

Junaid Aftab

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

Preprints

- **Junaid Aftab**, Yuehaw Khoo, Haizhao Yang. Non-Uniform Quantum Fourier Transform. Submitted to *SIAM Journal on Scientific Computing* (2026), [arXiv:2602.13472](https://arxiv.org/abs/2602.13472).
- **Junaid Aftab**, Christoph Schwab, Haizhao Yang, Jakob Zech. Quantum Circuit Encodings of Polynomial Chaos Expansions. Submitted to *Quantum* (2025), [arXiv:2506.01811](https://arxiv.org/abs/2506.01811).
- **Junaid Aftab**, Dong An, Konstantina Trivisa. Multi-product Hamiltonian simulation with explicit commutator scaling. Submitted to *Communications in Mathematical Physics* (2024), [arXiv:2403.0892](https://arxiv.org/abs/2403.0892).

Publications

- **Junaid Aftab**, Haizhao Yang. Approximating Korobov functions via quantum circuits. *Communications in Mathematical Sciences* 23(8), pp. 2077–2101, (2025).
- **Junaid Aftab**, Adam Zaman Chaudhry. Analyzing the quantum Zeno and anti-Zeno effects using optimal projective measurements. *Scientific Reports* 7, 11766 (2017).

Research Projects: In Preparation

- **Junaid Aftab**, 2D Hyperbolic Matter via Non-Commutative Geometry, The project aims to classify phases of matter in hyperbolic lattices using techniques from non-commutative geometry..
- **Junaid Aftab**, Multi-Product Formula Enhanced Linear Combination of Hamiltonian Simulation Algorithm. The project analyzes the error scaling of the integrated multi-product formula and linear combinations in Hamiltonian simulation algorithms..

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.

- o MATH 120: Elementary Calculus. Summer 2024*
- o 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.

- o MATH 240: Linear Algebra. Fall 2023
- o MATH 140: Calculus I. Fall 2022
- o MATH 135: Discrete Mathematics for Life Sciences. Fall 2021
- o MATH 141: Calculus II. Spring 2021, Spring 2023
- o 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.

- o MATH 340: Elementary Differential Equations. Fall 2019, Spring 2020
- o MATH 220: Analytic Geometry and Calculus I. Fall 2018, Spring 2019

Mentoring

2025– **Research Mentor**, *University of Maryland*.

I have mentored undergraduate students as part of the MathQuantum RTG.

- o Ava Petusky, Spring '25. Presented poster on quantum simulation 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:

- o Kelin Zhu, Fall '25. *K*-Theory.
- o Nashita Bhuiyan, Spring '24. Learning Theory: PAC-Learning & VC dimension.
- o Koran Bailey, Spring '23. Classical & Quantum random walks.
- o Matthew Cimerola, Fall '22. Neural Networks and 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.

- o Maryland Day 2025.
- o "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

Programming Python, Julia, MATLAB, Qiskit, Mathematica, LaTeX

Data Analysis PyTorch, Pandas, Scikit-Learn, Seaborn, Jupyter

Mathematics SageMath, SymPy, SciPy