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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

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

- **Junaid Aftab**, Haizhao Yang. Approximating Korobov functions via quantum circuits, Accepted by *Communications in Mathematical Sciences*. Awaiting publication. arXiv: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.
- **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.

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
- Developed a categorical framework that can be used to describe quantum machine learning models

Awards & Fellowships

2024 - 2026 **Math Quantum Research Training Program (RTG) 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

Multi-product Hamiltonian simulation with explicit commutator scaling.
- MathQuantum Symposium 2025, University of Maryland
- TQC Conference 2024, Okinawa Institute of Science and Technology

Research Interaction Team (RIT), *University of Maryland*.
- RIT on Geometry and Physics. March 2023, March 2025.
- RIT on ML for Rare Events. Oct. 2022.

2022 **Quantum Error Correction Reading Group**, *University of Maryland*, Homological Product Codes.

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: 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 mentored undergraduate students as part of the MathQuantum RTG.
- Ava Petusky. Two quantum algorithms for Hamiltonian simulation.

2022 - Present **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:
- Riya Metha, Fall 2025. Lie groups and Lie algebras.
- Nashita Bhuiyan, Spring 2024. Learning theory: PAC-Learning & VC dimension.
- Koran Bailey, Spring 2023. Classical and quantum random walks.
- Matthew Cimerola, Fall 2022. 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.
- 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.

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)*.

Software

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