOV 2–3, 2024
  — A miniconference in topology and quantum field theory at Providence College, Providence, RI