Junaid Aftab

4176 Campus Drive
University of Maryland
College Park, MD 20740 USA
☎ *(240) 898 6354*
✉ *junaida@umd.edu, junaid.aftab1994@gmail.com,*
🖥 *junaid-aftab.github.io/*

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.	

Research Interests

I am interested in mathematical problems in quantum physics. Topics of interest include quantum algorithms, quantum machine learning, topological quantum computation, and topological phases of matter.

Publications & Preprints

Junaid Aftab, Haizhao Yang. Approximating Korobov functions via quantum circuits, Submitted to *Communications in Mathematical Sciences*. 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 -	**Math Quantum 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*.

Conferences, Summer Schools

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

Talks

Sept. 2024   **TQC Conference**, *Multi-product Hamiltonian simulation with explicit commutator scaling*.

University of Maryland.
- RIT on Geometry and Physics. March 2023.
- RIT on ML for Rare Events. Oct. 2022.
- Quantum Error Correction Reading Group. May 2022.

Teaching

2022, 2024   **Instructor of Record**, *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

2017 - 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

Service

2024   **Course Staff**, *University of Maryland*.

I assisted professors in designing the course materials for AMSC 698: Mathematics of Quantum Information.

2024 -   **Research Mentor**, *University of Maryland*.

I am currently a research mentor for two CS students, Nashita Bhuiyan and Hana Fatima, for a quantum computing research project.

2024   **Guest Lecturer**, *University of Maryland*.

I was asked to deliver two lectures for a graduate-level course on differential geometry.

2022   **New Student Mentor**, *University of Maryland*.

I served as a mentor for a first-year graduate student, Valerie Wray.

2022 - 2024   **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:
- 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.

Relevant Courses

Mathematics   Real Analysis, Probability, Functional Analysis, Partial Differential Equations, Differential Geometry, Algebraic Topology, Abstract Algebra, Category Theory, Algebraic Geometry, Lie Groups

Computer Science   Quantum Computing, Computational Geometry, Randomized Algorithms, Coding Theory, Numerical Optimization, Neural Modeling, Scientific Computation

Physics   Classical & Quantum Mechanics, Condensed Matter Physics, Statistical Mechanics

Skills & Certifications

Programming   Python, Julia, MATLAB, Mathematica, LaTeX, Fortran

Frameworks   PyTorch, Qiskit

Data Analysis   Pandas, Scikit-Learn, Seaborn

MathSoftware   SageMath, SymPy, SciPy, Jupyter Notebook

Certifications   IBM Certified Qiskit Associate Developer. Passed: 2022. Badge