

Junaid Aftab

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Education

- 2020– **Ph.D. Candidate**, *University of Maryland, College Park*, Applied Mathematics.
2018–2020 **M.S.**, *Kansas State University*, Mathematics.
2013–2017 **B.S.**, *Lahore University of Management Sciences (LUMS)*, Economics & Mathematics.

Publications & Pre-Prints

Publications and pre-prints are listed in reverse chronological order.

- **Junaid Aftab**, Christoph Schwab, Haizhao Yang, Jakob Zech. Quantum Circuit Encodings of Polynomial Chaos Expansions. Submitted to *Quantum*, [arXiv:2506.01811](https://arxiv.org/abs/2506.01811).
- **Junaid Aftab**, Haizhao Yang. Approximating Korobov functions via quantum circuits. To appear in *Communications in Mathematical Sciences*, [arXiv:2404.14570](https://arxiv.org/abs/2404.14570).
- **Junaid Aftab**, Dong An, Konstantina Trivisa. Multi-product Hamiltonian simulation with explicit commutator scaling. Submitted to *Communications in Mathematical Physics*, [arXiv:2403.0892](https://arxiv.org/abs/2403.0892).
- **Junaid Aftab**, Adam Zaman Chaudhry. Analyzing the quantum Zeno and anti-Zeno effects using optimal projective measurements. *Scientific reports* 7.1 (2017): 1-10, [arXiv:1702.01609](https://arxiv.org/abs/1702.01609).

Research Internships

- 2023 **Quantum Computing Summer School**, Los Alamos National Laboratory.
◦ Used tools from representation theory to investigate the effect of noise in quantum neural networks

Awards & Fellowships

- 2024–2026 **Math Quantum Research Training Program Fellowship**, *University of Maryland, College Park*.
2024 **Herbert A. Hauptman Summer Fellowship**, *University of Maryland, College Park*.
2020–2022 **Dean's Fellowship**, *University of Maryland, College Park*.
2017 **NMF Gold Medal**, *Lahore University of Management Sciences*.
2013–2017 **Dean's Honour List**, *Lahore University of Management Sciences*.

Talks

- 2024–2025 **Multi-product Hamiltonian simulation with explicit commutator scaling**.
◦ MathQuantum Symposium 2025, University of Maryland
◦ TQC Conference 2024, Okinawa Institute of Science and Technology
- 2022–2025 **Research Interaction Team (RIT)**, *University of Maryland*.
◦ RIT on Geometry and Physics. March 2023, March 2025.
◦ RIT on Machine Learning. Oct. 2022.
- 2022 **Quantum Error Correction Reading Group**, *University of Maryland*, Homological Product Codes.

Conferences, Summer Schools

- June 2025 **QFT and Topological Phases via Homotopy and Operator Algebras**, *Harvard University*.
August 2024 **C*-Algebraic Quantum Mechanics and Topological Phases of Matter**, *CU Boulder*.
July 2024 **Groundwork for Operator Algebras Lecture Series**, *Institute for Pure & Applied Math (IPAM)*.
July 2023 **PCMI Graduate Summer School**, *Park City Mathematics Institute (PCMI)*.

Teaching

- 2022, 2024 **Instructor**, *University of Maryland*,
As the main instructor, I developed syllabi, quizzes, exams, and homework for the courses listed below. A star indicates I was ranked excellent by student course evaluations.
- MATH 120: Elementary Calculus. Summer 2024*
 - MATH 141: Calculus II. Summer 2022*
- 2020– **Graduate Teaching Assistant**, *University of Maryland*,
I organized weekly recitation sessions which were designed to go over worksheets and homework problems. My goals were for students to learn through guided exploration.
- MATH 240: Introduction to Linear Algebra. Fall 2023
 - MATH 140: Calculus I. Fall 2022
 - MATH 135: Discrete Mathematics for Life Sciences. Fall 2021
 - MATH 141: Calculus II. Spring 2021, Spring 2023
 - MATH 120: Elementary Calculus. Fall 2020
- 2018–2020 **Graduate Teaching Assistant**, *Kansas State University*,
I organized weekly recitation sessions for students which were designed to go over worksheets and homework problems.
- MATH 340: Elementary Differential Equations. Fall 2019, Spring 2020
 - MATH 220: Analytic Geometry and Calculus I. Fall 2018, Spring 2019
- 2016–2018 **Teaching Assistant**, *Lahore University of Management Sciences*,
I organized weekly recitation sessions for students which were designed to go over worksheets and homework problems.
- MATH 204: Introduction to Formal Mathematics. Spring 2018
 - MATH 120: Linear Algebra with Differential Equations. Spring 2018
 - MATH 101: Calculus I. Fall 2017
 - Introduction to Analysis I. Spring 2016, Spring 2017
 - Introduction to Formal Mathematics. Fall 2016

Mentoring

- 2025– **Research Mentor**, *University of Maryland*.
I have mentored undergraduate students as part of the MathQuantum RTG.
- Ava Petusky, Spring '25. Presented poster titled on quantum simulation algorithms at MathQuantum Symposium.
- 2022– **Directed Reading Program**, *University of Maryland*.
The **Directed Reading Program** (DRP) pairs undergraduate students with graduate student mentors for semester-long independent study projects. I have mentored the following students:
- Kelin Zhu, Fall '25. *K*-Theory.
 - Aiden Higgs, Fall '24. Categories in Quantum Theory.
 - Nashita Bhuiyan, Spring '24. Learning Theory: PAC-Learning & VC dimension.
 - Koran Bailey, Spring '23. Grover's Search Algorithm & Random Walks
 - Matthew Cimerola, Fall '22. Neural Networks & Their Applications.

Service

- 2024–2025 **MathQuantum RTG Outreach**, *University of Maryland*.
I volunteered for various outreach activities promoting quantum computing to a general audience as part of the MathQuantum RTG program.
- Maryland Day 2025.
 - "Spooky Math" Halloween Science Fest 2024 in Virginia.
- 2024 **Course Staff**, *University of Maryland*.
I assisted professors in designing the course materials for AMSC 698: Mathematics of Quantum Information.
- 2024 **Guest Lecturer**, *University of Maryland*.
I was asked to deliver two lectures for a graduate-level course on differential geometry.

Software

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| Programming | Python, Julia, MATLAB, Qiskit, Mathematica, LaTeX |
| Data Analysis | PyTorch, Pandas, Scikit-Learn, Seaborn, Jupyter |
| Mathematics | SageMath, SymPy, SciPy |